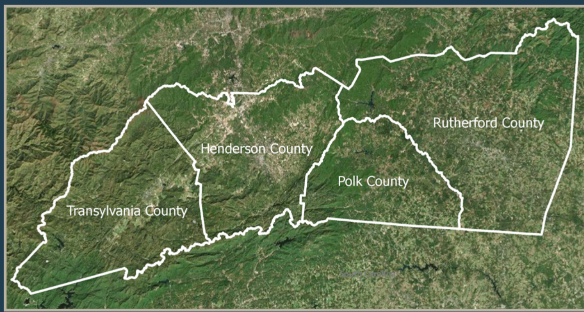


South Mountains

Regional Hazard Mitigation Plan

FINAL

Plan Design Enable

06030-BD-14

TABLE OF CONTENTS

SECTION 1
INTRODUCTION

This section provides a general introduction to the *South Mountains Regional Hazard Mitigation Plan*. It consists of the following five subsections:

- 1.1 Background
- 1.2 Purpose
- 1.3 Scope
- 1.4 Authority
- 1.5 Summary of Plan Contents

1.1 BACKGROUND

Natural hazards, such as winter storms, thunderstorms, floods, and landslides, are a part of the world around us. Their occurrence is natural and inevitable, and there is little we can do to control their force and intensity. We must consider these hazards to be legitimate and significant threats to human life, safety, and property.

The South Mountains Region is located in the western part of North Carolina and includes Henderson, Polk, Rutherford, and Transylvania Counties and the municipal governments within the counties. This area is vulnerable to a wide range of natural hazards such as winter storms, thunderstorms, floods, and landslides. It is also vulnerable to human-caused hazards, including hazardous material spills. These hazards threaten the life and safety of residents in the South Mountains Region and have the potential to damage or destroy both public and private property, disrupt the local economy, and impact the overall quality of life of individuals who live, work, and vacation in the region.

While the threat from hazardous events may never be fully eliminated, there is much we can do to lessen their potential impact upon our community and our citizens. By minimizing the impact of hazards upon our built environment, we can prevent such events from resulting in disasters. The concept and practice of reducing risks to people and property from known hazards is generally referred to as *hazard mitigation*.

FEMA Definition of Hazard Mitigation:
"Any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards."

Hazard mitigation techniques include both structural measures (such as strengthening or protecting buildings and infrastructure from the destructive forces of potential hazards) and non-structural measures (such as the adoption of sound land use policies and the creation of public awareness programs). It is widely accepted that the most effective mitigation measures are implemented at the local government level, where decisions on the regulation and control of development are ultimately made. A comprehensive mitigation approach addresses hazard vulnerabilities that exist today and in the foreseeable future. Therefore, it is essential that projected patterns of future development are evaluated and considered in terms of how that growth will increase or decrease a community's overall hazard vulnerability.

A key component in the formulation of a comprehensive approach to hazard mitigation is to develop, adopt, and update a local hazard mitigation plan as needed. A hazard mitigation plan establishes the broad community vision and guiding principles for reducing hazard risk, and further proposes specific mitigation actions to eliminate or reduce identified vulnerabilities.

Each of the four counties and their municipal jurisdictions participating in the development of the South Mountains Hazard Mitigation Plan have an existing hazard mitigation plan that has evolved over the years, as described in Section 2: *Planning Process*. This regional plan draws from each of the County plans to document the region's sustained efforts to incorporate hazard mitigation principles and practices into routine government activities and functions. At its core, the Plan recommends specific actions to minimize hazard vulnerability and protect residents from losses to those hazards that pose the greatest risk. These mitigation actions go beyond simply recommending structural solutions to reduce existing vulnerability, such as elevation, retrofitting, and acquisition projects. Local policies on community growth and development, incentives for natural resource protection, and public awareness and outreach activities are examples of other actions considered to reduce the South Mountains Region's vulnerability to identified hazards. The Plan remains a living document, with implementation and evaluation procedures established to help achieve meaningful objectives and successful outcomes over time.

1.1.1 The Disaster Mitigation Act and the Flood Insurance Reform Act

In an effort to reduce the Nation's mounting natural disaster losses, the U.S. Congress passed the Disaster Mitigation Act of 2000 (DMA 2000) in order to amend the Robert T. Stafford Disaster Relief and Emergency Assistance Act. Section 322 of DMA 2000 emphasizes the need for state, local and Tribal government entities to closely coordinate on mitigation planning activities and makes the development of a hazard mitigation plan a specific eligibility requirement for any local or Tribal government applying for federal mitigation grant funds. These funds include the Hazard Mitigation Grant Program (HMGP) and the Pre-Disaster Mitigation (PDM) program, both of which are administered by the Federal Emergency Management Agency (FEMA) under the Department of Homeland Security. Communities with an adopted and federally-approved hazard mitigation plan thereby become pre-positioned and more apt to receive available mitigation funds before and after the next disaster strikes.

Additionally, the Biggert Waters Flood Insurance Reform Act of 2012 modified the existing Flood Mitigation Assistance (FMA) program. One of the requirements of this Act is that a FEMA-approved Hazard Mitigation Plan is now required if communities wish to be eligible for these FEMA mitigation programs.

The South Mountains Regional Hazard Mitigation Plan has been prepared in coordination with FEMA Region IV and the North Carolina Division of Emergency Management (NCDEM) to ensure that the Plan meets all applicable FEMA and state requirements for hazard mitigation plans. A *Local Mitigation Plan Review Tool*, found in Appendix C, provides a summary of federal and state minimum standards and notes the location where each requirement is met within the Plan.

1.2 PURPOSE

The purpose of the South Mountains Regional Hazard Mitigation Plan is to:

- Merge the existing Henderson, Polk, Rutherford and Transylvania County hazard mitigation plans into one regional plan;
- Complete update of existing plans to demonstrate progress and reflect current conditions;
- Increase public awareness and education;
- Maintain grant eligibility for participating jurisdictions; and
- Maintain compliance with state and federal legislative requirements for local hazard mitigation plans.

1.3 SCOPE

The focus of the South Mountains Regional Hazard Mitigation Plan is on those hazards determined to be "high" or "moderate" risks to the South Mountains Region, as determined through a detailed hazard risk assessment. Other hazards that pose a "low" or "negligible" risk will continue to be evaluated during future updates to the Plan, but they may not be fully addressed until they are determined to be of high or moderate risk. This enables the participating counties and municipalities to prioritize mitigation actions based on those hazards which are understood to present the greatest risk to lives and property.

The geographic scope (i.e., the planning area) for the Plan includes the counties of Henderson, Polk, Rutherford and Transylvania, as well as their incorporated jurisdictions. **Table 1.1** indicates the participating jurisdictions.

TABLE 1.1: PARTICIPATING JURISDICTIONS IN THE SOUTH MOUNTAINS REGIONAL HAZARD MITIGATION PLAN

Henderson County	
Flat Rock	Laurel Park
Fletcher	Mills River
Hendersonville	
Polk County	
Columbus	Tryon
Saluda	
Rutherford County	
Bostic	Lake Lure
Chimney Rock Village	Ruth
Ellenboro	Rutherfordton
Forest City	Spindale
Transylvania County	
Brevard	Rosman

1.4 AUTHORITY

The South Mountains Regional Hazard Mitigation Plan has been developed in accordance with current state and federal rules and regulations governing local hazard mitigation plans and has been adopted by each participating county and local jurisdiction in accordance with standard local procedures. Copies of the adoption resolutions for each participating jurisdiction are provided in Appendix A. The Plan shall be routinely monitored and revised to maintain compliance with the following provisions, rules, and legislation:

- Section 322, Mitigation Planning, of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as enacted by Section 104 of the Disaster Mitigation Act of 2000 (P.L. 106-390);
- FEMA's Final Rule published in the Federal Register, at 44 CFR Part 201 (201.6 for local mitigation planning requirements); and
- Biggert Waters Flood Insurance Reform Act of 2012(P.L. 112-141).

1.5 SUMMARY OF PLAN CONTENTS

The contents of this Plan are designed and organized to be as reader-friendly and functional as possible. While significant background information is included on the processes used and studies completed (i.e., risk assessment, capability assessment), this information is separated from the more meaningful planning outcomes or actions (i.e., mitigation strategy, mitigation action plan).

Section 2, ***Planning Process***, provides a complete narrative description of the process used to prepare the Plan. This includes the identification of participants on the planning team and describes how the public and other stakeholders were involved. It also includes a detailed summary for each of the key meetings held, along with any associated outcomes.

The ***Community Profile***, located in Section 3, provides a general overview of the South Mountains Region, including prevalent geographic, demographic, and economic characteristics. In addition, building characteristics and land use patterns are discussed. This baseline information provides a snapshot of the planning area and helps local officials recognize those social, environmental, and economic factors that ultimately play a role in determining the region's vulnerability to hazards.

The Risk Assessment is presented in three sections: Section 4, ***Hazard Identification***; Section 5, ***Hazard Profiles***; and Section 6, ***Vulnerability Assessment***. Together, these sections serve to identify, analyze, and assess hazards that pose a threat to the South Mountains Region. The risk assessment also attempts to define any hazard risks that may uniquely or exclusively affect specific areas of the South Mountains Region.

The Risk Assessment begins by identifying hazards that threaten the South Mountains Region. Next, detailed profiles are established for each hazard, building on available historical data from past hazard occurrences, spatial extent, and probability of future occurrence. This section culminates in a hazard risk ranking based on conclusions regarding the frequency of occurrence, spatial extent, and potential impact highlighted in each of the hazard profiles. In the vulnerability assessment, FEMA's Hazus®MH loss estimation methodology is used to evaluate known hazard risks by their relative long-term cost in expected damages. In essence, the information generated through the risk assessment serves a critical function as the participating jurisdictions in the South Mountains Region seek to determine the most appropriate mitigation actions to pursue and implement—enabling them to prioritize and focus their efforts on those hazards of greatest concern and those structures or planning areas facing the greatest risk(s).

The ***Capability Assessment***, found in Section 7, provides a comprehensive examination of the South Mountains Region's capacity to implement meaningful mitigation strategies and identifies opportunities to increase and enhance that capacity. Specific capabilities addressed in this section include planning and regulatory capability, staff and organizational (administrative) capability, technical capability, fiscal capability, and political capability. Information was obtained through the use of a detailed survey questionnaire and an inventory and analysis of existing plans, ordinances, and relevant documents. The purpose of this assessment is to identify any existing gaps, weaknesses, or conflicts in programs or activities that may hinder mitigation efforts and to identify those activities that should be built upon in establishing a successful and sustainable local hazard mitigation program.

The *Community Profile*, *Risk Assessment*, and *Capability Assessment* collectively serve as a basis for determining the goals for the South Mountains Regional Hazard Mitigation Plan, each contributing to the development, adoption, and implementation of a meaningful and manageable *Mitigation Strategy* that is based on accurate background information.

The ***Mitigation Strategy***, found in Section 8, consists of broad goal statements as well as an analysis of hazard mitigation techniques for the jurisdictions participating in the South Mountains Regional Hazard Mitigation Plan to consider in reducing hazard vulnerabilities. The strategy provides the foundation for a detailed ***Mitigation Action Plan***, found in Section 9, which links specific mitigation actions for each county and municipal department or agency to locally-assigned implementation mechanisms and target completion dates. Together, these sections are designed to make the Plan both strategic, through the identification of long-term goals, and functional, through the identification of immediate and short-term actions that will guide day-to-day decision-making and project implementation.

In addition to the identification and prioritization of possible mitigation projects, emphasis is placed on the use of program and policy alternatives to help make the South Mountains Region less vulnerable to the damaging forces of hazards while improving the economic, social, and environmental health of the community. The concept of multi-objective planning was emphasized throughout the planning process, particularly in identifying ways to link, where possible, hazard mitigation policies and programs with complimentary community goals related to disaster recovery, housing, economic development, recreational opportunities, transportation improvements, environmental quality, land development, and public health and safety.

Plan Maintenance, found in Section 10, includes the measures that the jurisdictions participating in the South Mountains Regional plan will take to ensure the Plan's continuous long-term implementation. The procedures also include the manner in which the Plan will be regularly evaluated and updated to remain a current and meaningful planning document.

County-specific **Annexes** have been created to include specific information for each County and participating jurisdiction. Topics covered in the annexes include community profile, risk assessment, vulnerability, and capability assessment information. The mitigation actions relevant for each particular county and their participating municipal jurisdictions are also included in the Annex.

SECTION 2
PLANNING PROCESS

This section describes the planning process undertaken to develop the South Mountains Regional Hazard Mitigation Plan. It consists of the following eight subsections:

44 CFR Requirement
44 CFR Part 201.6(c)(1): The plan shall include documentation of the planning process used to develop the plan, including how it was prepared, who was involved in the process and how the public was involved.

2.1 OVERVIEW OF HAZARD MITIGATION PLANNING

Local hazard mitigation planning is the process of organizing community resources, identifying and assessing hazard risks, and determining how to best minimize or manage those risks. This process culminates in a hazard mitigation plan that identifies specific mitigation actions, each designed to achieve both short-term planning objectives and a long-term community vision.

To ensure the functionality of a hazard mitigation plan, responsibility is assigned for each proposed mitigation action to a specific individual, department, or agency along with a schedule or target completion date for its implementation (see Section 10: *Plan Maintenance*). Plan maintenance procedures are established for the routine monitoring of implementation progress, as well as the evaluation and enhancement of the mitigation plan itself. These plan maintenance procedures ensure that the Plan remains a current, dynamic, and effective planning document over time that becomes integrated into the routine local decision making process.

Communities that participate in hazard mitigation planning have the potential to accomplish many benefits, including:

- saving lives and property,
- saving money,
- speeding recovery following disasters,
- reducing future vulnerability through wise development and post-disaster recovery and reconstruction,

- expediting the receipt of pre-disaster and post-disaster grant funding, and
- demonstrating a firm commitment to improving community health and safety.

Typically, communities that participate in mitigation planning are described as having the potential to produce long-term and recurring benefits by breaking the repetitive cycle of disaster loss. A core assumption of hazard mitigation is that the investments made before a hazard event will significantly reduce the demand for post-disaster assistance by lessening the need for emergency response, repair, recovery, and reconstruction. Furthermore, mitigation practices will enable local residents, businesses, and industries to re-establish themselves in the wake of a disaster, getting the community economy back on track sooner and with less interruption.

The benefits of mitigation planning go beyond solely reducing hazard vulnerability. Mitigation measures such as the acquisition or regulation of land in known hazard areas can help achieve multiple community goals, such as preserving open space, maintaining environmental health, and enhancing recreational opportunities. Thus, it is vitally important that any local mitigation planning process be integrated with other concurrent local planning efforts, and any proposed mitigation strategies must take into account other existing community goals or initiatives that will help complement or hinder their future implementation.

2.2 HISTORY OF HAZARD MITIGATION PLANNING IN THE SOUTH MOUNTAINS REGION

Each of the four counties participating in this Plan has a previously adopted hazard mitigation plan. The FEMA approval dates for each of these plans, along with a list of the participating municipalities for each plan, are listed below:

- *Henderson County Multi-Jurisdictional Hazard Mitigation Plan* (5/18/11)
  - City of Hendersonville
  - Town of Fletcher
  - Town of Laurel Park
  - Village of Flat Rock
- *Polk County* (3/15/11)
  - Town of Columbus
  - City of Saluda
  - Town of Tryon
- *Rutherford County Hazard Mitigation Plan* (6/29/11)
  - Town of Bostic
  - Chimney Rock Village
  - Town of Ellenboro
  - Town of Forest City
  - Town of Lake Lure
  - Town of Ruth
  - Town of Rutherfordton

    - Town of Spindale
- *Transylvania County Hazard Mitigation Plan* (9/30/11)
    - City of Brevard
    - Town of Rosman

Each of the county-levels plans was developed using the multi-jurisdictional planning process recommended by the Federal Emergency Management Agency (FEMA). For this plan, all of the aforementioned jurisdictions have joined to form a regional plan. All of the jurisdictions that participated in previous planning efforts have participated in the development of this regional plan. The process of merging all of the above plans into this regional plan is described in more detail below.

2.3 PREPARING THE 2014 PLAN

Hazard mitigation plans are required to be updated every five years to remain eligible for federal mitigation funding. To simplify planning efforts for the jurisdictions in the South Mountains Region, decided to join together to create the *South Mountains Regional Hazard Mitigation Plan*. This allows resources to be shared amongst the participating jurisdictions and eases the administrative duties of all of the participants by combining the four existing county plans into one multi-jurisdictional plan.

To prepare the 2014 *South Mountains Regional Hazard Mitigation Plan*, Atkins was hired as an outside consultant to provide professional mitigation planning services. To meet requirements of the Community Rating System, the region ensured that the planning process was facilitated under the direction of a professional planner. Nathan Slaughter from Atkins served as the lead planner for this project and is a member of the American Institute of Certified Planners (AICP).

Per the contractual scope of work, the consultant team followed the mitigation planning process recommended by FEMA (Publication Series 386 and Local Mitigation Plan Review Guide) and recommendations provided by North Carolina Division of Emergency Management (NCEM) mitigation planning staff[1]. The Local Mitigation Plan Review Tool, found in Appendix C, provides a detailed summary of FEMA's current minimum standards of acceptability for compliance with DMA 2000 and notes the location where each requirement is met within this Plan. These standards are based upon FEMA's Final Rule as published in the Federal Register in Part 201 of the Code of Federal Regulations (CFR). The planning team used FEMA's Local Mitigation Plan Review Guide (October 2011) for reference as they completed the Plan.

Although each participating jurisdiction had already developed a plan in the past, the combination of the four plans into one regional plan still required making some plan update revisions based on FEMA's Local Mitigation Plan Guide. Since all sections of the regional plan are technically new, plan update requirements do not apply. However, since this is the first regional plan among the jurisdictions, key elements from the previous approved plans are referenced throughout the document (e.g., existing actions) and required a discussion of changes made. For example, all of the risk assessment elements needed to be updated to include most recent information. It was also necessary to formulate a single set of goals for the region, but they were based on previously determined goals (Section 8: *Mitigation Strategy*). The Capability Assessment section includes updated information for all of the participating

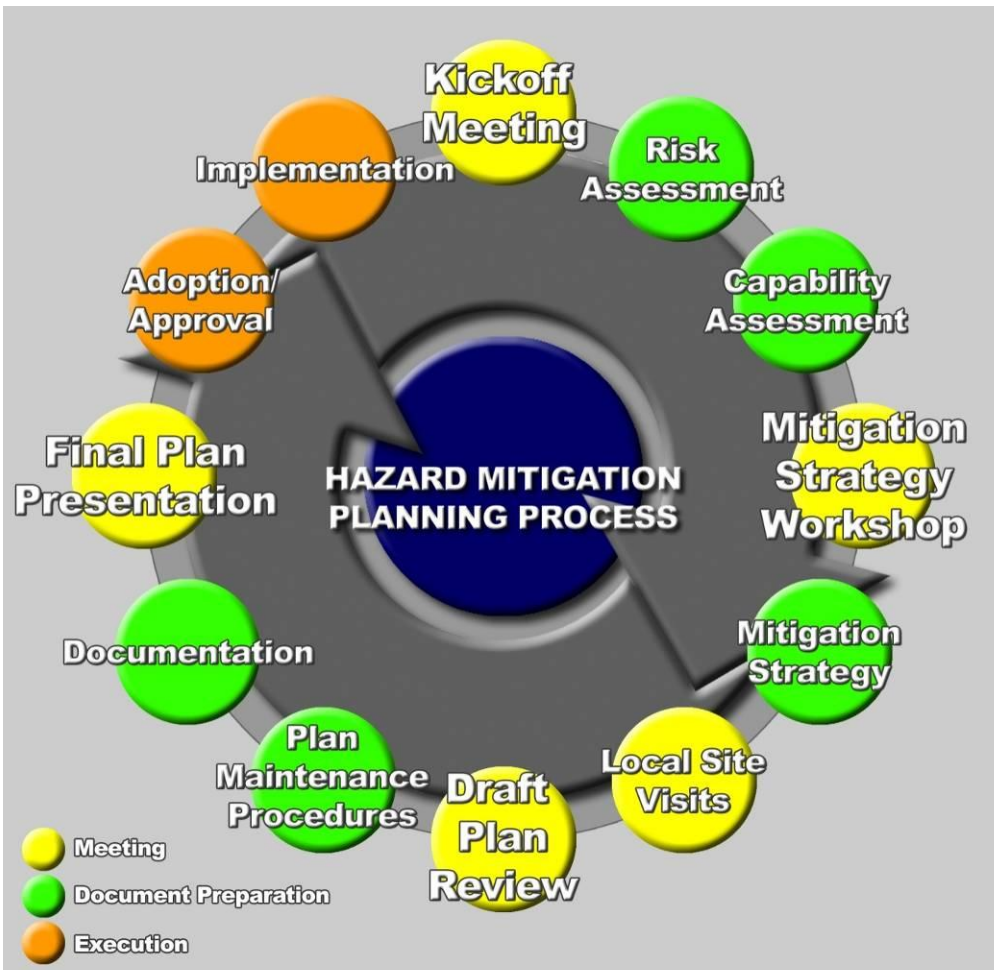
[1] A copy of the negotiated contractual scope of work between the participating counties and Atkins is available through Henderson County upon request.

jurisdictions and the Mitigation Action Plan provides implementation status updates for all of the actions identified in the previous plans.

The process used to prepare this Plan included twelve major steps that were completed over the course of approximately nine months beginning in October 2013. Each of these planning steps (illustrated in **Figure 2.1**) resulted in critical work products and outcomes that collectively make up the Plan. Specific plan sections are further described in Section 1: *Introduction*.

Over the past five years, each participating jurisdiction has been actively working to implement their existing plans. This is documented in the Mitigation Action Plan through the implementation status updates for each of the Mitigation Actions. The Capability Assessment also documents changes and improvements in the capabilities of each participating jurisdiction to implement the Mitigation Strategy.

FIGURE 2.1: MITIGATION PLANNING PROCESS FOR THE SOUTH MOUNTAINS REGION



2.4 THE SOUTH MOUNTAINS REGIONAL HAZARD MITIGATION PLANNING TEAM

In order to guide the development of this Plan, the South Mountains jurisdictions created the South Mountains Regional Hazard Mitigation Planning Team (Regional Hazard Mitigation Planning Team or

Regional Planning Team). The Regional Hazard Mitigation Planning Team represents a community-based planning team made up of representatives from various county and municipal departments, and other key stakeholders identified to serve as critical partners in the planning process.

Beginning in October 2013, the Regional Hazard Mitigation Planning Team members engaged in regular discussions as well as local meetings and planning workshops to discuss and complete tasks associated with preparing the Plan. This working group coordinated on all aspects of plan preparation and provided valuable input to the process. In addition to regular meetings, team members routinely communicated and were kept informed through an e-mail distribution list.

Specifically, the tasks assigned to the Regional Hazard Mitigation Planning Team members included:

- participate in Regional Hazard Mitigation Planning Team meetings and workshops
- provide best available data as required for the risk assessment portion of the Plan
- provide information that will help complete the Capability Assessment section of the plan and provide copies of any mitigation or hazard-related documents for review and incorporation into the Plan
- support the development of the Mitigation Strategy, including the design and adoption of regional goal statements
- help design and propose appropriate mitigation actions for their department/agency for incorporation into the Mitigation Action Plan
- review and provide timely comments on all study findings and draft plan deliverables
- support the adoption of the 2014 *South Mountains Regional Hazard Mitigation Plan*

Table 2.1 lists the members of the Regional Hazard Mitigation Planning Team who were responsible for participating in the development of the Plan. Team members are listed in alphabetical order by last name.

TABLE 2.1: MEMBERS OF THE SOUTH MOUNTAINS REGIONAL HAZARD MITIGATION PLANNING TEAM

NAME	DEPARTMENT / AGENCY
Arledge, Bobby*	Polk County
Ball, Jim	Laurel Park
Barnett, Mike	Henderson County EMS
Blanton, Tommy	Town of Rutherfordton Fire
Boleman, Judy	Village of Flat Rock
Cable, Matt	Henderson County
Cobb, Daniel	City of Brevard
Crater, Michael	Polk County EMS
Doherty, Katie	Henderson County GIS
Elliott, Daniel	Rutherford County Fire Marshal's Office
Harris, Phil	Brevard Police Department
Hollifield, Roger*	Rutherford County EM

NAME	DEPARTMENT / AGENCY
Hollis, Wally	HCFMO
Hyder, Rocky*	Henderson County Emergency Services
Jones, Marcus	Henderson County
Laughter, Jaime	Town of Mills River
Melnikova, Alison	Town of Laurel Park
Morgan, Ron	Lake Lure Fire/EM
Radcliff, Autumn	Henderson County
Rogers, Brian	Polk County NCFS
Rufa, Eric	Town of Fletcher
Shook, Kevin*	Transylvania County EM
Smith, Lee	Hendersonville Water and Sewer
Thompson, Doug	Rutherford County NCFS
Wooten, Tom	City of Hendersonville

Table 2.2 lists points of contact for several of the jurisdictions who elected to designate their respective county officials to represent their jurisdiction on the planning team, generally because they did not have the time or staff to be able to attend on their own. Although these members designated county officials to represent them at in-person meetings, each was still contacted throughout the planning process and participated by providing suggestions and comments on the Plan via email and phone conversations. These members are listed in alphabetical order by last name below.

TABLE 2.1: MEMBERS DESIGNATING REPRESENTATIVES TO SOUTH MOUNTAINS REGIONAL HAZARD MITIGATION PLANNING TEAM

NAME	DEPARTMENT / AGENCY
Baisden, Fred	Mayor, City of Saluda
Barth, Tim	Town Manager, Town of Columbus
Baynard, Don	Mayor, Town of Ruth
Bland, Mickey	Mayor, Town of Spindale
Davis, Joey	Town Manager, Town of Tryon
Harrill, Mitch	Mayor, Town of Bostic
Meliski, Barbara	Mayor, Chimney Rock Village
Ryan, Jim	Mayor, Town of Ellenboro
Shelton, Brian	Mayor, Town of Rosman
Tarlton, Dennis	Mayor, Town of Forest City

2.4.1 Multi-Jurisdictional Participation

The *South Mountains Regional Multi-Jurisdictional Hazard Mitigation Plan* includes four counties, and eighteen incorporated municipalities. To satisfy multi-jurisdictional participation requirements, each county and its participating jurisdictions were required to perform the following tasks:

- Participate in mitigation planning workshops;
- Identify completed mitigation projects, if applicable; and
- Develop and adopt (or update) their local Mitigation Action Plan.

Each jurisdiction participated in the planning process and has developed a local Mitigation Action Plan unique to their jurisdiction. Each jurisdiction will adopt their Mitigation Action Plan separately. This provides the means for jurisdictions to monitor and update their Plan on a regular basis.

2.5 COMMUNITY MEETINGS AND WORKSHOPS

The preparation of this Plan required a series of meetings and workshops for facilitating discussion, gaining consensus and initiating data collection efforts with local government staff, community officials, and other identified stakeholders. More importantly, the meetings and workshops prompted continuous input and feedback from relevant participants throughout the drafting stages of the Plan. The following is a summary of the key meetings and community workshops held during the development of the plan update.[2] In many cases, routine discussions and additional meetings were held by local staff to accomplish planning tasks specific to their department or agency, such as the approval of specific mitigation actions for their department or agency to undertake and include in the Mitigation Action Plan.


November 29, 2011 SMRHMPC Meeting

October 3, 2013
First Regional Hazard Mitigation Planning Team Meeting – Henderson County Training Room

April 4, 2013
Second Regional Hazard Mitigation Planning Team Meeting – Henderson County Training Room

2.6 INVOLVING THE PUBLIC

44 CFR Requirement
44 CFR Part 201.6(b)(1): The planning process shall include an opportunity for the public to comment on the plan during the drafting stage and prior to plan approval.

An important component of the mitigation planning process involved public participation. Individual citizen and community-based input provides the entire planning team with a greater understanding of local concerns and increases the likelihood of successfully implementing mitigation actions by

[2] Copies of agendas, sign-in sheets, minutes, and handout materials for all meetings and workshops can be found in Appendix D.

developing community "buy-in" from those directly affected by the decisions of public officials. As citizens become more involved in decisions that affect their safety, they are more likely to gain a greater appreciation of the hazards present in their community and take the steps necessary to reduce their impact. Public awareness is a key component of any community's overall mitigation strategy aimed at making a home, neighborhood, school, business or entire city safer from the potential effects of hazards.

Public involvement in the development of the *South Mountains Regional Hazard Mitigation Plan* was sought using two methods: (1) public survey instruments were made available in hard copy and online; and (3) copies of the draft Plan deliverables were made available for public review on county and municipal websites and at government offices. The public was provided two opportunities to be involved in the development of the regional plan at two distinct periods during the planning process: (1) during the drafting stage of the Plan; and (2) upon completion of a final draft Plan, but prior to official plan approval and adoption.

Each of the participating jurisdictions will hold public meetings before the final plan is officially adopted by the local governing bodies. These meetings will occur at different times once FEMA has granted conditional approval of the Plan. Adoption resolutions will be included in Appendix A.

2.6.1 Public Participation Survey

The Regional Hazard Mitigation Planning Team was successful in getting citizens to provide input to the mitigation planning process through the use of the *Public Participation Survey*. The *Public Participation Survey* was designed to capture data and information from residents of the South Mountains Region that might not be able to attend public meetings or participate through other means in the mitigation planning process.

Copies of the *Public Participation Survey* were distributed to the Regional Hazard Mitigation Planning Team to be made available for residents to complete at local public offices. A link to an electronic version of the survey was also posted on each county's website. A total of 156 survey responses were received, which provided valuable input for the Regional Hazard Mitigation Planning Team to consider in the development of the plan update. Selected survey results are presented below.

- Approximately 35 percent of survey respondents had been impacted by a disaster, mainly hurricanes, flooding, and winter storms.
- Respondents ranked Severe Winter Storm/Freeze and Severe Thunderstorm/High Wind as the highest threats to their neighborhood (25 percent each) followed by Wildfire (12 percent), and Flood (9 percent).
- Approximately 40 percent of respondents have taken actions to make their homes more resistant to hazards and 81 percent are interested in making their homes more resistant to hazards.
- 75 percent of respondents do not know what office to contact regarding reducing their risks to hazards.
- Emergency Services and Prevention were ranked as the most important activities for communities to pursue in reducing risks.

A copy of the survey is provided in Appendix B and a detailed summary of the survey results are provided in Appendix D.

2.7 INVOLVING THE STAKEHOLDERS

44 CFR Requirement
44 CFR Part 201.6(b)(2): The planning process shall include an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other non-profit interests to be involved in the planning process.

At the beginning of the planning process for the development of this plan, the project consultant worked with each of the County Emergency Management leads to initiate outreach to stakeholders to be involved in the planning process. The project consultant sent out a list of recommended stakeholders provided from FEMA Publication 386-1 titled **Getting Started: Building Support for Mitigation Planning**. The list of recommended stakeholders is found in Appendix C of that publication (Worksheet #1: Build the Planning Team) and has been included in **Appendix D** of this plan to demonstrate the wide range of stakeholders that were considered to participate in the development of this plan. Each of the County Emergency Management leads used that list for reference as they invited stakeholders from their counties to participate in the planning process.

In addition to the efforts described above, the regional Hazard Mitigation Planning Team encouraged more open and widespread participation in the mitigation planning process by designing and distributing the *Public Participation Survey*. These opportunities were provided for local officials, residents, businesses, academia, and other private interests in the region to be involved and offer input throughout the local mitigation planning process.

2.8 DOCUMENTATION OF PLAN PROGRESS

Progress in hazard mitigation planning for the participating jurisdictions in the South Mountains Region is documented in this plan update. Since hazard mitigation planning efforts officially began in the participating counties with the development of the initial Hazard Mitigation Plans in the late 1990s and early 2000s, many mitigation actions have been completed and implemented in the participating jurisdictions. These actions will help reduce the overall risk to natural hazards for the people and property in the South Mountains Region. The actions that have been completed are documented in the Mitigation Action Plan found in Section 9.

In addition, community capability continues to improve with the implementation of new plans, policies and programs that help to promote hazard mitigation at the local level. The current state of local capabilities for the participating jurisdictions is captured in Section 7: *Capability Assessment*. The participating jurisdictions continue to demonstrate their commitment to hazard mitigation and hazard mitigation planning and have proven this by developing the Regional Hazard Mitigation Planning Team to update the Plan and by continuing to involve the public in the hazard mitigation planning process.

SECTION 3
COMMUNITY PROFILE

This section of the Plan provides a general overview of the South Mountains Region. It consists of the following four subsections:

- 3.1 Geography and the Environment
- 3.2 Population and Demographics
- 3.3 Housing, Infrastructure, and Land Use
- 3.4 Employment and Industry

3.1 GEOGRAPHY AND THE ENVIRONMENT

The South Mountains Region is located in the western portion of the North Carolina separated from the Appalachian Mountains to the west by the Catawba River Valley. For the purposes of this plan, the South Mountains Region includes Henderson, Polk, Rutherford, and Transylvania Counties. An orientation map is provided as **Figure 3.1**.

The South Mountains Region is home to various parks, forests, and campgrounds which display the area's natural beauty and resources. Multiple US designated historic districts and landmarks are present throughout the South Mountains Region. Biking, camping, fishing, hiking, horseback riding, and picnicking are available activities within the region. The region also hosts events and educational programs highlighting the area's natural characteristics. The South Mountains Region includes a designated South Mountains Game Land maintained by the North Carolina Wildlife Resources Commission. Scenic driving tours are conducted throughout the region to highlight the natural beauty of the landscape.

The total land area of each of the participating counties is presented in **Table 3.1**.

TABLE 3.1: TOTAL LAND AREAS OF PARTICIPATING COUNTIES

County	Total Land Area
Henderson County	373 square miles
Polk County	238 square miles
Rutherford County	564 square miles
Transylvania County	379 square miles

Source: US Census Bureau, 2010

The South Mountains Region enjoys a generally mild year-round climate that is characterized by colder winters and warm summers; however, variation in elevation and topography can drastically affect local weather. According to the Southeast Regional Climate Center, the mean annual temperature average for this area is approximately 57˚F, with an average high of 71˚F and low of 45˚F.[1] On average, the

[1] *Henderson County Multi-Jurisdictional Hazard Mitigation Plan, 2010*

warmest month within the South Mountains Region is July and the coolest month is January. The highest recorded temperature was 107˚F in 1999 and the lowest recorded temperature was -8˚F in 1982.

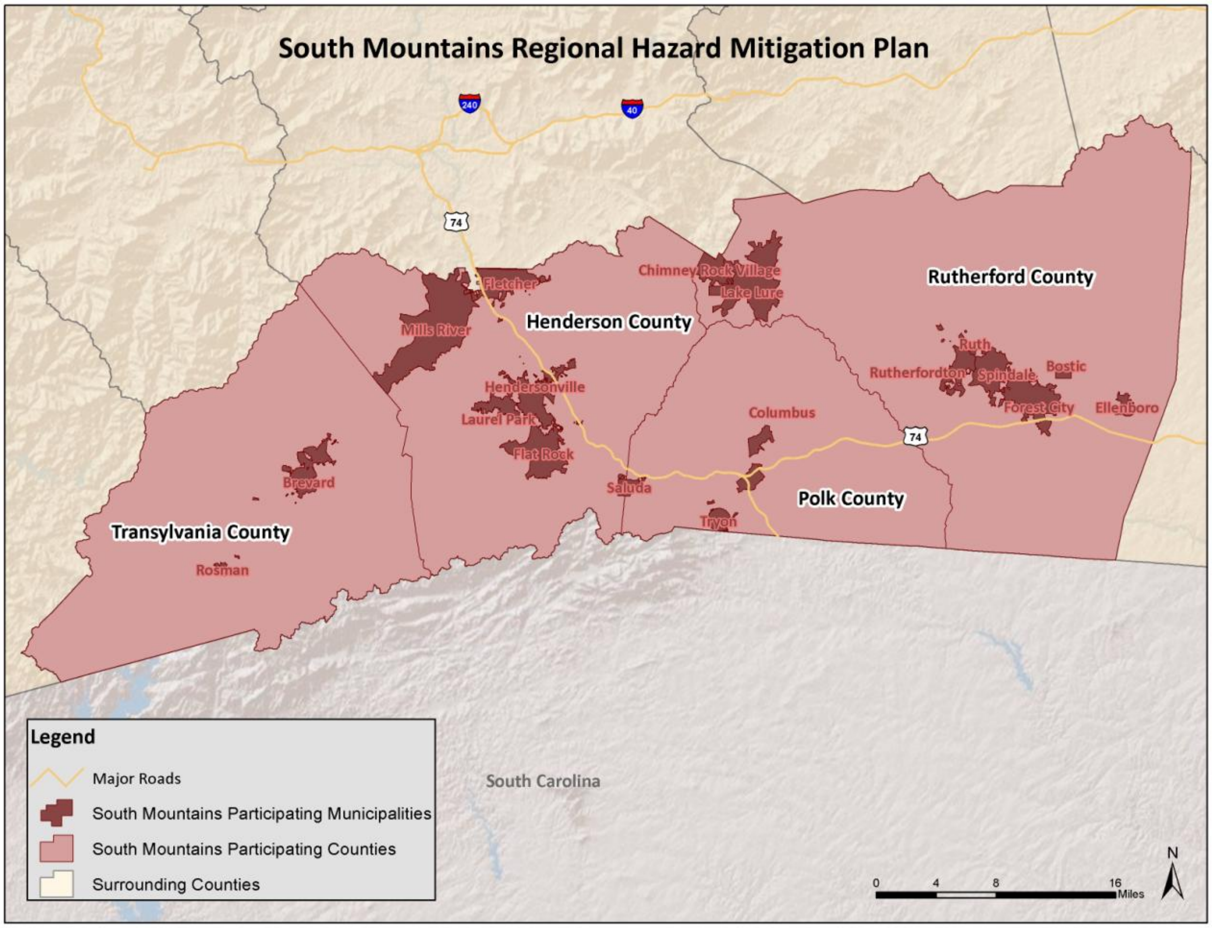
The region is located in the eastern portion of the wettest area of North Carolina and of the eastern United States. Data shows that, on average, the region receives 1 or 2 inches of precipitation per month with the exception of September and October.[2] The average annual precipitation is between 50 and 56 inches.[3]

In the summer, temperatures of 90˚F or higher occur, on average, 15 days.[1] The mean average temperature during the summer months of June, July and August is 72˚F, with an average high temperature of 88˚F and low temperature of 63˚F. Summertime in is typically moderately warm and very humid. At higher elevations, weather is much more pleasant during the summer. Rain in early summer is common. Because of localized summer thunderstorms, some areas of the region get more precipitation than others.

Winter in the South Mountains Region is generally moderate but extremes do occur, especially at higher elevations. Winter lows frequently drop below freezing and temperatures can be even lower at higher elevations. In the winter months the average high temperature is 53˚F and the average low temperature is 28˚F. The region averages about 7 inches of snow per year depending on altitude of the location. Winter precipitation usually results from low pressure storms which frequently pass through the area. The average annual snowfall amount is 5.5 inches with the heaviest monthly averages occurring in January (2.9 inches), February (1.4 inches), and March (0.9 inches).[1]

[2] *Polk County Multi-Jurisdictional Multi-Hazard Mitigation Plan, 2010*
[3] *Southeast Regional Climate Center, Forest City Station*

FIGURE 3.1: SOUTH MOUNTAINS REGION ORIENTATION MAP



3.2 POPULATION AND DEMOGRAPHICS

Rutherford County is the largest participating county by area but Henderson County has the largest population. Between 2000 and 2010, the majority of participating jurisdictions experienced population growth; however, three towns did see a decline. Three of the towns were not incorporated before the 1990 census. Henderson County had the highest county growth rate at 19.7% and it is also the most populous county within the region. Population counts from the US Census Bureau for 1990, 2000, and 2010 for each of the participating counties are presented in **Table 3.2**.

TABLE 3.2: POPULATION COUNTS FOR PARTICIPATING COUNTIES

Jurisdiction	1990 Census Population	2000 Census Population	2010 Census Population	% Change 2000-2010
Henderson County	69,285	89,173	106,740	19.7%
Polk County	14,416	18,324	20,510	11.9%
Rutherford County	56,918	62,899	67,810	7.8%
Transylvania County	25,520	29,334	33,090	12.8%

Source: US Census Bureau

Based on the 2010 Census, the median age of residents of the participating counties ranges from 42 to 49 years. The racial characteristics of the participating counties are presented in **Table 3.3**. Generally, whites make up the majority of the population in the region accounting for over 85 percent of the population in all South Mountains Region Counties. Rutherford County contains the most diverse population.

TABLE 3.3: DEMOGRAPHICS OF PARTICIPATING COUNTIES

Jurisdiction	White, Percent (2010)	Black or African American, Percent (2010)	American Indian or Alaska Native, Percent (2010)	Asian, Percent (2010)	Native Hawaiian or Other Pacific Islander, Percent (2010)	Other Race, Percent (2010)	Two or More Races, percent (2010)	Persons of Hispanic Origin, Percent (2010)*
Henderson County	88.9%	3.0%	0.4%	1.0%	0.2%	4.6%	1.9%	9.8%
Polk County	90.8%	4.5%	0.4%	0.3%	0.0%	2.6%	1.4%	5.5%
Rutherford County	85.9%	10.1%	0.3%	0.4%	0.0%	1.5%	1.8%	3.5%
Transylvania County	92.4%	3.9%	0.3%	0.4%	0.0%	1.3%	1.7%	2.9%

*Hispanics may be of any race, so also are included in applicable race categories
Source: US Census Bureau

3.3 HOUSING, INFRASTRUCTURE, AND LAND USE

3.3.1 Housing

According to the 2010 US Census, there were 119,183 housing units in the South Mountains Region, the majority of which are single family homes or mobile homes. Housing information for the four participating counties is presented in **Table 3.4**. As shown in the table, Henderson County has a lower percentage of seasonal housing units compared to the other counties while Transylvania County has the highest percentage.

TABLE 3.4: HOUSING CHARACTERISTICS OF PARTICIPATING COUNTIES

Jurisdiction	Housing Units (2000)	Housing Units (2010)	Seasonal Units, Percent (2010)	Median Home Value (2006-2010)
Henderson County	42,996	54,710	7.4%	$190,700
Polk County	9,192	11,432	10.5%	$168,800
Rutherford County	29,535	33,878	7.9%	$104,400
Transylvania County	15,553	19,163	16.5%	$166,300

Source: US Census Bureau

3.3.2 Infrastructure

Transportation

The main major highway that crosses the Smoky Mountain Region is Interstate 26 which runs north to south through Henderson County. US Route 74 is another east-west highway that runs across the state and travels roughly southeast to northwest in the region though Henderson, Polk, and Rutherford Counties. US Route 74 has alternating names and overlaps pre-existing highways in the region (including Interstates 26), but it is considered the commercial backbone and main truck route of Western North Carolina. US Route 276 runs north to south through Transylvania County into South Carolina.

Within Henderson County, the Apple County Public Transit system provides bus service though the City of Hendersonville, Town of Fletcher, and Town of Laurel Park. Asheville Regional/Hendersonville Airport is the largest airport in the mountains serving the South Mountains Region and all of Western North Carolina. The airport currently offers non-stop commercial flights on four airlines to six major cities. The major airport located nearest to the region is the Charlotte Douglas International Airport, which offers non-stop commercial flights on nine airlines to numerous destinations across the eastern US and Midwest as well as to several international destinations. Other major nearby airports include the Hartsfield-Jackson Atlanta International Airport in Georgia and the Nashville Metropolitan Airport in Tennessee.

Utilities

Electrical power in the South Mountains Region is provided by two public utilities and several electricity cooperatives. Duke Energy Progress provides service to Henderson County, Polk County, Rutherford County, and Transylvania County. The electricity cooperatives servicing the region include Haywood Electric Membership Corporation in Transylvania County, Rutherford Electric Membership Corporation in Rutherford and Polk Counties, and Halifax Electric Membership Cooperation in Henderson County.

Water and sewer service is provided by many of the towns in the South Mountains Region, but generally municipal water systems are extremely limited in the mountains and private or shared wells and septic systems are considered the norm. Henderson County operates and maintains a public sewer system through the Cane Creek Water and Sewer Districts.

Community Facilities

There are a number of public buildings and community facilities located throughout the South Mountains Region. According to the data collected for the vulnerability assessment (Section 6.4.1), there are 74 fire/EMS stations, 17 police stations, and 46 schools located within the study area.

Five hospitals are located in the South Mountains Region[4]. The largest is Margaret J. Pardee Memorial Hospital, a 201-bed community hospital center located in the City of Hendersonville. The Rutherford Regional Medical Center in the Town of Rutherfordton has 129 beds and serves both Rutherford County and Cleveland County, east of Rutherford. The three smaller hospitals are Transylvania Regional Hospital in the City of Brevard, Park Ridge Health in the City of Hendersonville, and St. Luke's Hospital in the Town of Columbus with 92 beds, 62 beds, and 45 beds, respectively.

The South Mountains Region contains numerous local, state, and national parks and recreation areas. These include the Blue Ridge Parkway, Carl Sandburg Home National Historic Site, Chimney Rock State Park, Gorges State Park, and Pisgah National Forest. These facilities offer recreational opportunities to area residents and millions of visitors each year.

[4] Licensed Hospitals in North Carolina, 8/2013 http://www.ncdhhs.gov/dhsr/data/hllist.pdf

3.3.3 Land Use

Many areas of the South Mountains Region are undeveloped or sparsely developed due to the mountainous terrain and the conservation of land in state and national parks and forests. As shown in **Figure 3.1** above, there are several small incorporated municipalities located throughout the study area, and these areas are where the region's population is generally concentrated. The incorporated areas are also where many businesses, commercial uses, and institutional uses are located. Land uses in the balance of the study area generally consist of rural residential development, agricultural uses, recreational areas, and forestland.

Local land use (and associated regulations, or lack thereof) is further discussed in *Section 7: Capability Assessment*.

3.4 EMPLOYMENT AND INDUSTRY

The early modern economy in the South Mountains Region was built around extractive industries; such as mining, logging, and agriculture; manufacturing; and textiles. Like many other mountain towns in North Carolina, the jurisdictions in the South Mountains Region have focused recent economic development efforts on cultural and natural heritage tourism. Second home development is another growing industry that can also help to boost the economy and promote revitalization.

According to the North Carolina Employment Security Commission (NCESC), in 2011, Henderson County had an average annual employment of 45,686 workers and an average unemployment rate of 4.4 percent (compared to 9.7 for the state). In 2011, the Education and Health Services industry employed 24.7 percent of the county's workforce followed by Manufacturing (9.4%); Retail Trade (12.0%); and Professional, Scientific, and Management, and Administrative and Waste Management Services (9.6%). From 2007 to 2011, the average annual median household income in Henderson County was $47,371 compared to $46,291 for the state of North Carolina.[5]

In 2011, Polk County had an average annual employment of 8,596 workers and an average unemployment rate of 7.1 percent. In 2011, the Education and Health Services industry employed the most people, with 23.3 percent of the workforce, followed by Manufacturing (18.9%); Retail Trade (12.6%); and Construction (8.7%). The average annual median household income in Polk County was $43,332 from 2007 to 2011.

Rutherford County had an average annual employment of 22,155 workers and an average unemployment rate of 13.6 percent in 2011. According to the U.S. Census Bureau, in 2011, the Education and Health Services industry was again the largest employment sector with 26.0 percent of the county's workforce. The other leading industries were Manufacturing (18.6%); Retail Trade (13.1%); and Construction (7.3%). The average annual median household income in Rutherford County was $37,128from 2007 to 2011.

[5] North Carolina Civilian Labor Force Estimate, May 2011
http://www.ncesc1.com/pmi/rates/PressReleases/County/NR_May2011CountyRates.pdf;
2007-2011 American Community Survey 5-Year Estimate, US Census Bureau
http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk

The NCESC reported an annual average employment of 11,791 workers and an average unemployment rate of 8.2 percent in Transylvania County for 2011. In 2011, the top employment industry was Education and Health Services, making up 24.1 percent of total employment. Other major industries were Construction (14.3%); Retail Trade (9.3%); and Arts, Entertainment, Recreation, and Accommodation and Food Services (9.3%). The county's average annual median household income was $41,103 from 2007 to 2011.

SECTION 4
HAZARD IDENTIFICATION

This section describes how the planning team identified the hazards to be included this plan. It consists of the following five subsections:

- 4.1 Overview
- 4.2 Description of Full Range of Hazards
- 4.3 Disaster Declarations
- 4.4 Hazard Evaluation
- 4.5 Hazard Identification Results

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44 CFR Requirement
44 CFR Part 201.6(c)(2)(i): The risk assessment shall include a description of the type, location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

4.1 OVERVIEW

The South Mountains Region is vulnerable to a wide range of natural and human-caused hazards that threaten life and property. Current FEMA regulations and guidance under the Disaster Mitigation Act of 2000 (DMA 2000) require, at a minimum, an evaluation of a full range of natural hazards. An evaluation of human-caused hazards (i.e., technological hazards, terrorism, etc.) is encouraged, though not required, for plan approval. The South Mountains Region has included a comprehensive assessment of both types of hazards.

Upon a review of the full range of natural hazards suggested under FEMA planning guidance, the participating counties in the South Mountains Region (Henderson County, Polk County, Rutherford County, and Transylvania County) have identified a number of hazards that are to be addressed in its Regional Hazard Mitigation Plan. These hazards were identified through an extensive process that utilized input from the South Mountains Regional Hazard Mitigation Planning Team members, research of past disaster declarations in the participating counties[1], and review of the North Carolina State Hazard Mitigation Plan (2010). Readily available information from reputable sources (such as federal and state agencies) was also evaluated to supplement information from these key sources.

Table 4.1 lists the full range of natural hazards initially identified for inclusion in the Plan and provides a brief description for each. This table includes 23 individual hazards. Some of these hazards are considered to be interrelated or cascading, but for preliminary hazard identification purposes these individual hazards are broken out separately.

Next, **Table 4.2** lists the disaster declarations in the South Mountains Region

[1] A complete list of disaster declarations for the South Mountains Region can be found below in Section 4.3.

Next, **Table 4.3** documents the evaluation process used for determining which of the initially identified hazards are considered significant enough to warrant further evaluation in the risk assessment. For each hazard considered, the table indicates whether or not the hazard was identified as a significant hazard to be further assessed, how this determination was made, and why this determination was made. The table works to summarize not only those hazards that *were* identified (and why) but also those that *were not* identified (and why not). Hazard events not identified for inclusion at this time may be addressed during future evaluations and updates of the risk assessment if deemed necessary by the Regional Hazard Mitigation Planning Team during the plan update process.

Lastly, **Table 4.4** provides a summary of the hazard identification and evaluation process noting that 15 of the 23 initially identified hazards are considered significant enough for further evaluation through this Plan's risk assessment (marked with a "☑").

4.2 DESCRIPTION OF FULL RANGE OF HAZARDS

TABLE 4.1: DESCRIPTIONS OF THE FULL RANGE OF INITIALLY IDENTIFIED HAZARDS

Hazard	Description
ATMOSPHERIC HAZARDS	
Avalanche	A rapid fall or slide of a large mass of snow down a mountainside.
Drought	A prolonged period of less than normal precipitation such that the lack of water causes a serious hydrologic imbalance. Common effects of drought include crop failure, water supply shortages, and fish and wildlife mortality. High temperatures, high winds, and low humidity can worsen drought conditions and also make areas more susceptible to wildfire. Human demands and actions have the ability to hasten or mitigate drought-related impacts on local communities.
Hailstorm	Any storm that produces hailstones that fall to the ground; usually used when the amount or size of the hail is considered significant. Hail is formed when updrafts in thunderstorms carry raindrops into parts of the atmosphere where the temperatures are below freezing.
Heat Wave	A heat wave may occur when temperatures hover 10 degrees or more above the average high temperature for the region and last for several weeks. Humid or muggy conditions, which add to the discomfort of high temperatures, occur when a "dome" of high atmospheric pressure traps hazy, damp air near the ground. Excessively dry and hot conditions can provoke dust storms and low visibility. A heat wave combined with a drought can be very dangerous and have severe economic consequences on a community.

Hurricane and Tropical Storm	Hurricanes and tropical storms are classified as cyclones and defined as any closed circulation developing around a low-pressure center in which the winds rotate counter-clockwise in the Northern Hemisphere (or clockwise in the Southern Hemisphere) and with a diameter averaging 10 to 30 miles across. When maximum sustained winds reach or exceed 39 miles per hour, the system is designated a tropical storm, given a name, and is closely monitored by the National Hurricane Center. When sustained winds reach or exceed 74 miles per hour the storm is deemed a hurricane. The primary damaging forces associated with these storms are high-level sustained winds, heavy precipitation and tornadoes. Coastal areas are also vulnerable to the additional forces of storm surge, wind-driven waves and tidal flooding which can be more destructive than cyclone wind. The majority of hurricanes and tropical storms form in the Atlantic Ocean, Caribbean Sea and Gulf of Mexico during the official Atlantic hurricane season, which extends from June through November.
Lightning	Lightning is a discharge of electrical energy resulting from the buildup of positive and negative charges within a thunderstorm, creating a “bolt” when the buildup of charges becomes strong enough. This flash of light usually occurs within the clouds or between the clouds and the ground. A bolt of lightning can reach temperatures approaching 50,000 degrees Fahrenheit. Lightning rapidly heats the sky as it flashes, but the surrounding air cools following the bolt. This rapid heating and cooling of the surrounding air causes thunder. On average, 73 people are killed each year by lightning strikes in the United States.
Nor’easter	Similar to hurricanes, nor’easters are ocean storms capable of causing substantial damage to coastal areas in the Eastern United States due to their associated strong winds and heavy surf. Nor'easters are named for the winds that blow in from the northeast and drive the storm up the East Coast along the Gulf Stream, a band of warm water that lies off the Atlantic coast. They are caused by the interaction of the jet stream with horizontal temperature gradients and generally occur during the fall and winter months when moisture and cold air are plentiful. Nor’easters are known for dumping heavy amounts of rain and snow, producing hurricane-force winds, and creating high surf that causes severe beach erosion and coastal flooding.
Tornado	A tornado is a violently rotating column of air that has contact with the ground and is often visible as a funnel cloud. Its vortex rotates cyclonically with wind speeds ranging from as low as 40 mph to as high as 300 mph. Tornadoes are most often generated by thunderstorm activity when cool, dry air intersects and overrides a layer of warm, moist air forcing the warm air to rise rapidly. The destruction caused by tornadoes ranges from light to catastrophic depending on the intensity, size and duration of the storm.
Severe Thunderstorm	Thunderstorms are caused by air masses of varying temperatures meeting in the atmosphere. Rapidly rising warm moist air fuels the formation of thunderstorms. Thunderstorms may occur singularly, in lines, or in clusters. They can move through an area very quickly or linger for several hours. Thunderstorms may result in hail, tornadoes, or straight-line winds. Windstorms pose a threat to lives, property, and vital utilities primarily due to the effects of flying debris and can down trees and power lines.

Winter Storm and Freeze	Winter storms may include snow, sleet, freezing rain, or a mix of these wintry forms of precipitation. Blizzards, the most dangerous of all winter storms, combine low temperatures, heavy snowfall, and winds of at least 35 miles per hour, reducing visibility to only a few yards. Ice storms occur when moisture falls and freezes immediately upon impact on trees, power lines, communication towers, structures, roads and other hard surfaces. Winter storms and ice storms can down trees, cause widespread power outages, damage property, and cause fatalities and injuries to human life.
GEOLOGIC HAZARDS	
Earthquake	A sudden, rapid shaking of the Earth caused by the breaking and shifting of rock beneath the surface. This movement forces the gradual building and accumulation of energy. Eventually, strain becomes so great that the energy is abruptly released, causing the shaking at the earth's surface which we know as an earthquake. Roughly 90 percent of all earthquakes occur at the boundaries where plates meet, although it is possible for earthquakes to occur entirely within plates. Earthquakes can affect hundreds of thousands of square miles; cause damage to property measured in the tens of billions of dollars; result in loss of life and injury to hundreds of thousands of persons; and disrupt the social and economic functioning of the affected area.
Expansive Soils	Soils that will exhibit some degree of volume change with variations in moisture conditions. The most important properties affecting degree of volume change in a soil are clay mineralogy and the aqueous environment. Expansive soils will exhibit expansion caused by the intake of water and, conversely, will exhibit contraction when moisture is removed by drying. Generally speaking, they often appear sticky when wet, and are characterized by surface cracks when dry. Expansive soils become a problem when structures are built upon them without taking proper design precautions into account with regard to soil type. Cracking in walls and floors can be minor, or can be severe enough for the home to be structurally unsafe.
Landslide	The movements of a mass of rock, debris, or earth down a slope when the force of gravity pulling down the slope exceeds the strength of the earth materials that comprise to hold it in place. Slopes greater than 10 degrees are more likely to slide, as are slopes where the height from the top of the slope to its toe is greater than 40 feet. Slopes are also more likely to fail if vegetative cover is low and/or soil water content is high.
Land Subsidence	The gradual settling or sudden sinking of the Earth's surface due to the subsurface movement of earth materials. Causes of land subsidence include groundwater pumpage, aquifer system compaction, drainage of organic soils, underground mining, hydrocompaction, natural compaction, sinkholes, and thawing permafrost.
Tsunami	A series of waves generated by an undersea disturbance such as an earthquake. The speed of a tsunami traveling away from its source can range from up to 500 miles per hour in deep water to approximately 20 to 30 miles per hour in shallower areas near coastlines. Tsunamis differ from regular ocean waves in that their currents travel from the water surface all the way down to the sea floor. Wave amplitudes in deep water are typically less than one meter; they are often barely detectable to the human eye. However, as they approach shore, they slow in shallower water, basically causing the waves from behind to effectively "pile up", and wave heights to increase dramatically. As opposed to typical waves which crash at the shoreline, tsunamis bring with them a continuously flowing 'wall of water' with the potential to cause devastating damage in coastal areas located immediately along the shore.

Volcano	A mountain that opens downward to a reservoir of molten rock below the surface of the earth. While most mountains are created by forces pushing up the earth from below, volcanoes are different in that they are built up over time by an accumulation of their own eruptive products: lava, ash flows, and airborne ash and dust. Volcanoes erupt when pressure from gases and the molten rock beneath becomes strong enough to cause an explosion.
HYDROLOGIC HAZARDS	
Dam and Levee Failure	Dam failure is the collapse, breach, or other failure of a dam structure resulting in downstream flooding. In the event of a dam failure, the energy of the water stored behind even a small dam is capable of causing loss of life and severe property damage if development exists downstream of the dam. Dam failure can result from natural events, human-induced events, or a combination of the two. The most common cause of dam failure is prolonged rainfall that produces flooding. Failures due to other natural events such as hurricanes, earthquakes or landslides are significant because there is generally little or no advance warning.
Erosion	Erosion is the gradual breakdown and movement of land due to both physical and chemical processes of water, wind, and general meteorological conditions. Natural, or geologic, erosion has occurred since the Earth's formation and continues at a very slow and uniform rate each year.
Flood	The accumulation of water within a water body which results in the overflow of excess water onto adjacent lands, usually floodplains. The floodplain is the land adjoining the channel of a river, stream ocean, lake or other watercourse or water body that is susceptible to flooding. Most floods fall into the following three categories: riverine flooding, coastal flooding, or shallow flooding (where shallow flooding refers to sheet flow, ponding and urban drainage).
Storm Surge	A storm surge is a large dome of water often 50 to 100 miles wide and rising anywhere from four to five feet in a Category 1 hurricane up to more than 30 feet in a Category 5 storm. Storm surge heights and associated waves are also dependent upon the shape of the offshore continental shelf (narrow or wide) and the depth of the ocean bottom (bathymetry). A narrow shelf, or one that drops steeply from the shoreline and subsequently produces deep water close to the shoreline, tends to produce a lower surge but higher and more powerful storm waves. Storm surge arrives ahead of a storm's actual landfall and the more intense the hurricane is, the sooner the surge arrives. Storm surge can be devastating to coastal regions, causing severe beach erosion and property damage along the immediate coast. Further, water rise caused by storm surge can be very rapid, posing a serious threat to those who have not yet evacuated flood-prone areas.

OTHER HAZARDS	
Hazardous Materials Incident	Hazardous material (HAZMAT) incidents can apply to fixed facilities as well as mobile, transportation-related accidents in the air, by rail, on the nation's highways and on the water. HAZMAT incidents consist of solid, liquid and/or gaseous contaminants that are released from fixed or mobile containers, whether by accident or by design as with an intentional terrorist attack. A HAZMAT incident can last hours to days, while some chemicals can be corrosive or otherwise damaging over longer periods of time. In addition to the primary release, explosions and/or fires can result from a release, and contaminants can be extended beyond the initial area by persons, vehicles, water, wind and possibly wildlife as well.
Terror Threat	Terrorism is defined by FEMA as, "the use of force or violence against persons or property in violation of the criminal laws of the United States for purposes of intimidation, coercion, or ransom." Terrorist acts may include assassinations, kidnappings, hijackings, bomb scares and bombings, cyber attacks (computer-based), and the use of chemical, biological, nuclear and radiological weapons.
Wildfire	An uncontrolled fire burning in an area of vegetative fuels such as grasslands, brush, or woodlands. Heavier fuels with high continuity, steep slopes, high temperatures, low humidity, low rainfall, and high winds all work to increase risk for people and property located within wildfire hazard areas or along the urban/wildland interface. Wildfires are part of the natural management of forest ecosystems, but most are caused by human factors. Over 80 percent of forest fires are started by negligent human behavior such as smoking in wooded areas or improperly extinguishing campfires. The second most common cause for wildfire is lightning.

4.3 DISASTER DECLARATIONS

Disaster declarations provide initial insight into the hazards that may impact the South Mountains Regional planning area. Since 1977, ten presidential disaster declarations have been reported in the South Mountains Region. This includes three storms related to severe storms and flooding, three storms related to winter storm events, three storms related to hurricane/tropical storm events, and one storm related to tornadoes.

TABLE 4.2: SOUTH MOUNTAINS REGION DISASTER DECLARATIONS

Year	Disaster Number	Description	Henderson County	Polk County	Rutherford County	Transylvania County
1977	542	Severe Storms & Flooding	X	X	X	
1989	827	Tornadoes			X	
1995	1073	Severe Storms, Flooding, High Winds				X
1996	1087	Blizzard Of 96	X	X	X	X
1996	1103	Winter Storm	X	X	X	
1996	1134	Hurricane Fran	X	X	X	
1998	1200	Severe Storms And Flooding				X
2002	1448	Severe Ice Storm		X	X	

Year	Disaster Number	Description	Henderson County	Polk County	Rutherford County	Transylvania County
2004	1546	Tropical Storm Frances	X	X	X	X
2004	1553	Hurricane Ivan	X	X	X	X

4.4 HAZARD EVALUATION

TABLE 4.3: DOCUMENTATION OF THE HAZARD EVALUATION PROCESS

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
ATMOSPHERIC HAZARDS			
Avalanche	NO	• Review of US Forest Service National Avalanche Center web site • Review of the NC State Hazard Mitigation Plan • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of previous county hazard mitigation plans in the South Mountains Region	• There is no risk of avalanche events in North Carolina. The United States avalanche hazard is limited to mountainous western states including Alaska, as well as some areas of low risk in New England. • Avalanche hazard was removed from the North Carolina State Hazard Mitigation Plan after determining the mountain elevation in Western North Carolina did have enough snow not produce this hazard. • Avalanche is not included in any of the previous South Mountains hazard mitigation plans.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Drought	YES	• Review of the NC State Hazard Mitigation Plan • Review of the North Carolina Drought Monitor website • Review of previous county hazard mitigation plans in the South Mountains Region	• There are reports of drought conditions in thirteen out of the last fourteen years in the South Mountains Region, according to the North Carolina Drought Monitor. • Droughts are discussed in NC State Hazard Mitigation Plan as a lesser hazard. • The NC State Hazard Mitigation Plan lists drought as a top hazard for the Mountain 1 Region which includes the South Mountains counties. • Drought is included in all of the previous South Mountains hazard mitigation plans.
Hailstorm	YES	• Review of NC State Hazard Mitigation Plan • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NOAA NCDC Storm Events Database • Review of previous hazard mitigation plans in the South Mountains counties	• Hailstorm events are discussed in the state plan under the Severe Thunderstorm hazard. • NCDC reports 329 hailstorm events (3/4 inch size hail to 2.75 inches) for the South Mountains Region between 1977 and 2013. For these events there were $4.4 million (2013 dollars) in property damages. • Although hail is addressed as an individual hazard in only one of the previous hazard mitigation plans, it is addressed as a sub-item under thunderstorms in the other three plans. Given the frequency of the event, individual analysis is warranted.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Heat Wave	YES	• Review of NOAA NCDC Storm Events Database • Review of the North Carolina State Hazard Mitigation Plan • Review of previous county hazard mitigation plans in the South Mountains Region	• Although NCDC does not report any extreme heat event for the South Mountains counties, the highest recorded temperature in the region was 107 F which is high enough to warrant consideration. • The NC State Hazard Mitigation Plan reports the western portion of the state as having a relatively low vulnerability in the state. However, given the state's location in the typically hot and humid southeast of the United States, some vulnerability still exists. • Heat wave or extreme temperatures were mentioned in two of the four previous hazard mitigation plans in tandem with the drought hazard.
Hurricane and Tropical Storm	YES	• Review of NC State Hazard Mitigation Plan • Analysis of NOAA historical tropical cyclone tracks and National Hurricane Center Website • Review of NOAA NCDC Storm Events Database • Review of historical presidential disaster declarations • FEMA Hazus-MH storm return periods • Review of previous county hazard mitigation plans in the South Mountains Region	• Hurricane and tropical storm events are discussed in the state plan and are listed as a top hazard in the Mountain 1 Region which includes the South Mountains counties. • NOAA historical records indicate 7 tropical storms and 23 tropical depressions have come within 75 miles of the South Mountains Region since 1859. • Three out of ten disaster declarations in the South Mountains Region are directly related to hurricane and tropical storm events. • The 50-year return period peak gust for hurricane and tropical storm events in the South Mountains Region is around 57 mph. • Hurricane and tropical storm hazard was addressed in three of the four previous South Mountains hazard mitigation plans.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Lightning	YES	• Review of NC State Hazard Mitigation Plan • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NOAA NCDC Storm Events Database, NOAA lightning statistics • Review of previous county hazard mitigation plans in the South Mountains Region	• Lightning events are discussed in the state plan as part of the severe thunderstorm hazard. • NCDC reports 46 lightning events for the South Mountains Region since 1950. These events have resulted in a recorded 38 injuries and $2.2 million (2013 dollars) in property damage. • Although lightning is not addressed as an individual hazard in any of the previous South Mountains hazard mitigation plans, it is addressed under thunderstorms in all of the other plans. Given the damage and reported death and injuries, individual analysis is warranted.
Nor'easter	NO	• Review of NC State Hazard Mitigation Plan • Review of NOAA NCDC Storm Events Database • Review of previous county hazard mitigation plans in the South Mountains Region	• Nor'easters are discussed in the state plan. The Mountain 1 Region, which includes the South Mountains Region, has the lowest vulnerability in the state. • NCDC does not report any nor'easter activity for the South Mountains Region. However, nor'easters may have affected the region as severe winter storms. In this case, the activity would be reported under winter storm events. • Nor'easters were not identified in any of the previous South Mountains hazard mitigation plans.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Tornado	YES	• Review of NC State Hazard Mitigation Plan • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NOAA NCDC Storm Events Database • Review of previous county hazard mitigation plans in the South Mountains Region	• Tornado events are discussed in the NC State Hazard Mitigation Plan. • NCDC reports 16 tornado events in South Mountains Region counties since 1973. These events have resulted in no recorded deaths but have caused 10 injuries and $3 million (2013dollars) in property damage with the most severe being an F4. • One of the region's ten disaster declarations was directly related to tornadoes. • Tornado events were addressed in all of the previous South Mountains hazard mitigation plans.
Severe Thunderstorm	YES	• Review of NC State Hazard Mitigation Plan • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NOAA NCDC Storm Events Database • Review of previous county hazard mitigation plans in the South Mountains Region	• Severe thunderstorm events are discussed in the NC State Hazard Mitigation Plan. The Mountain 1 Region, including the South Mountains counties, has the greatest vulnerability in the state. • According to the NC State Hazard Mitigation Plan, severe thunderstorm is the top hazard the Mountain 1 Region which includes the South Mountains counties. • NCDC reports 501 thunderstorm wind events in the South Mountains Region counties between since 1950. These events have resulted in 2 deaths, 9 injuries, and $8.7 million (2013 dollars) in property damage. • Severe thunderstorm events were addressed in all of the previous South Mountains hazard mitigation plans.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Winter Storm and Freeze	YES	• Review of NC State Hazard Mitigation Plan • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of historical presidential disaster declarations. • Review of NOAA NCDC Storm Events Database • Review of previous county hazard mitigation plans in the South Mountains Region	• Severe winter storms, including snow storms and ice storms, are discussed in the state plan. They are listed as a top hazard in the Mountain 1 Region which includes the South Mountains Region counties. • NCDC reports that the South Mountains counties have been affected by 303 snow and ice events since 1993. These events resulted in over $53 million (2013 dollars) in damages but did not cause any deaths or injuries. • Three of the region's ten disaster declarations were directly related to winter storm events. • Winter storm events were addressed in all of the previous South Mountains hazard mitigation plans.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
GEOLOGIC HAZARDS			
Earthquake	YES	• Review of NC State Hazard Mitigation Plan • Review of previous county hazard mitigation plans in the South Mountains Region • USGS Earthquake Hazards Program web site • Review of the National Geophysical Data Center • Review of FEMA's Multi-Hazard Identification and Risk Assessment	• Earthquake events are discussed in the state plan and all of the participating counties in the South Mountains Region are considered to be at moderate risk to an earthquake event (no counties are high risk). • All of the previous hazard mitigation plans in the South Mountains Region address earthquake. • Earthquakes have occurred in and around the State of North Carolina in the past. The state is affected by the Charleston and the New Madrid (near Missouri) Fault lines which have generated a magnitude 8.0 earthquake in the last 200 years. • 135 events are known to have occurred in the region according to the National Geophysical Data Center. The greatest MMI reported was a 6. • According to USGS seismic hazard maps, the peak ground acceleration (PGA) with a 10% probability of exceedance in 50 years for the South Mountains Region is approximately 4%g. FEMA recommends that earthquakes be further evaluated for mitigation purposes in areas with a PGA of 3%g or more.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Expansive Soils	NO	• Review of NC State Hazard Mitigation Plan • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of USDA Soil Conservation Service's Soil Survey • Review of previous county hazard mitigation plans in the South Mountains Region	• Expansive soils are identified in the state plan; however Mountain Region 1 does not identify expansive soils as a top hazard. • According to FEMA and USDA sources, the South Mountains Region is located in an area that has a "little to no" clay swelling potential. • None of the previous South Mountains hazard mitigation plans identify expansive soils as a potential hazard.
Landslide	YES	• Review of NC State Hazard Mitigation Plan • Review of USGS Landslide Incidence and Susceptibility Hazard Map • Review of the North Carolina Geological Survey database of historic landslides • Review of previous county hazard mitigation plans in the South Mountains Region	• Landslide/debris flow events are discussed in the state plan, and ranked as the top hazard in the Mountain 1 Region which includes South Mountains counties. Further, the Mountain Region received the highest vulnerability score in the state. • USGS landslide hazard maps indicate "high landslide incidence" (more than 15% of the area is involved in landsliding) is found in one of the counties. All counties also have areas of moderate incidence with high susceptibility. • Data provided by NCGS indicate 47 recorded landslide events in the South Mountains Region. There were no recorded deaths or injuries but some reports of damage to houses and roads. • All of the previous South Mountains hazard mitigation plans address landslides.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Land Subsidence	NO	• Review of NC State Hazard Mitigation Plan • Review of previous county hazard mitigation plans in the South Mountains Region	• The state plan delineates certain areas that are susceptible to land subsidence hazards in North Carolina; however none of these areas are located in South Mountains counties. • The plan identifies South Mountains counties as having scored a zero for the land subsidence hazard. • None of the previous South Mountains hazard mitigation plans identifies land subsidence as a potential hazard.
Tsunami	NO	• Review of NC State Hazard Mitigation Plan • Review of previous county hazard mitigation plans in the South Mountains Region • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of FEMA "How-to" mitigation planning guidance (Publication 386-2, "Understanding Your Risks – Identifying Hazards and Estimating Losses).	• Tsunamis are discussed in the state plan and described as a "greater" hazard for the state. However, the Mountain Region scored a zero for tsunami hazard risk. • Two of the previous plans in the South Mountains Region address tsunami, but it is identified as being highly unlikely to occur. • No record exists of a catastrophic Atlantic basin tsunami impacting the mid-Atlantic coast of the United States. • Tsunami inundation zone maps are not available for communities located along the U.S. East Coast. • FEMA mitigation planning guidance suggests that locations along the U.S. East Coast have a relatively low tsunami risk and need not conduct a tsunami risk assessment at this time.
Volcano	NO	• Review of NC State Hazard Mitigation Plan • Review of USGS Volcano Hazards Program web site	• There are no active volcanoes in North Carolina. • There has not been a volcanic eruption in North Carolina in over 1 million years. • No volcanoes are located near the South Mountains Region.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
HYDROLOGIC HAZARDS			
Dam and Levee Failure	YES	• Review of NC State Hazard Mitigation Plan • Review of North Carolina Division of Land Management web site • Review of U.S. Army Corps of Engineers National Inventory of Dams database • Review of previous county hazard mitigation plans in the South Mountains Region	• Dam failure is discussed in the state plan as a hazard of concern for the South Mountains Region. It is a top hazard for Mountain Region 1 which includes the South Mountains counties. However, the region does not have the greatest vulnerability in the state. • Of the 324 dams reported on the National Inventory of Dams, 118 are high hazard (36%), (High hazard is defined as "where failure or mis-operation will probably cause loss of human life.") • All four of the previous South Mountains hazard mitigation plans address dam failure.
Erosion	YES	• Review of NC State Hazard Mitigation Plan • Review of previous county hazard mitigation plans in the South Mountains Region	• Riverine erosion is discussed in all of the previous South Mountains hazard mitigation plans.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Flood	YES	• Review of NC State Hazard Mitigation Plan • Review of historical disaster declarations • Review of NOAA NCDC Storm Events Database • Review of FEMA's NFIP Community Status Book and Community Rating System (CRS) • Review of previous county hazard mitigation plans in the South Mountains Region	• The flood hazard is thoroughly discussed in the state plan. • Three out of ten Presidential Disaster Declarations were flood-related and an additional three were hurricane or tropical storm-related which caused flooding issues. • NCDC reports that South Mountains Region counties have been affected by 160 flood events since 1993. These events in total caused 13 reported injuries and an estimated $40.5 million (2013 dollars) in property damages. • Over 6% of the South Mountains Region is located in an identified floodplain (100 or 500 year). • All but three municipalities participate in the NFIP. • All of the previous hazard mitigation plans in the South Mountains Region address flood hazard.
Storm Surge	NO	• Review of NC State Hazard Mitigation Plan • Review of previous county hazard mitigation plans in the South Mountains Region • Review of NOAA NCDC Storm Events Database	• Storm surge is discussed in the state plan under the hurricane hazard and indicates that the Mountain Region has zero vulnerability to storm surge. • None of the previous hazard mitigation plans in the South Mountains Region address storm surge. • No historical events were reported by NCDC • Given the inland location of the South Mountains Region, storm surge would not affect the area.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
OTHER HAZARDS			
Hazardous Materials Incident	YES	• Review of previous county hazard mitigation plans in the South Mountains Region	• Two of the four previous South Mountains Region hazard mitigation plans include hazardous materials incident.
Terror Threat	NO	• Review of previous county hazard mitigation plans in the South Mountains Region • Review of local official knowledge	• None of the previous hazard mitigation plans for the region included terrorism threat as a hazard. • There are few high profiles targets in the area.
Wildfire	YES	• Review of NC State Hazard Mitigation Plan • Review of previous county hazard mitigation plans in the South Mountains Region • Review of Southern Wildfire Risk Assessment (SWRA) Data • Review of the NC Division of Forest Resources website	• Wildfires are discussed in the state plan as a "greater" hazard of concern. • All of the previous plans in the South Mountains Region address wildfire. • The state plan lists wildfire as a top hazard in the Mountain 1 Region. • A review of SWRA data indicates that there are areas of elevated concern in the South Mountains Region. • According to the North Carolina Division of Forest Resources, the South Mountains Region experiences an average of 140 fires each year which burn a combined 686 acres. • Wildfire hazard risks will increase as low-density development along the urban/wildland interface increases.

4.5 HAZARD IDENTIFICATION RESULTS

TABLE 4.4: SUMMARY RESULTS OF THE HAZARD IDENTIFICATION AND EVALUATION PROCESS

ATMOSPHERIC HAZARDS	GEOLOGIC HAZARDS
☐ Avalanche	☑ Earthquake
☑ Drought	☐ Expansive Soils
☑ Hailstorm	☑ Landslide
☑ Heat Wave	☐ Land Subsidence
☑ Hurricane and Tropical Storm	☐ Tsunami
☑ Lightning	☐ Volcano
☐ Nor'easter	**HYDROLOGIC HAZARDS**
☑ Tornado	☑ Dam and Levee Failure
☑ Severe Thunderstorm	☑ Erosion
☑ Winter Storm and Freeze	☑ Flood
	☐ Storm Surge
	OTHER HAZARDS
	☑ Hazardous Materials Incident
	☐ Terror Threat
	☑ Wildfire

☑ = Hazard considered significant enough for further evaluation in the South Mountains Region hazard risk assessment.

SECTION 5
HAZARD PROFILES

This section includes detailed hazard profiles for each of the hazards identified in the previous section (*Hazard Identification*) as significant enough for further evaluation in the South Mountains Regional Hazard Mitigation Plan. It contains the following subsections:

44 CFR Requirement
44 CFR Part 201.6(c)(2)(i): The risk assessment shall include a description of the type, location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events

5.1 OVERVIEW

This section includes detailed hazard profiles for each of the hazards identified in the previous section (*Hazard Identification*) as significant enough for further evaluation in the South Mountains Region hazard risk assessment by creating a hazard profile. Each hazard profile includes a general description of the hazard, its location and extent, notable historical occurrences, and the probability of future occurrences. Each profile also includes specific items noted by members of the South Mountains Regional Hazard Mitigation Planning Team as it relates to unique historical or anecdotal hazard information for the counties in the South Mountains Region, or a participating municipality within them.

The following hazards were identified:

- **Atmospheric**
  - Drought
  - Extreme Heat
  - Hailstorm
  - Hurricane and Tropical Storm
  - Lightning

- Severe Thunderstorm (including straight-line winds)
- Tornado
- Winter Storm and Freeze

- **Geologic**
  - Earthquake
  - Landslide
- **Hydrologic**
  - Dam and Levee Failure
  - Erosion
  - Flood
- **Other**
  - Hazardous Materials Incident
  - Wildfire

5.2 STUDY AREA

The South Mountains Region includes four counties: Henderson, Polk, Rutherford, and Transylvania. **Table 5.1** provides a summary table of the participating jurisdictions within each county. In addition, **Figure 5.1** provides a base map, for reference, of the South Mountains Region.

TABLE 5.1: PARTICIPATING JURISDICTIONS IN THE SOUTH MOUNTAINS REGIONAL HAZARD MITIGATION PLAN

Henderson County	
Flat Rock	Laurel Park
Fletcher	Mills River
Hendersonville	
Polk County	
Columbus	Tryon
Saluda	
Rutherford County	
Bostic	Lake Lure
Chimney Rock Village	Ruth
Ellenboro	Rutherfordton
Forest City	Spindale
Transylvania County	
Brevard	Rosman

FIGURE 5.1: SOUTH MOUNTAINS REGION BASE MAP

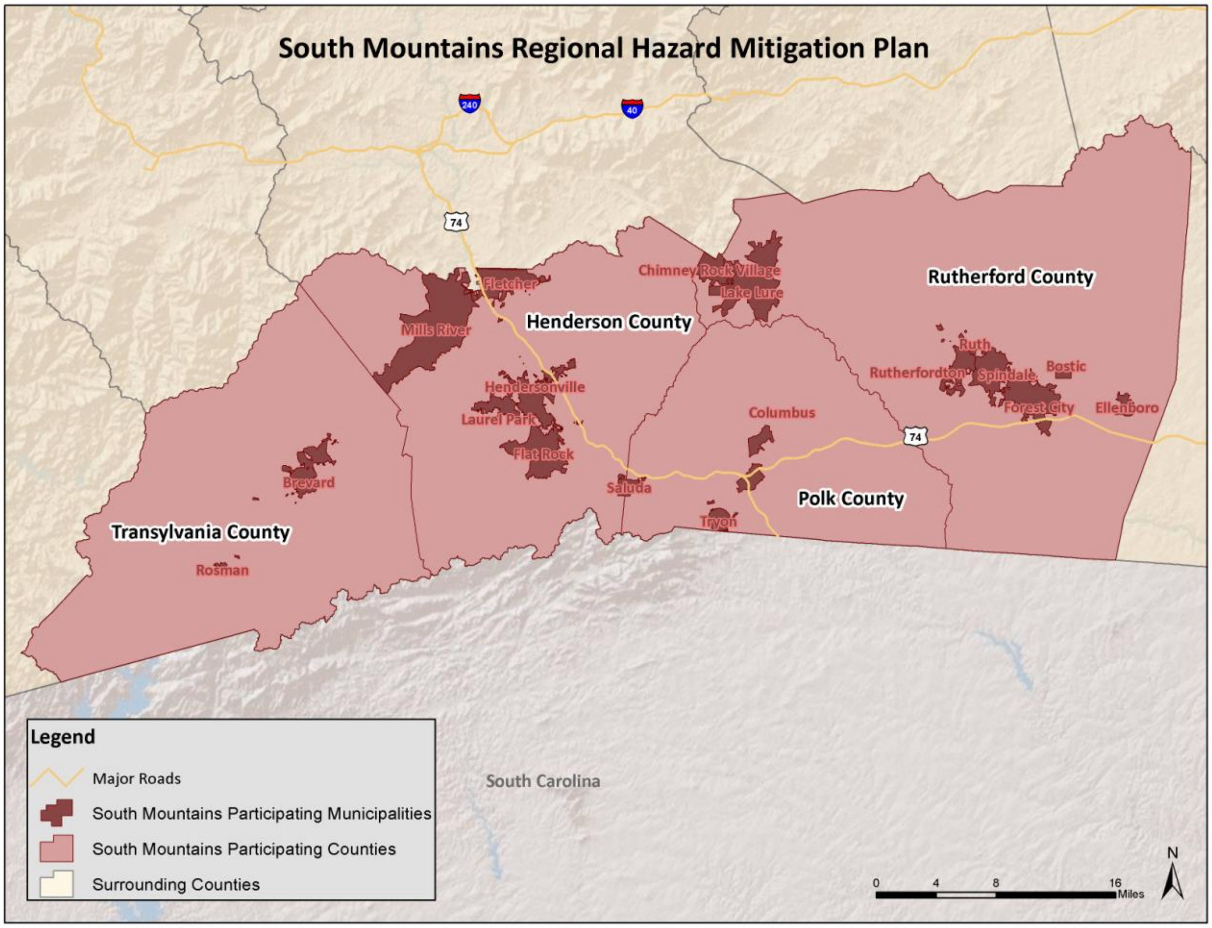


Table 5.2 lists each significant hazard for the South Mountains Region and identifies whether or not it has been determined to be a specific hazard of concern for the eighteen municipal jurisdictions and each of the four county's unincorporated areas. This is the based on the best available data and information from the South Mountains Regional Hazard Mitigation Planning Team. (● = hazard of concern)

TABLE 5.2 SUMMARY OF IDENTIFIED HAZARD EVENTS IN THE SOUTH MOUNTAINS REGION

Jurisdiction	Atmospheric								Geologic		Hydrologic			Other	
	Drought	Extreme Heat	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm	Earthquake	Landslide	Dam and Levee Failure	Erosion	Flood	HAZMAT	Wildfire
Henderson County															
Flat Rock	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Fletcher	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Hendersonville	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Laurel Park	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

Jurisdiction	Atmospheric								Geologic		Hydrologic			Other	
	Drought	Extreme Heat	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm	Earthquake	Landslide	Dam and Levee Failure	Erosion	Flood	HAZMAT	Wildfire
Mills River	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Unincorporated Area	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Polk County															
Columbus	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Saluda	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Tryon	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Unincorporated Area	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Rutherford County															
Bostic	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Chimney Rock Village	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Ellenboro	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Forest City	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Lake Lure	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Ruth	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Rutherfordton	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Spindale	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Unincorporated Area	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Transylvania County															
Brevard	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Rosman	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Unincorporated Area	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

Atmospheric Hazards

5.3 DROUGHT

5.3.1 Background

Drought is a normal part of virtually all climatic regions, including areas with high and low average rainfall. Drought is the consequence of a natural reduction in the amount of precipitation expected over an extended period of time, usually a season or more in length. High temperatures, high winds, and low humidity can exacerbate drought conditions. In addition, human actions and demands for water resources can hasten drought-related impacts.

Droughts are typically classified into one of four types: 1) meteorological, 2) hydrologic, 3) agricultural, or 4) socioeconomic. **Table 5.3** presents definitions for these types of drought.

TABLE 5.3 DROUGHT CLASSIFICATION DEFINITIONS

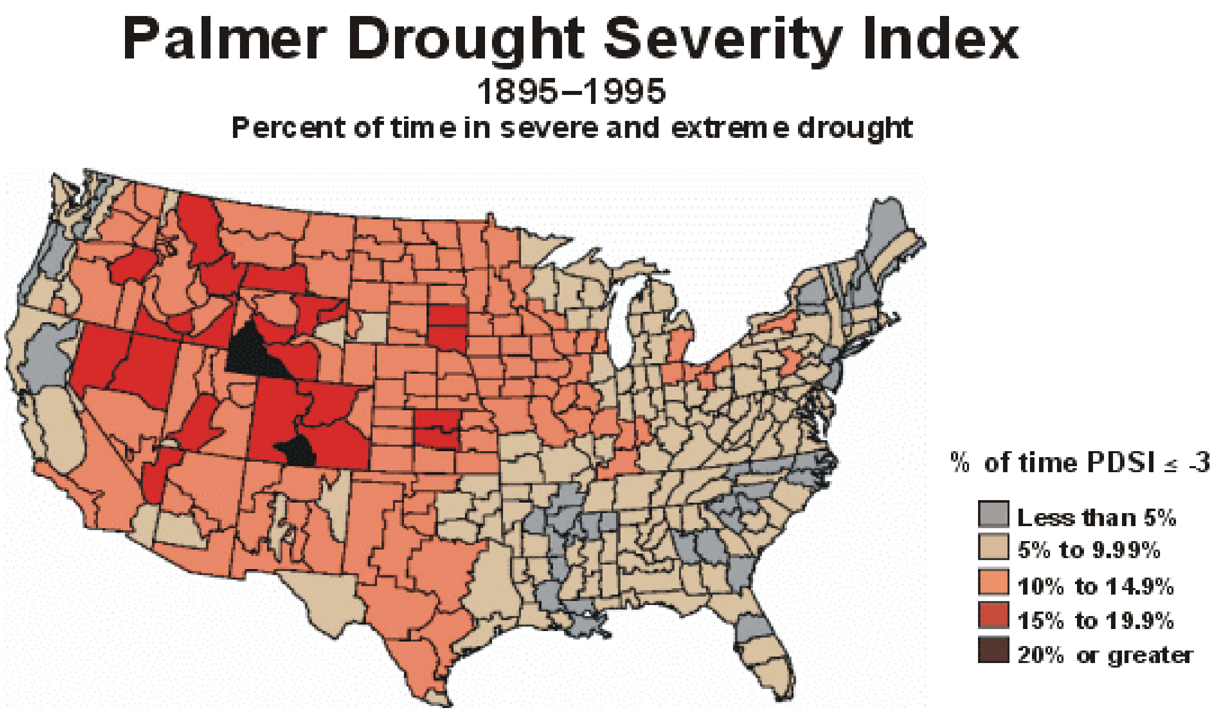
Meteorological Drought	The degree of dryness or departure of actual precipitation from an expected average or normal amount based on monthly, seasonal, or annual time scales.
Hydrologic Drought	The effects of precipitation shortfalls on stream flows and reservoir, lake, and groundwater levels.
Agricultural Drought	Soil moisture deficiencies relative to water demands of plant life, usually crops.
Socioeconomic Drought	The effect of demands for water exceeding the supply as a result of a weather-related supply shortfall.

Source: Multi-Hazard Identification and Risk Assessment: A Cornerstone of the National Mitigation Strategy, FEMA

Droughts are slow-onset hazards, but, over time, can have very damaging affects to crops, municipal water supplies, recreational uses, and wildlife. If drought conditions extend over a number of years, the direct and indirect economic impact can be significant.

The Palmer Drought Severity Index (PDSI) is based on observed drought conditions and range from -0.5 (incipient dry spell) to -4.0 (extreme drought). Evident in **Figure 5.2**, the Palmer Drought Severity Index Summary Map for the United Stated, drought affects most areas of the United States, but is less severe in the Eastern United States.

FIGURE 5.2: PALMER DROUGHT SEVERITY INDEX SUMMARY MAP FOR THE UNITED STATES



Source: National Drought Mitigation Center

5.3.2 Location and Spatial Extent

Drought typically covers a large area and cannot be confined to any geographic or political boundaries. According to the Palmer Drought Severity Index (**Figure 5.2**), Western North Carolina has a relatively low risk for drought hazard. However, local areas may experience much more severe and/or frequent drought events than what is represented on the Palmer Drought Severity Index map. Furthermore, it is assumed that the South Mountains Region would be uniformly exposed to drought, making the spatial extent potentially widespread. It is also notable that drought conditions typically do not cause significant damage to the built environment.

5.3.3 Historical Occurrences

Data from the North Carolina Drought Management Advisory Council and National Climatic Data Center (NCDC) were used to ascertain historical drought events in the South Mountains Region. The North Carolina Drought Management Advisory Council reports data on North Carolina drought conditions from 2000 to 2013 through the North Carolina Drought Monitor. It classifies drought conditions by county on a scale of D0 to D4:

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

According to the North Carolina Drought Monitor, at least one or more of the counties in the South Mountains Region has had drought occurrences (including abnormally dry) in 13 of the last 14 years (2000-2013) (**Table 5.4**). In addition, the most severe drought classification reported for each year in each county, according to North Carolina Drought Monitor classifications, is listed in the jurisdiction-specific annexes. It should be noted that the North Carolina Drought Monitor also estimates what percentage of the county is in each classification of drought severity. For example, the most severe classification reported may be exceptional, but a majority of the county may actually be in a less severe condition.

TABLE 5.4: SUMMARY OF DROUGHT OCCURRENCES IN THE SOUTH MOUNTAINS REGION

Location	Number Years with Drought Occurrences	Number Years with Exceptional Drought Occurrences
Henderson County	13	3
Polk County	13	3
Rutherford County	13	3
Transylvania County	13	3

Source: North Carolina Drought Monitor

5.3.4 Probability of Future Occurrences

Based on historical occurrence information, it is assumed that all of the South Mountains Region has a probability level of likely (10 to 100 percent annual probability) for future drought events. This hazard may vary slightly by location but each area has an equal probability of experiencing a drought. However, historical information also indicates that there is a much lower probability for extreme, long-lasting drought conditions.

5.4 EXTREME HEAT

5.4.1 Background

Extreme heat, like drought, poses little risk to property. However, extreme heat can have devastating effects on health. Extreme heat is often referred to as a "heat wave." According to the National Weather Service, there is no universal definition for a heat wave, but the standard U.S. definition is any event lasting at least three days where temperatures reach ninety degrees Fahrenheit or higher. However, it may also be defined as an event at least three days long where temperatures are ten degrees greater than the normal temperature for the affected area. Heat waves are typically accompanied by humidity but may also be very dry. These conditions can pose serious health threats causing an average of 1,500 deaths each summer in the United States[1].

According to the National Oceanic and Atmospheric Administration, heat is the number one weather-related killer among natural hazards, followed by frigid winter temperatures[1]. The National Weather Service devised the Heat Index as a mechanism to better inform the public of heat dangers. The Heat Index Chart, shown in **Figure 5.3**, uses air temperature and humidity to determine the heat index or apparent temperature. **Table 5.5** shows the dangers associated with different heat index temperatures. Some populations, such as the elderly and young, are more susceptible to heat danger than other segments of the population.

[1] http://www.noaawatch.gov/themes/heat.php

FIGURE 5.3: HEAT INDEX CHART

Relative Humidity (in percent)

Air Temp (in F)	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
140	125																				
135	120	128																			
130	117	122	131																		
125	111	116	123	131	141																
120	107	111	116	123	130	139	148														
115	103	107	111	115	120	127	135	143	151												
110	99	102	105	108	112	117	123	130	137	143	150										
105	95	97	100	102	105	109	113	118	123	129	135	142	149								
100	91	93	95	97	99	101	104	107	110	115	120	126	132	138	144						
95	87	88	90	91	93	94	96	98	101	104	107	110	114	119	124	130	136				
90	83	84	85	86	87	88	90	91	93	95	96	98	100	102	106	109	113	117	122		
85	78	79	80	81	82	83	84	85	86	87	88	89	90	91	93	95	97	99	102	105	108
80	73	74	75	76	77	77	78	79	79	80	81	81	82	83	85	86	86	87	88	89	91
75	69	69	70	71	72	72	73	73	74	74	75	75	76	76	77	77	78	78	79	79	80
70	64	64	65	65	66	66	67	67	68	68	69	69	70	70	70	70	71	71	71	71	72

Source: NOAA

TABLE 5.5: HEAT DISORDERS ASSOCIATED WITH HEAT INDEX TEMPERATURE

Heat Index Temperature (Fahrenheit)	Description of Risks
80°- 90°	Fatigue possible with prolonged exposure and/or physical activity
90°- 105°	Sunstroke, heat cramps, and heat exhaustion possible with prolonged exposure and/or physical activity
105°- 130°	Sunstroke, heat cramps, and heat exhaustion likely, and heatstroke possible with prolonged exposure and/or physical activity
130° or higher	Heatstroke or sunstroke is highly likely with continued exposure

Source: National Weather Service, NOAA

In addition, NOAA has seventeen metropolitan areas participating in the Heat HealthWatch/Warning System in order to better inform and warn the public of heat dangers. A Heat HealthWatch is issued when conditions are favorable for an excessive heat event in the next 12 to 48 hours. A Heat Warning is issued when an excessive heat event is expected in the next 36 hours. Furthermore, a warning is issued when the conditions are occurring, imminent, or have a high likelihood of occurrence. Urban areas participate in the Heat Health Watch/Warning System because urban areas are at greater risk to heat affects. Stagnant atmospheric conditions trap pollutants, thus adding unhealthy air to excessively hot temperatures. In addition, the "urban heat island effect" can produce significantly higher nighttime temperatures because asphalt and concrete (which store heat longer) gradually release heat at night.

5.4.2 Location and Spatial Extent

Excessive heat typically impacts a large area and cannot be confined to any geographic or political boundaries. The entire South Mountains Region is susceptible to extreme heat conditions.

5.4.3 Historical Occurrences

Data from the National Climatic Data Center was used to determine historical extreme heat and heat wave events in the South Mountains Region. There were no events reported.

In addition, information from the State Climate Office of North Carolina was reviewed to obtain historical temperature records in the region. Temperature information has been reported since 1898. The recorded maximum for each county can be found below in **Table 5.6**.

TABLE 5.6: HIGHEST RECORDED TEMPERATURE IN THE SOUTH MOUNTAINS REGION

Location	Date	Temperature (°F)
Henderson County	8/23/1983	101
Polk County	6/22/1964	105
Rutherford County	8/1/1999	107
Transylvania County	6/6/1977	100
SOUTH MOUNTAINS REGION MAXIMUM	**--**	**107**

Source: State Climate Office of North Carolina

The State Climate Office also reports average maximum temperatures in various locations in the region. The most centralized location is in Hendersonville (Henderson County). **Table 5.7** shows the average maximum temperatures from 1971 to 2000 at the Hendersonville observation station which can be used as a general comparison for the region.

TABLE 5.7: AVERAGE MAXIMUM TEMPERATURE IN HENDERSONVILLE, HENDERSON COUNTY

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Avg. Max (°F)	46.7	50.7	58.5	67.0	74.3	80.6	84.3	82.5	76.9	67.8	58.4	49.7

Source: State Climate Office of North Carolina

5.4.4 Probability of Future Occurrences

Based on historical occurrence information, it is assumed that all of the South Mountains Region has a probability level of possible (1 to 10 percent annual probability) for future extreme heat events to impact the region.

5.5 HAILSTORM

5.5.1 Background

Hailstorms are a potentially damaging outgrowth of severe thunderstorms (thunderstorms are discussed separately in Section 5.8). Early in the developmental stages of a hailstorm, ice crystals form within a low-pressure front due to the rapid rising of warm air into the upper atmosphere and the subsequent cooling of the air mass. Frozen droplets gradually accumulate on the ice crystals until they develop to a sufficient weight and fall as precipitation. Hail typically takes the form of spheres or irregularly-shaped masses greater than 0.75 inches in diameter. The size of hailstones is a direct function of the size and severity of the storm. High velocity updraft winds are required to keep hail in suspension in thunderclouds. The strength of the updraft is a function of the intensity of heating at the Earth's surface. Higher temperature gradients relative to elevation above the surface result in increased suspension time and hailstone size.

5.5.2 Location and Spatial Extent

Hailstorms frequently accompany thunderstorms, so their locations and spatial extents coincide. It is assumed that the South Mountains Region is uniformly exposed to severe thunderstorms; therefore, all areas of the region are equally exposed to hail which may be produced by such storms.

5.5.3 Historical Occurrences

According to the National Climatic Data Center, 329 recorded hailstorm events have affected the South Mountains Region since 1963.[2] **Table 5.8** is a summary of the hail events in the South Mountains Region. Detailed information about each event that occurred in the region is provided in the jurisdiction-specific annexes. In all, hail occurrences resulted in over $4.4 million (2013 dollars) in property damages, most of which were reported in Henderson County. Hail ranged in diameter from 0.75 inches to 2.75 inches. It should be noted that hail is notorious for causing substantial damage to cars, roofs, and other areas of the built environment that may not be reported to the National Climatic Data Center. Furthermore, high losses in Henderson County indicate that neighboring counties may also be subject to additional, unreported losses. Therefore, it is likely that damages are greater than the reported value. Additionally, a single storm event may have affected multiple counties.

TABLE 5.8: SUMMARY OF HAIL OCCURRENCES IN THE SOUTH MOUNTAINS REGION

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Henderson County	**107**	**0/0**	**$4,328,047**
Flat Rock	2	0/0	$0
Fletcher	10	0/0	$0
Hendersonville	26	0/0	$2,687,833
Laurel Park	0	0/0	$0
Mills River	11	0/0	$0

[2] These hail events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is likely that additional hail events have affected the South Mountains Region. In addition to NCDC, the North Carolina Department of Insurance office was contacted for information. As additional local data becomes available, this hazard profile will be amended.

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Unincorporated Area	58	0/0	$1,640,214
Polk County	**53**	**0/0**	**$4,153**
Columbus	12	0/0	$4,153
Saluda	9	0/0	$0
Tryon	5	0/0	$0
Unincorporated Area	27	0/0	$0
Rutherford County	**93**	**0/0**	**$33,598**
Bostic	2	0/0	$0
Chimney Rock Village	2	0/0	$0
Ellenboro	4	0/0	$0
Forest City	14	0/0	$0
Lake Lure	6	0/0	$33,598
Ruth	0	0/0	$0
Rutherfordton	20	0/0	$0
Spindale	2	0/0	$0
Unincorporated Area	43	0/0	$0
Transylvania County	**76**	**0/0**	**$108,141**
Brevard	15	0/0	$80,456
Rosman	7	0/0	$27,685
Unincorporated Area	54	0/0	$0
SOUTH MOUNTAINS REGION TOTAL	**329**	**0/0**	**$4,473,939**

Source: National Climatic Data Center

5.5.4 Probability of Future Occurrences

Based on historical occurrence information, it is assumed that the probability of future hail occurrences is highly likely (100 percent annual probability). Since hail is an atmospheric hazard (coinciding with thunderstorms), it is assumed that the entire South Mountains Region has equal exposure to this hazard. It can be expected that future hail events will continue to cause minor damage to property and vehicles throughout the region.

5.6 HURRICANE AND TROPICAL STORM

5.6.1 Background

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

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

As an incipient hurricane develops, barometric pressure (measured in millibars or inches) at its center falls and winds increase. If the atmospheric and oceanic conditions are favorable, it can intensify into a tropical depression. When maximum sustained winds reach or exceed 39 miles per hour, the system is designated a tropical storm, given a name, and is closely monitored by the National Hurricane Center in Miami, Florida. When sustained winds reach or exceed 74 miles per hour the storm is deemed a hurricane. Hurricane intensity is further classified by the Saffir-Simpson Scale (**Table 5.9**), which rates hurricane intensity on a scale of 1 to 5, with 5 being the most intense.

TABLE 5.9: SAFFIR-SIMPSON SCALE

Category	Maximum Sustained Wind Speed (MPH)	Minimum Surface Pressure (Millibars)
1	74–95	Greater than 980
2	96–110	979–965
3	111–129	964–945
4	130–156	944–920
5	157 +	Less than 920

Source: National Hurricane Center (2012)

The Saffir-Simpson Scale categorizes hurricane intensity linearly based upon maximum sustained winds and barometric pressure, which are combined to estimate potential damage. Categories 3, 4, and 5 are classified as "major" hurricanes and, while hurricanes within this range comprise only 20 percent of total tropical cyclone landfalls, they account for over 70 percent of the damage in the United States. **Table 5.10** describes the damage that could be expected for each category of hurricane. Damage during hurricanes may also result from spawned tornadoes, storm surge, and inland flooding associated with heavy rainfall that usually accompanies these storms.

TABLE 5.10: HURRICANE DAMAGE CLASSIFICATIONS

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

Source: National Hurricane Center; Federal Emergency Management Agency

5.6.2 Location and Spatial Extent

Hurricanes and tropical storms threaten the entire Atlantic and Gulf seaboard of the United States. While coastal areas are most directly exposed to the brunt of landfalling storms, their impact is often felt hundreds of miles inland and they can affect the South Mountains Region. All areas in the South Mountains Region are equally susceptible to hurricane and tropical storms.

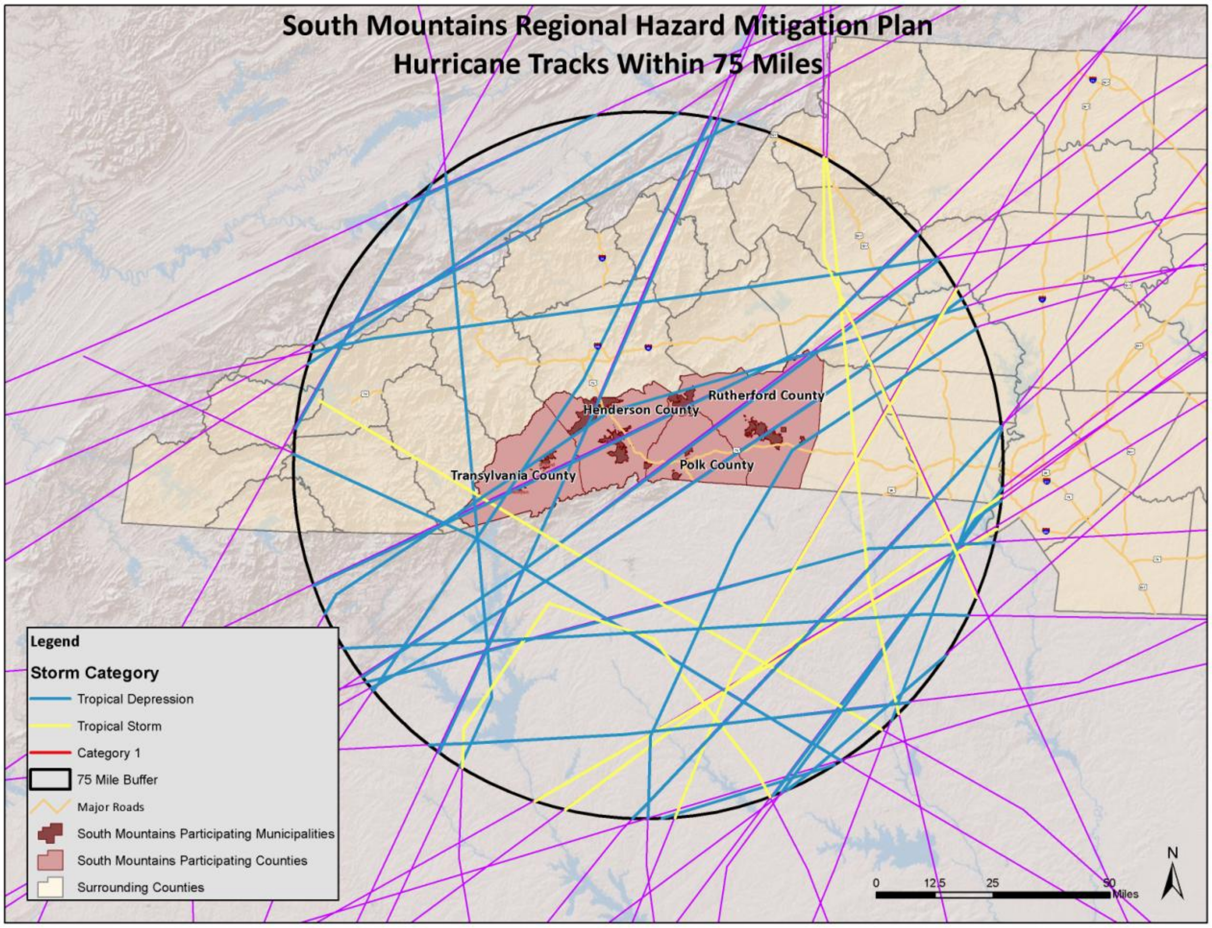
5.5.3 Historical Occurrences

According to the National Hurricane Center's historical storm track records, 30 hurricane or tropical storm tracks have passed within 75 miles of the South Mountains Region since 1850.[3] This includes 7 tropical storms and 23 tropical depressions.

Of the recorded storm events, nine storms traversed directly through the South Mountains Region as shown in **Figure 5.4**. **Table 5.11** provides for each event the date of occurrence, name (if applicable), maximum wind speed (as recorded within 75 miles of the South Mountains Region) and maximum Category of the storm based on the Saffir-Simpson Scale.

[3] These storm track statistics do not include extra-tropical storms. Though these related hazard events are less severe in intensity, they may cause significant local impact in terms of rainfall and high winds.

FIGURE 5.4: HISTORICAL HURRICANE STORM TRACKS WITHIN 75 MILES OF THE SOUTH MOUNTAINS REGION



Source: National Oceanic and Atmospheric Administration; National Hurricane Center

TABLE 5.11: HISTORICAL STORM TRACKS WITHIN 75 MILES OF THE SOUTH MOUNTAINS REGION (1850–2010)

Date of Occurrence	Storm Name	Maximum Wind Speed (knots)	Storm Category
9/17/1859	NOT NAMED	--	Tropical Depression (TD)
9/24/1886	NOT NAMED	35	Tropical Storm (TS)
8/1/1891	NOT NAMED	35	Tropical Storm (TS)
7/8/1896	NOT NAMED	26	Tropical Depression (TD)
9/28/1901	NOT NAMED	22	Tropical Depression (TD)
10/11/1902	NOT NAMED	31	Tropical Depression (TD)
10/10/1905	NOT NAMED	--	Tropical Depression (TD)
9/18/1906	NOT NAMED	31	Tropical Depression (TD)
9/23/1907	NOT NAMED	40	Tropical Storm (TS)
8/30/1911	NOT NAMED	26	Tropical Depression (TD)
6/17/1912	NOT NAMED	--	Tropical Depression (TD)

Date of Occurrence	Storm Name	Maximum Wind Speed (knots)	Storm Category
9/4/1913	NOT NAMED	26	Tropical Depression (TD)
8/31/1915	NOT NAMED	26	Tropical Depression (TD)
7/15/1916	NOT NAMED	31	Tropical Depression (TD)
8/11/1928	NOT NAMED	35	Tropical Storm (TS)
5/30/1934	NOT NAMED	26	Tropical Depression (TD)
8/28/1949	NOT NAMED	35	Tropical Storm (TS)
9/30/1959	GRACIE	22	Tropical Depression (TD)
8/30/1964	CLEO	22	Tropical Depression (TD)
6/8/1968	CELESTE	53	Tropical Storm (TS)
9/8/1977	BABE	22	Tropical Depression (TD)
8/18/1985	ONE-C	48	Tropical Storm (TS)
9/22/1989	HUGO	22	Tropical Depression (TD)
8/17/1994	BERYL	--	Tropical Depression (TD)
7/24/1997	DANNY	18	Tropical Depression (TD)
7/10/2003	DOLORES	--	Tropical Depression (TD)
9/8/2004	FRANCES	18	Tropical Depression (TD)
9/17/2004	IVAN	13	Tropical Depression (TD)
9/28/2004	JEANNE	18	Tropical Depression (TD)
7/7/2005	CINDY	18	Tropical Depression (TD)

Source: National Hurricane Center

The National Climatic Data Center did not report any events associated with a hurricane or tropical storm in the South Mountains Region between 1950 and 2013.

Federal records indicate that three disaster declarations were made in 1996 (Hurricane Fran) and 2004 (Tropical Storm Frances and Hurricane Ivan) for the region.[4]

Flooding is generally the greatest hazard of concern with hurricane and tropical storm events in the South Mountains Region. Most events do not carry winds that are above that of the winter storms and straight line winds received by the South Mountains counties. Some anecdotal information is available for the major storms that have impacted that area as found below:

Hurricane Fran – September 5, 1996
Just prior to landfall of Hurricane Fran, a small portion of the region, in the Bat Cave (Henderson County), Chimney Rock (Rutherford County), Lake Lure (Rutherford County) areas, received up to 11 inches of rain in a 3 hour period. The rains were the result of nearly stationary, very heavy thunderstorms. Severe damage to property in the immediate area resulted, with about 70 homes and businesses destroyed or significantly damaged. As Hurricane Fran moved inland, it dropped an additional 5 to 10 inches of rain over the area resulting in significant flooding throughout the region.

[4] Not all of the participating counties were declared disaster areas for these storms. A complete listing of historical disaster declarations, including the affected counties, can be found in Section 4: *Hazard Identification*.

Tropical Storm Frances – September 7-8, 2004
Tropical Storm Frances was a slow-moving, relatively large storm that dumped heavy rains over the eastern United States. The remnants of Frances produced a swath of 5 to 15 inches of rain across the North Carolina Mountains with reports of 12 to 15 inches of rain along the higher terrain and isolated reports in excess of 18 inches. Wind gusts reached between 40 and 60 mph along the Appalachian Mountains and thousands of trees were downed. Trees fell on structures, vehicles, and power lines. Additionally, the downed trees led to the death of an elderly man in Hendersonville when a tree fell through the resident's structure. Flooding also led to numerous landslides in the area which added to the damage of infrastructure and residential and commercial structures. Frances caused significant crop damages totaling $55 million statewide. North Carolina residents received almost $20.6 million in federal disaster assistance following the storm.

Hurricane Ivan – September 16-17, 2004
Just a week and a half following Tropical Storm Frances, the remnants of Hurricane Ivan hit western North Carolina when many streams and rivers were already well above flood stage. The widespread flooding forced many roads to be closed and landslides were common across the mountain region. Wind gusts reached between 40 and 60 mph across the higher elevations of the Appalachian Mountains resulting in numerous downed trees. More than $13.8 million of federal aid was dispersed across North Carolina following Ivan.

The Hurricane Frances/Ivan combination of events resulted in widespread road closures (including Highways 64, 280, 25, and 276) as well as infrastructure damages (many bridges and roads were completely washed out), residential structure damages, and commercial structure damages due to massive flooding. Trees were blown down and fell on structures, vehicles, and powerlines, adding to the already widespread debris buildup and power outages.

5.6.4 Probability of Future Occurrences

Given the inland location of the region, it is more likely to be affected by remnants of hurricane and tropical storm systems (as opposed to a major hurricane) which may result in flooding or high winds. The probability of being impacted is less than coastal areas, but still remains a real threat to the South Mountains Region due to induced events like flooding and landsliding. Based on historical evidence, the probability level of future occurrence is possible (between 1 and 10 percent annual probability). Given the regional nature of the hazard, all areas are equally exposed to this hazard. However, when the region is impacted, the damage could be catastrophic, threatening lives and property throughout the planning area.

5.7 LIGHTNING

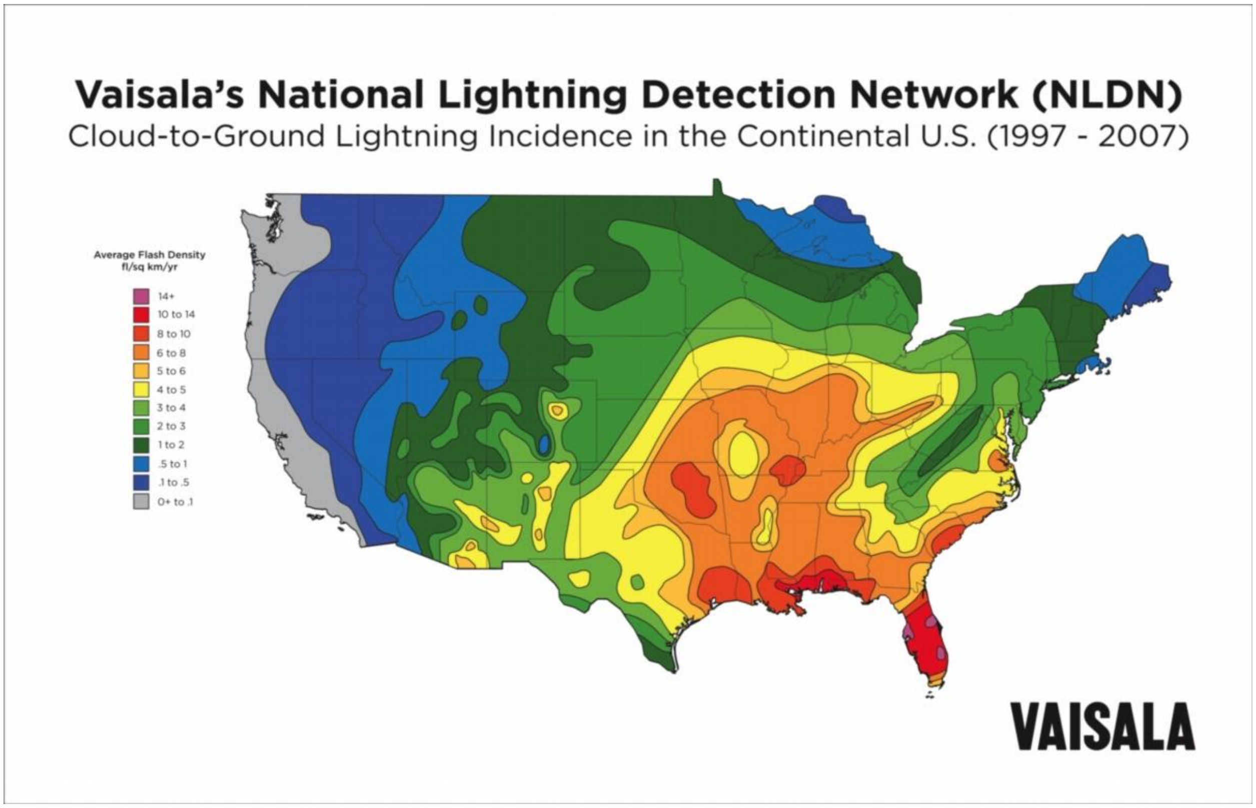
5.7.1 Background

Lightning is a discharge of electrical energy resulting from the buildup of positive and negative charges within a thunderstorm, creating a "bolt" when the buildup of charges becomes strong enough. This flash of light usually occurs within the clouds or between the clouds and the ground. A bolt of lightning can reach temperatures approaching 50,000 degrees Fahrenheit. Lightning rapidly heats the sky as it flashes but the surrounding air cools following the bolt. This rapid heating and cooling of the surrounding air causes the thunder which often accompanies lightning strikes. While most often affiliated with severe thunderstorms, lightning may also strike outside of heavy rain and might occur as far as 10 miles away from any rainfall.

Lightning strikes occur in very small, localized areas. For example, they may strike a building, electrical transformer, or even a person. According to FEMA, lightning injures an average of 300 people and kills 80 people each year in the United States. Direct lightning strikes also have the ability to cause significant damage to buildings, critical facilities, and infrastructure largely by igniting a fire. Lightning is also responsible for igniting wildfires that can result in widespread damages to property.

Figure 5.5 shows a lightning flash density map for the years 1997-2007 based upon data provided by Vaisala's U.S. National Lightning Detection Network (NLDN®).

FIGURE 5.5: LIGHTNING FLASH DENSITY IN THE UNITED STATES



Source: Vaisala U.S. National Lightning Detection Network

5.7.2 Location and Spatial Extent

Lightning occurs randomly, therefore it is impossible to predict where and with what frequency it will strike. It is assumed that all of the South Mountains Region is uniformly exposed to lightning.

5.7.3 Historical Occurrences

According to the National Climatic Data Center, there have been a total of 46 recorded lightning events in the South Mountains Region since 1995.[5] These events resulted in more than $2.2 million (2013 dollars) in damages, as listed in summary **Table 5.12**. Furthermore, lightning caused 38 injuries throughout the South Mountains Region. Detailed information on historical lightning events can be found in the jurisdiction-specific annexes.

It is certain that more than 46 events have impacted the region. Many of the reported events are those that caused damage, and it should be expected that damages are likely much higher for this hazard than what is reported.

TABLE 5.12: SUMMARY OF LIGHTNING OCCURRENCES IN THE SOUTH MOUNTAINS REGION

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Henderson County	**17**	**0/19**	**$55,932**
Flat Rock	0	0/0	$0
Fletcher	0	0/0	$0
Hendersonville	3	0/0	$64,512
Laurel Park	0	0/0	$0
Mills River	0	0/0	$0
Unincorporated Area	14	0/19	$488,420
Polk County	**4**	**0/6**	**$226,514**
Columbus	0	0/0	$0
Saluda	1	0/0	$69,212
Tryon	2	0/0	$157,302
Unincorporated Area	1	0/6	$0
Rutherford County	**15**	**0/7**	**$660,356**
Bostic	2	0/0	$1,426
Chimney Rock Village	1	0/1	$0
Ellenboro	1	0/0	$0
Forest City	3	0/1	$367,669
Lake Lure	2	0/0	$70,516
Ruth	0	0/0	$0
Rutherfordton	2	0/0	$67,196
Spindale	0	0/0	$0
Unincorporated Area	4	0/5	$153,549
Transylvania County	**10**	**0/6**	**$791,223**
Brevard	4	0/5	$302,518
Rosman	0	0/0	$0
Unincorporated Area	6	0/1	$488,704

[5] These lightning events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is certain that additional lightning events have occurred in the South Mountains Region. The State Fire Marshall's office was also contacted for additional information but none could be provided. As additional local data becomes available, this hazard profile will be amended.

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
SOUTH MOUNTAINS REGION TOTAL	46	0/38	$2,231,025

Source: National Climatic Data Center

5.7.4 Probability of Future Occurrences

Although there was not a high number of historical lightning events reported throughout the South Mountains Region via NCDC data, it is considered a regular occurrence, especially accompanied by thunderstorms. In fact, lightning events will assuredly happen on an annual basis, though not all events will cause damage. According to Vaisala's U.S. National Lightning Detection Network (NLDN®), the South Mountains Region is located in an area of the country that experienced an average of 2 to 4 lightning flashes per square kilometer per year between 1997 and 2010. Therefore, the probability of future events is highly likely (100 percent annual probability). It can be expected that future lightning events will continue to threaten life and cause minor property damages throughout the region.

5.8 THUNDERSTORM WIND/HIGH WIND

5.8.1 Background

Thunderstorms can produce a variety of accompanying hazards including wind (discussed here), hail, and lightning.[6] Although thunderstorms generally affect a small area, they are very dangerous and may cause substantial property damage.

Three conditions need to occur for a thunderstorm to form. First, it needs moisture to form clouds and rain. Second, it needs unstable air, such as warm air that can rise rapidly (this often referred to as the "engine" of the storm). Third, thunderstorms need lift, which comes in the form of cold or warm fronts, sea breezes, mountains, or the sun's heat. When these conditions occur simultaneously, air masses of varying temperatures meet, and a thunderstorm is formed. These storm events can occur singularly, in lines, or in clusters. Furthermore, they can move through an area very quickly or linger for several hours.

According to the National Weather Service, more than 100,000 thunderstorms occur each year, though only about 10 percent of these storms are classified as "severe." A severe thunderstorm occurs when the storm produces at least one of these three elements: 1) hail at least one inch in diameter, 2) a tornado, or 3) winds of at least 58 miles per hour.

Thunderstorm events have the capability of producing straight-line winds that can cause severe destruction to communities and threaten the safety of a population. Such wind events, sometimes separate from a thunderstorm event, are common throughout the South Mountains Region. Therefore, high winds are also reported in this section.

High winds can form due to pressure of the Northeast coast that combines with strong pressure moving through the Ohio Valley. This creates a tight pressure gradient across the region, resulting in high winds

[6] Lightning and hail hazards are discussed as separate hazards in this section.

which increase with elevation. It is common for gusts of 30 to 60 miles per hour during the winter months.

Downbursts are also possible with thunderstorm events. Such events are an excessive burst of wind in excess of 125 miles per hour. They are often confused with tornadoes. Downbursts are caused by down drafts from the base of a convective thunderstorm cloud. It occurs when rain-cooled air within the cloud becomes heavier than its surroundings. Thus, air rushes towards the ground in a destructive yet isolated manner. There are two types of downbursts. Downbursts less than 2.5 miles wide, duration less than 5 minutes, and winds up to 168 miles per hour are called "microbursts." Larger events greater than 2.5 miles at the surface and longer than 5 minutes with winds up to 130 miles per hour are referred to as "macrobursts."

5.8.2 Location and Spatial Extent

A wind event is an atmospheric hazard, and thus has no geographic boundaries. It is typically a widespread event that can occur in all regions of the United States. However, thunderstorms are most common in the central and southern states because atmospheric conditions in those regions are favorable for generating these powerful storms. Also, the South Mountains Region typically experiences several straight-line wind events each year. These wind events can and have caused significant damage. It is assumed that the South Mountains Region has uniform exposure to a thunderstorm/wind event and the spatial extent of an impact could be large.

5.8.3 Historical Occurrences

Severe storms resulted in three disaster declarations in the South Mountains Region in 1977, 1995, and 1998.[7] According to NCDC, there have been 501 reported thunderstorm wind and high wind events since 1959 in the South Mountains Region.[8] These events caused nearly $8.8 million (2013 dollars) in damages. There were reports of nine injuries and two fatalities. **Table 5.13** summarizes this information. Detailed thunderstorm wind and high wind event reports, including date, magnitude, and associated damages for each event, are presented in the jurisdiction-specific annexes.[9]

TABLE 5.13: SUMMARY OF THUNDERSTORM / HIGH WIND OCCURRENCES IN THE SOUTH MOUNTAINS REGION

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Henderson County	**137**	**1/5**	**$2,721,411**
Flat Rock	0	0/0	$0
Fletcher	5	0/0	$89,554
Hendersonville	20	0/3	$67,280
Laurel Park	3	0/0	$22,028

[7]Not all of the participating counties were declared disaster areas for these storms. A complete listing of historical disaster declarations, including the affected counties, can be found in Section 4: *Hazard Profiles*.

[8] These thunderstorm events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is likely that additional thunderstorm events have occurred in the South Mountains Region. As additional local data becomes available, this hazard profile will be amended.

[9] The dollar amount of damages provided by NCDC is divided by the number of affected counties to reflect a damage estimate for the county.

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Mills River	8	0/0	$37,815
Unincorporated Area	101	1/2	$2,504,734
Polk County	**89**	**0/2**	**$272,416**
Columbus	16	0/2	$38,896
Saluda	3	0/0	$0
Tryon	7	0/0	$1,344
Unincorporated Area	63	0/0	$232,176
Rutherford County	**187**	**1/2**	**$3,519,278**
Bostic	6	0/0	$0
Chimney Rock Village	5	0/0	$0
Ellenboro	5	0/0	$1,344
Forest City	21	0/0	$544,184
Lake Lure	14	0/0	$2,728
Ruth	0	0/0	$0
Rutherfordton	42	1/0	$428,127
Spindale	5	0/0	$0
Unincorporated Area	89	0/2	$2,542,895
Transylvania County	**88**	**0/0**	**$2,239,535**
Brevard	20	0/0	$123,727
Rosman	4	0/0	$0
Unincorporated Area	64	0/0	$2,115,808
SOUTH MOUNTAINS REGION TOTAL	**501**	**2/9**	**$8,752,640**

Source: National Climatic Data Center

5.8.4 Probability of Future Occurrences

Given the high number of previous events, it is certain that wind events, including straight-line wind and thunderstorm wind, will occur in the future. This results in a probability level of highly likely (100 percent annual probability) for future wind events for the entire planning area.

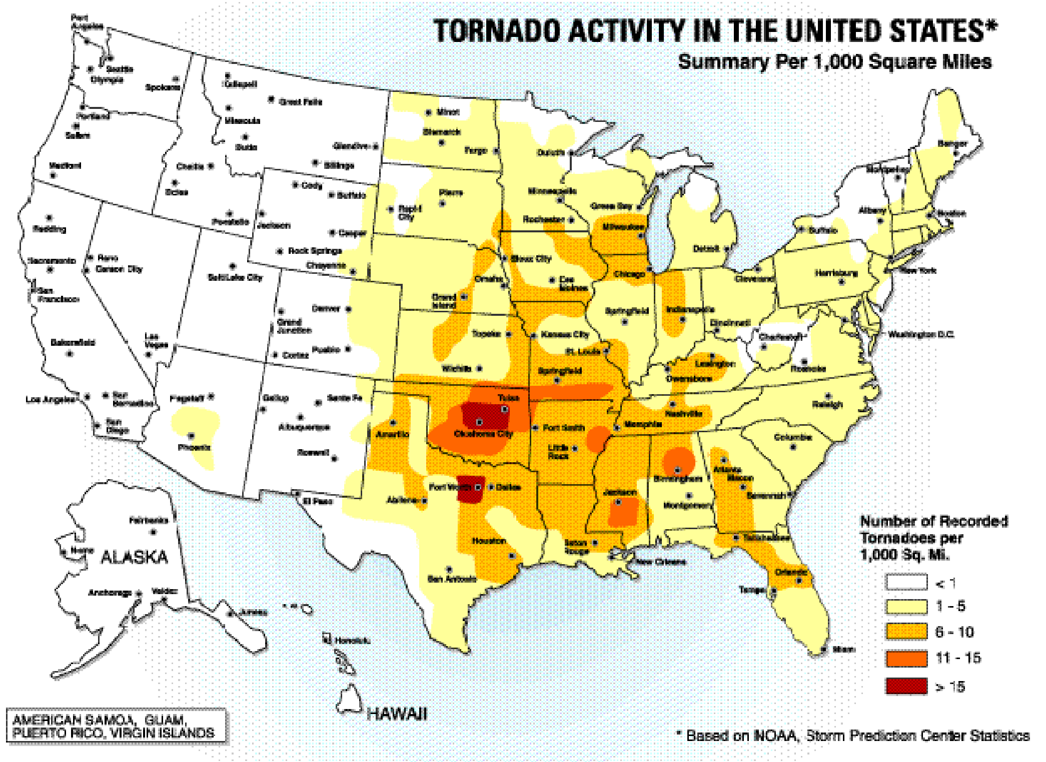
5.9 TORNADO

5.9.1 Background

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

Each year, an average of over 800 tornadoes is reported nationwide, resulting in an average of 80 deaths and 1,500 injuries.[10] According to the NOAA Storm Prediction Center (SPC), the highest concentration of tornadoes in the United States has been in Oklahoma, Texas, Kansas, and Florida respectively. Although the Great Plains region of the Central United States does favor the development of the largest and most dangerous tornadoes (earning the designation of "tornado alley"), Florida experiences the greatest number of tornadoes per square mile of all U.S. states (SPC, 2002). **Figure 5.6** shows tornado activity in the United States based on the number of recorded tornadoes per 1,000 square miles.

FIGURE 5.6: TORNADO ACTIVITY IN THE UNITED STATES



Source: Federal Emergency Management Agency

Tornadoes are more likely to occur during the months of March through May and are most likely to form in the late afternoon and early evening. Most tornadoes are a few dozen yards wide and touch down briefly, but even small short-lived tornadoes can inflict tremendous damage. Highly destructive tornadoes may carve out a path over a mile wide and several miles long.

The destruction caused by tornadoes ranges from light to inconceivable depending on the intensity, size, and duration of the storm. Typically, tornadoes cause the greatest damage to structures of light construction, including residential dwellings (particularly mobile homes). Tornadic magnitude is reported according to the Fujita and Enhanced Fujita Scales. Tornado magnitudes prior to 2005 were determined using the traditional version of the Fujita Scale (**Table 5.14**). Tornado magnitudes that were determined in 2005 and later were determined using the Enhanced Fujita Scale (**Table 5.15**).

[10] NOAA, 2009.

TABLE 5.14: THE FUJITA SCALE (EFFECTIVE PRIOR TO 2005)

F-SCALE NUMBER	INTENSITY	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 to 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 re-enforced concrete structures badly damaged.
F6	INCONCEIVABLE TORNADO	319–379 MPH	These winds are very unlikely. The small area of damage they might produce would probably not be recognizable along with the mess produced by F4 and F5 wind that would surround the F6 winds. Missiles, such as cars and refrigerators would do serious secondary damage that could not be directly identified as F6 damage. If this level is ever achieved, evidence for it might only be found in some manner of ground swirl pattern, for it may never be identifiable through engineering studies.

Source: National Weather Service

TABLE 5.15 THE ENHANCED FUJITA SCALE (EFFECTIVE 2005 AND LATER)

EF-SCALE NUMBER	INTENSITY PHRASE	3 SECOND GUST (MPH)	TYPE OF DAMAGE DONE
F0	GALE	65–85	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages to sign boards.
F1	MODERATE	86–110	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
F2	SIGNIFICANT	111–135	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
F3	SEVERE	136–165	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.
F4	DEVASTATING	166–200	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
F5	INCREDIBLE	Over 200	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel re-enforced concrete structures badly damaged.

Source: National Weather Service

5.9.2 Location and Spatial Extent

Tornadoes occur throughout the state of North Carolina, and thus in the South Mountains Region. Tornadoes typically impact a relatively small area, but damage may be extensive. Event locations are completely random and it is not possible to predict specific areas that are more susceptible to tornado strikes over time. Therefore, it is assumed that the South Mountains Region is uniformly exposed to this hazard.

5.9.3 Historical Occurrences

Tornadoes are a fairly rare occurrence in mountainous areas. However, they have and do occur in the South Mountains Region. Tornadoes have resulted in one disaster declaration in the South Mountains Region in 1989.[11] According to the National Climatic Data Center, there have been a total of 16 recorded tornado events in the South Mountains Region since 1973 (**Table 5.16**), resulting in over $3 million (2013 dollars) in property damages.[12] In addition, 10 injuries were reported. The magnitude of these tornadoes ranges from F0 to F4 in intensity, although an F5 event is possible. It is important to note that only tornadoes that have been reported are factored into this risk assessment. It is likely that a high number of occurrences have gone unreported over the past 63 years. Detailed information on historical tornado events can be found in the jurisdiction-specific annexes.

[11] A complete listing of historical disaster declarations can be found in Section 4: *Hazard Profiles*.
[12] These tornado events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is likely that additional tornadoes have occurred in the South Mountains Region. As additional local data becomes available, this hazard profile will be amended.

TABLE 5.16: SUMMARY OF TORNADO OCCURRENCES IN THE SOUTH MOUNTAINS REGION

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Henderson County	**3**	**0/0**	**$1,227,209**
Flat Rock	0	0/0	$0
Fletcher	0	0/0	$0
Hendersonville	0	0/0	$0
Laurel Park	0	0/0	$0
Mills River	0	0/0	$0
Unincorporated Area	3	0/0	$1,227,209
Polk County	**2**	**0/0**	**$213,490**
Columbus	0	0/0	$0
Saluda	0	0/0	$0
Tryon	0	0/0	$0
Unincorporated Area	2	0/0	$213,490
Rutherford County	**8**	**0/10**	**$712,488**
Bostic	0	0/0	$0
Chimney Rock Village	0	0/0	$0
Ellenboro	1	0/10	$0
Forest City	2	0/0	$74,266
Lake Lure	0	0/0	$0
Ruth	0	0/0	$0
Rutherfordton	1	0/0	$0
Spindale	0	0/0	$0
Unincorporated Area	4	0/0	$638,222
Transylvania County	**3**	**0/0**	**$853,066**
Brevard	0	0/0	$0
Rosman	0	0/0	$0
Unincorporated Area	3	0/0	$853,066
SOUTH MOUNTAINS REGION TOTAL	**16**	**0/10**	**$3,006,253**

Source: National Climatic Data Center

5.9.4 Probability of Future Occurrences

According to historical information, tornado events are not an annual occurrence for the region. Furthermore, the mountainous terrain of the region makes tornadoes a rare occurrence. While the majority of the reported tornado events are small in terms of size, intensity, and duration, they do pose a significant threat should the South Mountains Region experience a direct tornado strike. The probability of future tornado occurrences affecting the South Mountains Region is possible (1 to 10 percent annual probability).

5.10 WINTER STORM AND FREEZE

5.10.1 Background

A winter storm can range from a moderate snow over a period of a few hours to blizzard conditions with blinding wind-driven snow that lasts for several days. Events may include snow, sleet, freezing rain, or a mix of these wintry forms of precipitation. Some winter storms might be large enough to affect several states, while others might affect only localized areas. Occasionally, heavy snow might also cause significant property damages, such as roof collapses on older buildings.

All winter storm events have the potential to present dangerous conditions to the affected area. Larger snowfalls pose a greater risk, reducing visibility due to blowing snow and making driving conditions treacherous. A heavy snow event is defined by the National Weather Service as an accumulation of 4 of more inches in 12 hours or less. A blizzard is the most severe form of winter storm. It combines low temperatures, heavy snow, and winds of 35 miles per hour or more, which reduces visibility to a quarter mile or less for at least 3 hours. Winter storms are often accompanied by sleet, freezing rain, or an ice storm. Such freeze events are particularly hazardous as they create treacherous surfaces.

Ice storms are defined as storms with significant amounts of freezing rain and are a result of cold air damming (CAD). CAD is a shallow, surface-based layer of relatively cold, stably-stratified air entrenched against the eastern slopes of the Appalachian Mountains. With warmer air above, falling precipitation in the form of snow melts, then becomes either super-cooled (liquid below the melting point of water) or re-freezes. In the former case, super-cooled droplets can freeze on impact (freezing rain), while in the latter case, the re-frozen water particles are ice pellets (or sleet). Sleet is defined as partially frozen raindrops or refrozen snowflakes that form into small ice pellets before reaching the ground. They typically bounce when they hit the ground and do not stick to the surface. However, it does accumulate like snow, posing similar problems and has the potential to accumulate into a layer of ice on surfaces. Freezing rain, conversely, usually sticks to the ground, creating a sheet of ice on the roadways and other surfaces. All of the winter storm elements – snow, low temperatures, sleet, ice, etcetera – have the potential to cause significant hazard to a community. Even small accumulations can down power lines and trees limbs and create hazardous driving conditions. Furthermore, communication and power may be disrupted for days.

5.10.2 Location and Spatial Extent

Nearly the entire continental United States is susceptible to winter storm and freeze events. Some ice and winter storms may be large enough to affect several states, while others might affect limited, localized areas. The degree of exposure typically depends on the normal expected severity of local winter weather. The South Mountains Region is accustomed to severe winter weather conditions and frequently receives winter weather during the winter months. Given the atmospheric nature of the hazard, the entire region has uniform exposure to a winter storm.

5.10.3 Historical Occurrences

Winter weather has resulted in three disaster declarations in the South Mountains Region. This includes the Blizzard of 1996, one subsequent 1996 winter storm, and a severe ice storm in 2002.[13] According to the National Climatic Data Center, there have been a total of 303 recorded winter storm events in the South Mountains Region since 1993 (**Table 5.17**).[14] These events resulted in nearly $53.9 million (2013 dollars) in damages. Detailed information on the recorded winter storm events can be found in the jurisdiction-specific annexes.[15]

TABLE 5.17: SUMMARY OF WINTER STORM EVENTS IN THE SOUTH MOUNTAINS REGION

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Henderson County	91	0/0	$1,209,621
Polk County	64	0/0	$15,988,915
Rutherford County	61	0/0	$15,988,915
Transylvania County	87	0/0	$20,680,523
SOUTH MOUNTAINS REGION TOTAL	**303**	**2/10[16]**	**$53,867,974**

Source: National Climatic Data Center

There have been several severe winter weather events in the South Mountains Region. The text below describes one of the major events and associated impacts on the region. Similar impacts can be expected with severe winter weather.

1996 Winter Storm

This storm left two feet of snow and several thousand citizens without power for up to nine days. Although shelters were opened, some roads were impassible for up to four days. This event caused considerable disruption to business, industry, schools, and government services.

Winter storms throughout the planning area have several negative externalities including hypothermia, cost of snow and debris cleanup, business and government service interruption, traffic accidents, and power outages. Furthermore, citizens may resort to using inappropriate heating devices that could to fire or an accumulation of toxic fumes.

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13 Not all of the participating counties were declared disaster areas for these events. A complete listing of historical disaster declarations, including the affected counties, can be found in Section 4: *Hazard Profiles*.

14 These ice and winter storm events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is likely that additional winter storm conditions have affected the South Mountains Region. In addition, the 701 are reported by county, so many of these storms likely affected all of the counties.

15 The dollar amount of damages provided by NCDC is divided by the number of affected counties to reflect a damage estimate for the county.

16 No deaths/injuries were reported at the county level for any events, however the winter storm of 1993 caused 2 deaths and 10 injuries across the state, so these totals were included in the analysis.

5.10.4 Probability of Future Occurrences

Winter storm events will remain a regular occurrence in the South Mountains Region due to location and elevation. According to historical information, the South Mountains Region generally experiences multiple winter storm events each year. Therefore, the annual probability is highly likely (100 percent).

Geologic Hazards

5.11 EARTHQUAKE

5.11.1 Background

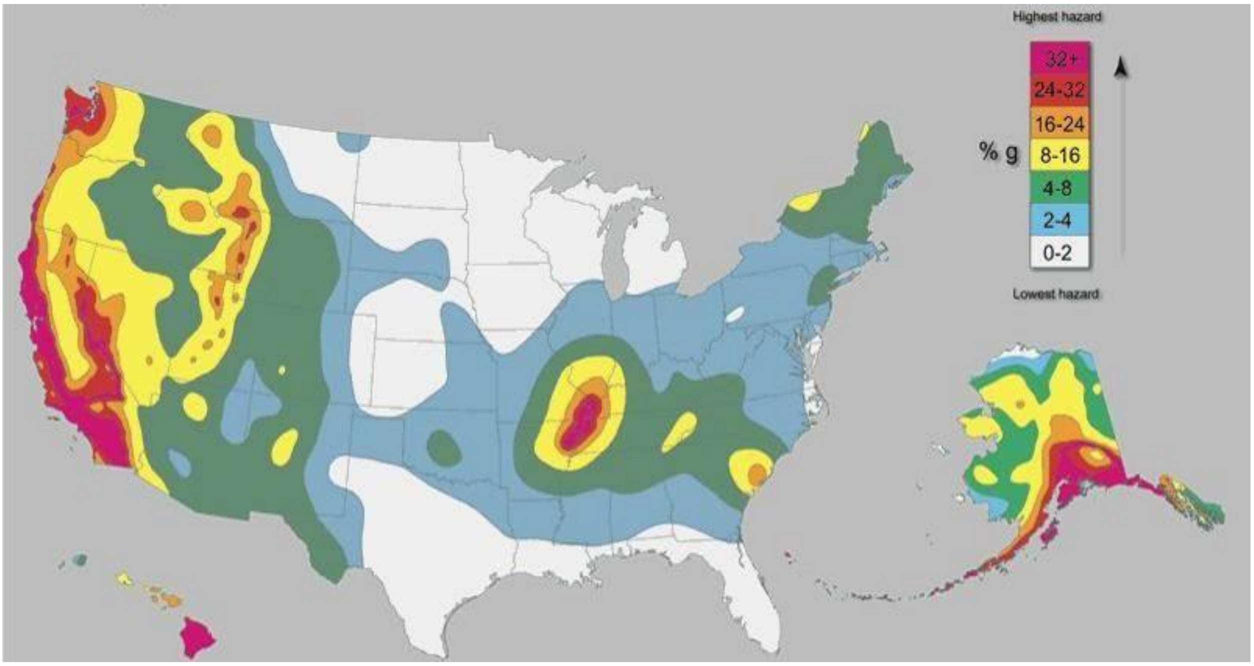
An earthquake is movement or trembling of the ground produced by sudden displacement of rock in the Earth's crust. Earthquakes result from crustal strain, volcanism, landslides, or the collapse of caverns. Earthquakes can affect hundreds of thousands of square miles, cause damage to property measured in the tens of billions of dollars, result in loss of life and injury to hundreds of thousands of persons, and disrupt the social and economic functioning of the affected area.

Most property damage and earthquake-related deaths are caused by the failure and collapse of structures due to ground shaking. The level of damage depends upon the amplitude and duration of the shaking, which are directly related to the earthquake size, distance from the fault, site, and regional geology. Other damaging earthquake effects include landslides, the down-slope movement of soil and rock (mountain regions and along hillsides), and liquefaction, in which ground soil loses the ability to resist shear and flows much like quick sand. In the case of liquefaction, anything relying on the substrata for support can shift, tilt, rupture, or collapse.

Most earthquakes are caused by the release of stresses accumulated as a result of the rupture of rocks along opposing fault planes in the Earth’s outer crust. These fault planes are typically found along borders of the Earth's 10 tectonic plates. The areas of greatest tectonic instability occur at the perimeters of the slowly moving plates, as these locations are subjected to the greatest strains from plates traveling in opposite directions and at different speeds. Deformation along plate boundaries causes strain in the rock and the consequent buildup of stored energy. When the built-up stress exceeds the rocks' strength a rupture occurs. The rock on both sides of the fracture is snapped, releasing the stored energy and producing seismic waves, generating an earthquake.

The greatest earthquake threat in the United States is along tectonic plate boundaries and seismic fault lines located in the central and western states; however, the Eastern United State does face moderate risk to less frequent, less intense earthquake events. **Figure 5.7** shows relative seismic risk for the United States.

FIGURE 5.7: UNITED STATES EARTHQUAKE HAZARD MAP



Source: United States Geological Survey

Earthquakes are measured in terms of their magnitude and intensity. Magnitude is measured using the Richter Scale, an open-ended logarithmic scale that describes the energy release of an earthquake through a measure of shock wave amplitude (**Table 5.18**). Each unit increase in magnitude on the Richter Scale corresponds to a 10-fold increase in wave amplitude, or a 32-fold increase in energy. Intensity is most commonly measured using the Modified Mercalli Intensity (MMI) Scale based on direct and indirect measurements of seismic effects. The scale levels are typically described using roman numerals, ranging from “I” corresponding to imperceptible (instrumental) events to “XII” for catastrophic (total destruction). A detailed description of the Modified Mercalli Intensity Scale of earthquake intensity and its correspondence to the Richter Scale is given in **Table 5.19**.

TABLE 5.18: RICHTER SCALE

RICHTER MAGNITUDES	EARTHQUAKE EFFECTS
< 3.5	Generally not felt, but recorded.
3.5 - 5.4	Often felt, but rarely causes damage.
5.4 - 6.0	At most slight damage to well-designed buildings. Can cause major damage to poorly constructed buildings over small regions.
6.1 - 6.9	Can be destructive in areas up to about 100 kilometers across where people live.
7.0 - 7.9	Major earthquake. Can cause serious damage over larger areas.
8 or >	Great earthquake. Can cause serious damage in areas several hundred kilometers across.

Source: Federal Emergency Management Agency

TABLE 5.19: MODIFIED MERCALLI INTENSITY SCALE FOR EARTHQUAKES

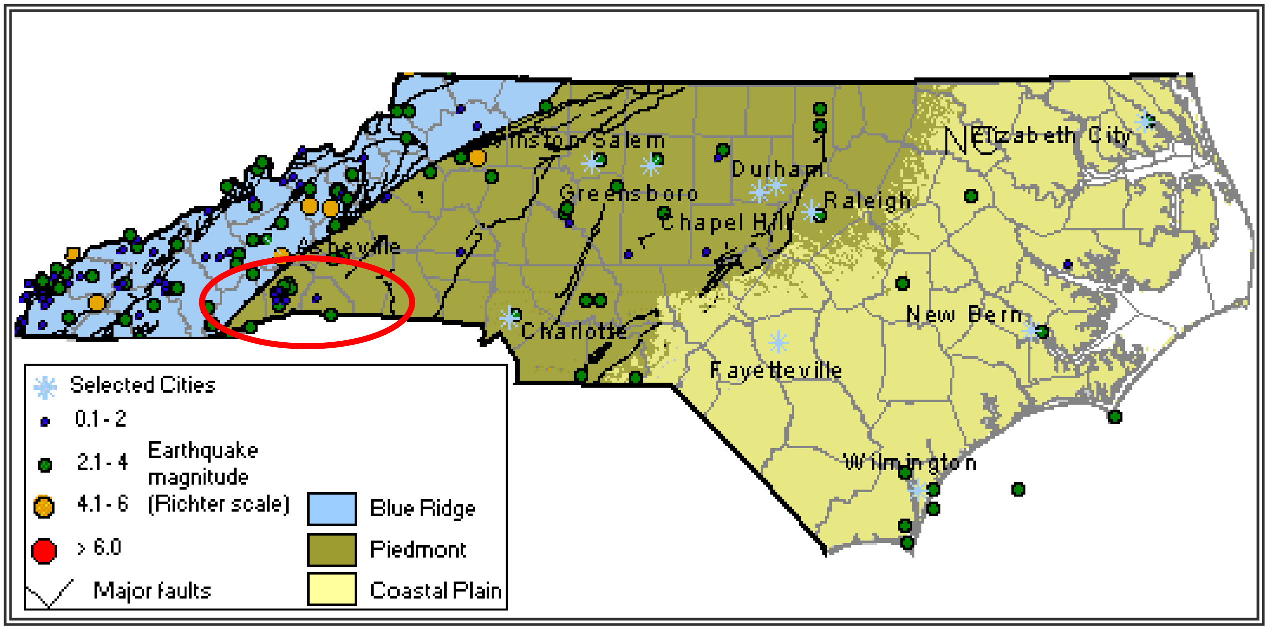
SCALE	INTENSITY	DESCRIPTION OF EFFECTS	CORRESPONDING RICHTER SCALE MAGNITUDE
I	INSTRUMENTAL	Detected only on seismographs.	
II	FEEBLE	Some people feel it.	< 4.2
III	SLIGHT	Felt by people resting; like a truck rumbling by.	
IV	MODERATE	Felt by people walking.	
V	SLIGHTLY STRONG	Sleepers awake; church bells ring.	< 4.8
VI	STRONG	Trees sway; suspended objects swing, objects fall off shelves.	< 5.4
VII	VERY STRONG	Mild alarm; walls crack; plaster falls.	< 6.1
VIII	DESTRUCTIVE	Moving cars uncontrollable; masonry fractures, poorly constructed buildings damaged.	
IX	RUINOUS	Some houses collapse; ground cracks; pipes break open.	< 6.9
X	DISASTROUS	Ground cracks profusely; many buildings destroyed; liquefaction and landslides widespread.	< 7.3
XI	VERY DISASTROUS	Most buildings and bridges collapse; roads, railways, pipes and cables destroyed; general triggering of other hazards.	< 8.1
XII	CATASTROPHIC	Total destruction; trees fall; ground rises and falls in waves.	> 8.1

Source: Federal Emergency Management Agency

5.11.2 Location and Spatial Extent

Approximately two-thirds of North Carolina is subject to earthquakes, with the western and southeast region most vulnerable to a very damaging earthquake. The state is affected by both the Charleston Fault in South Carolina and New Madrid Fault in Tennessee. Both of these faults have generated earthquakes measuring greater than 8 on the Richter Scale during the last 200 years. In addition, there are several smaller fault lines throughout North Carolina. **Figure 5.8** is a map showing geological and seismic information for North Carolina.

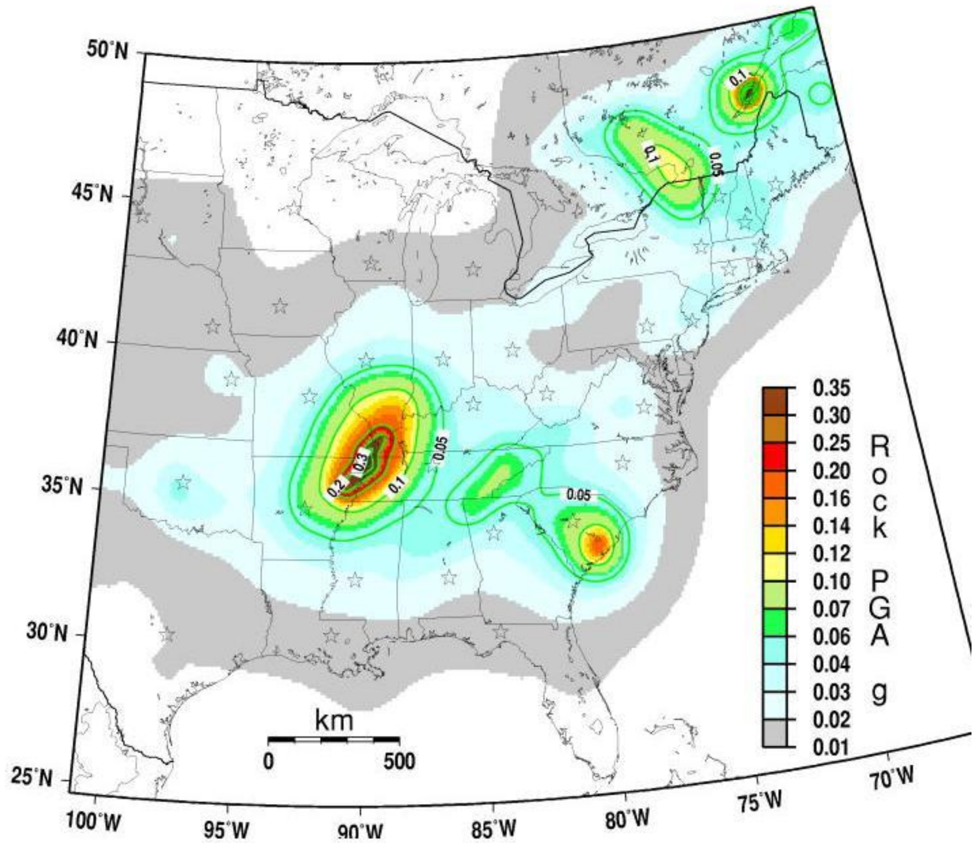
FIGURE 5.8: GEOLOGICAL AND SEISMIC INFORMATION FOR NORTH CAROLINA



Source: North Carolina Geological Survey

Figure 5.9 shows the intensity level associated with the South Mountains Region, based on the national USGS map of peak acceleration with 10 percent probability of exceedance in 50 years. It is the probability that ground motion will reach a certain level during an earthquake. The data show peak horizontal ground acceleration (the fastest measured change in speed, for a particle at ground level that is moving horizontally due to an earthquake) with a 10 percent probability of exceedance in 50 years. The map was compiled by the U.S. Geological Survey (USGS) Geologic Hazards Team, which conducts global investigations of earthquake, geomagnetic, and landslide hazards. According to this map, all of the South Mountains Region lies within an approximate zone of level “4” to “6” ground acceleration. This indicates that the region as a whole exists within an area of moderate seismic risk.

FIGURE 5.9: PEAK ACCELERATION WITH 10 PERCENT PROBABILITY OF EXCEEDANCE IN 50 YEARS



Source: USGS, 2008

5.11.3 Historical Occurrences

At least 135 earthquakes are known to have affected the South Mountains Region since 1886. The strongest of these measured a VI on the Modified Mercalli Intensity (MMI) scale. **Table 5.20** provides a summary of earthquake events reported by the National Geophysical Data Center between 1638 and 1985. A detailed occurrence of each event including the date, distance from the epicenter, magnitude, and Modified Mercalli Intensity (if known) can be found in the jurisdiction-specific annexes.[17]

TABLE 5.20: SUMMARY OF SEISMIC ACTIVITY IN THE SOUTH MOUNTAINS REGION

Location	Number of Occurrences	Greatest MMI Reported	Richter Scale Equivalent
Henderson County	**60**	**VI**	**< 5.4**
Flat Rock	6	VI	< 5.4
Fletcher	5	IV	< 4.8
Hendersonville	10	VI	< 5.4
Laurel Park	0	--	--

[17] Due to reporting mechanisms, not all earthquakes events were recorded during this time. Furthermore, some are missing data, such as the epicenter location, due to a lack of widely used technology. In these instances, a value of "unknown" is reported.

Location	Number of Occurrences	Greatest MMI Reported	Richter Scale Equivalent
Mills River	1	IV	< 4.8
Unincorporated Area	38	VI	< 5.4
Polk County	**18**	**V**	**< 4.8**
Columbus	3	IV	< 4.8
Saluda	5	V	< 4.8
Tryon	4	IV	< 4.8
Unincorporated Area	6	IV	< 4.8
Rutherford County	**22**	**V**	**< 4.8**
Bostic	0	--	--
Chimney Rock Village	3	V	< 4.8
Ellenboro	1	IV	< 4.8
Forest City	2	IV	< 4.8
Lake Lure	2	IV	< 4.8
Ruth	0	--	--
Rutherfordton	4	V	< 4.8
Spindale	3	IV	< 4.8
Unincorporated Area	7	V	< 4.8
Transylvania County	**35**	**V**	**< 4.8**
Brevard	11	V	< 4.8
Rosman	5	V	< 4.8
Unincorporated Area	19	V	< 4.8
SOUTH MOUNTAINS REGION TOTAL	**135**	**VI**	**< 5.4**

Source: National Geophysical Data Center

In addition to those earthquakes specifically affecting the South Mountains Region, a list of earthquakes that have caused damage throughout North Carolina is presented below in **Table 5.21.**

TABLE 5.21: EARTHQUAKES WHICH HAVE CAUSED DAMAGE IN NORTH CAROLINA

Date	Location	Richter Scale (Magnitude)	MMI (Intensity)	MMI in North Carolina
12/16/1811 - 1	NE Arkansas	8.5	XI	VI
12/16/1811 - 2	NE Arkansas	8.0	X	VI
12/18/1811 - 3	NE Arkansas	8.0	X	VI
01/23/1812	New Madrid, MO	8.4	XI	VI
02/071812	New Madrid, MO	8.7	XII	VI
04/29/1852	Wytheville, VA	5.0	VI	VI
08/31/1861	Wilkesboro, NC	5.1	VII	VII
12/23/1875	Central Virginia	5.0	VII	VI
08/31/1886	Charleston, SC	7.3	X	VII
05/31/1897	Giles County, VA	5.8	VIII	VI
01/01/1913	Union County, SC	4.8	VII	VI
02/21/1916*	Asheville, NC	5.5	VII	VII
07/08/1926	Mitchell County, NC	5.2	VII	VII
11/03/1928*	Newport, TN	4.5	VI	VI

Date	Location	Richter Scale (Magnitude)	MMI (Intensity)	MMI in North Carolina
05/13/1957 *	McDowell County, NC	4.1	VI	VI
07/02/1957*	Buncombe County, NC	3.7	VI	VI
11/24/1957*	Jackson County, NC	4.0	VI	VI
10/27/1959 **	Chesterfield, SC	4.0	VI	VI
07/13/1971	Newry, SC	3.8	VI	VI
11/30/1973*	Alcoa, TN	4.6	VI	VI
11/13/1976	Southwest Virginia	4.1	VI	VI
05/05/1981*	Henderson County, NC	3.5	VI	VI

*This event is accounted for in the South Mountains Region occurrences.

** Conflicting reports on this event, intensity in North Carolina could have been either V or VI

Source: This information compiled by Dr. Kenneth B. Taylor and provided by Tiawana Ramsey of NCEM. Information was compiled from the National Earthquake Center, Earthquakes of the US by Carl von Hake (1983), and a compilation of newspaper reports in the Eastern Tennessee Seismic Zone compiled by Arch Johnston, CERI, Memphis State University (1983).

5.11.4 Probability of Future Occurrences

The probability of significant, damaging earthquake events affecting the South Mountains Region is unlikely. However, it is likely that future earthquakes resulting in light to moderate perceived shaking and damages ranging from none to very light will affect the region. The annual probability level for the region is estimated between 1 and 10 percent (possible).

5.12 LANDSLIDE

5.12.1 Background

A landslide is the downward and outward movement of slope-forming soil, rock, and vegetation, which is driven by gravity. Landslides may be triggered by both natural and human-caused changes in the environment, including heavy rain, rapid snow melt, steepening of slopes due to construction or erosion, earthquakes, volcanic eruptions, and changes in groundwater levels.

There are several types of landslides: rock falls, rock topple, slides, and flows. Rock falls are rapid movements of bedrock, which result in bouncing or rolling. A topple is a section or block of rock that rotates or tilts before falling to the slope below. Slides are movements of soil or rock along a distinct surface of rupture, which separates the slide material from the more stable underlying material. Mudflows, sometimes referred to as mudslides, mudflows, lahars or debris avalanches, are fast-moving rivers of rock, earth, and other debris saturated with water. They develop when water rapidly accumulates in the ground, such as heavy rainfall or rapid snowmelt, changing the soil into a flowing river of mud or "slurry." Slurry can flow rapidly down slopes or through channels and can strike with little or no warning at avalanche speeds. Slurry can travel several miles from its source, growing in size as it picks up trees, cars, and other materials along the way. As the flows reach flatter ground, the mudflow spreads over a broad area where it can accumulate in thick deposits.

Landslides are typically associated with periods of heavy rainfall or rapid snow melt and tend to worsen the effects of flooding that often accompanies these events. In areas burned by forest and brush fires, a lower threshold of precipitation may initiate landslides. Some landslides move slowly and cause damage gradually, whereas others move so rapidly that they can destroy property and take lives suddenly and unexpectedly.

Among the most destructive types of debris flows are those that accompany volcanic eruptions. A spectacular example in the United States was a massive debris flow resulting from the 1980 eruptions of Mount St. Helens, Washington. Areas near the bases of many volcanoes in the Cascade Mountain Range of California, Oregon, and Washington are at risk from the same types of flows during future volcanic eruptions.

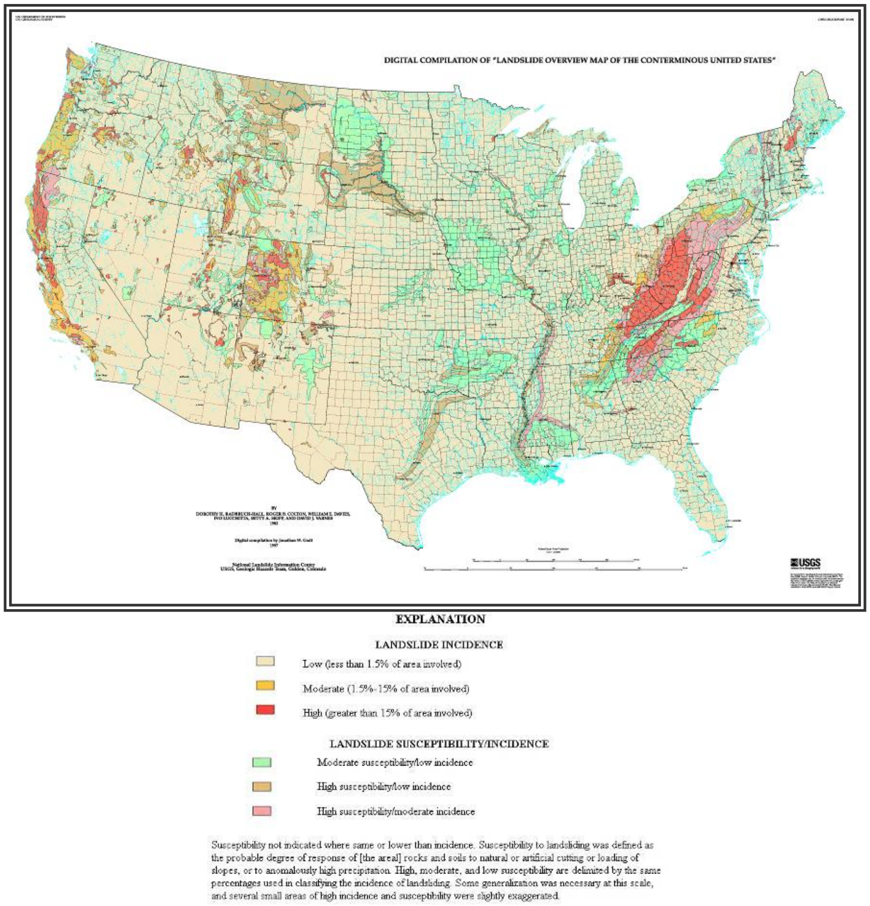
Areas that are generally prone to landslide hazards include previous landslide areas, the bases of steep slopes, the bases of drainage channels, and developed hillsides where leach-field septic systems are used. Areas that are typically considered safe from landslides include areas that have not moved in the past, relatively flat-lying areas away from sudden changes in slope, and areas at the top or along ridges set back from the tops of slopes.

According to the United States Geological Survey, each year landslides cause $5.1 billion (2009 dollars) in damage and between 25 and 50 deaths in the United States.[18] **Figure 5.10** delineates areas where large numbers of landslides have occurred and areas that are susceptible to landsliding in the conterminous United States.[19]

[18] United States Geological Survey (USGS). United States Department of the Interior. "Landslide Hazards – A National Threat." 2005.

[19] This map layer is provided in the U.S. Geological Survey Professional Paper 1183, Landslide Overview Map of the Conterminous United States, available online at: http://landslides.usgs.gov/html_files/landslides/nationalmap/national.html.

FIGURE 5.10: LANDSLIDE OVERVIEW MAP OF THE CONTERMINOUS UNITED STATES



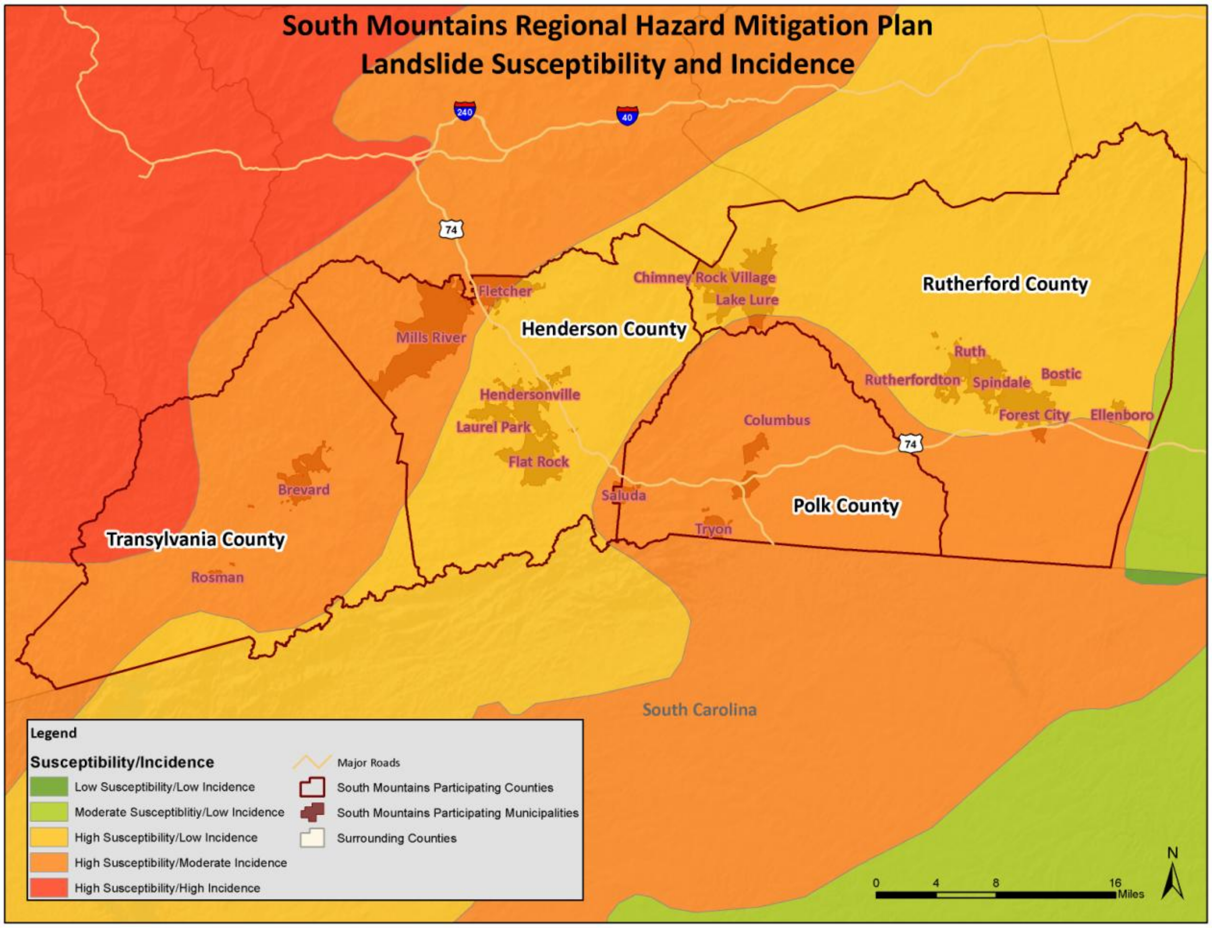
Source: USGS

5.12.2 Location and Spatial Extent

Landslides occur along steep slopes when the pull of gravity can no longer be resisted (often due to heavy rain throughout the Appalachian Mountain region). Human development can also exacerbate risk by building on previously undevelopable steep slopes and constructing roads by cutting through mountains. Landslides are possible throughout the South Mountains Region.

According to **Figure 5.11** below, some areas of the region have high landslide activity. The majority of the region has a moderate incidence occurrence rate. There is high susceptibility throughout the region.

FIGURE 5.11: LANDSLIDE SUSCEPTIBILITY AND INCIDENCE MAP OF THE SOUTH MOUNTAINS REGION



Source: USGS

5.12.3 Historical Occurrences

Steep topography throughout the South Mountains Region makes the planning area susceptible to landslides. Most landslides are caused by heavy rainfall in the area. Building on steep slopes that was not previously possible also contributes to risk. **Table 5.22** presents a summary of the landslide occurrence events as provided by the North Carolina Geological Survey[20]. The locations of the landslide events presented in the aforementioned tables are presented in **Figure 5.12**. Some incidence mapping has also been completed throughout the western portion of North Carolina though it is not complete. Therefore, it should be noted that many more incidents than what is reported are likely to have occurred in the region.

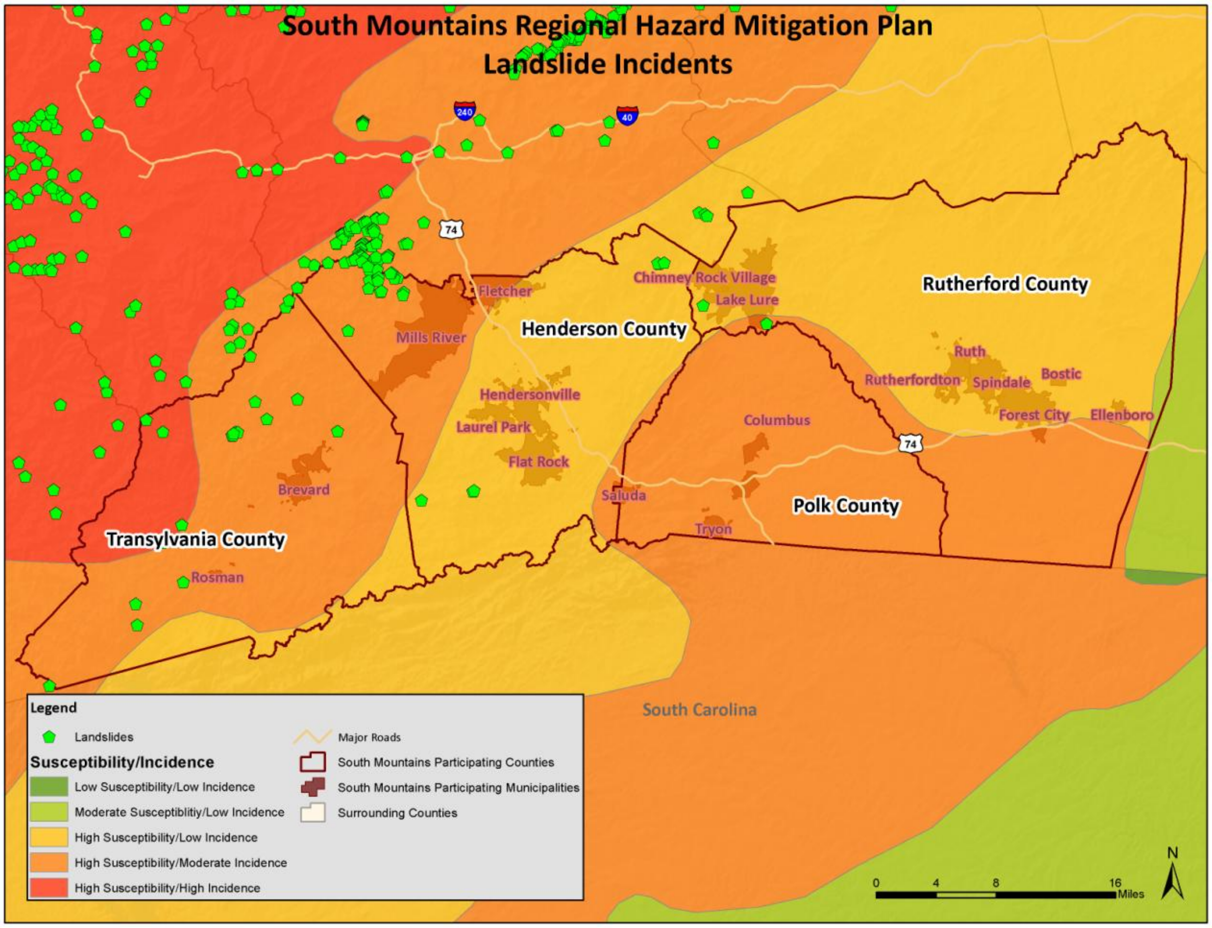
[20] It should be noted that the North Carolina Geological Survey (NCGS) emphasized the dataset provided was incomplete. Therefore, there may be additional historical landslide occurrences. Furthermore, dates were not included for every event. The earliest date reported was 1940. No damage information was provided by NCGS.

TABLE 5.22: SUMMARY OF LANDSLIDE ACTIVITY IN THE SOUTH MOUNTAINS REGION

Location	Number of Occurrences
Henderson County	**28**
Flat Rock	0
Fletcher	0
Hendersonville	0
Laurel Park	0
Mills River	0
Unincorporated Area	28
Polk County	**0**
Columbus	0
Saluda	0
Tryon	0
Unincorporated Area	0
Rutherford County	**2**
Bostic	0
Chimney Rock Village	0
Ellenboro	0
Forest City	0
Lake Lure	0
Ruth	0
Rutherfordton	0
Spindale	0
Unincorporated Area	2
Transylvania County	**17**
Brevard	0
Rosman	0
Unincorporated Area	17
SOUTH MOUNTAINS REGION TOTAL	**47**

Source: North Carolina Geological Survey

FIGURE 5.12: LOCATION OF PREVIOUS LANDSLIDE OCCURRENCES IN THE SOUTH MOUNTAINS REGION



Source: North Carolina Geological Survey

The National Climatic Data Center also reported three landslide events in the South Mountains Region.

Henderson and Transylvania County — September 8, 2004
The remnants of Hurricane Frances brought very heavy rainfall to western North Carolina, resulting in widespread severe flooding across the mountains and foothills (Haywood, Transylvania, and Henderson Counties). Flooding developed along Shaws Creek in Henderson County. Flooding was widespread and severe across much of the area, with most creeks and streams in flood. Hundreds of homes and businesses were damaged or destroyed across the area, necessitating a number of evacuations and rescues. Numerous roads and bridges were washed out as well. Resulting landslides caused $1,522,235 (2013 dollars) of property damage in Henderson County and $1,522,235 (2013 dollars) of property damage in Transylvania County.

Transylvania County — July 14, 2005
A mudslide off of highway 64 between Rosman and Lake Toxaway moved a mobile home from its foundation, rendering it uninhabitable. There was a total of $63,339 (2013 dollars) of property damage.

Henderson County — December 1, 2010
After 6 to 10 inches of rain fell in around 24 hours, a landslide developed near the Holiday Drive area, pushing a small house off its foundation. There was a total of $81,955 (2013 dollars) of property damage.

The information below identifies additional historical information reported in the previous hazard mitigation plans.

Henderson County
In the past in the unincorporated areas of the county, there have been major injuries resulting from landslides but no deaths. Additionally, there has been damage to property and infrastructure and a loss of utilities. However, this damage has been limited to a small portion of the county known as Bat Cave. The Town of Laurel Park also has areas identified as having landslide events and areas prone to landslides; however, there has been no major damage to property, no loss of life, and no major injuries. There has been no landslide damage in any of the other incorporated areas of Henderson County.

During September 2004 when Hurricane Frances and Tropical Storm Ivan moved through Henderson County, landsides caused significant infrastructure damage and the rerouting of neighborhood access. The most significant of the sections identified is the area near US Highway 74 and NC Highway 9 (Bat Cave). Bear Rock Estates was also heavily damaged by a 1,200-foot landside that resulted from Hurricane Frances. $2.3 million in federal and state money was used to repair approximately 130 sites across the county, including the Bear Rock slide.

In 1995, excessive rains from a severe thunderstorm/windstorm caused a mudslide which led to the destruction of a home that was not built to county code according to emergency officials. Two people received minor injuries during this incident. Additionally, there was mud and debris that covered parts of US Highway 74 and NC Highway 9 as well as the bridge that led to Chimney Rock. According to the utility company, debris from the slide and storm downed power lines and led to power outages. The storm and slide caused a total of approximately $2 million in property and infrastructure damage in the area.

Polk County
In 2002 and 2003, heavy rains combined with development on and along steep slopes caused landslides on Hogback Mountain, White Oak Mountain, Holbert's Cove, Green River Cove, and Highway 176. These landslides closed down portions of state roads and cost approximately $210,000 to repair.

Rutherford County
In Rutherford County there have been very few incidents of landslides. Most have occurred along road cuts and have been caused during periods of severe storms.

Transylvania County
In the past in the unincorporated areas of the county, there has been one residential structure destroyed and no damage to commercial or industrial property because of landslides. In addition there have been no reported deaths or injuries. However, the county has received significant damage to its infrastructure because of landslides, specifically in the 2004 hurricane season. There has been no landslide damage in any of the incorporated areas of Transylvania County.

The most significant issues the county faces with landslides are road closures, as was seen during Hurricane Frances and Tropical Storm Ivan. These storms spawned numerous slides in the unincorporated areas of Transylvania County; however, two slides were considered significant events. First, a slide covered portions of Sky Drive causing the road to give-way, resulting in $400,000 in damage. The second major event was on Cardinal Drive West where a slide caused $300,000 in damages to infrastructure. The slide not only resulted in road damages, but the debris from the slide flowed into Cardinal Lake causing debris blockage issues. The NCDOT has repaired and stabilized both roads that were damaged.

5.12.4 Probability of Future Occurrences

Based on historical information and the USGS susceptibility index, the probability of future landslide events is likely (10 to 100 percent annual probability). Local conditions may become more favorable for landslides due to heavy rain, for example. This would increase the likelihood of occurrence. It should also be noted that some areas in the South Mountains Region have greater risk than others given factors such as steepness on slope and modification of slopes.

Hydrologic Hazards

5.13 DAM AND LEVEE FAILURE

5.13.1 Background

Worldwide interest in dam and levee safety has risen significantly in recent years. Aging infrastructure, new hydrologic information, and population growth in floodplain areas downstream from dams and near levees have resulted in an increased emphasis on safety, operation, and maintenance.

There are approximately 80,000 dams in the United States today, the majority of which are privately owned. Other owners include state and local authorities, public utilities, and federal agencies. The benefits of dams are numerous: they provide water for drinking, navigation, and agricultural irrigation. Dams also provide hydroelectric power, create lakes for fishing and recreation, and save lives by preventing or reducing floods.

Though dams have many benefits, they also can pose a risk to communities if not designed, operated, and maintained properly. In the event of a dam failure, the energy of the water stored behind even a small dam is capable of causing loss of life and great property damage if development exists downstream. If a levee breaks, scores of properties may become submerged in floodwaters and residents may become trapped by rapidly rising water. The failure of dams and levees has the potential to place large numbers of people and great amounts of property in harm’s way.

5.13.2 Location and Spatial Extent

The North Carolina Division of Land Resources provides information on dams, including a hazard potential classification. There are three hazard classifications—high, intermediate, and low—that correspond to qualitative descriptions and quantitative guidelines. **Table 5.23** explains these classifications.

TABLE 5.23: NORTH CAROLINA DAM HAZARD CLASSIFICATIONS

Hazard Classification	Description	Quantitative Guidelines
Low	Interruption of road service, low volume roads	Less than 25 vehicles per day
	Economic damage	Less than $30,000
Intermediate	Damage to highways, Interruption of service	25 to less than 250 vehicles per day
	Economic damage	$30,000 to less than $200,000
High	Loss of human life*	Probable loss of 1 or more human lives
	Economic damage	More than $200,000
	*Probable loss of human life due to breached roadway or bridge on or below the dam.	250 or more vehicles per day

Source: North Carolina Division of Land Resources

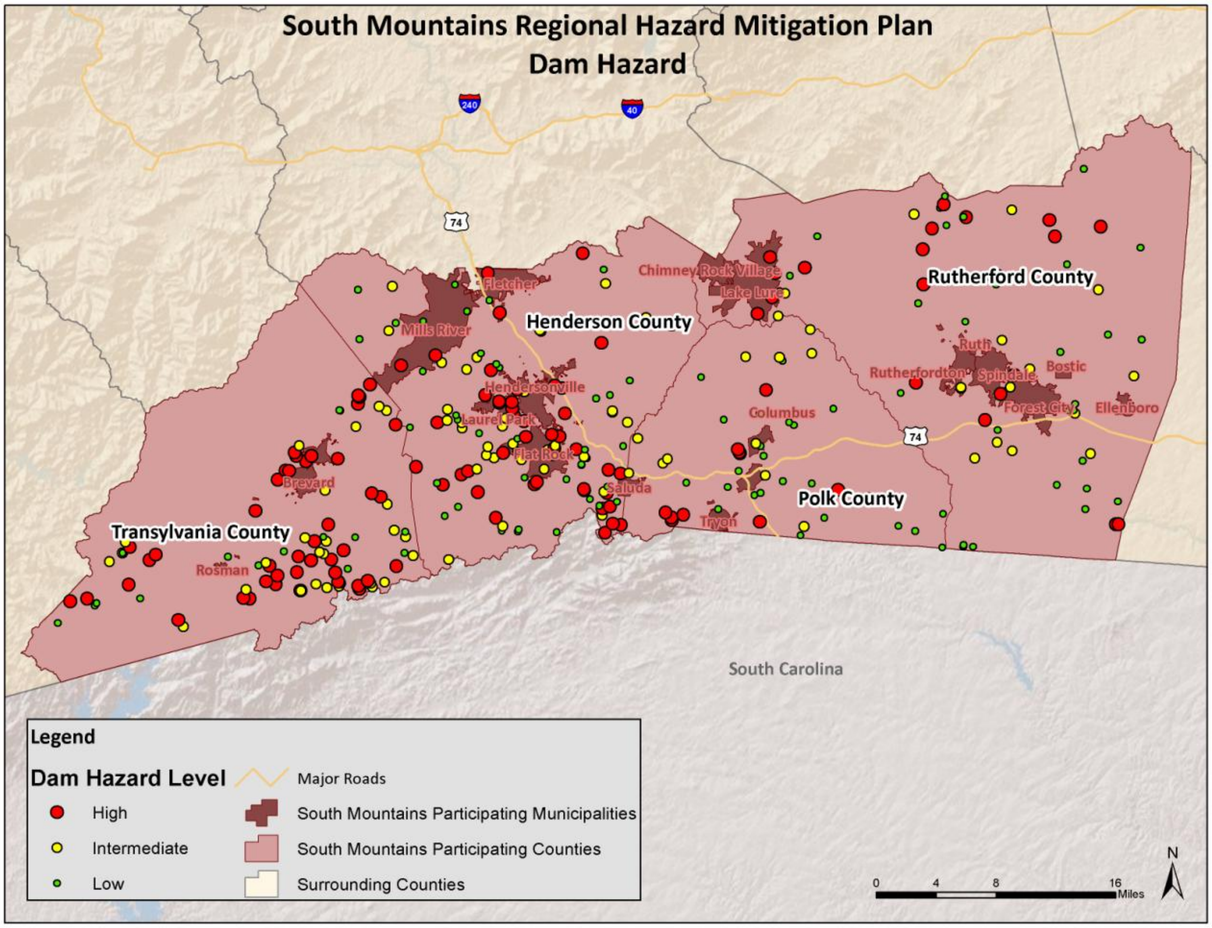
According to the North Carolina Division of Energy, Mineral, and Land Resources, there are 324 dams in the South Mountains Region.[21] **Figure 5.13** shows the dam location and the corresponding hazard ranking for each. Of these dams, 118 are classified as high hazard potential. These high hazard dams are summarized by county in **Table 5.24** and more detailed information for each dam is listed in the jurisdiction-specific annexes.

TABLE 5.24: SUMMARY OF HIGH HAZARD DAM LOCATION

Location	Number High Hazard Dams
Henderson County	43
Polk County	10
Rutherford County	20
Transylvania County	45
SOUTH MOUNTAINS REGION TOTAL	**118**

[21] The February 8, 2012 list of high hazard dams obtained from the North Carolina Division of Energy, Mineral, and Land Resources (http://portal.ncdenr.org/web/lr/dams) was reviewed and amended by local officials to the best of their knowledge.

FIGURE 5.13: SOUTH MOUNTAINS REGION DAM LOCATION AND HAZARD RANKING



Source: North Carolina Division of Land Resources, 2012

It should also be noted that dam regulations for classifying dams was recently changed. As a result, generally more dams are classified as high hazard.

5.13.3 Historical Occurrences

There have been a total of two dam breaches reported in the South Mountains Region, though neither resulted in any injuries, deaths, or significant damage. However, it should be noted that several breach scenarios in the region could be catastrophic.

The information below identifies additional historical information reported in the previous hazard mitigation plans.

Henderson County

There has been one incident of dam failure in Henderson County over the last 10 years. In 1995, this incident was located off Highway 64 E in Hendersonville and spilled onto Fruitland Road. The dam in question was a Class A dam and did not cause any damage to personal property. The water flowed from the dam onto Fruitland Road causing the road to be closed for a brief period. There were no injuries or deaths reported during this incident and there was no interruption to critical facilities.

Polk County
Polk County has had one dam failure, the 1926 Lake Lanier Dam failure. Lake Lanier is a product of the 1920s boom and is an artificial, man-made lake fed by Vaughn's Creek at the base of Hogback Mountain. Spring rains in 1926 caused a portion of the dam to break off and sent water gushing forward. Property damage and cost are unknown.

Rutherford County
Most of the dams in Rutherford County are earthen type and do not hold enough water to cause major problems if the dam were to be breached or collapse. However, the dam at Lake Lure is a major issue, and the effects of its failure could be sizeable. Conditions affecting Lake Lure Dam could result in a hazard to life and/or property downstream of the dam due to a sudden release of large volumes of water.

Transylvania County
There have been no significant incidents of dam failure in Transylvania County within the last 60 years.

5.13.4 Probability of Future Occurrence

Given the current dam inventory and historic data, a dam breach is unlikely (less than 1 percent annual probability) in the future. However, as has been demonstrated in the past, regular monitoring is necessary to prevent these events. No further analysis will be completed in Section 6: *Vulnerability Assessment* as more sophisticated dam breach plans (typically completed by the U.S. Army Corp of Engineers) have been completed for dams of concern in the region.

5.14 EROSION

5.14.1 Background

Erosion is the gradual breakdown and movement of land due to both physical and chemical processes of water, wind, and general meteorological conditions. Natural, or geologic, erosion has occurred since the Earth's formation and continues at a very slow and uniform rate each year.

There are two types of soil erosion: wind erosion and water erosion. Wind erosion can cause significant soil loss. Winds blowing across sparsely vegetated or disturbed land can pick up soil particles and carry them through the air, thus displacing them. Water erosion can occur over land or in streams and channels. Water erosion that takes place over land may result from raindrops, shallow sheets of water flowing off the land, or shallow surface flow, which becomes concentrated in low spots. Stream channel erosion may occur as the volume and velocity of water flow increases enough to cause movement of the streambed and bank soils. Major storms, such hurricanes in coastal areas, may cause significant erosion by combining high winds with heavy surf and storm surge to significantly impact the shoreline.

An area's potential for erosion is determined by four factors: soil characteristics, vegetative cover, topography climate or rainfall, and topography. Soils composed of a large percentage of silt and fine sand are most susceptible to erosion. As the clay and organic content of these soils increases, the potential for erosion decreases. Well-drained and well-graded gravels and gravel-sand mixtures are the least likely to erode. Coarse gravel soils are highly permeable and have a good capacity for absorption, which can prevent or delay the amount of surface runoff. Vegetative cover can be very helpful in controlling erosion by shielding the soil surface from falling rain, absorbing water from the soil, and slowing the velocity of runoff. Runoff is also affected by the topography of the area including size, shape, and slope. The greater the slope length and gradient, the more potential an area has for erosion. Climate can affect the amount of runoff, especially the frequency, intensity, and duration of rainfall and storms. When rainstorms are frequent, intense, or of long duration, erosion risks are high. Seasonal changes in temperature and rainfall amounts define the period of highest erosion risk of the year.

During the past 20 years, the importance of erosion control has gained the increased attention of the public. Implementation of erosion control measures consistent with sound agricultural and construction operations is needed to minimize the adverse effects associated with harmful chemicals run-off due to wind or water events. The increase in government regulatory programs and public concern has resulted in a wide range of erosion control products, techniques, and analytical methodologies in the United States. The preferred method of erosion control in recent years has been the restoration of vegetation.

5.14.2 Location and Spatial Extent

Erosion in the South Mountains Region is typically caused by flash flooding events. Unlike coastal areas, where the soil is mainly composed of fine grained particles such as sand, South Mountains soils have much greater organic matter content. Furthermore, extensive vegetation also helps to prevent erosion in the area. Erosion occurs in the South Mountains Region, particularly along the banks of rivers and streams, but it is not an extreme threat to any of the participating counties and jurisdictions. No areas of concern were reported by the planning team.

5.14.3 Historical Occurrences

Several sources were vetted to identify areas of erosion in the South Mountains Region. This includes searching local newspapers, interviewing local officials, and reviewing previous hazard mitigation plans. Little information could be found beyond the hazard mitigation plans.

Erosion was addressed in the previous South Mountains Region hazard mitigation plans; however, it was found to be a relatively low-risk hazard. The information below identifies historical information presented in the plans.

Henderson County
There is no recorded history of injuries, deaths, or critical facilities loss due to erosion.

Polk County
Most recent erosion concerns in Polk County have stemmed from clear-cutting on steep slopes. Heavy erosion from stormwater can lead to large amounts of sedimentation being carried down slopes causing flooding, property damage, road blockage, and in extreme cases the occurrence of mudslides.

Rutherford County
Erosion was deemed an insignificant hazard.

Transylvania County
There is no recorded history of losses to structures from past erosion.

5.14.4 Probability of Future Occurrences

Erosion remains a natural, dynamic, and continuous process for the South Mountains Region, and it will continue to occur. The annual probability level assigned for erosion is likely (between 10 and 100 percent). However, given the lack of historical events, location, data, and threat to life or property, no further analysis will be done in Section 6: *Vulnerability Assessment*.

5.15 FLOOD

5.15.1 Background

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

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

General floods are usually long-term events that may last for several days. The primary types of general flooding include riverine, coastal, and urban flooding. Riverine flooding is a function of excessive precipitation levels and water runoff volumes within the watershed of a stream or river. Coastal flooding is typically a result of storm surge, wind-driven waves, and heavy rainfall produced by hurricanes, tropical storms, and other large coastal storms. Urban flooding occurs where manmade development has obstructed the natural flow of water and decreased the ability of natural groundcover to absorb and retain surface water runoff.

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

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

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

5.15.2 Location and Spatial Extent

There are areas in the South Mountains Region that are susceptible to flood events. Special flood hazard areas in the South Mountains Region were mapped using Geographic Information System (GIS) and FEMA Digital Flood Insurance Rate Maps (DFIRM).[22] This includes Zone A (1-percent annual chance floodplain), Zone AE (1-percent annual chance floodplain with elevation), and Zone X500 (0.2-percent annual chance floodplain). According to GIS analysis, of the 1,554 square miles that make up the South Mountains Region, there are 89.57 square miles of land in zones A and AE (1-percent annual chance floodplain/100-year floodplain) and 4.64 square miles of land in zone X500 (0.2-percent annual chance floodplain/500-year floodplain). The county totals are presented below in **Table 5.25**.

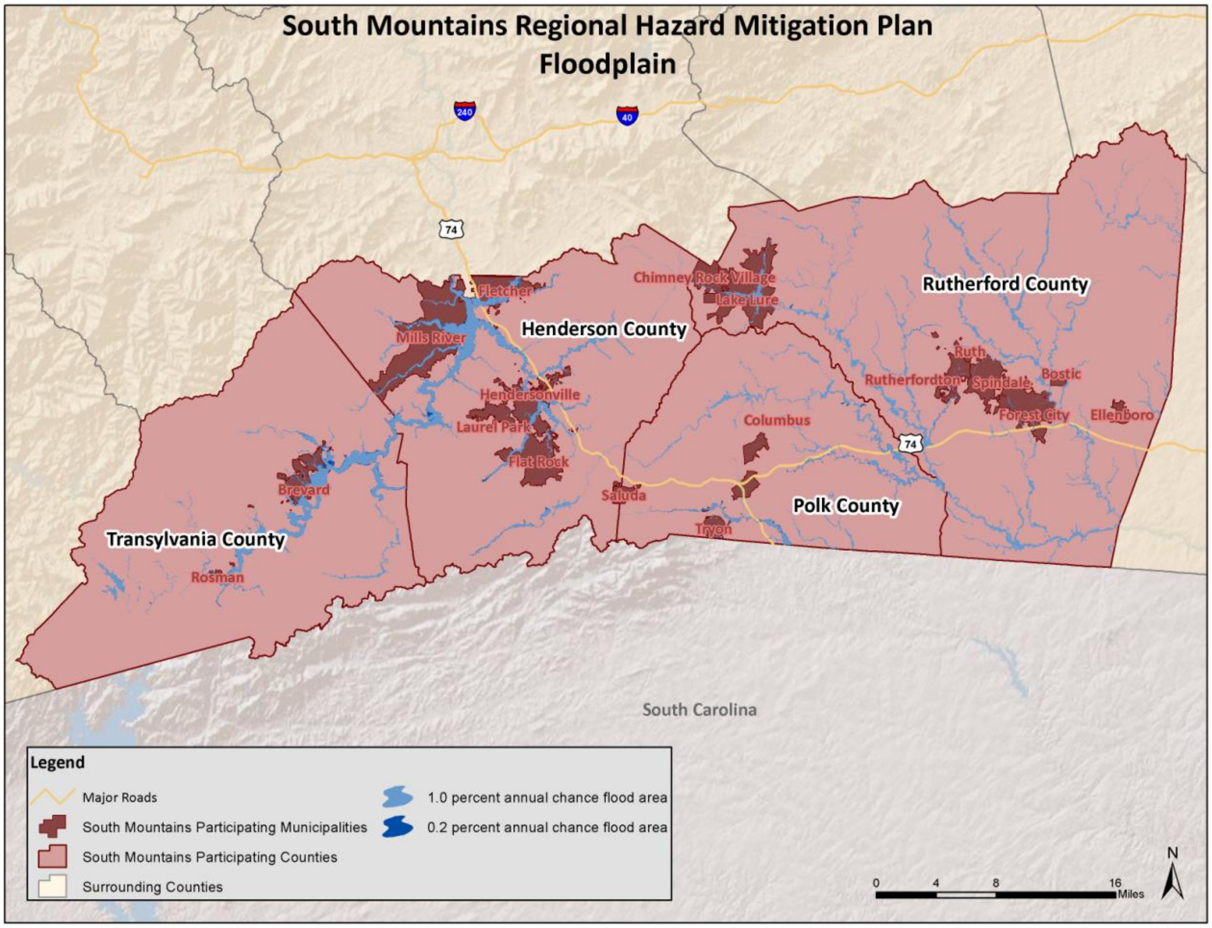
TABLE 5.25: SUMMARY OF FLOODPLAIN AREAS IN THE SOUTH MOUNTAINS REGION

Location	100-year area (square miles)	500-year area (square miles)
Henderson County	31.46	2.15
Polk County	12.68	0.75
Rutherford County	28.84	0.25
Transylvania County	16.59	1.49
SOUTH MOUNTAINS REGION TOTAL	**89.57**	**4.64**

These flood zone values account for 6.1 percent of the total land area in the South Mountains Region. It is important to note that while FEMA digital flood data is recognized as best available data for planning purposes, it does not always reflect the most accurate and up-to-date flood risk. Flooding and flood-related losses often do occur outside of delineated special flood hazard areas. **Figure 5.14** illustrates the location and extent of currently mapped special flood hazard areas for the South Mountains Region based on best available FEMA DFIRM data.

[22] The county-level DFIRM data used for the South Mountains Region were updated in 2010 for each of the counties.

FIGURE 5.14: SPECIAL FLOOD HAZARD AREAS IN THE SOUTH MOUNTAINS REGION



Source: Federal Emergency Management Agency

Additional, more detailed county-level and jurisdiction-level maps can be found in the jurisdiction-specific annexes.

5.15.3 Historical Occurrences

Floods have resulted in three disaster declarations in the South Mountains Region in 1997, 1995, and 1998.[23] Information from the National Climatic Data Center was used to ascertain additional historical flood events. The National Climatic Data Center reported a total of 160 events throughout the South Mountains Region since 1993.[24] A summary of these events is presented in **Table 5.26**. These events accounted for over $40.5 million (2013 dollars) in property damage throughout the region.[25] In addition, 13 injuries were reported. Specific information on flood events for each county, including date, type of flooding, and deaths and injuries, can be found in the jurisdiction-specific annexes.

[23] A complete listing of historical disaster declarations can be found in Section 4: *Hazard Profiles*.
[24] These events are only inclusive of those reported by NCDC. It is likely that additional occurrences have occurred and have gone unreported.
[25] The total damage amount was averaged over the number of affected counties when multiple counties were involved in the flood event.

TABLE 5.26: SUMMARY OF FLOOD OCCURRENCES IN THE SOUTH MOUNTAINS REGION

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Henderson County	**64**	**0/1**	**$8,502,054**
Flat Rock	0	0/0	$0
Fletcher	6	0/0	$66,287
Hendersonville	5	0/0	$165,709
Laurel Park	3	0/0	$0
Mills River	6	0/0	$11,091
Unincorporated Area	44	0/1	$8,258,967
Polk County	**19**	**0/0**	**$3,426,657**
Columbus	2	0/0	$0
Saluda	1	0/0	$0
Tryon	0	0/0	$0
Unincorporated Area	16	0/0	$3,426,657
Rutherford County	**25**	**0/2**	**$10,527,653**
Bostic	0	0/0	$0
Chimney Rock Village	1	0/0	$4,827,330
Ellenboro	0	0/0	$0
Forest City	5	0/2	$142,576
Lake Lure	3	0/0	$3,710,170
Ruth	0	0/0	$0
Rutherfordton	2	0/0	$0
Spindale	0	0/0	$0
Unincorporated Area	14	0/0	$1,847,577
Transylvania County	**52**	**0/10**	**$18,098,736**
Brevard	2	0/0	$0
Rosman	6	0/10	$2,374,009
Unincorporated Area	44	0/0	$15,724,727
SOUTH MOUNTAINS REGION TOTAL	**160**	**0/13**	**$40,555,100**

Source: National Climatic Data Center

5.15.4 Historical Summary of Insured Flood Losses

According to FEMA flood insurance policy records as of June 2013, there have been 215 flood losses reported in the South Mountains Region through the National Flood Insurance Program (NFIP) since 1978, totaling nearly $2.9 million in claims payments. A summary of these figures for each South Mountains county is provided in **Table 5.27**. It should be emphasized that these numbers include only those losses to structures that were insured through the NFIP policies, and for losses in which claims were sought and received. It is likely that many additional instances of flood loss in the South Mountains Region were either uninsured, denied claims payment, or not reported.

TABLE 5.27: SUMMARY OF INSURED FLOOD LOSSES IN THE SOUTH MOUNTAINS REGION

Location	Flood Losses	Claims Payments
Henderson County	**122**	**$1,593,269**
Flat Rock	0	$0
Fletcher	1	$14,745
Hendersonville	116	$1,336,191
Laurel Park	1	$2,980
Mills River*	--	--
Unincorporated Area	4	$239,353
Polk County	**10**	**$87,286**
Columbus	0	$0
Saluda	0	$0
Tryon	0	$0
Unincorporated Area	10	$87,286
Rutherford County	**30**	**$626,560**
Bostic	0	$0
Chimney Rock Village	0	$0
Ellenboro*	--	--
Forest City	0	$0
Lake Lure	0	$0
Ruth*	--	--
Rutherfordton	0	$0
Spindale	0	$0
Unincorporated Area	30	$626,560
Transylvania County	**53**	**$550,021**
Brevard	11	$150,815
Rosman	21	$93,223
Unincorporated Area	21	$305,983
SOUTH MOUNTAINS REGION TOTAL	**215**	**$2,857,136**

*This community does not participate in the National Flood Insurance Program. Therefore, no values are reported.
Source: FEMA, NFIP

5.15.5 Repetitive Loss Properties

FEMA defines a repetitive loss property as any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling 10-year period, since 1978. A repetitive loss property may or may not be currently insured by the NFIP. Currently there are over 140,000 repetitive loss properties nationwide.

Currently (as of October 2013), there are 26 non-mitigated repetitive loss properties located in the South Mountains Region, which accounted for 85 losses and more than $1.4 million in claims payments under the NFIP. The average claim amount for these properties is $17,195. Twelve of the twenty-six properties are single family residential and the remaining fourteen are other residential, commercial, or government-owned buildings. Without mitigation these properties will likely continue to experience flood losses. **Table 5.28** presents a summary of these figures for the South Mountains Region. Detailed information on repetitive loss properties and NFIP claims and policies can be found in the jurisdiction-specific annexes.

TABLE 5.28: SUMMARY OF REPETITIVE LOSS PROPERTIES IN THE SOUTH MOUNTAINS REGION

Location	Number of Properties	Number of Losses	Total Payments
Henderson County	**14**	**55**	**$993,301**
Flat Rock	0	0	$0
Fletcher	0	0	$0
Hendersonville	14	55	$993,301
Laurel Park	0	0	$0
Mills River*	--	--	--
Unincorporated Area	0	0	$0
Polk County	**1**	**2**	**$15,820**
Columbus	0	0	$0
Saluda	0	0	$0
Tryon	0	0	$0
Unincorporated Area	1	2	$15,820
Rutherford County	**6**	**15**	**$300,008**
Bostic	0	0	$0
Chimney Rock Village	0	0	$0
Ellenboro*	--	--	--
Forest City	0	0	$0
Lake Lure	0	0	$0
Ruth*	--	--	--
Rutherfordton	0	0	$0
Spindale	0	0	$0
Unincorporated Area	6	15	$300,008
Transylvania County	**5**	**13**	**$152,452**
Brevard	0	0	$0
Rosman	3	8	$80,805
Unincorporated Area	2	5	$71,647
SOUTH MOUNTAINS REGION TOTAL	**26**	**85**	**$1,461,581**

Source: National Flood Insurance Program

5.15.6 Probability of Future Occurrences

Flood events will remain a threat in the South Mountains Region, and the probability of future occurrences will remain likely (between 10 and 100 percent annual probability). The probability of future flood events based on magnitude and according to best available data is illustrated in the figures above, which indicates those areas susceptible to the 1-percent annual chance flood (100-year floodplain) and the 0.2-percent annual chance flood (500-year floodplain).

It can be inferred from the floodplain location maps, previous occurrences, and repetitive loss properties that risk varies throughout the South Mountains Region. For example, Brevard, Fletcher, and Hendersonville have more floodplain and thus a higher risk of flood than other municipalities. Flood is not the greatest hazard of concern but will continue to occur and cause damage. Therefore, mitigation actions may be warranted, particularly for repetitive loss properties.

Other Hazards

5.16 HAZARDOUS MATERIALS INCIDENTS

5.16.1 Background

Hazardous materials can be found in many forms and quantities that can potentially cause death; serious injury; long-lasting health effects; and damage to buildings, homes, and other property in varying degrees. Such materials are routinely used and stored in many homes and businesses and are also shipped daily on the nation's highways, railroads, waterways, and pipelines. This subsection on the hazardous material hazard is intended to provide a general overview of the hazard, and the threshold for identifying fixed and mobile sources of hazardous materials is limited to general information on rail, highway, and FEMA-identified fixed HAZMAT sites determined to be of greatest significance as appropriate for the purposes of this plan.

Hazardous material (HAZMAT) incidents can apply to fixed facilities as well as mobile, transportation-related accidents in the air, by rail, on the nation's highways, and on the water. Approximately 6,774 HAZMAT events occur each year, 5,517 of which are highway incidents, 991 are railroad incidents, and 266 are due to other causes.[26] In essence, HAZMAT incidents consist of solid, liquid, and/or gaseous contaminants that are released from fixed or mobile containers, whether by accident or by design as with an intentional terrorist attack. A HAZMAT incident can last hours to days, while some chemicals can be corrosive or otherwise damaging over longer periods of time. In addition to the primary release, explosions and/or fires can result from a release, and contaminants can be extended beyond the initial area by persons, vehicles, water, wind, and possibly wildlife as well.

HAZMAT incidents can also occur as a result of or in tandem with natural hazard events, such as floods, hurricanes, tornadoes, and earthquakes, which in addition to causing incidents can also hinder response efforts. In the case of Hurricane Floyd in September 1999, communities along the Eastern United States were faced with flooded junkyards, disturbed cemeteries, deceased livestock, floating propane tanks, uncontrolled fertilizer spills, and a variety of other environmental pollutants that caused widespread toxological concern.

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

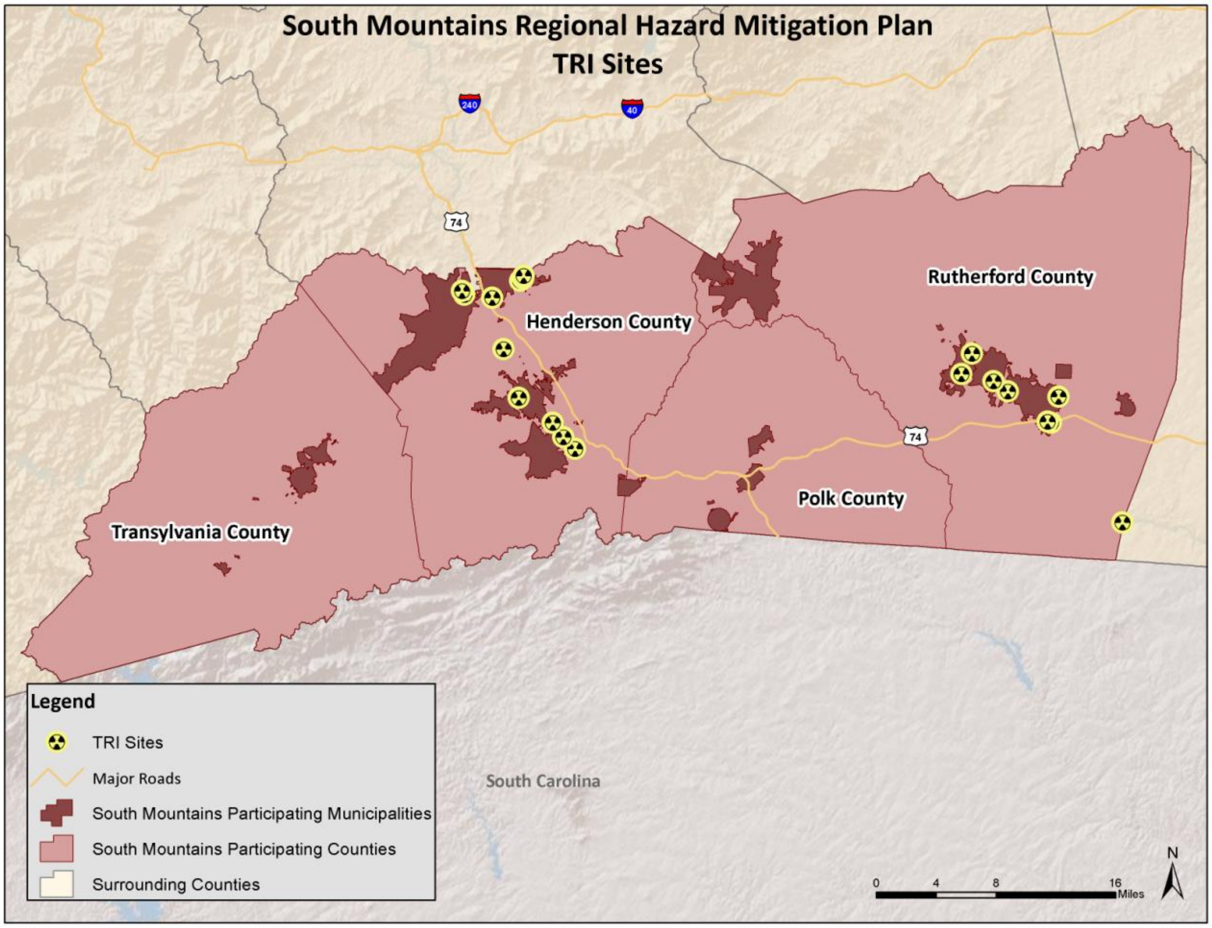
5.16.2 Location and Spatial Extent

As a result of the 1986 Emergency Planning and Community Right to Know Act (EPCRA), the Environmental Protection Agency provides public information on hazardous materials. One facet of this program is to collect information from industrial facilities on the releases and transfers of certain toxic

[26] FEMA, 1997.

agents. This information is then reported in the Toxic Release Inventory (TRI). TRI sites indicate where such activity is occurring. The South Mountains Region has 18 TRI sites. These sites are shown in **Figure 5.15.**

FIGURE 5.15: TOXIC RELEASE INVENTORY (TRI) SITES IN THE SOUTH MOUNTAINS REGION



Source: Environmental Protection Agency

In addition to "fixed" hazardous materials locations, hazardous materials may also impact the region via roadways and rail. Many roads in the region are narrow and winding, making hazardous material transport in the area especially treacherous. All roads that permit hazardous material transport are considered potentially at risk to an incident.

5.16.3 Historical Occurrences

The U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA) lists historical occurrences throughout the nation. A "serious incident" is a hazardous materials incident that involves:

- a fatality or major injury caused by the release of a hazardous material,
- the evacuation of 25 or more persons as a result of release of a hazardous material or exposure to fire,

- a release or exposure to fire which results in the closure of a major transportation artery,
- the alteration of an aircraft flight plan or operation,
- the release of radioactive materials from Type B packaging,
- the release of over 11.9 galls or 88.2 pounds of a severe marine pollutant, or
- the release of a bulk quantity (over 199 gallons or 882 pounds) of a hazardous material.

However, prior to 2002, a hazardous materials "serious incident" was defined as follows:

- a fatality or major injury due to a hazardous material,
- closure of a major transportation artery or facility or evacuation of six or more person due to the presence of hazardous material, or
- a vehicle accident or derailment resulting in the release of a hazardous material.

Table 5.29 summarizes the HAZMAT incidents reported in the South Mountains Region. Detailed information on these events is presented in the jurisdiction-specific annexes.

TABLE 5.29: SUMMARY OF HAZMAT INCIDENTS IN THE SOUTH MOUNTAINS REGION

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Henderson County	**42**	**0/0**	**$0**
Flat Rock	0	--	--
Fletcher	34	0/0	$0
Hendersonville	1	0/0	$0
Laurel Park	0	--	--
Mills River	0	--	--
Unincorporated Area	7	0/0	$0
Polk County	**2**	**0/0**	**$51,137**
Columbus	0	--	--
Saluda	1	0/0	$30,978
Tryon	0	--	--
Unincorporated Area	1	0/0	$20,159
Rutherford County	**1**	**0/0**	**$0**
Bostic	0	--	--
Chimney Rock Village	0	--	--
Ellenboro	0	--	--
Forest City	1	0/0	$0
Lake Lure	0	--	--
Ruth	0	--	--
Rutherfordton	0	--	--
Spindale	0	--	--
Unincorporated Area	0	--	--
Transylvania County	**1**	**0/0**	**$0**
Brevard	1	0/0	$0
Rosman	0	--	--
Unincorporated Area	0	--	--

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
SOUTH MOUNTAINS REGION TOTAL	46	0/0	$51,137

Source: U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration

5.16.4 Probability of Future Occurrence

Given the location of 18 toxic release inventory sites in the South Mountains Region and prior roadway incidents it is possible that a hazardous material incident may occur in the region (between 1 and 10 percent annual probability). County and municipal officials are mindful of this possibility and take precautions to prevent such an event from occurring. Furthermore, there are detailed plans in place to respond to an occurrence.

5.17 WILDFIRE

5.17.1 Background

A wildfire is any outdoor fire (i.e. grassland, forest, brush land) that is not under control, supervised, or prescribed.[27] Wildfires are part of the natural management of forest ecosystems, but may also be caused by human factors.

Nationally, over 80 percent of forest fires are started by negligent human behavior such as smoking in wooded areas or improperly extinguishing campfires. The second most common cause for wildfire is lightning. In North Carolina, a majority of fires are caused by debris burning.

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

Wildfire probability depends on local weather conditions, outdoor activities such as camping, debris burning, and construction, and the degree of public cooperation with fire prevention measures. Drought conditions and other natural hazards (such as tornadoes, hurricanes, etc.) increase the probability of wildfires by producing fuel in both urban and rural settings.

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

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

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

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

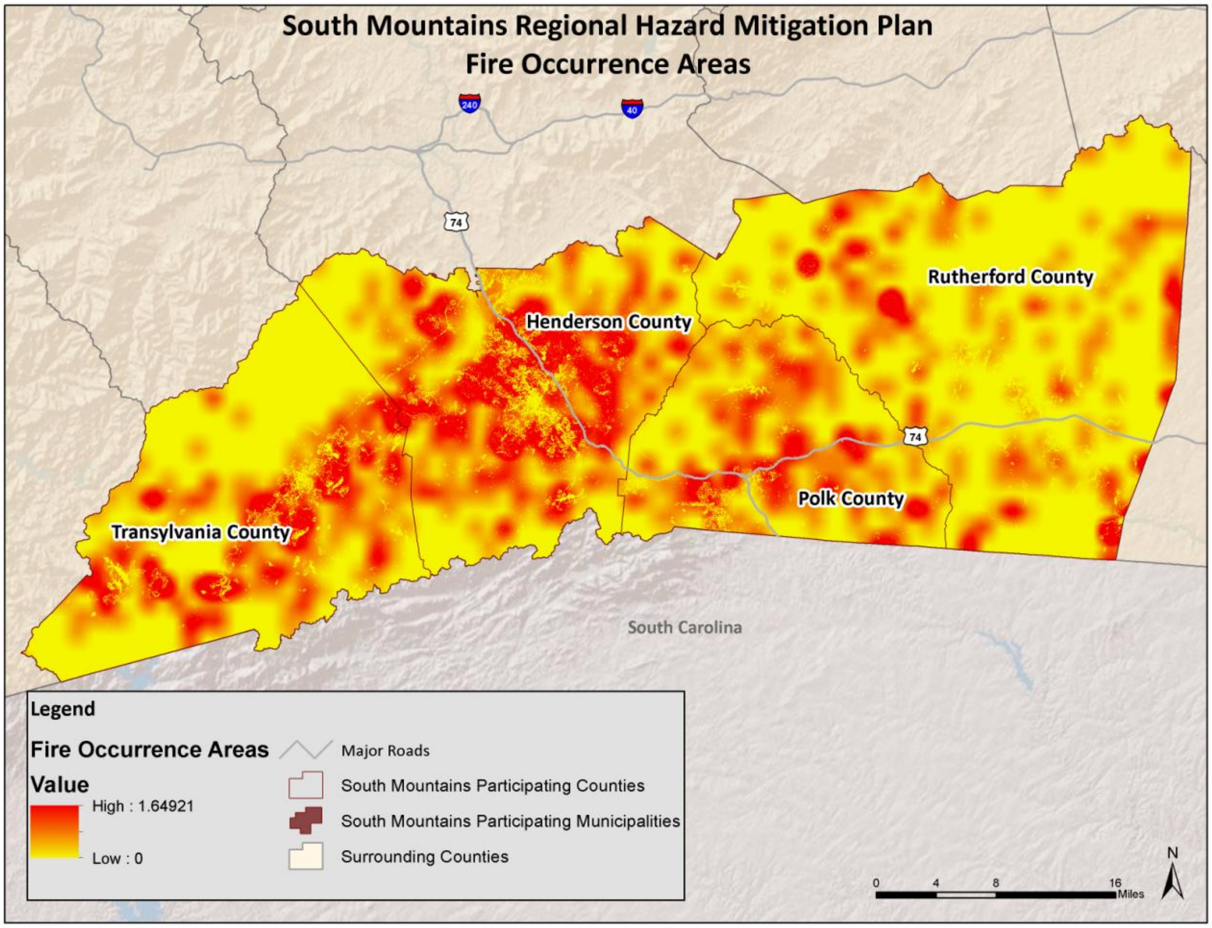
5.17.2 Location and Spatial Extent

The entire region is at risk to a wildfire occurrence. However, several factors such as drought conditions or high levels of fuel on the forest floor, may make a wildfire more likely. Furthermore, areas in the urban-wildland interface are particularly susceptible to fire hazard as populations abut formerly undeveloped areas. The Fire Occurrence Areas in the figure below give an indication of historic locations impacted.

5.17.3 Historical Occurrences

Figure 5.16 shows the Fire Occurrence Areas (FOA) in the South Mountains Region based on data from the Southern Wildfire Risk Assessment. This data is based on historical fire ignitions and is reported as the number of fires that occur per 1,000 acres each year.

FIGURE 5.16: HISTORIC WILDFIRE EVENTS IN THE SOUTH MOUNTAINS REGION



Source: Southern Wildfire Risk Assessment

Based on data from the North Carolina Division of Forest Resources from 2003 to 2012, the South Mountains Region experienced an average of 140 wildfires annually which burn a combined 686 acres, on average. The data indicates that most of these fires are small, averaging about five acres per fire. **Table 5.30** provides a summary table for wildfire occurrences in the South Mountains Region. The number of reported wildfire occurrences in the participating counties between the years 2003 and 2012 is listed in the jurisdiction-specific annexes.

TABLE 5.30: SUMMARY TABLE OF ANNUAL WILDFIRE OCCURRENCES (2003-2012)*

	Henderson County	Polk County	Rutherford County	Transylvania County	South Mountains Region
Average Number of Fires per year	51	17	48	24	140
Average Number of Acres Burned per year	99	245	292	50	686
Average Number of Acres Burned per fire	2	14	6	2	5

The National Climatic Data Center also reported one wildfire event in the Rutherford Mountains on February 12, 2011. A wildfire that began in the Chimney Rock State Park area quickly spread during a period of windy and very dry conditions. The fire burned almost 1,500 acres near the Polk and Rutherford County line south of Chimney Rock before being contained.

5.17.4 Probability of Future Occurrences

Wildfire events will be an ongoing occurrence in the South Mountains Region. The likelihood of wildfires increases during drought cycles and abnormally dry conditions. Fires are likely to stay small in size but could increase due local climate and ground conditions. Dry, windy conditions with an accumulation of forest floor fuel (potentially due to ice storms or lack of fire) could create conditions for a large fire that spreads quickly. It should also be noted that some areas do vary somewhat in risk. For example, highly developed areas are less susceptible unless they are located near the urban-wildland boundary. The risk will also vary due to assets. Areas in the urban-wildland interface will have much more property at risk, resulting in increased vulnerability and need to mitigate compared to rural, mainly forested areas. The probability assigned to the South Mountains Region for future wildfire events is likely (10 to 100 percent annual probability).

5.18 CONCLUSIONS ON HAZARD RISK

The hazard profiles presented in this section were developed using best available data and result in what may be considered principally a qualitative assessment as recommended by FEMA in its "How-to" guidance document titled *Understanding Your Risks: Identifying Hazards and Estimating Losses* (FEMA Publication 386-2). It relies heavily on historical and anecdotal data, stakeholder input, and professional and experienced judgment regarding observed and/or anticipated hazard impacts. It also carefully considers the findings in other relevant plans, studies, and technical reports.

5.18.1 Hazard Extent

Table 5.31 describes the extent of each natural hazard identified for the South Mountains Region. The extent of a hazard is defined as its severity or magnitude, as it relates to the planning area.

TABLE 5.31: EXTENT OF SOUTH MOUNTAINS REGION HAZARDS

Atmospheric Hazards	
Drought	Drought extent is defined by the North Carolina Drought Monitor Classifications which include Abnormally Dry, Moderate Drought, Severe Drought, Extreme Drought, and Exceptional Drought (page 5:6). According to the North Carolina Drought Monitor Classifications, the most severe drought condition is Exceptional. Each of the participating counties has received this ranking (three times) over the fourteen-year reporting period.
Extreme Heat	The extent of extreme heat can be defined by the maximum temperature reached. The highest temperature recorded in the South Mountains Region is 107 degrees Fahrenheit (reported on August 1, 1999). • Henderson County: 101°F • Polk County: 105°F • Rutherford County: 107°F • Transylvania County: 100°F

Hailstorm	Hail extent can be defined by the size of the hail stone. The largest hail stone reported in the South Mountains Region was 2.75 inches (last reported on June 24, 1986). It should be noted that future events may exceed this. • Henderson County: 2.5 inches • Polk County: 2.75 inches • Rutherford County: 2.0 inches • Transylvania County: 2.75 inches
Hurricane and Tropical Storm	Hurricane extent is defined by the Saffir-Simpson Scale which classifies hurricanes into Category 1 through Category 5 (Table 5.9). The greatest classification of hurricane to traverse directly through the South Mountains Region was Hurricane Celeste which carried tropical force winds of 53 knots upon arrival in the region. The following lists the greatest extent of hurricane winds to pass through the area, though it should be noted that stronger storms could impact the region without a direct hit: • Henderson County: Unnamed 1902 Strom, Category 2 Hurricane (31 knots) • Polk County: Unnamed 1902 Strom, Category 2 Hurricane (31 knots) • Rutherford County: Unnamed 1902 Strom, Category 2 Hurricane (31 knots) • Transylvania County: Unnamed 1916 Storm, Tropical Storm (40 knots)
Lightning	According to the Vaisala flash density map (Figure 5.5), the South Mountains Region is located in an area that experiences 2 to 4 lightning flashes per square kilometer per year. It should be noted that future lightning occurrences may exceed these figures.
Thunderstorm Wind / High Wind	Thunderstorm extent is defined by the number of thunder events and wind speeds reported. According to a 63-year history from the National Climatic Data Center, the strongest recorded wind event in the South Mountains Region was reported on March 1, 1999 at 77 knots (approximately 89 mph). It should be noted that future events may exceed these historical occurrences. • Henderson County: 70 knots • Polk County: 65 knots • Rutherford County: 77 knots • Transylvania County: 70 knots
Tornado	Tornado hazard extent is measured by tornado occurrences in the US provided by FEMA (Figure 5.6) as well as the Fujita/Enhanced Fujita Scale (Tables 5.14 and 5.15). The greatest magnitude reported in the region was an F4 (reported on May 5, 1989). • Henderson County: F1 • Polk County: F1 • Rutherford County: F4 • Transylvania County: F2
Winter Storm and Freeze	The extent of winter storms can be measured by the amount of snowfall received (in inches). The greatest 24-hour snowfall reported in the region was 22 inches reported on March 2, 1942. Due to extreme variations in elevation throughout the region, extent totals will vary for each participating jurisdiction and reliable data on snowfall totals is not available. • Henderson County: 22 inches • Polk County: 15 inches • Rutherford County: 16 inches • Transylvania County: 17 inches

Geologic Hazards	
Earthquake	Earthquake extent can be measured by the Richter Scale (Table 5.18) and the Modified Mercalli Intensity (MMI) scale (Table 5.19) and the distance of the epicenter from the South Mountains Region. According to data provided by the National Geophysical Data Center, the greatest MMI to impact the region was VI (strong) with a correlating Richter Scale measurement of approximately 5.4 (last reported on May 5, 1981). The epicenter of this earthquake was located 10.0 km away. • Henderson County: VI; 10.0 km to epicenter • Polk County: V; 31.0 km to epicenter • Rutherford County: V; 241.0 km to epicenter • Transylvania County: V; 26.0 km to epicenter
Landslide	As noted above in the landslide profile, the landslide data provided by the North Carolina Geological survey is incomplete. This provides a challenge when trying to determine an accurate extent for the landslide hazard. However, when using the USGS landslide susceptibility index, extent can be measured with incidence, which is between low and high. There is also high susceptibility throughout the region.
Hydrologic Hazards	
Dam Failure	Dam failure extent is defined using the North Carolina Division of Land Resources criteria (Table 5.23). Of the 324 dams in the South Mountains Region, 118 are classified as high-hazard. • Henderson County: 43 high hazard dams • Polk County: 10 high hazard dams • Rutherford County: 20 high hazard dams • Transylvania County: 45 high hazard dams
Erosion	The extent of erosion can be defined by the measurable rate of erosion that occurs. There are no erosion rate records available for the South Mountains Region.

Flood	Flood extent can be measured by the amount of land and property in the floodplain as well as flood height and velocity. The amount of land in the floodplain accounts for 6.1 percent of the total land area in the South Mountains Region. Flood depth and velocity are recorded via United States Geological Survey stream gages throughout the region. While a gage does not exist for each participating jurisdiction, there is one at or near many areas. The greatest peak discharge recorded for the region was reported on October 5, 1964. Water reached a discharge of 30,000 cubic feet per second and the stream gage height was recorded at 25.50 feet. Additional peak discharge readings and gage heights are in the table below.

Location/Jurisdiction	Date	Peak Discharge (cfs)	Gage Height (ft)
Henderson County			
Mills River near Mills River	8/30/1940	13,400	13.62
French Broad River near Fletcher	9/8/2004	25,500	20.13
Polk County			
N/A	--	--	--
Rutherford County			
Cove Creek near Lake Lure	6/5/1957	7,050	18.53
Second Broad River near Logan	1/25/2010	4,810	16.38
Transylvania County			
French Broad River at Rosman	10/4/1964	13,500	14.95
Davidson River near Brevard	8/15/1928	8,400	11.80
French Broad River at Blantyre	10/5/1964	30,000	25.50

Other Hazards

Hazardous Materials Incident	According to USDOT PHMSA, the largest hazardous materials incident reported in the region was 1,687.5 LGA released on the highway on December 6, 1998. It should be noted that larger events are possible. • Henderson County: 25 LGA • Polk County: 1,687.5 LGA • Rutherford County: 0 • Transylvania County: 50 LGA

Wildfire	Wildfire data was provided by the North Carolina Division of Forest Resources and is reported annually by county from 2003-2012. Analyzing the data by county indicates the following wildfire hazard extent for each county. ***Henderson County*** • The greatest number of fires to occur in any year was 77 in 2006. • The greatest number of acres to burn in a single year occurred in 2006 when 221 acres were burned. ***Polk County*** • The greatest number of fires to occur in any year was 34 in 2006. • The greatest number of acres to burn in a single year occurred in 2011 when 1,506 acres were burned. ***Rutherford County*** • The greatest number of fires to occur in any year was 95 in 2011. • The greatest number of acres to burn in a single year occurred in 2008 when 1,114 acres were burned. ***Transylvania County*** • The greatest number of fires to occur in any year was 35 in 2006. • The greatest number of acres to burn in a single year occurred in 2006 when 133 acres were burned. Although this data lists the extent that has occurred, larger and more frequent wildfires are possible throughout the region.

5.18.2 Priority Risk Index

In order to draw some meaningful planning conclusions on hazard risk for the South Mountains Region, the results of the hazard profiling process were used to generate countywide hazard classifications according to a "Priority Risk Index" (PRI). The purpose of the PRI is to categorize and prioritize all potential hazards for the South Mountains Region as high, moderate, or low risk. Combined with the asset inventory and quantitative vulnerability assessment provided in the next section, the summary hazard classifications generated through the use of the PRI allows for the prioritization of those high hazard risks for mitigation planning purposes, and more specifically, the identification of hazard mitigation opportunities for the jurisdictions in the South Mountains Region to consider as part of their proposed mitigation strategy.

The prioritization and categorization of identified hazards for the South Mountains Region is based principally on the PRI, a tool used to measure the degree of risk for identified hazards in a particular planning area. The PRI is used to assist the South Mountains Regional Hazard Mitigation Planning Team in gaining consensus on the determination of those hazards that pose the most significant threat to the South Mountains counties based on a variety of factors. The PRI is not scientifically based, but is rather meant to be utilized as an objective planning tool for classifying and prioritizing hazard risks in the South Mountains Region based on standardized criteria.

The application of the PRI results in numerical values that allow identified hazards to be ranked against one another (the higher the PRI value, the greater the hazard risk). PRI values are obtained by assigning varying degrees of risk to five categories for each hazard (probability, impact, spatial extent, warning time, and duration). Each degree of risk has been assigned a value (1 to 4) and an agreed upon weighting factor[28], as summarized in **Table 5.32**. To calculate the PRI value for a given hazard, the assigned risk value for each category is multiplied by the weighting factor. The sum of all five categories equals the final PRI value, as demonstrated in the example equation below:

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

According to the weighting scheme and point system applied, the highest possible value for any hazard is 4.0. When the scheme is applied for the South Mountains Region, the highest PRI value is 3.3 (winter storm and freeze hazard). Prior to being finalized, PRI values for each identified hazard were reviewed and accepted by the members of the Regional Hazard Mitigation Planning Team.

[28] The Regional Hazard Mitigation Planning Team, based upon any unique concerns or factors for the planning area, may adjust the PRI weighting scheme during future plan updates.

TABLE 5.32: PRIORITY RISK INDEX FOR THE SOUTH MOUNTAINS REGION

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

5.18.3 Priority Risk Index Results

Table 5.33 summarizes the degree of risk assigned to each category for all initially identified hazards based on the application of the PRI. Assigned risk levels were based on the detailed hazard profiles developed for this section, as well as input from the Regional Hazard Mitigation Planning Team. The results were then used in calculating PRI values and making final determinations for the risk assessment.

TABLE 5.33: SUMMARY OF PRI RESULTS FOR THE SOUTH MOUNTAINS REGION

Hazard	Category/Degree of Risk					
	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Atmospheric Hazards						
Drought	Likely	Minor	Large	More than 24 hours	More than 1 week	**2.5**
Extreme Heat	Possible	Minor	Large	More than 24 hours	Less than 1 week	**2.1**
Hailstorm	Highly Likely	Limited	Moderate	Less than 6 hours	Less than 6 hours	**2.9**
Hurricane and Tropical Storm	Possible	Limited	Large	More than 24 hours	Less than 24 hours	**2.3**
Lightning	Highly Likely	Minor	Negligible	Less than 6 hours	Less than 6 hours	**2.2**
Thunderstorm / High Wind	Highly Likely	Critical	Moderate	6 to 12 hours	Less than 6 hours	**3.1**
Tornado	Possible	Critical	Small	Less than 6 hours	Less than 6 hours	**2.4**
Winter Storm and Freeze	Highly Likely	Critical	Large	More than 24 hours	Less than 1 week	**3.3**
Geologic Hazards						
Earthquake	Possible	Minor	Moderate	Less than 6 hours	Less than 6 hours	**2.0**
Landslide	Likely	Critical	Small	Less than 6 hours	Less than 6 hours	**2.5**
Hydrologic Hazards						
Dam and Levee Failure	Unlikely	Critical	Moderate	Less than 6 hours	Less than 6 hours	**2.3**
Erosion	Likely	Minor	Small	More than 24 hours	More than 1 week	**2.1**
Flood	Likely	Critical	Moderate	6 to 12 hours	Less than 1 week	**3.0**
Other Hazards						
Hazardous Materials Incident	Possible	Limited	Small	Less than 6 hours	Less than 24 hours	**2.2**
Wildfire	Likely	Minor	Moderate	Less than 6 hours	Less than 1 week	**2.6**

5.19 FINAL DETERMINATIONS

The conclusions drawn from the hazard profiling process for the South Mountains Region, including the PRI results and input from the Regional Hazard Mitigation Planning Team, resulted in the classification of risk for each identified hazard according to three categories: High Risk, Moderate Risk, and Low Risk (**Table 5.34**). For purposes of these classifications, risk is expressed in relative terms according to the estimated impact that a hazard will have on human life and property throughout all of the South Mountains Region. A more quantitative analysis to estimate potential dollar losses for each hazard has been performed separately, and is described in Section 6: *Vulnerability Assessment*. It should be noted that although some hazards are classified below as posing low risk, their occurrence of varying or unprecedented magnitudes is still possible in some cases and their assigned classification will continue to be evaluated during future plan updates.

TABLE 5.34: CONCLUSIONS ON HAZARD RISK FOR THE SOUTH MOUNTAINS REGION

HIGH RISK	Winter Storm and Freeze Thunderstorm Wind / High Wind Flood Hailstorm
MODERATE RISK	Landslide Wildfire Drought Tornado Hurricane and Tropical Storm Dam and Levee Failure
LOW RISK	Lightning Hazardous Material Incident Extreme Heat Erosion Earthquake

SECTION 6
VULNERABILITY ASSESSMENT

This section identifies and quantifies the vulnerability of the jurisdictions within the South Mountains Region to the significant hazards identified in the previous sections (*Hazard Identification and Profiles*). It consists of the following subsections:

- 6.1 Overview
- 6.2 Methodology
- 6.3 Explanation of Data Sources
- 6.4 Asset Inventory
- 6.5 Vulnerability Assessment Results
- 6.6 Conclusions on Hazard Vulnerability

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44 CFR Requirement
44 CFR Part 201.6(c)(2)(ii): The risk assessment shall include a description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. The description shall include an overall summary of each hazard and its impact on the community. The plan should describe vulnerability in terms of: (A) The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas; (B) An estimate of the potential losses to vulnerable structures identified in paragraph (c)(2)(ii)(A) of this section and a description of the methodology used to prepare the estimate; (C) Providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

6.1 OVERVIEW

This section builds upon the information provided in Section 4: *Hazard Identification and* Section 5*: Hazard Profiles* by identifying and characterizing an inventory of assets in the South Mountains Region. In addition, the potential impact and expected amount of damages caused to these assets by each identified hazard event is assessed. The primary objective of the vulnerability assessment is to quantify exposure and the potential loss estimates for each hazard. In doing so, the South Mountains counties and their participating jurisdictions may better understand their unique risks to identified hazards and be better prepared to evaluate and prioritize specific hazard mitigation actions.

This section begins with an explanation of the methodology applied to complete the vulnerability assessment, followed by a summary description of the asset inventory as compiled for jurisdictions in the South Mountains Region. The remainder of this section focuses on the results of the assessment conducted.

6.2 METHODOLOGY

This vulnerability assessment was conducted using three distinct methodologies: (1) A stochastic risk assessment; (2) a geographic information system (GIS)-based analysis; and (3) a risk modeling software analysis. Each approach provides estimates for the potential impact of hazards by using a common, systematic framework for evaluation, including historical occurrence information provided in the *Hazard Identification* and *Hazard Profiles* sections. A brief description of the three different approaches is provided on the following pages.

6.2.1 Stochastic Risk Assessment

The stochastic risk assessment methodology was applied to analyze hazards of concern that were outside the scope of hazard risk models and the GIS-based risk assessment. This involves the consideration of annualized loss estimates and impacts of current and future buildings and populations. Annualized loss is the estimated long-term weighted average value of losses to property in any single year in a specified geographic area (i.e., municipal jurisdiction or county). This methodology is applied primarily to hazards that do not have geographically-definable boundaries and are therefore excluded from spatial analysis through GIS. A stochastic risk methodology was used for the following hazards:

- Dam Failure
- Drought
- Erosion
- Hailstorm
- Lightning
- Thunderstorm Wind
- Tornado
- Winter Storm and Freeze

With the exception of Dam Failure and Erosion, the hazards listed above are considered atmospheric and have the potential to affect all current and future buildings and all populations. **Table 6.1** provides information about all improved property in the South Mountains region that is vulnerable to these hazards. For all hazards annualized loss estimates were determined using the best available data on historical losses from sources including NOAA's National Climatic Data Center records, South Mountains Region county hazard mitigation plans, and local knowledge. Annualized loss estimates were generated by totaling the amount of property damage over the period of time for which records were available, and calculating the average annual loss. Given the standard weighting analysis, losses can be readily compared across hazards providing an objective approach for evaluating mitigation alternatives.

For the dam failure[1], drought, and erosion, no data with historical property damages was available. Therefore a detailed vulnerability assessment could not be completed for these hazards at this time.

The results for these hazards are found at the end of this section in **Table 6.14**.

6.2.2 GIS-Based Analysis

Other hazards have specified geographic boundaries that permit additional analysis using Geographic Information Systems (GIS). These hazards include:

[1] As noted in Section 5: *Hazard Profiles*, dam failure could be catastrophic to structures and populations in the inundation area. However, due to lack of data, no additional analysis was performed. Further, local USACE and NCDENR also complete separate dam failure plans to identify risk and response measures.

- Flood
- Hazardous Material Incident
- Landslide
- Wildfire

The objective of the GIS-based analysis was to determine the estimated vulnerability of critical facilities and populations for the identified hazards in the South Mountains Region using best available geospatial data. Digital data was collected from local, regional, state, and national sources for hazards and buildings. This included local tax assessor records for individual parcels and buildings and geo-referenced point locations for identified assets (critical facilities and infrastructure, special populations, etc.) when available. ESRI® ArcGIS™ 10.0 was used to assess hazard vulnerability utilizing digital hazard data, as well as local building data. Using these data layers, hazard vulnerability can be quantified by estimating the assessed building value for parcels and/or buildings determined to be located in identified hazard areas. To estimate vulnerable populations in hazard areas, digital Census 2010 data by census tract was obtained. This was intersected with hazard areas to determine exposed population counts. Unfortunately, due to the large scale of census tracts, the results are limited, but will be revised with population by census block becomes available for all areas in the region. The results of the analysis provided an estimate of the number of people and critical facilities, as well as the assessed value of parcels and improvements, determined to be potentially at risk to those hazards with delineable geographic hazard boundaries.

6.2.3 Risk Modeling Software Analysis

A risk modeling software was used for the following hazards:

- Earthquake
- Hurricane and Tropical Storm

There are several models that exist to model hazards. Hazus-MH was used in this vulnerability assessment to address the aforementioned hazards.

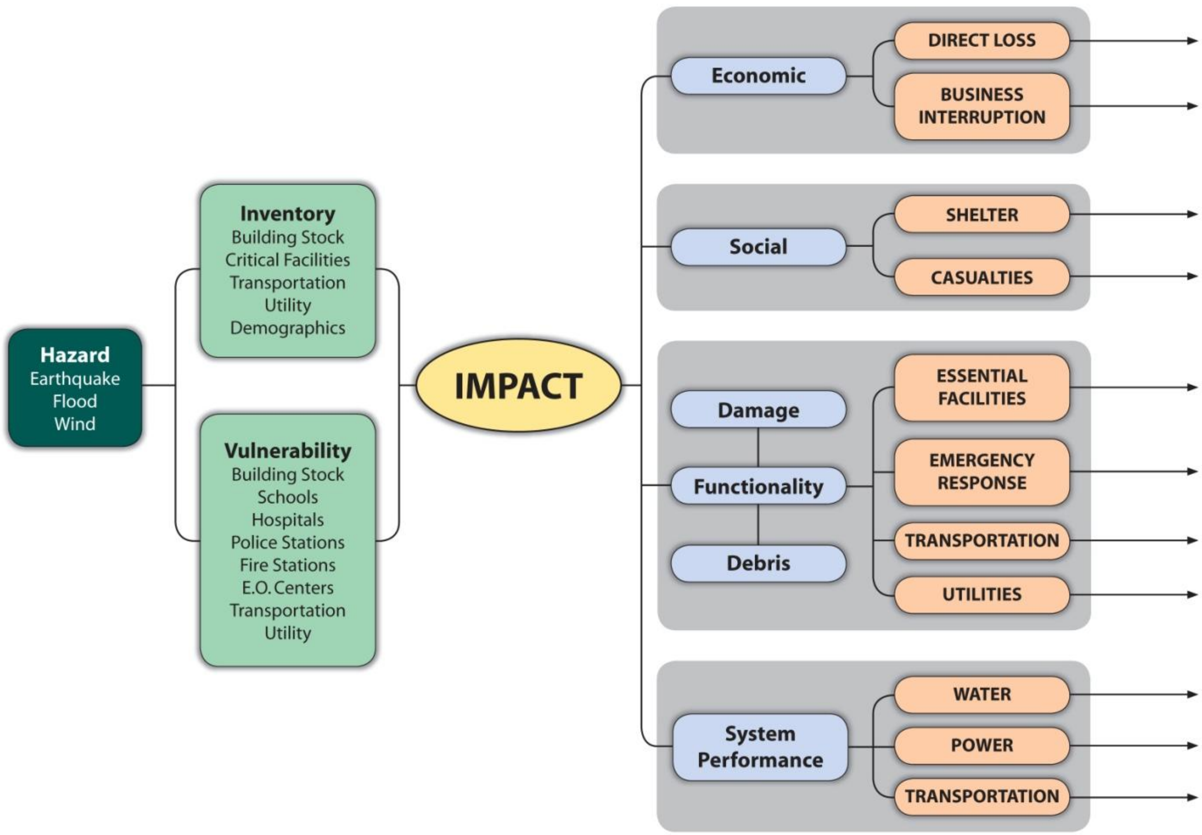
Hazus-MH

Hazus-MH ("Hazus") is a standardized loss estimation software program developed by FEMA. It is built upon an integrated GIS platform to conduct analysis at a regional level (i.e., not on a structure-by-structure basis). The Hazus risk assessment methodology is parametric, in that distinct hazard and inventory parameters (e.g., wind speed and building types) can be modeled using the software to determine the impact (i.e., damages and losses) on the built environment.

The South Mountains Regional Risk Assessment utilized Hazus-MH to produce hazard damage loss estimations for hazards for the planning area. At the time this analysis was completed, Hazus-MH 2.1 was used to estimate potential damages from hurricane winds earthquake hazards using Hazus-MH methodology. Although the program can also model losses for flood and storm surge, it was not used in this Risk Assessment.

Figure 6.1 illustrates the conceptual model of the Hazus-MH methodology.

FIGURE 6.1: CONCEPTUAL MODEL OF HAZUS-MH METHODOLOGY



Hazus-MH is capable of providing a variety of loss estimation results. In order to be consistent with other hazard assessments, annualized losses are presented when possible. Some additional results based on location-specific scenarios may also be presented to provide a complete picture of hazard vulnerability.

Loss estimates provided in this vulnerability assessment are based on best available data and methodologies. The results are an approximation of risk. These estimates should be used to understand relative risk from hazards and potential losses. Uncertainties are inherent in any loss estimation methodology, arising in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties also result from approximations and simplifications that are necessary for a comprehensive analysis (e.g., incomplete inventories, non-specific locations, demographics, or economic parameters).

All conclusions are presented in "Conclusions on Hazard Vulnerability" at the end of this section.

6.3 EXPLANATION OF DATA SOURCES

Earthquake

Hazus-MH 2.1 (as described above) was used to assess earthquake vulnerability. A level 1, probabilistic scenario to estimate annualized loss was utilized. In this scenario, several return periods (events of varying intensities) are run to determine annualized loss. Default Hazus earthquake damage functions and methodology were used to determine the probability of damage for 100-, 250- 500-, 750-, 1,000-, 1,500-, and 2,500-year frequency events (also known as a return period). Results are calculated at the 2000 U.S. Census tract level in Hazus and presented at the county level.

Flood

FEMA Digital Flood Insurance Rate Maps (DFIRMs) were used to determine flood vulnerability. DFIRM data can be used in ArcGIS for mapping purposes and, they identify several features including floodplain boundaries and base flood elevations. Identified areas on the DFIRM represent some features of a Flood Insurance Rate Maps including the 100-year flood areas (1.0-percent annual chance flood), and the 500-year flood areas (0.2-percent annual chance flood). For the vulnerability assessment, local parcel data and critical facilities were overlaid on the 100-year floodplain areas and 500-year floodplain areas. It should be noted that such an analysis does not account for building elevation.

Hurricane and Tropical Storm Wind

Hazus-MH 2.1 (as described above) was used to assess wind vulnerability. For the hurricane wind analysis, a probabilistic scenario was created to estimate the annualized loss damage and probable peak wind speeds in the South Mountains Region. Default Hazus wind speed data, damage functions, and methodology were used in to determine the probability of damage for 50-, 100-, 500-, and 1,000-year frequency events (also known as return periods) in the scenario. Results are calculated in Hazus at the 2000 U.S. Census tract level and presented at the county level.

Hazardous Materials Incident

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

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

For the mobile hazardous materials incident analysis, transportation data including major highways and railroads were obtained from the North Carolina Department of Transportation. This data is ArcGIS compatible, lending itself to buffer analysis to determine risk.

Wildfire

The data used to determine vulnerability to wildfire in the South Mountains Region is based on GIS data called the Southern Wildfire Risk Assessment (SWRA). It was provided for use in this plan by the North Carolina Division of Forest Resources. A specific layer, known as "Level of Concern" (LOC) was used to determine vulnerability of people and property. The LOC is presented on a scale of 1 to 100. It combines a Wildfire Susceptibility Index (WFSI) with a Fire Effects Index (FEI). The primariy purpose of the LOC data is to highlight areas of concern that may be conducive to mitigation actions. Due to the assumptions made, it is not a true probability. However, it does provide a comparison of risk throughout the region.

6.4 ASSET INVENTORY

An inventory of geo-referenced assets within the South Mountains counties and jurisdictions was compiled in order to identify and characterize those properties potentially at risk to the identified hazards[2]. By understanding the type and number of assets that exist and where they are located in relation to known hazard areas, the relative risk and vulnerability for such assets can be assessed. Under this assessment, two categories of physical assets were created and then further assessed through GIS analysis. Additionally, social assets are addressed to determine population at risk to the identified hazards. These are presented below in Section 6.4.2.

6.4.1 Physical and Improved Assets

The two categories of physical assets consist of:

1. Improved Property: Includes all improved properties in the South Mountains Region according to local parcel data provided by counties and the Tribe. The information has been expressed in terms of the number of parcels and total assessed value of improvements (buildings) that may be exposed to the identified hazards.

2. Critical Facilities: Critical facilities vary by jurisdiction. When provided, the critical facilities provided by the jurisdiction are used in this section. If no critical facilities are identified, facilities were used from Hazus-MH which includes fire stations, police station, medical care facilities, schools, and emergency operation centers. It should be noted that this listing is not all-inclusive for assets located in the region, but it is anticipated that it will be expanded during future plan updates as more geo-referenced data becomes available for use in GIS analysis.

The following tables provide a detailed listing of the geo-referenced assets that have been identified for inclusion in the vulnerability assessment for the South Mountains Region.

[2] While potentially not all-inclusive for the jurisdictions in the Smoky Mountain region, "georeferenced" assets include those assets for which specific location data is readily available for connecting the asset to a specific geographic location for purposes of GIS analysis.

Table 6.1 lists the number of parcels, total value of parcels, total number of parcels with improvements, and the total assessed value of improvements for participating areas of the South Mountains Region (study area of vulnerability assessment).[3]

TABLE 6.1: IMPROVED PROPERTY IN THE SOUTH MOUNTAINS REGION

Location	Number of Parcels	Total Assessed Value of Parcels	Estimated Number of Buildings	Total Assessed Value of Improvements
Henderson County[4]	**66,107**	**$10,396,776,039**	**45,556**	**$7,739,549,906**
Flat Rock	2,606	$758,010,392	2,010	$589,718,500
Fletcher	3,013	$591,563,653	2,681	$447,841,700
Hendersonville	6,171	$1,239,785,324	5,251	$1,008,549,200
Laurel Park	1,752	$320,468,100	1,230	$247,351,500
Mills River	3,751	$651,179,503	2,647	$495,320,800
Unincorporated Area	48,814	$6,835,769,067	31,737	$4,950,768,206
Polk County	**17,539**	**$3,168,593,354**	**10,066**	**$1,673,429,111**
Columbus	557	$138,070,173	426	$94,219,961
Saluda	684	$90,214,073	461	$61,178,796
Tryon	1,076	$156,252,053	812	$115,486,478
Unincorporated Area	15,222	$2,784,057,055	8,367	$1,402,543,876
Rutherford County	**58,410**	**$5,415,218,020**	**32,801**	**$3,475,907,050**
Bostic	258	$24,957,450	179	$21,554,050
Chimney Rock Village	438	$47,710,950	188	$18,841,350
Ellenboro	542	$24,788,350	399	$17,807,450
Forest City	4,603	$456,893,840	3,276	$321,462,000
Lake Lure	4,434	$752,508,400	1,729	$302,754,000
Ruth	232	$18,082,500	158	$13,931,200
Rutherfordton	2,389	$303,983,850	1,678	$252,924,100
Spindale	2,785	$172,674,050	1,888	$133,768,150
Unincorporated Area	42,729	$3,613,618,630	23,306	$2,392,864,750
Transylvania County	**30,006**	**$6,591,668,384**	**16,654**	**$3,359,008,574**
Brevard	3,613	$5,555,744,965	2,944	$649,029,699
Rosman	232	$1,004,137,829	131	$23,565,880
Unincorporated Area	26,161	$31,785,590	13,579	$2,686,412,995
SOUTH MOUNTAINS REGION TOTAL	**172,062**	**$25,572,255,797**	**105,077**	**$16,247,894,641**

Table 6.2 lists the fire stations, police stations, emergency operations centers (EOCs), medical care facilities, and schools and other critical facilities located in the South Mountains Region. Local county GIS departments supplied the critical facility data in most cases and when that information was not available, the data was pulled from Hazus-MH 2.1. It should be noted that some counties did not have

[3] Total assessed values for improvements is based on tax assessor records as joined to digital parcel data. This data does not include dollar figures for tax-exempt improvements such as publicly-owned buildings and facilities. It should also be noted that, due to record keeping, some duplication is possible thus potentially resulting in an inflated value exposure for an area.
[4] Number of buildings for each county is based on the number of parcels with an improved building value greater than zero.

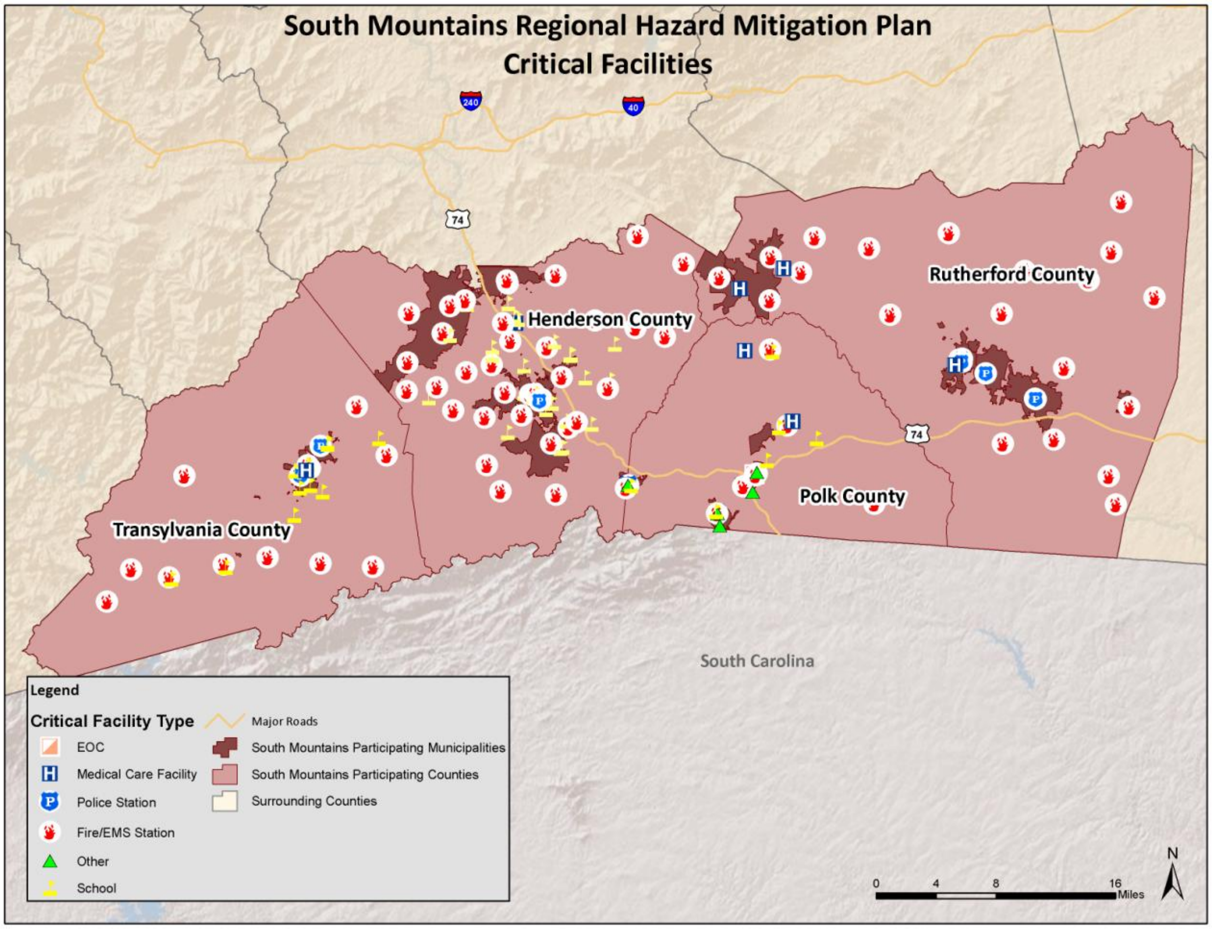
digital data available for some of the critical facility categories. Therefore, information provided may be incomplete. In addition, **Figure 6.2** shows the locations of essential facilities in the South Mountains Region. **Table 6.14**, near the end of this section, shows a complete list of the critical facilities by name, as well as the hazards that affect each facility. As noted previously, this list is not all-inclusive and only includes information provided by the counties.

TABLE 6.2: CRITICAL FACILITY INVENTORY IN THE SOUTH MOUNTAINS REGION

Location	Fire/EMS Stations	Police Stations	Medical Care Facilities	EOC	Schools	Other
Henderson County	**35**	**4**	**2**	**0**	**28**	**0**
Flat Rock	1	0	0	0	0	0
Fletcher	1	1	0	0	0	0
Hendersonville	3	3	1	0	6	0
Laurel Park	1	0	0	0	0	0
Mills River	5	0	0	0	2	0
Unincorporated Area	24	0	1	0	20	0
Polk County	**8**	**4**	**3**	**1**	**6**	**8**
Columbus	3	2	1	1	0	4
Saluda	1	1	0	0	1	1
Tryon	1	1	0	0	1	2
Unincorporated Area	3	0	2	0	4	1
Rutherford County	**23**	**4**	**3**	**0**	**0**	**0**
Bostic	1	0	0	0	0	0
Chimney Rock Village	1	0	0	0	0	0
Ellenboro	1	0	0	0	0	0
Forest City	1	1	0	0	0	0
Lake Lure	2	0	1	0	0	0
Ruth	0	0	0	0	0	0
Rutherfordton	1	2	1	0	0	0
Spindale	1	1	0	0	0	0
Unincorporated Area	15	0	1	0	0	0
Transylvania County	**13**	**2**	**1**	**0**	**12**	**0**
Brevard	3	2	1	0	6	0
Rosman	1	0	0	0	1	0
Unincorporated Area	9	0	0	0	5	0
SOUTH MOUNTAINS REGION TOTAL	**79**	**14**	**9**	**1**	**46**	**8**

Source: Hazus-MH

FIGURE 6.2: CRITICAL FACILITY LOCATIONS IN THE SOUTH MOUNTAINS REGION



Source: Hazus-MH 2.1

6.4.2 Social Vulnerability

In addition to identifying those assets potentially at risk to identified hazards, it is important to identify and assess those particular segments of the resident population in the South Mountains Region that are potentially at risk to these hazards.

Table 6.3 lists the population by jurisdiction according to U.S. Census 2010 population estimates. Unfortunately, estimates were not available at the census block level, which limited the results to county-wide estimates. The total population in the South Mountains Region according to Census data is 228,150 persons. Additional population estimates are presented in Section 3: *Community Profile*.

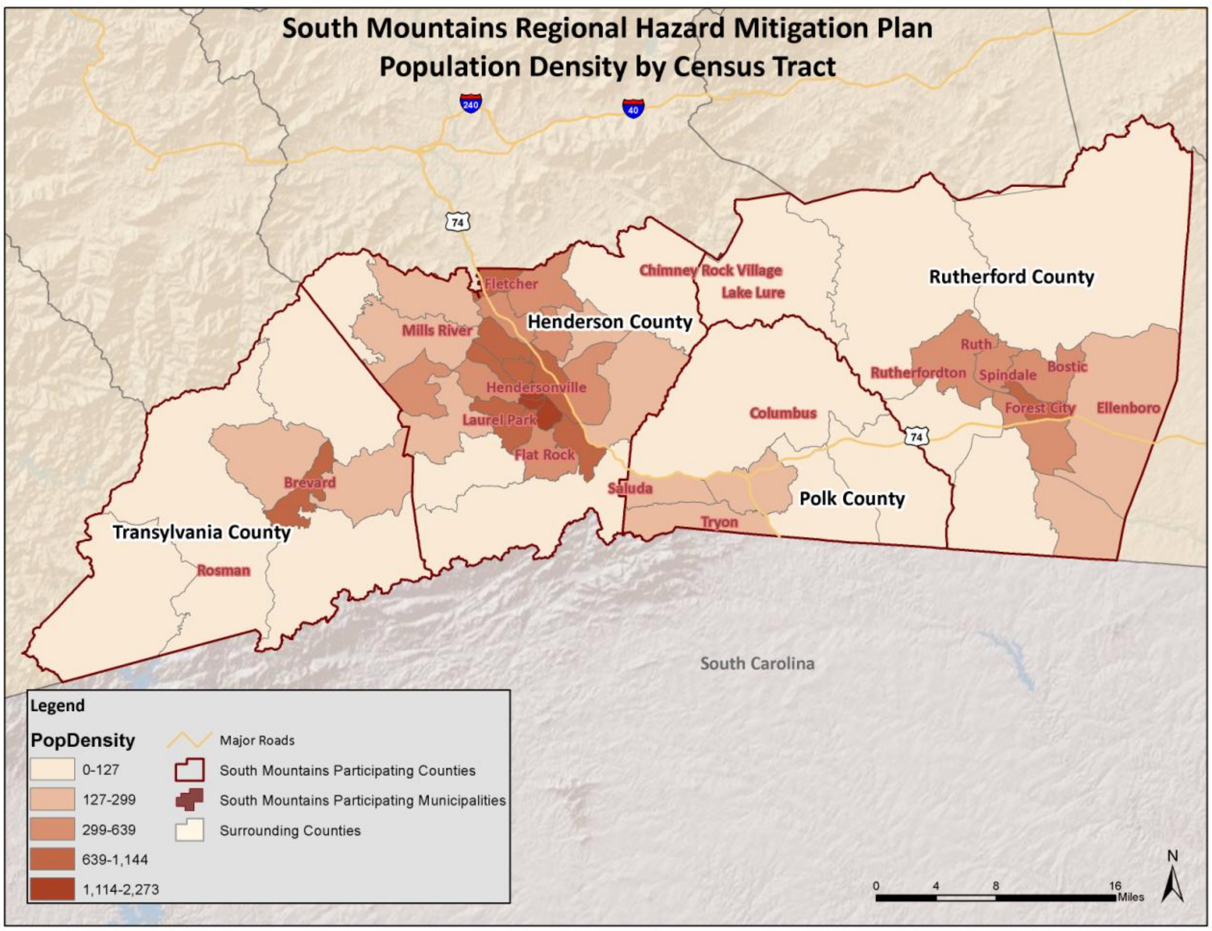
TABLE 6.3: TOTAL POPULATION IN THE SOUTH MOUNTAINS REGION

Location	Total 2010 Population
Henderson County	106,740
Polk County	20,510
Rutherford County	67,810
Transylvania County	33,090
SOUTH MOUNTAINS REGION TOTAL	**228,150**

Source: U.S. Census 2010

In addition, **Figure 6.3** illustrates the population density by census tract as it was reported by the U.S. Census Bureau in 2010.[5]

FIGURE 6.3: POPULATION DENSITY IN THE SOUTH MOUNTAINS REGION



Source: U.S. Census Bureau, 2010

[5] Population by census block was not available at the time this plan was completed.

6.4.3 Development Trends and Changes in Vulnerability

Since the previous county hazard mitigation plans were approved (in 2011), the South Mountains Region has experienced limited growth and development. **Table 6.4** shows the number of building units constructed since 2010 according to the US Census American Community Survey.

TABLE 6.4: BUILDING COUNTS FOR THE SOUTH MOUNTAINS REGION

Jurisdiction	Total Housing Units (2012)	Units Built 2010 or later	% Building Stock Built Post-2010
Henderson County	**54,510**	**214**	**0.4%**
Flat Rock	1,901	0	0.0%
Fletcher	3,297	17	0.5%
Hendersonville	6,925	43	0.6%
Laurel Park	1,420	0	0.0%
Mills River	3,255	0	0.0%
Unincorporated Area	37,712	154	0.4%
Polk County	**11,373**	**23**	**0.2%**
Columbus	732	0	0.0%
Saluda	529	0	0.0%
Tryon	1,163	0	0.0%
Unincorporated Area	8,949	23	0.3%
Rutherford County	**33,769**	**26**	**0.1%**
Bostic	175	0	0.0%
Chimney Rock Village	225	0	0.0%
Ellenboro	390	0	0.0%
Forest City	3,894	0	0.0%
Lake Lure	2,106	8	0.4%
Ruth	160	2	1.3%
Rutherfordton	1,970	0	0.0%
Spindale	2,265	0	0.0%
Unincorporated Area	22,584	16	0.1%
Transylvania County	**19,092**	**0**	**0.0%**
Brevard	3,808	0	0.0%
Rosman	414	0	0.0%
Unincorporated Area	14,870	0	0.0%
SOUTH MOUNTAINS REGION TOTAL	**118,744**	**263**	**0.2%**

Source: US Census Bureau

Table 6.5 shows population growth estimates for the region from 2010 to 2013 based on the US Census Annual Estimates of Resident Population.

TABLE 6.5: POPULATION GROWTH FOR THE SOUTH MOUNTAINS REGION

Jurisdiction	Population Estimates (as of July 1)				% Change 2010-2013
	2010	2011	2012	2013	
Henderson County	**106,941**	**107,522**	**108,097**	**109,540**	**2.4%**
Flat Rock	3,121	3,145	3,171	3,222	3.2%
Fletcher	7,206	7,243	7,281	7,378	2.4%
Hendersonville	13,132	13,210	13,282	13,466	2.5%
Laurel Park	2,183	2,211	2,221	2,255	3.3%
Mills River	6,817	6,852	6,888	6,979	2.4%
Unincorporated Area	74,482	74,861	75,254	76,240	2.4%
Polk County	**20,442**	**20,278**	**20,242**	**20,411**	**-0.2%**
Columbus	996	989	988	997	0.1%
Saluda	715	701	701	707	-1.1%
Tryon	1,638	1,618	1,622	1,638	0.0%
Unincorporated Area	17,093	16,970	16,931	17,069	-0.1%
Rutherford County	**67,784**	**67,412**	**67,303**	**66,956**	**-1.2%**
Bostic	386	383	381	378	-2.1%
Chimney Rock Village	110	110	110	109	-0.9%
Ellenboro	873	868	867	862	-1.3%
Forest City	7,475	7,441	7,438	7,404	-0.9%
Lake Lure	1,195	1,193	1,195	1,193	-0.2%
Ruth	440	436	435	431	-2.0%
Rutherfordton	4,230	4,227	4,231	4,222	-0.2%
Spindale	4,321	4,309	4,299	4,285	-0.8%
Unincorporated Area	48,754	48,445	48,347	48,072	-1.4%
Transylvania County	**33,080**	**32,828**	**32,805**	**32,903**	**-0.5%**
Brevard	7,682	7,628	7,619	7,645	-0.5%
Rosman	576	569	565	565	-1.9%
Unincorporated Area	24,822	24,631	24,621	24,693	-0.5%
SOUTH MOUNTAINS REGION TOTAL	**228,247**	**228,040**	**228,447**	**229,810**	**0.7%**

Source: US Census Bureau

Based on the data above, there has been a low rate of residential development and population growth in the region since 2010. Therefore, changes in development have not impacted the region's vulnerability since the previous county hazard mitigation plans were approved and there has been little change in the overall vulnerability. However, it is important to note that as development increases in the future, greater populations and more structures and infrastructure will be exposed to potential hazards if development occurs in the floodplains, high and moderate landside susceptibility areas, primary and secondary TRI site buffers, or high wildfire risk areas.

6.5 VULNERABILITY ASSESSMENT RESULTS

As noted earlier, only hazards with a specific geographic boundary, modeling tool, or sufficient historical data allow for further analysis. Those results are presented here. All other hazards are assumed to impact the entire planning region (drought, hailstorm, lightning, thunderstorm wind, tornado, and winter storm and freeze) or, due to lack of data, analysis would not lead to credible results (erosion, dam and levee failure). The total region exposure, and thus risk, was presented in **Table 6.1**.

The annualized loss estimate for all hazards is presented at the end of this section in **Table 6.13.**

The hazards presented in this subsection include: hurricane and tropical storm winds, earthquake, landslide, flood, hazardous materials incident, and wildfire.

6.5.1 Hurricane and Tropical Storm

Historical evidence indicates that the South Mountains Region has a significant risk to the hurricane and tropical storm hazard. There have been two disaster declarations due to hurricanes (Hurricane Ivan and Tropical Storm Frances) in the region. Several tracks have come near or traversed through the South Mountains Region, as shown and discussed in Section 5: *Hazard Profiles*.

Hurricanes and tropical storms can cause damage through numerous additional hazards such as flooding, erosion, tornadoes, and high winds and precipitation, thus it is difficult to estimate total potential losses from these cumulative effects. The current Hazus-MH hurricane model only analyzes hurricane winds and is not capable of modeling and estimating cumulative losses from all hazards associated with hurricanes; therefore only hurricane winds are analyzed in this section. It can be assumed that all existing and future buildings and populations are at risk to the hurricane and tropical storm hazard. Hazus-MH 2.1 was used to determine annualized losses for the region as shown below in **Table 6.6.** Only losses to buildings are reported, in order to best match annualized losses reported for other hazards. Hazus-MH reports losses at the U.S. Census tract level, so determining participating jurisdiction losses was not possible.

TABLE 6.6: ANNUALIZED LOSS ESTIMATIONS FOR HURRICANE WIND HAZARD

Location	Total Annualized Loss
Henderson County	$151,000
Polk County	$36,000
Rutherford County	$167,000
Transylvania County	$43,000
SOUTH MOUNTAINS REGION TOTAL	**$397,000**

Source: Hazus-MH 2.1

In addition, probable peak wind speeds were calculated in Hazus. These are shown below in **Table 6.7.**

TABLE 6.7: PROBABLE PEAK HURRICANE/TROPICAL STORM WIND SPEEDS (MPH)

Location	50-year event	100-year event	500-year event	1,000-year event
Henderson County	**54**	**63**	**82**	**90**
Flat Rock	54	63	82	90

Location	50-year event	100-year event	500-year event	1,000-year event
Fletcher	53	62	81	88
Hendersonville	54	63	82	90
Laurel Park	53	62	81	89
Mills River	52	61	80	88
Polk County	**55**	**65**	**84**	**92**
Columbus	55	65	84	92
Saluda	55	64	83	92
Tryon	55	64	83	92
Rutherford County	**57**	**66**	**86**	**92**
Bostic	56	66	85	91
Chimney Rock Village	53	63	82	89
Ellenboro	57	66	86	92
Forest City	56	66	86	92
Lake Lure	53	63	82	89
Ruth	56	66	85	91
Rutherfordton	56	66	85	91
Spindale	56	66	86	92
Transylvania County	**53**	**62**	**81**	**89**
Brevard	53	62	81	89
Rosman	52	62	80	87
MAXIMUM WIND SPEED REPORTED	**57**	**66**	**86**	**92**

Source: Hazus-MH 2.1

Social Vulnerability

Given some equal susceptibility across the entire South Mountains Region, it is assumed that the total population is at risk to the hurricane and tropical storm hazard.

Critical Facilities

Given equal vulnerability across the South Mountains Region, all critical facilities are considered to be at risk. Some buildings may perform better than others in the face of such an event due to construction and age, among other factors. Determining individual building response is beyond the scope of this plan. However, this plan will consider mitigation actions for vulnerable structures, including critical facilities, to reduce the impacts of the hurricane wind hazard. A list of specific critical facilities and their associated risk can be found in **Table 6.14** at the end of this section.

In conclusion, a hurricane event has the potential to impact many existing and future buildings, critical facilities, and populations in the South Mountain Region. Hurricane events can cause substantial damage in their wake including fatalities, extensive debris clean-up, and extended power outages.

6.5.2 Earthquake

For the earthquake hazard vulnerability assessment, a probabilistic scenario was created to estimate the annualized loss for the region. The results of the analysis reported at the U.S. Census tract level do not make it feasible to estimate losses at the jurisdiction level. Since the scenario is annualized, no building counts are provided. Losses reported included losses due to building damage and do not include losses to contents, inventory, or business interruption. **Table 6.8** summarizes the findings.

TABLE 6.8: ANNUALIZED LOSS ESTIMATIONS FOR EARTHQUAKE HAZARD

Location	Total Annualized Loss
Henderson County	$51,000
Polk County	$9,000
Rutherford County	$30,000
Transylvania County	$18,000
SOUTH MOUNTAINS REGION TOTAL	**$107,000**

Source: Hazus-MH 2.1

Social Vulnerability

It can be assumed that all existing future populations are at risk to the earthquake hazard.

Critical Facilities

The Hazus probabilistic analysis indicated that no critical facilities would sustain measurable damage in an earthquake event. However, all critical facilities should be considered at-risk to minor damage, should an event occur. A list of individual critical facilities and their risk can be found in **Table 6.14**.

In conclusion, an earthquake has the potential to impact all existing and future buildings, facilities, and populations in the South Mountains Region. Minor earthquakes may rattle dishes and cause minimal damage while stronger earthquakes will result in structural damage as indicated in the Hazus scenario above. Impacts of earthquakes include debris clean-up, service disruption and, in severe cases, fatalities due to building collapse. Specific vulnerabilities for assets will be greatly dependent on their individual design and the mitigation measures in place, where appropriate. Such site-specific vulnerability determinations are outside the scope of this assessment but will be considered during future plan updates if data becomes available. Furthermore, mitigation actions to address earthquake vulnerability will be considered.

6.5.3 Landslide

In order to complete the vulnerability assessment for landslides in the South Mountains Region, GIS analysis was used. The potential dollar value of exposed land and property total can be determined using the USGS Landslide Susceptibility Index (detailed in Section 5: *Hazard Profiles*), county level tax parcel data, and GIS analysis. **Table 6.9** presents the potential at-risk property where available. Many areas of the South Mountains Region are identified as moderate or high incidence areas by the USGS landslide data and nearly all areas of the counties are also areas of high landslide susceptibility. The incidence levels (high and moderate) were used to identify different areas of concern for the analysis below.

TABLE 6.9: TOTAL POTENTIAL AT-RISK PARCELS FOR THE LANDSLIDE HAZARD

Location	Number of Parcels At Risk		Number of Improvements At Risk		Total Value of Improvements At Risk ($)	
Incidence Level	Moderate	High	Moderate	High	Moderate	High
Henderson County	**14,671**	**0**	**10,109**	**0**	**$1,713,769,900**	**$0**
Flat Rock	0	0	0	0	$0	$0
Fletcher	2,261	0	2,009	0	$338,940,400	$0
Hendersonville	0	0	0	0	$0	$0
Laurel Park	0	0	0	0	$0	$0
Mills River	3,758	0	2,647	0	$495,320,800	$0
Unincorporated Area	8,652	0	5,453	0	$879,508,700	$0
Polk County	**17,508**	**0**	**10,050**	**0**	**$1,672,140,909**	**$0**
Columbus	557	0	426	0	$94,219,961	$0
Saluda	684	0	461	0	$61,178,796	$0
Tryon	1,076	0	812	0	$115,486,478	$0
Unincorporated Area	15,191	0	8,351	0	$1,401,255,674	$0
Rutherford County	**14,190**	**0**	**8,996**	**0**	**$834,070,220**	**$0**
Bostic	0	0	0	0	$0	$0
Chimney Rock Village	0	0	0	0	$0	$0
Ellenboro	0	0	0	0	$0	$0
Forest City	350	0	270	0	$11,281,600	$0
Lake Lure	36	0	17	0	$6,465,300	$0
Ruth	0	0	0	0	$0	$0
Rutherfordton	0	0	0	0	$0	$0
Spindale	0	0	0	0	$0	$0
Unincorporated Area	13,804	0	8,709	0	$816,323,320	$0
Transylvania County	**26,941**	**1,609**	**15,404**	**716**	**$3,169,966,133**	**$92,238,450**
Brevard	3,613	0	2,944	0	$649,029,699	$0
Rosman	232	0	131	0	$23,565,880	$0
Unincorporated Area	23,096	1,609	12,329	716	$2,497,370,554	$92,238,450
SOUTH MOUNTAINS REGION TOTAL	**73,310**	**1,609**	**44,559**	**716**	**$7,389,947,162**	**$92,238,450**

Source: USGS

Social Vulnerability

Given high susceptibility across the entire South Mountains Region, it is assumed that the total population is at risk.

Critical Facilities

All critical facilities are located in a high susceptibility area. Only one critical facility is located in a high incidence area, a fire station in Transylvania County. In addition, two police stations, twelve fire stations, twelve schools, and one medical care facility are located in moderate incidence area of Transylvania County. In Rutherford County four fire stations are located in the moderate incidence area and in Polk County, all critical facilities are located in the moderate incidence area. Finally, Henderson County has seven fire stations, one police station, and three schools located in the moderate incidence area. A list of specific critical facilities and their associated risk can be found in **Table 6.14** at the end of this section.

In conclusion, a landslide has the potential to impact all existing and future buildings, facilities, and populations in the South Mountains Region, though some areas are at a higher risk than others due to a variety of factors. For example, steep slopes and modified slopes bear a greater risk than flat areas. Specific vulnerabilities for South Mountains assets will be greatly dependent on their individual design and the mitigation measures in place, where appropriate. Such site-specific vulnerability determinations are outside the scope of this assessment but will be considered during future plan updates if data becomes available.

6.5.4 Flood

Historical evidence indicates that the South Mountains Region is susceptible to flood events. A total of 160 flood events have been reported by the National Climatic Data Center resulting in $40.6 million dollars in damages and thirteen injuries. On an annualized level, these damages amounted to just over $2 million for the South Mountains Region.

In order to assess flood risk, a GIS-based analysis was used to estimate exposure to flood events using Digital Flood Insurance Rate Map (DFIRM) data in combination with local tax assessor records for each of the South Mountains counties. The determination of assessed value at-risk (exposure) was calculated using GIS analysis by summing the total assessed building values for only those improved properties that were confirmed to be located within an identified floodplain. **Table 6.10** presents the potential at-risk property. Both the number of parcels and the approximate value are presented.

TABLE 6.10: ESTIMATED EXPOSURE OF PARCELS TO THE FLOOD HAZARD

	1.0-percent ACF			0.2-percent ACF		
Location	Approx. Number of Parcels	Approx. Number Improved Buildings	Approx. Improved Value of Buildings	Approx. Number of Parcels	Approx. Number Improved Buildings	Approx. Improved Value of Buildings
Henderson County	**4,936**	**3,365**	**$741,877,000**	**759**	**591**	**$91,650,800**
Flat Rock	117	83	$28,171,600	8	5	$1,082,800
Fletcher	557	498	$104,945,200	66	61	$9,351,500
Hendersonville	659	531	$125,910,400	129	105	$17,061,200
Laurel Park	47	32	$5,387,800	35	29	$4,491,800
Mills River	326	190	$51,923,800	49	28	$8,065,900
Unincorporated Area	3,230	2,031	$425,538,200	472	363	$51,597,600
Polk County	**1,786**	**859**	**$174,067,053**	**63**	**44**	**$9,384,918**
Columbus	3	3	$677,362	0	0	$0
Saluda	1	1	$20,486	0	0	$0
Tryon	82	50	$7,891,077	0	0	$0
Unincorporated Area	1,700	805	$165,478,128	63	44	$9,384,918
Rutherford County	**5,272**	**2,780**	**$492,073,110**	**73**	**33**	**$4,118,100**
Bostic	1	1	$5,300	0	0	$0
Chimney Rock Village	81	36	$4,244,200	13	10	$626,400

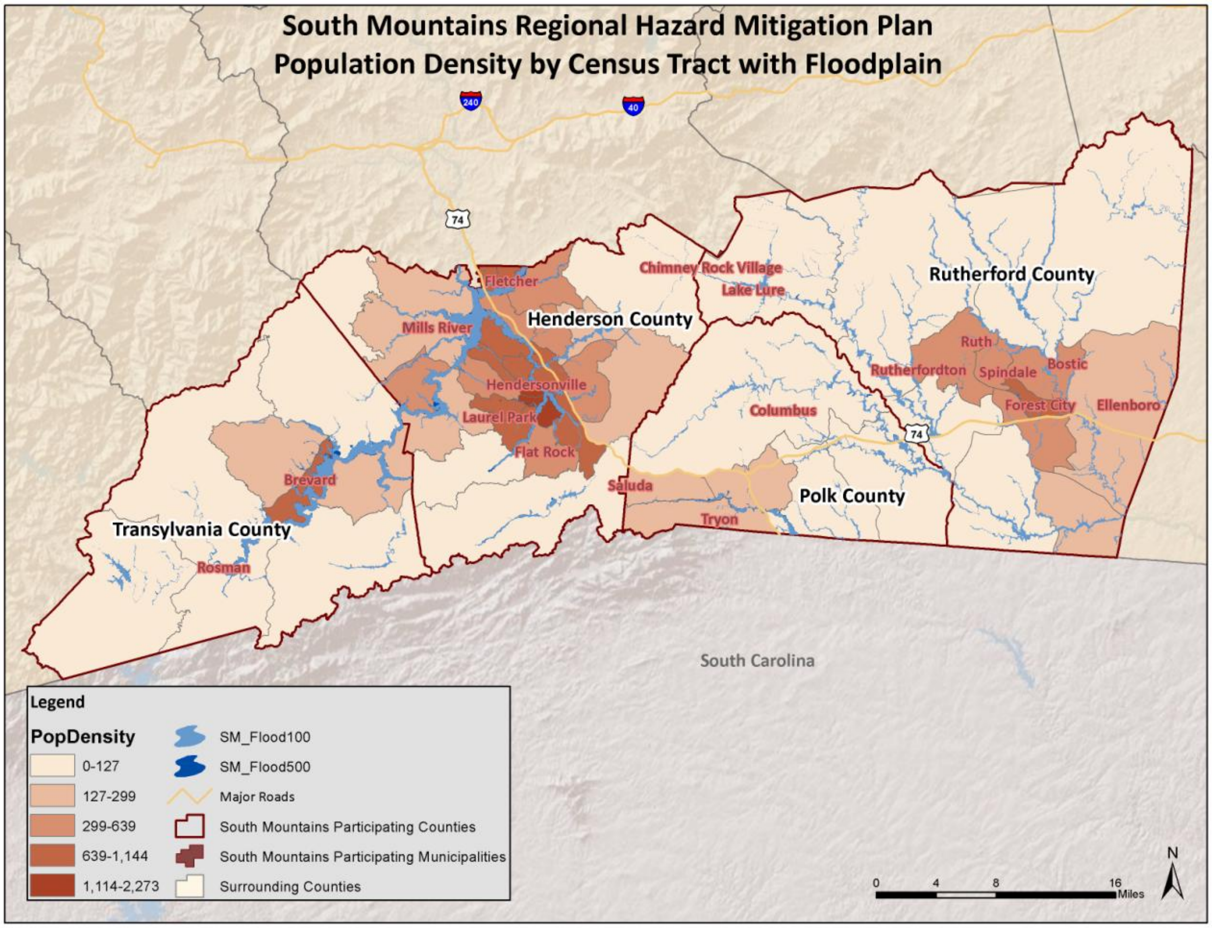
	1.0-percent ACF			0.2-percent ACF		
Location	Approx. Number of Parcels	Approx. Number Improved Buildings	Approx. Improved Value of Buildings	Approx. Number of Parcels	Approx. Number Improved Buildings	Approx. Improved Value of Buildings
Ellenboro	0	0	$0	0	0	$0
Forest City	182	76	$15,837,400	23	10	$1,446,900
Lake Lure	915	677	$122,617,650	2	2	$1,299,900
Ruth	15	8	$390,800	0	0	$0
Rutherfordton	233	142	$14,545,300	5	5	$361,800
Spindale	31	18	$2,414,300	0	0	$0
Unincorporated Area	3,814	1,822	$332,018,160	30	6	$383,100
Transylvania County	**3,023**	**1,850**	**$573,042,954**	**301**	**219**	**$68,883,785**
Brevard	423	328	$166,517,904	75	60	$16,923,625
Rosman	58	30	$3,665,740	27	18	$1,327,820
Unincorporated Area	2,542	1,492	$402,859,310	199	141	$50,632,340
SOUTH MOUNTAINS REGION TOTAL	**15,017**	**8,854**	**$1,981,060,117**	**1,196**	**887**	**$174,037,603**

Source: FEMA DFIRM

Social Vulnerability

Since 2010 population was available at the tract level, it was difficult to determine a reliable figure on population at-risk to flood due to tract level population data. **Figure 6.4** is presented to gain a better understanding of at risk population.

FIGURE 6.4 : POPULATION DENSITY NEAR FLOODPLAINS



Source: FEMA DFIRM, U.S. Census 2010

Critical Facilities

The critical facility analysis revealed that there are a total of six critical facilities located in the South Mountains Region 1.0-percent annual chance floodplain and 0.2-percent annual chance floodplain based on FEMA DFIRM boundaries and GIS analysis. (As previously noted, this analysis does not consider building elevation, which may negate risk.) There are no critical facilities in floodplains in Polk or Rutherford County floodplains. Henderson County analysis indicates 2 fire/EMS stations in the 100 year floodplain. Meanwhile, the Transylvania County analysis indicates 1 medical care facility, 1 fire/EMS station, and 1 school in the 100 year floodplain and 1 school in the 500 year floodplain. A list of specific critical facilities and their associated risk can be found in **Table 6.14** at the end of this section.

In conclusion, a flood has the potential to impact many existing and future buildings, facilities, and populations in the South Mountains Region, though some areas are at a higher risk than others. All types of structures in a floodplain are at-risk, though elevated structures will have a reduced risk. As noted, the floodplains used in this analysis include the 100-year and 500-year FEMA regulated floodplain boundaries. It is certainly possible that more severe events could occur beyond these boundaries or urban (flash) flooding could impact additional structures. Such site-specific vulnerability determinations are outside the scope of this assessment but will be considered during future plan updates. Furthermore, areas subject to repetitive flooding should be analyzed for potential mitigation actions.

6.5.5 Hazardous Materials Incident

Although historical evidence and existing Toxic Release Inventory sites indicate that the South Mountains Region is susceptible to hazardous materials events, there are few reports of damage. Therefore, it is difficult to calculate a reliable annualized loss figure. It is assumed that while one major event could result in significant losses, annualizing structural losses over a long period of time would most likely yield a negligible annualized loss estimate for the South Mountains Region.

Most hazardous materials incidents that occur are contained and suppressed before destroying any property or threatening lives. However, they can have a significant negative impact. Such events can cause multiple deaths, completely shut down facilities for 30 days or more, and cause more than 50 percent of affected properties to be destroyed or suffer major damage. In a hazardous materials incident, solid, liquid, and/or gaseous contaminants may be released from fixed or mobile containers. Weather conditions will directly affect how the hazard develops. Certain chemicals may travel through the air or water, affecting a much larger area than the point of the incidence itself. Non-compliance with fire and building codes, as well as failure to maintain existing fire and containment features, can substantially increase the damage from a hazardous materials release. The duration of a hazardous materials incident can range from hours to days. Warning time is minimal to none.

In order to conduct the vulnerability assessment for this hazard, GIS intersection analysis was used for fixed and mobile areas and parcels.[6] In both scenarios, two sizes of buffers—500 and 2,500 meters—were used. These areas are assumed to respect the different levels of effect: immediate (primary) and secondary. Primary and secondary impact sites were selected based on guidance from FEMA 426, Reference Manual to Mitigate Potential Terrorist Attacks against Buildings and engineering judgment. For the fixed site analysis, geo-referenced TRI listed toxic sites in the South Mountains Region, along with buffers, were used for analysis as shown in **Figure 6.5.** For the mobile analysis, the major roads (Interstate highway, U.S. highway, and State highway) and railroads, where hazardous materials are primarily transported that could adversely impact people and buildings, were used for the GIS buffer analysis. **Figure 6.6** shows the areas used for mobile toxic release buffer analysis. The results indicate the approximate number of parcels, improved value, as shown in **Table 6.11** (fixed sites), **Table 6.12** (mobile road sites) and **Table 6.13** (mobile railroad sites).[7]

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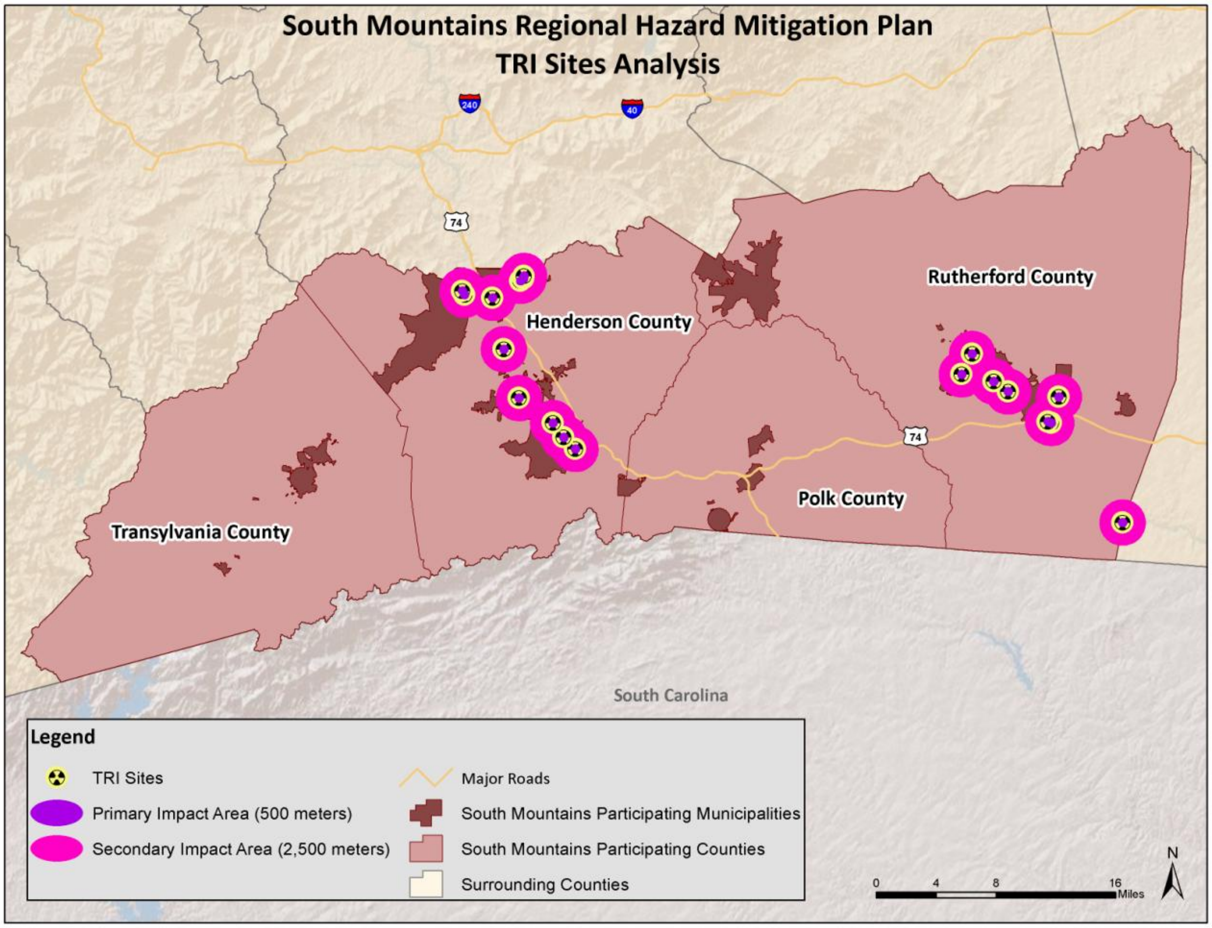
[6] This type of analysis will likely yield inflated results (generally higher than what is actually reported after an actual event).
[7] Note that parcels included in the 2,500 meter analysis are also included in the 500 meter analysis.

FIGURE 6.5 : TRI SITES WITH BUFFERS IN THE SOUTH MOUNTAINS REGION



Source: EPA

TABLE 6.11: EXPOSURE OF IMPROVED PROPERTY TO HAZARDOUS MATERIALS (FIXED SITES)

	500-meter buffer			2,500-meter buffer		
Location	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value
Henderson County	**1,179**	**933**	**$221,107,600**	**22,165**	**17,539**	**$3,009,127,606**
Flat Rock	115	102	$20,635,700	1,205	930	$210,844,100
Fletcher	46	37	$35,438,000	2,455	2,165	$362,888,800
Hendersonville	255	211	$44,682,000	5,183	4,415	$779,074,700
Laurel Park	0	0	$0	1,088	847	$146,970,400
Mills River	21	11	$19,901,200	980	689	$148,943,100
Unincorporated Area	742	572	$100,450,700	11,254	8,493	$1,360,406,506
Polk County	**0**	**0**	**$0**	**0**	**0**	**$0**
Columbus	0	0	$0	0	0	$0
Saluda	0	0	$0	0	0	$0
Tryon	0	0	$0	0	0	$0
Unincorporated Area	0	0	$0	0	0	$0
Rutherford County	**890**	**641**	**$86,246,750**	**13,715**	**9,430**	**$1,134,057,000**
Bostic	0	0	$0	75	57	$3,431,000
Chimney Rock Village	0	0	$0	0	0	$0
Ellenboro	0	0	$0	0	0	$0
Forest City	231	161	$33,345,200	3,839	2,766	$283,969,200
Lake Lure	0	0	$0	0	0	$0
Ruth	55	39	$4,985,100	232	158	$13,931,200
Rutherfordton	192	146	$10,386,700	2,325	1,642	$244,318,200
Spindale	221	166	$9,708,200	2,771	1,878	$132,875,750
Unincorporated Area	191	129	$27,821,550	4,473	2,929	$455,531,650
Transylvania County	**0**	**0**	**$0**	**0**	**0**	**$0**
Brevard	0	0	$0	0	0	$0
Rosman	0	0	$0	0	0	$0
Unincorporated Area	0	0	$0	0	0	$0
SOUTH MOUNTAINS REGION TOTAL	**2,069**	**1,574**	**$307,354,350**	**35,880**	**26,969**	**$4,143,184,606**

FIGURE 6.6 : MOBILE HAZMAT BUFFERS IN THE SOUTH MOUNTAINS REGION

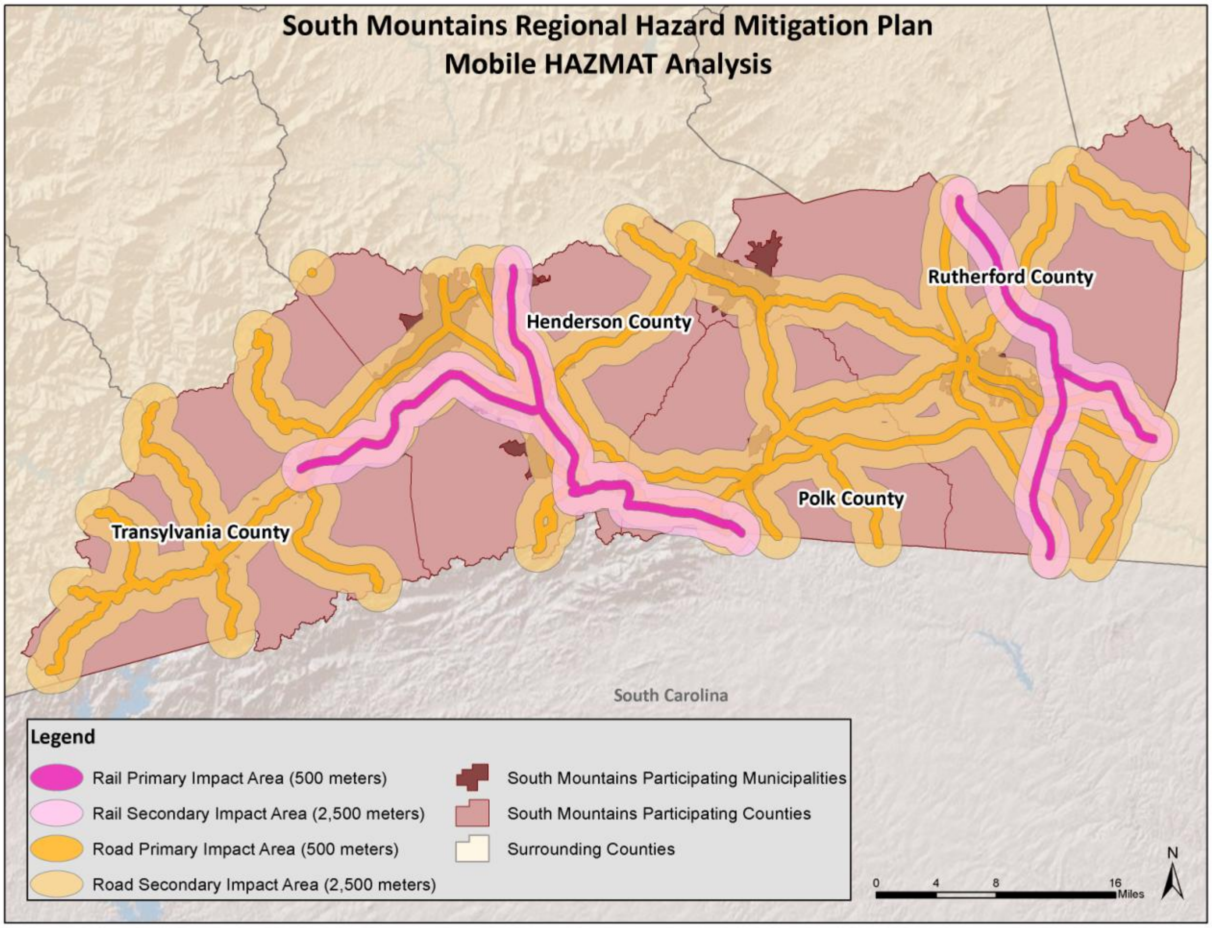


TABLE 6.12: EXPOSURE OF IMPROVED PROPERTY TO HAZARDOUS MATERIALS SPILL (MOBILE ANALYSIS - ROAD)

	500-meter buffer			2,500-meter buffer		
Location	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value
Henderson County	**22,160**	**16,854**	**$3,039,893,506**	**50,372**	**36,708**	**$6,282,320,806**
Flat Rock	777	613	$142,105,300	2,209	1,697	$497,135,400
Fletcher	1,176	1,011	$161,700,700	2,272	2,015	$345,905,800
Hendersonville	4,896	4,146	$870,805,400	6,171	5,251	$1,008,549,200
Laurel Park	271	240	$50,248,200	1,674	1,195	$237,329,100
Mills River	1,706	1,258	$234,334,500	3,687	2,609	$490,774,000
Unincorporated Area	13,334	9,586	$1,580,699,406	34,359	23,941	$3,702,627,306
Polk County	**5,327**	**3,555**	**$603,770,256**	**13,131**	**7,981**	**$1,300,152,719**
Columbus	416	308	$81,841,167	557	426	$94,219,961
Saluda	457	311	$40,301,108	684	461	$61,178,796
Tryon	673	546	$84,966,643	1,076	812	$115,486,478
Unincorporated Area	3,781	2,390	$396,661,338	10,814	6,282	$1,029,267,484
Rutherford County	**20,447**	**12,891**	**$1,508,018,220**	**42,974**	**25,809**	**$2,737,042,730**
Bostic	0	0	$0	3	2	$192,400
Chimney Rock Village	391	175	$14,201,250	438	188	$18,841,350
Ellenboro	427	323	$15,006,450	542	399	$17,807,450
Forest City	3,030	2,223	$237,191,600	4,603	3,276	$321,462,000
Lake Lure	1,662	691	$86,849,750	2,963	1,185	$175,312,350
Ruth	215	147	$12,070,000	232	158	$13,931,200
Rutherfordton	1,890	1,344	$197,686,000	2,389	1,678	$252,924,100
Spindale	1,586	1,114	$88,724,950	2,785	1,888	$133,768,150
Unincorporated Area	11,246	6,874	$856,288,220	29,019	17,035	$1,802,803,730
Transylvania County	**10,749**	**6,702**	**$1,263,157,345**	**24,684**	**14,335**	**$2,847,294,283**
Brevard	2,538	2,086	$486,167,349	3,613	2,944	$649,029,699
Rosman	213	116	$22,163,420	232	131	$23,565,880
Unincorporated Area	7,998	4,500	$754,826,576	20,839	11,260	$2,174,698,704
SOUTH MOUNTAINS REGION TOTAL	**58,683**	**40,002**	**$6,414,839,327**	**131,161**	**84,833**	**$13,166,810,538**

TABLE 6.13: EXPOSURE OF IMPROVED PROPERTY TO HAZARDOUS MATERIALS SPILL (MOBILE ANALYSIS - RAILROAD)

	500-meter buffer			2,500-meter buffer		
Location	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value
Henderson County	**7,782**	**6,041**	**$1,041,021,900**	**30,651**	**23,245**	**$3,952,176,606**
Flat Rock	262	221	$45,274,800	1,313	1,024	$242,793,800
Fletcher	95	62	$32,794,300	1,401	1,160	$219,115,600
Hendersonville	2,500	2,046	$325,273,100	5,577	4,740	$885,634,000
Laurel Park	708	578	$90,903,200	1,752	1,230	$247,351,500
Mills River	0	0	$0	50	38	$6,053,500
Unincorporated Area	4,217	3,134	$546,776,500	20,558	15,053	$2,351,228,206
Polk County	**1,440**	**1,041**	**$168,622,873**	**4,234**	**2,814**	**$423,346,591**
Columbus	0	0	$0	0	0	$0
Saluda	376	258	$34,361,083	684	461	$61,178,796
Tryon	561	462	$78,152,255	1,076	812	$115,486,478
Unincorporated Area	503	321	$56,109,535	2,474	1,541	$246,681,317
Rutherford County	**2,459**	**1,684**	**$157,315,170**	**10,368**	**6,956**	**$702,069,270**
Bostic	220	151	$20,451,750	258	179	$21,554,050
Chimney Rock Village	0	0	$0	0	0	$0
Ellenboro	342	257	$12,001,750	542	399	$17,807,450
Forest City	4	1	$22,600	1,402	1,011	$75,758,700
Lake Lure	0	0	$0	0	0	$0
Ruth	0	0	$0	0	0	$0
Rutherfordton	0	0	$0	0	0	$0
Spindale	0	0	$0	0	0	$0
Unincorporated Area	1,893	1,275	$124,839,070	8,166	5,367	$586,949,070
Transylvania County	**1,556**	**1,170**	**$241,394,575**	**7,245**	**5,206**	**$1,030,490,804**
Brevard	679	593	147376080	3452	2818	631494299
Rosman	0	0	0	0	0	0
Unincorporated Area	877	577	94018495	3793	2388	398996505
SOUTH MOUNTAINS REGION TOTAL	**13,237**	**9,936**	**$1,608,354,518**	**52,498**	**38,221**	**$6,108,083,271**

Social Vulnerability

Given high susceptibility across the entire South Mountains Region, it is assumed that the total population is at risk to hazardous materials incidents. It should be noted that areas of population concentration may be at an elevated risk due to a greater burden to evacuate population quickly.

Critical Facilities

Fixed Site Analysis:
The critical facility analysis for fixed TRI sites revealed that there are 40 facilities located in a HAZMAT risk zone. All the identified facilities are located in the secondary impact area as there are no critical facilities located in the primary impact zone. Included in the secondary, 2,500 meter zone are 17 Fire/EMS Stations, 2 Medical Care Facilities, 7 Police Stations, and 14 Schools. A list of specific critical facilities and their associated risk can be found in **Table 6.14** at the end of this section.

Mobile Analysis:
The critical facility analysis for road and railroad transportation corridors revealed that there are 139 critical facilities located in the primary and secondary mobile HAZMAT buffer areas for roads and 63 critical facilities located in the railroad HAZMAT buffer areas. The 2,500 meter road buffer area (worst case scenario modeled) includes the following critical facilities: 43 schools, 19 police stations, 63 fire/EMS stations, 1 EOC, 8 medical care facilities, and 8 other facilities. The railroad buffer areas include the following critical facilities: 25 schools, 8 police stations, 3 medical care facilities, 26 fire stations, and 3 other facilities. It should be noted that many of the facilities located in the buffer areas for road are also located in the buffer areas for railroad and/or the fixed site analysis. A list of specific critical facilities and their associated risk can be found in **Table 6.14** at the end of this section.

In conclusion, a hazardous material incident has the potential to impact many existing and future buildings, critical facilities, and populations in the South Mountains Region. Those areas in a primary buffer are at the highest risk, though all areas carry some vulnerability due to variations in conditions that could alter the impact area such as direction and speed of wind, volume of release, etc.

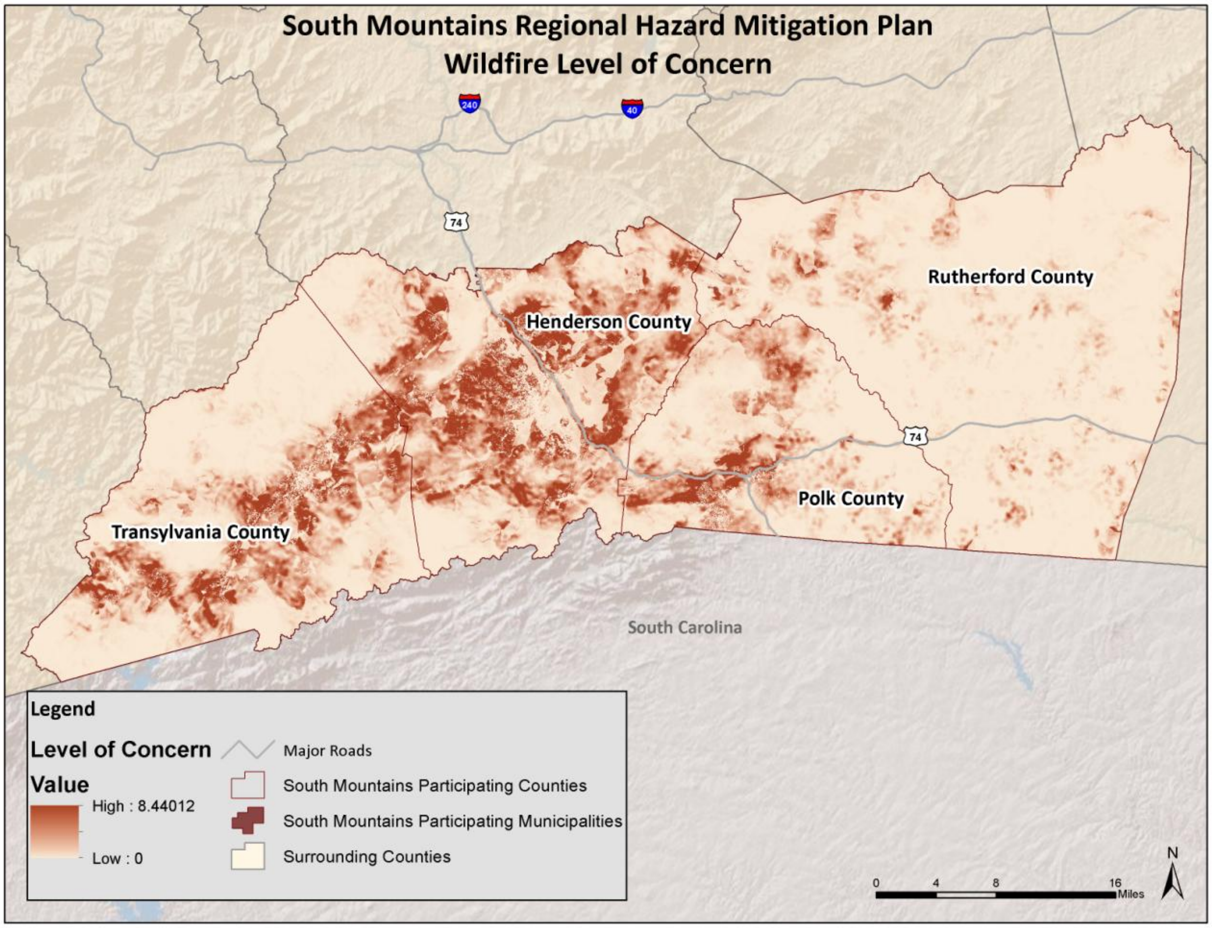
6.5.6 Wildfire

Although historical evidence indicates that the South Mountains Region is susceptible to wildfire events, there are few reports of damage. Therefore, it is difficult to calculate a reliable annualized loss figure. Annualized loss is considered negligible, though it should be noted that a single event could result in significant damages throughout the region.

To estimate exposure to wildfire, the approximate number of parcels and their associated improved value was determined using GIS analysis. For the critical facility analysis, areas of concern were intersected with critical facility locations. **Figure 6.7** shows the Level of Concern data. Initially provided as raster data, it was converted to a polygon to allow for analysis. The LOC data ranges from 1 – 100 with higher values being most severe (as noted previously, this is only a measure of relative risk). Eight was the highest level recorded in the South Mountains planning area. Therefore, areas with a value above 1 were chosen to be displayed as areas of risk. The region contains some lands where the value falls into the at-risk category, though the region has somewhat less land labeled as at-risk compared to other regions of North Carolina. Since all of this land area is on the lower tenth of the overall LOC scale, there is likely considerably less risk in the region than in other areas of the country.

Table 6.14 shows the results of the analysis.

FIGURE 6.7: WILDFIRE RISK AREAS IN THE SOUTH MOUNTAINS REGION



Source: Southern Wildfire Risk Assessment Data

TABLE 6.14: EXPOSURE OF IMPROVED PROPERTY TO WILDFIRE AREAS OF CONCERN

	HIGH WILDFIRE RISK AREA		
Location	**Approx. Number of Parcels**	**Approx. Number of Buildings**	**Approx. Improved Value**
Henderson County	**14,607**	**10,505**	**$1,977,579,000**
Flat Rock	866	667	$181,322,800
Fletcher	3	3	$313,400
Hendersonville	1,391	1,205	$225,183,000
Laurel Park	611	425	$101,368,500
Mills River	625	435	$55,416,900
Unincorporated Area	11,111	7,770	$1,413,974,400
Polk County	**1,437**	**935**	**$159,865,830**
Columbus	186	137	$16,007,159
Saluda	12	9	$1,334,990
Tryon	106	84	$16,664,538
Unincorporated	1,133	705	$125,859,143

	HIGH WILDFIRE RISK AREA		
Location	Approx. Number of Parcels	Approx. Number of Buildings	Approx. Improved Value
Area			
Rutherford County	**135**	**62**	**$7,506,250**
Bostic	0	0	$0
Chimney Rock Village	6	0	$0
Ellenboro	0	0	$0
Forest City	0	0	$0
Lake Lure	3	0	$0
Ruth	0	0	$0
Rutherfordton	0	0	$0
Spindale	0	0	$0
Unincorporated Area	126	62	$7,506,250
Transylvania County	**8,139**	**5,072**	**$893,896,083**
Brevard	1,090	884	$187,804,233
Rosman	6	4	$342,650
Unincorporated Area	7,043	4,184	$705,749,200
SOUTH MOUNTAINS REGION TOTAL	**24,318**	**16,574**	**$3,038,847,163**

Social Vulnerability

Although not all areas have equal vulnerability, there is some susceptibility across the entire South Mountains Region. It is assumed that the total population is at risk to the wildfire hazard. Determining the exact number of people in certain wildfire zones is difficult with existing data and could be misleading.

Critical Facilities

The critical facility analysis revealed that there are 18 facilities located in the wildfire area of concern. All of these facilities are located in either Henderson or Transylvania Counties including 7 schools, 8 fire/EMS stations, 1 police station, and 1 medical care facility. This reflects the elevated risk in these counties. It should be noted, however, that several factors could impact the spread of a wildfire putting all facilities at risk. A list of specific critical facilities and their associated risk can be found in **Table 6.15** at the end of this section.

In conclusion, a wildfire event has the potential to impact many existing and future buildings, critical facilities, and populations in the South Mountains Region.

6.6 CONCLUSIONS ON HAZARD VULNERABILITY

The results of this vulnerability assessment are useful in at least three ways:

- Improving our understanding of the risk associated with the natural hazards in the South Mountains Region through better understanding of the complexities and dynamics of risk, how levels of risk can be measured and compared, and the myriad of factors that influence risk. An understanding of these relationships is critical in making balanced and informed decisions on managing the risk.
- Providing a baseline for policy development and comparison of mitigation alternatives. The data used for this analysis presents a current picture of risk in the South Mountains Region. Updating this risk "snapshot" with future data will enable comparison of the changes in risk with time. Baselines of this type can support the objective analysis of policy and program options for risk reduction in the region.
- Comparing the risk among the natural hazards addressed. The ability to quantify the risk to all these hazards relative to one another helps in a balanced, multi-hazard approach to risk management at each level of governing authority. This ranking provides a systematic framework to compare and prioritize the very disparate natural hazards that are present in the South Mountains Region. This final step in the risk assessment provides the necessary information for local officials to craft a mitigation strategy to focus resources on only those hazards that pose the most threat to the South Mountains counties.

Exposure to hazards can be an indicator of vulnerability. Economic exposure can be identified through locally assessed values for improvements (buildings), and social exposure can be identified by estimating the population exposed to each hazard. This information is especially important for decision-makers to use in planning for evacuation or other public safety related needs.

The types of assets included in these analyses include all building types in the participating jurisdictions. Specific information about the types of assets that are vulnerable to the identified hazards is included in each hazard subsection (for example all building types are considered at risk to the winter storm hazard and commercial, residential, and government owned facilities are at risk to repetitive flooding, etc).

Table 6.15 presents a summary of annualized loss for each hazard in the South Mountains Region. Due to the reporting of hazard damages primarily at the county level, it was difficult to determine an accurate annualized loss estimate for each municipality. Therefore, an annualized loss was determined through the damage reported through historical occurrences at the county level. These values should be used as an additional planning tool or measure risk for determining hazard mitigation strategies throughout the region.

TABLE 6.15: ANNUALIZED LOSS FOR THE SOUTH MOUNTAINS REGION

Event	Henderson County	Polk County	Rutherford County	Transylvania County	Total
Dam Failure	Negligible	Negligible	Negligible	Negligible	Negligible
Drought	Negligible	Negligible	Negligible	Negligible	Negligible
Erosion	Negligible	Negligible	Negligible	Negligible	Negligible
Extreme Heat	Negligible	Negligible	Negligible	Negligible	Negligible
Hail	$167,196	$260	$2,584	$7,040	$177,080
Hurricane & Tropical Storm	$151,000	$36,000	$167,000	$43,000	$397,000

Event	Henderson County	Polk County	Rutherford County	Transylvania County	Total
Landslide	$178,243	Negligible	Negligible	$176,175	$354,418
Lightning	$33,586	$15,545	$43,272	$70,479	$162,881
Thunderstorm Wind/High Wind[8]	$59,712	$7,474	$108,725	$56,483	$232,394
Tornado	$1,308	$5,930	$25,239	$21,873	$54,351
Winter Storm & Freeze	$60,481	$799,446	$799,446	$1,034,026	$2,693,399
Flood	$428,371	$171,333	$605,552	$925,884	$2,131,140
Earthquake	$51,000	$9,000	$30,000	$18,000	$107,000
HAZMAT Incident	Negligible	Negligible	Negligible	Negligible	Negligible
Wildfire	Negligible	Negligible	Negligible	Negligible	Negligible

As noted previously, all existing and future buildings and populations (including critical facilities) are vulnerable to atmospheric hazards including drought, hailstorm, hurricane and tropical storm, lightning, thunderstorm wind, tornado, and winter storm and freeze. Some buildings may be more vulnerable to these hazards based on locations, construction, and building type. **Table 6.16** shows the critical facilities vulnerable to additional hazards analyzed in this section. The table lists those assets that are determined to be exposed to each of the identified hazards (marked with an "**X**").

8 The annualized losses for these hazards were combined.

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TABLE 6.16: AT-RISK CRITICAL FACILITIES

		ATMOSPHERIC							GEOLOGIC			HYDROLOGIC		OTHER						
FACILITY NAME	FACILITY TYPE	Drought	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 500m	Fixed HAZMAT 2,500 meter	Mobile HZMT 500 METER (road)	Mobile HZMT 2,500 meter (road)	Mobile HZMT 500 METER (rail)	Mobile HZMT 2,500 METER (rail)	Wildfire
HENDERSON COUNTY																				
121 SCHOOL HOUSE RD	FIRE STATION	X	X	X	X	X	X	X	X		X					X	X			
GLEN MARLOWE ELEMENTARY	SCHOOL	X	X	X	X	X	X	X	X		X				X		X			
MILLS RIVER STA 4	FIRE STATION	X	X	X	X	X	X	X	X		X									
NEW MILLS RIVER ELEM SCHOOL	SCHOOL	X	X	X	X	X	X	X	X		X						X			
MILLS RIVER STATION 3	FIRE STATION	X	X	X	X	X	X	X	X		X					X	X			
MILLS RIVER FIRE DEPT STA 2	FIRE STATION	X	X	X	X	X	X	X	X		X				X	X	X			
EMS STATION 2	EMS STATION	X	X	X	X	X	X	X	X		X				X	X	X			X
POLICE STATION	POLICE STATION	X	X	X	X	X	X	X	X		X				X	X	X		X	
FLETCHER FIRE DEPT	FIRE STATION	X	X	X	X	X	X	X	X		X				X	X	X		X	
VALLEY HILL FIRE DEPT	FIRE STATION	X	X	X	X	X	X	X	X						X		X		X	
BLUE RIDGE FIRE DEPT STA 2	FIRE STATION	X	X	X	X	X	X	X	X						X	X	X		X	X
800 N JUSTICE ST	HOSPITAL	X	X	X	X	X	X	X	X						X	X	X		X	
HENDERSONVILLE MIDDLE SCHOOL	SCHOOL	X	X	X	X	X	X	X	X						X	X	X		X	
HENDERSONVILLE ELEMENTARY	SCHOOL	X	X	X	X	X	X	X	X						X	X	X		X	
311 8TH AVE W	SCHOOL	X	X	X	X	X	X	X	X						X	X	X		X	

		ATMOSPHERIC							GEOLOGIC			HYDROLOGIC		OTHER						
FACILITY NAME	FACILITY TYPE	Drought	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 500m	Fixed HAZMAT 2,500 meter	Mobile HZMT 500 METER (road)	Mobile HZMT 2,500 meter (road)	Mobile HZMT 500 METER (rail)	Mobile HZMT 2,500 METER (rail)	Wildfire
EMS STATION 3	EMS STATION	X	X	X	X	X	X	X	X						X	X	X		X	
IMMACULATA CATHOLIC SCHOOL	SCHOOL	X	X	X	X	X	X	X	X						X	X	X		X	
IMPOUND LOT	POLICE STATION	X	X	X	X	X	X	X	X						X	X	X	X	X	
HENDERSON COUNTY RESCUE SQUAD	EMS STATION	X	X	X	X	X	X	X	X						X	X	X	X	X	
802 OLD SPARTANBURG HWY	SCHOOL	X	X	X	X	X	X	X	X						X	X	X	X	X	
HENDERSONVILLE FIRE DEPT	FIRE STATION	X	X	X	X	X	X	X	X						X	X	X		X	
BRUCE DRYSDALE SCHOOL/834 N MAIN ST	SCHOOL	X	X	X	X	X	X	X	X						X	X	X		X	
HENDERSON COUNTY DETENTION CENTER	POLICE STATION	X	X	X	X	X	X	X	X						X	X	X	X	X	
LAW ENFORCEMENT CENTER	POLICE STATION	X	X	X	X	X	X	X	X						X	X	X	X	X	
WEST HENDERSON HIGH SCHOOL	SCHOOL	X	X	X	X	X	X	X	X						X	X	X			
MOUNTAIN HOME FIRE DEPT STA 3	FIRE STATION	X	X	X	X	X	X	X	X						X		X			X
RUGBY MIDDLE SCHOOL	SCHOOL	X	X	X	X	X	X	X	X						X	X	X			X
ETOWAH ELEMENTARY SCHOOL	SCHOOL	X	X	X	X	X	X	X	X		X					X	X		X	
100 HOSPITAL DR	HOSPITAL	X	X	X	X	X	X	X	X							X	X	X	X	X
BALFOUR ELEMENTARY	SCHOOL	X	X	X	X	X	X	X	X							X	X		X	
FLETCHER FIRE DEPT STA 2	FIRE STATION	X	X	X	X	X	X	X	X											
CAPTAIN GILMER	SCHOOL	X	X	X	X	X	X	X	X							X	X	X	X	

		ATMOSPHERIC							GEOLOGIC			HYDROLOGIC		OTHER						
FACILITY NAME	FACILITY TYPE	Drought	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 500m	Fixed HAZMAT 2,500 meter	Mobile HZMT 500 METER (road)	Mobile HZMT 2,500 meter (road)	Mobile HZMT 500 METER (rail)	Mobile HZMT 2,500 METER (rail)	Wildfire
4800 HOWARD GAP RD	SCHOOL	X	X	X	X	X	X	X	X								X		X	X
FLETCHER ELEMENTARY	SCHOOL	X	X	X	X	X	X	X	X						X		X		X	
GREEN RIVER FIRE DEPT STA 2	FIRE STATION	X	X	X	X	X	X	X	X											
GREEN RIVER FIRE DEPARTMENT	FIRE STATION	X	X	X	X	X	X	X	X							X	X		X	X
BLUE RIDGE FIRE DEPT	FIRE STATION	X	X	X	X	X	X	X	X						X	X	X		X	
EAST HENDERSON HIGH SCHOOL	SCHOOL	X	X	X	X	X	X	X	X						X		X		X	
FLAT ROCK MIDDLE SCHOOL	SCHOOL	X	X	X	X	X	X	X	X						X		X		X	
UPWARD ELEMENTARY SCHOOL	SCHOOL	X	X	X	X	X	X	X	X								X			
272 GERTON HWY	FIRE STATION	X	X	X	X	X	X	X	X							X	X			
EMS STATION 3	EMS STATION	X	X	X	X	X	X	X	X						X	X	X		X	
BAT CAVE FIRE DEPT	FIRE STATION	X	X	X	X	X	X	X	X							X	X			
MOUNTAIN HOME FIRE DEPT	FIRE STATION	X	X	X	X	X	X	X	X						X	X	X		X	
EDNEYVILLE FIRE DEPT STA 2	FIRE STATION	X	X	X	X	X	X	X	X								X			X
MOUNTAIN HOME FIRE DEPT STA 2	FIRE STATION	X	X	X	X	X	X	X	X								X		X	
1022 W BLUE RIDGE RD/NEW HILLANDALE ELEM SCHOOL	SCHOOL	X	X	X	X	X	X	X	X						X		X		X	X
EDNEYVILLE FIRE DEPT	FIRE STATION	X	X	X	X	X	X	X	X							X	X			

		ATMOSPHERIC							GEOLOGIC			HYDROLOGIC		OTHER						
FACILITY NAME	FACILITY TYPE	Drought	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 500m	Fixed HAZMAT 2,500 meter	Mobile HZMT 500 METER (road)	Mobile HZMT 2,500 meter (road)	Mobile HZMT 500 METER (rail)	Mobile HZMT 2,500 METER (rail)	Wildfire
NORTH HENDERSON HIGH	SCHOOL	X	X	X	X	X	X	X	X							X	X			
APPLE VALLEY MIDDLE SCHOOL	SCHOOL	X	X	X	X	X	X	X	X							X	X			
ATKINS ELEMENTARY SCHOOL	SCHOOL	X	X	X	X	X	X	X	X											X
DANA ELEMENTARY	SCHOOL	X	X	X	X	X	X	X	X											
EDNYVILLE ELEMENTARY	SCHOOL	X	X	X	X	X	X	X	X							X	X			
CLEAR CREEK ELEMENTARY	SCHOOL	X	X	X	X	X	X	X	X								X			X
EDNEYVILLE FIRE DEPT STA 3	FIRE STATION	X	X	X	X	X	X	X	X								X			
VALLEY HILL FIRE DEPT STA 2	FIRE STATION	X	X	X	X	X	X	X	X											
ETOWAH FIRE DEPT.	FIRE STATION	X	X	X	X	X	X	X	X		X	X				X	X	X	X	
VALLEY HILL FIRE DEPT STA 3	FIRE STATION	X	X	X	X	X	X	X	X											
GERTON FIRE DEPARTMENT	FIRE STATION	X	X	X	X	X	X	X	X							X	X			
613 GLOVER ST	SCHOOL	X	X	X	X	X	X	X	X						X		X		X	
ETOWAH HORSE SHOE STATION 2	FIRE STATION	X	X	X	X	X	X	X	X											
5399 ASHEVILLE HWY	FIRE STATION	X	X	X	X	X	X	X	X			X				X	X		X	
NEW SUGARLOAF SCHOOL LOCATION	SCHOOL	X	X	X	X	X	X	X	X											
FIRE STATION	FIRE STATION	X	X	X	X	X	X	X	X							X	X	X	X	X
WAITING ON DRIVEWAY TO BE CUT	FIRE STATION	X	X	X	X	X	X	X	X		X						X		X	

		ATMOSPHERIC							GEOLOGIC			HYDROLOGIC		OTHER						
FACILITY NAME	FACILITY TYPE	Drought	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 500m	Fixed HAZMAT 2,500 meter	Mobile HZMT 500 METER (road)	Mobile HZMT 2,500 meter (road)	Mobile HZMT 500 METER (rail)	Mobile HZMT 2,500 METER (rail)	Wildfire
VALLEY HILL STA 4	FIRE STATION	X	X	X	X	X	X	X	X						X	X	X		X	X
SCHOOL	SCHOOL	X	X	X	X	X	X	X	X							X	X			
DANA FIRE HOUSE/SERVICE BAY	FIRE STATION	X	X	X	X	X	X	X	X											
FIRE STATION	FIRE STATION	X	X	X	X	X	X	X	X								X			
POLK COUNTY																				
POLK COUNTY SHERIFF'S OFFICE	Police Station	X	X	X	X	X	X	X	X		X					X	X			
COLUMBUS FIRE DEPARTMENT	Fire/EMS Station	X	X	X	X	X	X	X	X		X					X	X			
ST. LUKES HOSPITAL	Medical Care Facility	X	X	X	X	X	X	X	X		X					X	X			
COLUMBUS POLICE DEPARTMENT	Police Station	X	X	X	X	X	X	X	X		X					X	X			
POLK COUNTY EMS	Fire/EMS Station	X	X	X	X	X	X	X	X		X					X	X			
POLK COUNTY ADMINISTRATION; WOMACK BUILDING	Other	X	X	X	X	X	X	X	X		X					X	X			
POLK COUNTY COURTHOUSE	Other	X	X	X	X	X	X	X	X		X					X	X			
COLUMBUS TOWN HALL	Other	X	X	X	X	X	X	X	X		X					X	X			
EMERGENCY OPERATIONS CENTER; GIS, IT, EDC, TOURISM	EOC	X	X	X	X	X	X	X	X		X					X	X			
POLK COUNTY RESCUE SQUAD	Fire/EMS Station	X	X	X	X	X	X	X	X		X					X	X			

		ATMOSPHERIC							GEOLOGIC			HYDROLOGIC		OTHER							
FACILITY NAME	FACILITY TYPE	Drought	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 500m	Fixed HAZMAT 2,500 meter	Mobile HZMT 500 METER (road)	Mobile HZMT 2,500 meter (road)	Mobile HZMT 500 METER (rail)	Mobile HZMT 2,500 METER (rail)	Wildfire
AMERICAN RED CROSS, POLK COUNTY CHAPTER	Other	X	X	X	X	X	X	X	X		X					X	X			
SALUDA POLICE DEPARTMENT	Police Station	X	X	X	X	X	X	X	X		X					X	X	X	X	
SALUDA FIRE DEPARTMENT	Fire/EMS Station	X	X	X	X	X	X	X	X		X					X	X		X	
SALUDA TOWN HALL	Other	X	X	X	X	X	X	X	X		X					X	X	X	X	
SALUDA ELEMENTARY & MIDDLE SCHOOL	School	X	X	X	X	X	X	X	X		X					X	X	X	X	
TRYON POLICE DEPARTMENT	Police Station	X	X	X	X	X	X	X	X		X					X	X		X	
TRYON FIRE DEPARTMENT	Fire/EMS Station	X	X	X	X	X	X	X	X		X					X	X		X	
TRYON TOWN HALL	Other	X	X	X	X	X	X	X	X		X					X	X		X	
DEPARTMENT OF SOCIAL SERVICES; JERVEY-PALMER	Other	X	X	X	X	X	X	X	X		X					X	X		X	
TRYON ELEMENTARY SCHOOL	School	X	X	X	X	X	X	X	X		X					X	X		X	
GREEN CREEK FIRE DEPARTMENT	Fire/EMS Station	X	X	X	X	X	X	X	X		X					X	X			
MILL SPRING FIRE DEPARTMENT	Fire/EMS Station	X	X	X	X	X	X	X	X		X					X	X			
SUNNY VIEW FIRE DEPARTMENT	Fire/EMS Station	X	X	X	X	X	X	X	X		X					X	X			
THE PAVILLION INTERNATIONAL (TREATMENT CENTER)	Medical Care Facility	X	X	X	X	X	X	X	X		X						X			
COOPER-RIIS (MENTAL HEALTH & ADULT CARE)	Medical Care	X	X	X	X	X	X	X	X		X					X	X			

		ATMOSPHERIC							GEOLOGIC			HYDROLOGIC		OTHER						
FACILITY NAME	FACILITY TYPE	Drought	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 500m	Fixed HAZMAT 2,500 meter	Mobile HZMT 500 METER (road)	Mobile HZMT 2,500 meter (road)	Mobile HZMT 500 METER (rail)	Mobile HZMT 2,500 METER (rail)	Wildfire
	Facility																			
POLK COUNTY HIGH SCHOOL	School	X	X	X	X	X	X	X	X		X					X	X			
POLK COUNTY MIDDLE SCHOOL	School	X	X	X	X	X	X	X	X		X						X			
POLK CENTRAL	School	X	X	X	X	X	X	X	X		X					X	X			
SUNNY VIEW ELEMENTARY SCHOOL	School	X	X	X	X	X	X	X	X		X					X	X			
TRYON ESTATES (RETIREMENT CENTER)	Other	X	X	X	X	X	X	X	X		X					X	X			
RUTHERFORD COUNTY																				
RUTHERFORDTON FIRE DEPT	Fire Station	X	X	X	X	X	X	X	X						X	X	X			
RUTHERFORD COUNTY SHERIFF	Police Station	X	X	X	X	X	X	X	X						X	X	X			
RUTHERFORDTON POLICE DEPT	Police Station	X	X	X	X	X	X	X	X						X	X	X			
RUTHERFORD COUNTY HO	Hospital	X	X	X	X	X	X	X	X						X	X	X			
FAIRFIELD MOUNTAINS FIRE DEPT	Fire Station	X	X	X	X	X	X	X	X											
LAKE LURE FIRE DEPT	Fire Station	X	X	X	X	X	X	X	X							X	X			
MEDICAL CLINIC	Hospital	X	X	X	X	X	X	X	X							X	X			
BOSTIC FIRE DEPT	Fire Station	X	X	X	X	X	X	X	X									X	X	
FOREST CITY FIRE DEPARTMENT	Fire Station	X	X	X	X	X	X	X	X							X	X			
FOREST CITY POLICE DEPT.	Police Station	X	X	X	X	X	X	X	X							X	X			

		ATMOSPHERIC							GEOLOGIC			HYDROLOGIC		OTHER						
FACILITY NAME	FACILITY TYPE	Drought	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 500m	Fixed HAZMAT 2,500 meter	Mobile HZMT 500 METER (road)	Mobile HZMT 2,500 meter (road)	Mobile HZMT 500 METER (rail)	Mobile HZMT 2,500 METER (rail)	Wildfire
SPINDALE FIRE DEPT	Fire Station	X	X	X	X	X	X	X	X						X	X	X			
SPINDALE POLICE DEPT.	Police Station	X	X	X	X	X	X	X	X						X	X	X			
ELLENBORO FIRE DEPT	Fire Station	X	X	X	X	X	X	X	X							X	X	X	X	
CHIMNEY ROCK FIRE DEPT	Fire Station	X	X	X	X	X	X	X	X							X	X			
CLIFFSIDE STATION 2	Fire Station	X	X	X	X	X	X	X	X		X					X	X			
BILLS CREEK STATION 1	Fire Station	X	X	X	X	X	X	X	X											
HUDLOW STATION 2	Fire Station	X	X	X	X	X	X	X	X							X	X			
HOLLIS (POLKVILLE) FIRE DEPT	Fire Station	X	X	X	X	X	X	X	X											
CHERRY MOUNTAIN STATION 1	Fire Station	X	X	X	X	X	X	X	X											
CHERRY MOUNTAIN STATION 2	Fire Station	X	X	X	X	X	X	X	X											
CHERRY MOUNTAIN STATION 3	Fire Station	X	X	X	X	X	X	X	X							X	X			
GREEN HILL FIRE DEPARTMENT	Fire Station	X	X	X	X	X	X	X	X							X	X			
CLIFFSIDE STATION 1	Fire Station	X	X	X	X	X	X	X	X		X				X	X	X			
SDO FIRE DEPT	Fire Station	X	X	X	X	X	X	X	X		X					X	X			
UNION MILLS FIRE DEPT	Fire	X	X	X	X	X	X	X	X							X	X			

		ATMOSPHERIC							GEOLOGIC			HYDROLOGIC		OTHER						
FACILITY NAME	FACILITY TYPE	Drought	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 500m	Fixed HAZMAT 2,500 meter	Mobile HZMT 500 METER (road)	Mobile HZMT 2,500 meter (road)	Mobile HZMT 500 METER (rail)	Mobile HZMT 2,500 METER (rail)	Wildfire
	Station																			
HUDLOW STATION 1	Fire Station	X	X	X	X	X	X	X	X							X	X		X	
SHINGLE HOLLOW FIRE DEPT	Fire Station	X	X	X	X	X	X	X	X											
SANDY MUSH FIRE DEPT	Fire Station	X	X	X	X	X	X	X	X		X				X	X	X		X	
BILLS CREEK STATION 2	Fire Station	X	X	X	X	X	X	X	X											
MEDICAL CLINIC	Hospital	X	X	X	X	X	X	X	X											
TRANSYLVANIA COUNTY																				
BREVARD ELEMENTARY	School	X	X	X	X	X	X	X	X		X					X	X		X	
BREVARD HIGH	School	X	X	X	X	X	X	X	X		X					X	X		X	
DAVIDSON RIVER SCHOOL	School	X	X	X	X	X	X	X	X		X		X			X	X		X	
BREVARD MIDDLE	School	X	X	X	X	X	X	X	X		X					X	X	X	X	
ROSMAN HIGH	School	X	X	X	X	X	X	X	X		X						X		X	
ROSMAN MIDDLE	School	X	X	X	X	X	X	X	X		X						X		X	
TRANSYLVANIA COMMUNITY HOSPITAL	Medical Care Facility	X	X	X	X	X	X	X	X		X	X				X	X		X	
ROSMAN ELEMENTARY	School	X	X	X	X	X	X	X	X		X					X	X			
PISGAH FOREST ELEMENTARY	School	X	X	X	X	X	X	X	X		X					X	X		X	
TC HENDERSON ELEMENTARY	School	X	X	X	X	X	X	X	X		X					X	X			X
ANCHOR BAPTIST	School	X	X	X	X	X	X	X	X		X					X	X	X	X	X

		ATMOSPHERIC							GEOLOGIC			HYDROLOGIC		OTHER						
FACILITY NAME	FACILITY TYPE	Drought	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 500m	Fixed HAZMAT 2,500 meter	Mobile HZMT 500 METER (road)	Mobile HZMT 2,500 meter (road)	Mobile HZMT 500 METER (rail)	Mobile HZMT 2,500 METER (rail)	Wildfire
BETHANY CHRISTIAN SCHOOL	School	X	X	X	X	X	X	X	X		X	X					X			X
BREVARD ACADEMY	School	X	X	X	X	X	X	X	X		X						X			
TRANSYLVANIA COUNTY EMS BREVARD	Fire/EMS Station	X	X	X	X	X	X	X	X		X					X	X		X	
TRANSYLVANIA COUNTY EMS QUEBEC	Fire/EMS Station	X	X	X	X	X	X	X	X		X					X	X			X
TRANSYLVANIA COUNTY RESCUE SQUAD	Fire/EMS Station	X	X	X	X	X	X	X	X		X					X	X	X	X	
NORTH TRANSYLVANIA FIRE DEPT	Fire/EMS Station	X	X	X	X	X	X	X	X		X					X	X			
CONNESTEE FIRE RESCUE	Fire/EMS Station	X	X	X	X	X	X	X	X		X						X			
LITTLE RIVER FIRE DEPT	Fire/EMS Station	X	X	X	X	X	X	X	X		X						X		X	
ROSMAN FIRE RESCUE	Fire/EMS Station	X	X	X	X	X	X	X	X		X					X	X			
LAKE TOAXAWAY FIRE RESCUE	Fire/EMS Station	X	X	X	X	X	X	X	X		X					X	X			
BREVARD FIRE DEPT	Fire/EMS Station	X	X	X	X	X	X	X	X		X					X	X		X	
BALSAM GROVE FIRE DEPT	Fire/EMS Station	X	X	X	X	X	X	X	X	X						X	X			
CEDAR MTN FIRE RESCUE	Fire/EMS Station	X	X	X	X	X	X	X	X			X				X	X			
LAKE TOXAWAY FIRE RESCUE #2	Fire/EMS Station	X	X	X	X	X	X	X	X		X					X	X			
CONNESTEE FIRE RESCUE #2	Fire/EMS Station	X	X	X	X	X	X	X	X		X									

		ATMOSPHERIC							GEOLOGIC			HYDROLOGIC		OTHER						
FACILITY NAME	FACILITY TYPE	Drought	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 500m	Fixed HAZMAT 2,500 meter	Mobile HZMT 500 METER (road)	Mobile HZMT 2,500 meter (road)	Mobile HZMT 500 METER (rail)	Mobile HZMT 2,500 METER (rail)	Wildfire
CITY OF BREVARD POLICE DEPARTMENT	Police Station	X	X	X	X	X	X	X	X		X					X	X		X	
TRANSYLVANIA COUNTY SHERIFF DEPARTMENT	Police Station	X	X	X	X	X	X	X	X		X					X	X		X	X

SECTION 7
CAPABILITY ASSESSMENT

This section of the Plan discusses the capability of the communities in the South Mountains Region to implement hazard mitigation activities. It consists of the following four subsections:

- 7.1 What is a Capability Assessment?
- 7.2 Conducting the Capability Assessment
- 7.3 Capability Assessment Findings
- 7.4 Conclusions on Local Capability

7.1 WHAT IS A CAPABILITY ASSESSMENT

The purpose of conducting a capability assessment is to determine the ability of a local jurisdiction to implement a comprehensive mitigation strategy and to identify potential opportunities for establishing or enhancing specific mitigation policies, programs, or projects.[1] As in any planning process, it is important to try to establish which goals, objectives, and/or actions are feasible based on an understanding of the organizational capacity of those agencies or departments tasked with their implementation. A capability assessment helps to determine which mitigation actions are practical, and likely to be implemented over time, given a local government's planning and regulatory framework, level of administrative and technical support, amount of fiscal resources, and current political climate.

A capability assessment has two primary components: 1) an inventory of a local jurisdiction's relevant plans, ordinances, or programs already in place and 2) an analysis of its capacity to carry them out. Careful examination of local capabilities will detect any existing gaps, shortfalls, or weaknesses with ongoing government activities that could hinder proposed mitigation activities and possibly exacerbate community hazard vulnerability. A capability assessment also highlights the positive mitigation measures already in place or being implemented at the local government level, which should continue to be supported and enhanced through future mitigation efforts.

The capability assessment completed for the South Mountains Region serves as a critical planning step and an integral part of the foundation for designing an effective hazard mitigation strategy. Coupled with the Risk Assessment, the Capability Assessment helps identify and target meaningful mitigation actions for incorporation in the Mitigation Strategy portion of the Hazard Mitigation Plan. It not only helps establish the goals and objectives for the region to pursue under this Plan, but it also ensures that those goals and objectives are realistically achievable under given local conditions.

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[1] While the Final Rule for implementing the Disaster Mitigation Act of 2000 does not require a local capability assessment to be completed for local hazard mitigation plans, it is a critical step in developing a mitigation strategy that meets the needs of the region while taking into account their own unique abilities. The Rule does state that a community's mitigation strategy should be "based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools" (44 CFR, Part 201.6(c)(3)).

7.2 CONDUCTING THE CAPABILITY ASSESSMENT

In order to facilitate the inventory and analysis of local government capabilities within the South Mountains counties, a detailed Capability Assessment Survey was completed for each of the participating jurisdictions based on the information found in existing hazard mitigation plans and local government websites. The survey questionnaire compiled information on a variety of "capability indicators" such as existing local plans, policies, programs, or ordinances that contribute to and/or hinder the region's ability to implement hazard mitigation actions. Other indicators included information related to the communities' fiscal, administrative, and technical capabilities, such as access to local budgetary and personnel resources for mitigation purposes. The current political climate, an important consideration for any local planning or decision making process, was also evaluated with respect to hazard mitigation.

At a minimum, survey results provide an extensive inventory of existing local plans, ordinances, programs, and resources that are in place or under development in addition to their overall effect on hazard loss reduction. However, the survey instrument can also serve to identify gaps, weaknesses, or conflicts that counties and local jurisdictions can recast as opportunities for specific actions to be proposed as part of the hazard mitigation strategy.

The information collected in the survey questionnaire was incorporated into a database for further analysis. A general scoring methodology was then applied to quantify each jurisdiction's overall capability.[2] According to the scoring system, each capability indicator was assigned a point value based on its relevance to hazard mitigation.

Using this scoring methodology, a total score and an overall capability rating of "high," "moderate," or "limited" could be determined according to the total number of points received. These classifications are designed to provide nothing more than a general assessment of local government capability. The results of this capability assessment provide critical information for developing an effective and meaningful mitigation strategy.

7.3 CAPABILITY ASSESSMENT FINDINGS

The findings of the capability assessment are summarized in this Plan to provide insight into the relevant capacity of the jurisdictions in the South Mountains Region to implement hazard mitigation activities. All information is based upon the review of existing hazard mitigation plans and local government websites through the Capability Assessment Survey and input provided by local government officials during meetings of the South Mountains Regional Hazard Mitigation Planning Team.

7.3.1 Planning and Regulatory Capability

Planning and regulatory capability is based on the implementation of plans, ordinances, and programs that demonstrate a local jurisdiction's commitment to guiding and managing growth, development, and redevelopment in a responsible manner while maintaining the general welfare of the community. It includes emergency response and mitigation planning, comprehensive land use planning, and transportation planning; the enforcement of zoning or subdivision ordinances and building codes that regulate how land is developed and structures are built; as well as protecting environmental, historic,

[2] The scoring methodology used to quantify and rank the region's capability can be found in Appendix B.

and cultural resources in the community. Although some conflicts can arise, these planning initiatives generally present significant opportunities to integrate hazard mitigation principles and practices into the local decision making process.

This assessment is designed to provide a general overview of the key planning and regulatory tools and programs that are in place or under development for the jurisdictions in the South Mountains Region along with their potential effect on loss reduction. This information will help identify opportunities to address existing gaps, weaknesses, or conflicts with other initiatives in addition to integrating the implementation of this Plan with existing planning mechanisms where appropriate.

Table 7.1 provides a summary of the relevant local plans, ordinances, and programs already in place or under development for the jurisdictions in the South Mountains Region. A checkmark (✓) indicates that the given item is currently in place and being implemented. An asterisk (*) indicates that the given item is currently being developed for future implementation. Each of these local plans, ordinances, and programs should be considered available mechanisms for incorporating the requirements of the South Mountains Regional Hazard Mitigation Plan.

TABLE 7.1: RELEVANT PLANS, ORDINANCES, AND PROGRAMS

Planning / Regulatory Tool	HENDERSON COUNTY	Flat Rock	Fletcher	Hendersonville	Laurel Park	Mills River	POLK COUNTY	Columbus	Saluda	Tryon	RUTHERFORD COUNTY	Bostic	Chimney Rock Village	Ellenboro	Forest City	Lake Lure	Ruth	Rutherfordton	Spindale	TRANSYLVANIA COUNTY	Brevard	Rosman
Hazard Mitigation Plan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Comprehensive Land Use Plan	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Floodplain Management Plan																				✓	✓	✓
Open Space Management Plan (Parks & Rec/Greenway Plan)			✓	✓	✓	✓										✓				✓	✓	
Stormwater Management Plan/Ordinance	✓			✓	✓										✓						✓	
Natural Resource Protection Plan																						
Flood Response Plan																						
Emergency Operations Plan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Continuity of Operations Plan	✓			✓																		
Evacuation Plan																						
Disaster Recovery Plan				✓																		
Capital Improvements Plan	✓		✓	✓	✓	✓	✓	✓		✓	✓				✓	✓		✓		✓	✓	
Economic Development Plan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Historic Preservation Plan																						

Planning / Regulatory Tool	HENDERSON COUNTY	Flat Rock	Fletcher	Hendersonville	Laurel Park	Mills River	POLK COUNTY	Columbus	Saluda	Tryon	RUTHERFORD COUNTY	Bostic	Chimney Rock Village	Ellenboro	Forest City	Lake Lure	Ruth	Rutherfordton	Spindale	TRANSYLVANIA COUNTY	Brevard	Rosman
Flood Damage Prevention Ordinance	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓
Zoning Ordinance	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓		✓	✓		✓	✓		✓	
Subdivision Ordinance	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓				✓	✓	
Unified Development Ordinance	✓	✓	✓			✓	*	✓		✓			✓		✓						✓	
Post-Disaster Redevelopment Ordinance																						
Building Code	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Fire Code	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
National Flood Insurance Program (NFIP)	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓
NFIP Community Rating System																					✓	

A more detailed discussion on the region's planning and regulatory capability follows.

7.3.2 Emergency Management

Hazard mitigation is widely recognized as one of the four primary phases of emergency management. The three other phases include preparedness, response, and recovery. In reality, each phase is interconnected with hazard mitigation, as **Figure 7.1** suggests. Opportunities to reduce potential losses through mitigation practices are most often implemented before disaster strikes, such as the elevation of flood prone structures or the continuous enforcement of policies that prevent and regulate development that is vulnerable to hazards due to its location, design, or other characteristics. Mitigation opportunities will also be presented during immediate preparedness or response activities, such as installing storm shutters in advance of a hurricane, and certainly during the long-term recovery and redevelopment process following a hazard event.

FIGURE 7.1: THE FOUR PHASES OF EMERGENCY MANAGEMENT

Planning for each phase is a critical part of a comprehensive emergency management program and a key to the successful implementation of hazard mitigation actions. As a result, the Capability Assessment Survey asked several questions across a range of emergency management plans in order to assess the South Mountains Region's willingness to plan and their level of technical planning proficiency.

Hazard Mitigation Plan: A hazard mitigation plan represents a community's blueprint for how it intends to reduce the impact of natural and human-caused hazards on people and the built environment. The essential elements of a hazard mitigation plan include a risk assessment, capability assessment, and mitigation strategy.

- ❖ Each of the four counties participating in this multi-jurisdictional plan has previously adopted a hazard mitigation plan. Each participating municipality was included in their respective county's plan.

Disaster Recovery Plan: A disaster recovery plan serves to guide the physical, social, environmental, and economic recovery and reconstruction process following a disaster. In many instances, hazard mitigation principles and practices are incorporated into local disaster recovery plans with the intent of capitalizing on opportunities to break the cycle of repetitive disaster losses. Disaster recovery plans can also lead to the preparation of disaster redevelopment policies and ordinances to be enacted following a hazard event.

- ❖ The City of Hendersonville is the only participating jurisdiction that has adopted a disaster recovery plan. The other jurisdictions should consider developing a plan to guide the recovery and reconstruction process following a disaster.

Emergency Operations Plan: An emergency operations plan outlines responsibilities and the means by which resources are deployed during and following an emergency or disaster.

- ❖ Henderson County, Polk County, Rutherford County, and Transylvania County each maintain emergency operations plans through their respective Emergency Management Departments.
- ❖ Henderson County coordinates all emergency management operations for the county and its incorporated municipalities.

- All emergency management operations for Polk County are coordinated through the Polk County Emergency Management Agency. Although, the municipalities may choose to have their own emergency management agency, the coordination of resources during an emergency will be managed through the county.
- Rutherford County maintains a countywide emergency operations plan that covers all of its municipalities. However, the Town of Lake Lure has adopted its own town emergency operations plan administrated by the town's Emergency Management Department.
- Transylvania County maintains a countywide emergency operations plan that covers all of its municipalities.

Continuity of Operations Plan: A continuity of operations plan establishes a chain of command, line of succession, and plans for backup or alternate emergency facilities in case of an extreme emergency or disaster event.

- Only Henderson County and the City Hendersonville have continuity of operations plans in place.

7.3.3 General Planning

The implementation of hazard mitigation activities often involves agencies and individuals beyond the emergency management profession. Stakeholders may include local planners, public works officials, economic development specialists, and others. In many instances, concurrent local planning efforts will help to achieve or complement hazard mitigation goals, even though they are not designed as such. Therefore, the Capability Assessment Survey also asked questions regarding general planning capabilities and the degree to which hazard mitigation is integrated into other on-going planning efforts in the South Mountains Region.

Comprehensive Land Use Plan: A comprehensive land use plan establishes the overall vision for what a community wants to be and serves as a guide for future governmental decision making. Typically a comprehensive plan contains sections on demographic conditions, land use, transportation elements, and community facilities. Given the broad nature of the plan and its regulatory standing in many communities, the integration of hazard mitigation measures into the comprehensive plan can enhance the likelihood of achieving risk reduction goals, objectives, and actions.

- Henderson County and its participating municipalities have each adopted a local comprehensive plan.
- Polk County, the Town of Columbus, and the City of Saluda have each adopted a local land use plan.
- Rutherford County has adopted a land use plan that encompasses the county as well as the Town of Bostic, the Village of Chimney Rock, the Town of Ellenboro, the Town of Forest City, the Town of Lake Lure, the Town of Ruth, the Town of Rutherfordton, and the Town of Spindale. Chimney Rock Village, Forest City, Lake Lure, Rutherfordton, and Spindale have also adopted municipal-level comprehensive plans.
- Transylvania County has adopted a comprehensive plan that addresses land uses within the county and the Town of Rosman. The City of Brevard has adopted a city land use plan.

Capital Improvements Plan: A capital improvements plan guides the scheduling of spending on public improvements. A capital improvements plan can serve as an important mechanism for guiding future development away from identified hazard areas. Limiting public spending in hazardous areas is one of the most effective long-term mitigation actions available to local governments.

- Henderson County, the Town of Fletcher, the City of Hendersonville, the Town of Laurel Park, and the Town Mills River have capital improvement plans in place.
- Polk County, the Town of Columbus, and the Town of Tyron have capital improvement plans in place.
- Rutherford County, the Town of Forest City, the Town of Lake Lure, and the Town of Rutherfordton also have capital improvement plans.
- Transylvania County and the City of Brevard have capital improvement plans.

Historic Preservation Plan: A historic preservation plan is intended to preserve historic structures or districts within a community. An often overlooked aspect of the historic preservation plan is the assessment of buildings and sites located in areas subject to natural hazards and the identification of ways to reduce future damages. This may involve retrofitting or relocation techniques that account for the need to protect buildings that do not meet current building standards or are within a historic district that cannot easily be relocated out of harm's way.

- None of the counties or municipalities participating in this multi-jurisdictional plan have a historic preservation plan.

Zoning Ordinance: Zoning represents the primary means by which land use is controlled by local governments. As part of a community's police power, zoning is used to protect the public health, safety, and welfare of those in a given jurisdiction that maintains zoning authority. A zoning ordinance is the mechanism through which zoning is typically implemented. Since zoning regulations enable municipal governments to limit the type and density of development, a zoning ordinance can serve as a powerful tool when applied in identified hazard areas.

- Henderson County and each of its participating municipalities administer a zoning ordinance.
- Polk County and each of its participating municipalities also administer a zoning ordinance.
- Rutherford County does not have a zoning ordinance. However, the municipalities of Chimney Rock Village, Forest City, Lake Lure, Rutherfordton, and Spindale have adopted zoning ordinances that are overseen by municipal zoning administrators.
- Transylvania County does not have a zoning ordinance. However, the City of Brevard has adopted a zoning ordinance that is administered by the city.

Subdivision Ordinance: A subdivision ordinance is intended to regulate the development of residential, commercial, industrial, or other uses, including associated public infrastructure, as land is subdivided into buildable lots for sale or future development. Subdivision design that accounts for natural hazards can dramatically reduce the exposure of future development.

- Henderson County and all of its participating municipalities have adopted and enforce subdivision regulations.

- Polk County and all of its participating municipalities have also adopted and enforce subdivision regulations.
- Rutherford County, the Village of Chimney Rock, the Town of Forest City, and the Town of Lake Lure have each adopted subdivision regulations.
- Transylvania County and the City of Brevard have also both adopted subdivision regulations.

Building Codes, Permitting, and Inspections: Building codes regulate construction standards. In many communities, permits and inspections are required for new construction. Decisions regarding the adoption of building codes (that account for hazard risk), the type of permitting process required both before and after a disaster, and the enforcement of inspection protocols all affect the level of hazard risk faced by a community.

- North Carolina has a state compulsory building code, which applies throughout the state; however, jurisdictions may adopt codes if approved as providing adequate minimum standards. All of the participating counties and municipalities have adopted a building code.
- Henderson County provides building code enforcement for the county and all of its municipalities.
- Polk County Building Inspections enforces the building code within the county.
- Rutherford County provides building code enforcement not only for the county but also for the Village of Chimney Rock and the Towns of Lake Lure, Rutherfordton, Ruth, Spindale, Ellenboro, and Bostic.
- Transylvania County enforces the building code for the county and both of its municipalities.

The adoption and enforcement of building codes by local jurisdictions is routinely assessed through the Building Code Effectiveness Grading Schedule (BCEGS) program developed by the Insurance Services Office, Inc. (ISO).[3] In North Carolina, the North Carolina Department of Insurance assesses the building codes in effect in a particular community and how the community enforces its building codes *with special emphasis on mitigation of losses from natural hazards*. The results of BCEGS assessments are routinely provided to ISO's member private insurance companies, which in turn may offer ratings credits for new buildings constructed in communities with strong BCEGS classifications. The concept is that communities with well-enforced, up-to-date codes should experience fewer disaster-related losses and, as a result, should have lower insurance rates.

In conducting the assessment, ISO collects information related to personnel qualification and continuing education as well as the number of inspections performed per day. This type of information combined with local building codes is used to determine a grade for that jurisdiction. The grades range from 1 to 10 with a BCEGS grade of 1 representing exemplary commitment to building code enforcement and a grade of 10 indicating less than minimum recognized protection.

7.3.4 Floodplain Management

Flooding represents the greatest natural hazard facing the nation. At the same time, the tools available to reduce the impacts associated with flooding are among the most developed when compared to other

[3] Participation in BCEGS is voluntary and may be declined by local governments if they do not wish to have their local building codes evaluated.

hazard-specific mitigation techniques. In addition to approaches that cut across hazards such as education, outreach, and the training of local officials, the *National Flood Insurance Program* (NFIP) contains specific regulatory measures that enable government officials to determine where and how growth occurs relative to flood hazards. Participation in the NFIP is voluntary for local governments; however, program participation is strongly encouraged by FEMA as a first step for implementing and sustaining an effective hazard mitigation program. It is therefore used as part of this assessment as a key indicator for measuring local capability.

In order for a county or municipality to participate in the NFIP, they must adopt a local flood damage prevention ordinance that requires jurisdictions to follow established minimum building standards in the floodplain. These standards require that all new buildings and substantial improvements to existing buildings will be protected from damage by a 100-year flood event and that new development in the floodplain will not exacerbate existing flood problems or increase damage to other properties.

A key service provided by the NFIP is the mapping of identified flood hazard areas. Once completed, the Flood Insurance Rate Maps (FIRMs) are used to assess flood hazard risk, regulate construction practices, and set flood insurance rates. FIRMs are an important source of information to educate residents, government officials, and the private sector about the likelihood of flooding in their community.

Table 7.2 provides NFIP policy and claim information for each participating jurisdiction in the South Mountains Region.

TABLE 7.2: NFIP POLICY AND CLAIM INFORMATION

Jurisdiction	Date Joined NFIP	Current Effective Map Date	NFIP Policies in Force	Insurance in Force	Closed Claims	Total Payments to Date
HENDERSON COUNTY†	03/01/82	01/06/10	224	$55,227,900	4	$239,353
Flat Rock	12/12/08	01/06/10	25	$5,590,000	0	$0
Fletcher	10/28/03	01/06/10	0	$0	1	$14,745
Hendersonville	01/20/82	01/06/10	163	$37,851,500	116	$1,336,191
Laurel Park	10/02/08	01/06/10	7	$2,135,000	1	$2,980
Mills River*	--	--	--	--	--	--
POLK COUNTY†	01/01/87	10/02/08	37	$8,536,300	10	$87,286
Columbus	04/24/09	10/02/08	1	$600,000	0	$0
Saluda	02/19/10	10/02/08	1	$175,000	0	$0
Tryon	08/19/86	10/02/08(M)	15	$2,957,000	0	$0
RUTHERFORD COUNTY†	06/01/87	01/06/10	63	$14,961,300	30	$626,560
Bostic	09/25/09	01/06/10	1	$350,000	0	$0
Chimney Rock Village	02/14/97	01/06/10	15	$3,659,000	0	$0

Jurisdiction	Date Joined NFIP	Current Effective Map Date	NFIP Policies in Force	Insurance in Force	Closed Claims	Total Payments to Date
Ellenboro*	--	--	--	--	--	--
Forest City	06/17/86	01/06/10	4	$1,015,000	0	$0
Lake Lure	03/04/97	01/06/10	24	$8,866,000	0	$0
Ruth*	--	--	--	--	--	--
Rutherfordton	06/17/86	01/06/10	6	$1,378,000	0	$0
Spindale	06/04/79	01/06/10	2	$400,000	0	$0
TRANSYLVANIA COUNTY†	01/02/80	04/19/10	157	$43,712,400	21	$305,983
Brevard	09/29/78	04/19/10	109	$26,894,400	11	$150,815
Rosman	06/02/72	04/19/10	15	$3,030,100	21	$93,223

†Includes unincorporated areas of county only
*Community does not participate in the NFIP
(M) – No Elevation Determined, all Zone A, C and X
Source: NFIP Community Status information as of 9/5/13; NFIP claims and policy information as of 6/30/13

All jurisdictions listed above that are participants in the NFIP will continue to comply with all required provisions of the program and will work to adequately comply in the future utilizing a number of strategies. For example, the jurisdictions will coordinate with NCEM and FEMA to develop maps and regulations related to special flood hazard areas within their jurisdictional boundaries and, through a consistent monitoring process, will design and improve their floodplain management program in a way that reduces the risk of flooding to people and property.

The Town of Ellenboro does not participate in the NFIP because none of its land area is currently located within the floodplain. The Towns of Mills River and Ruth also do not participate in the NFIP due to lack of available funding and political support.

Community Rating System: An additional indicator of floodplain management capability is the active participation of local jurisdictions in the Community Rating System (CRS). The CRS is an incentive-based program that encourages counties and municipalities to undertake defined flood mitigation activities that go beyond the minimum requirements of the NFIP by adding extra local measures to provide protection from flooding. All of the 18 creditable CRS mitigation activities are assigned a range of point values. As points are accumulated and reach identified thresholds, communities can apply for an improved CRS class rating. Class ratings, which range from 10 to 1, are tied to flood insurance premium reductions as shown in **Table 7.3**. As class rating improves (the lower the number the better), the percent reduction in flood insurance premiums for NFIP policyholders in that community increases.

TABLE 7.3: CRS PREMIUM DISCOUNTS, BY CLASS

CRS Class	Premium Reduction
1	45%
2	40%

3	35%
4	30%
5	25%
6	20%
7	15%
8	10%
9	5%
10	0

Source: *FEMA*

Community participation in the CRS is voluntary. Any community that is in full compliance with the rules and regulations of the NFIP may apply to FEMA for a CRS classification better than class 10. The CRS application process has been greatly simplified over the past several years based on community comments. Changes were made with the intent to make the CRS more user-friendly and make extensive technical assistance available for communities who request it.

- The City of Brevard is the only jurisdiction that currently participates in the CRS. Participation in the CRS program should be considered as a mitigation action by the counties and other municipalities. The program would be most beneficial to Henderson County, the City of Hendersonville, and Transylvania County, which have 224, 163, and 157 NFIP policies, respectively.

Flood Damage Prevention Ordinance: A flood damage prevention ordinance establishes minimum building standards in the floodplain with the intent to minimize public and private losses due to flood conditions.

- All communities participating in the NFIP are required to adopt a local flood damage prevention ordinance. All counties and municipalities participating in this hazard mitigation plan, with the exception of the Towns of Mills River, Ellenboro, and Ruth, also participate in the NFIP and they all have adopted flood damage prevention regulations.

Floodplain Management Plan: A floodplain management plan (or a flood mitigation plan) provides a framework for action regarding corrective and preventative measures to reduce flood-related impacts.

- Transylvania County has a floodplain management plan that contains information about the location of floodplains within the jurisdictions.

Open Space Management Plan*:* An open space management plan is designed to preserve, protect, and restore largely undeveloped lands in their natural state and to expand or connect areas in the public domain such as parks, greenways, and other outdoor recreation areas. In many instances, open space management practices are consistent with the goals of reducing hazard losses, such as the preservation of wetlands or other flood-prone areas in their natural state in perpetuity.

- Henderson County does not have an open space management plan in place. However, the Town of Fletcher has a greenway master plan, the City of Hendersonville has a parks and greenspace master plan, the Town of Laurel Park has a parks and greenways plan, and the Town of Mills River has a parks master plan.

- Neither Polk County nor any of its participating municipalities have adopted an open space management plan.
- Rutherford County does not have an open space management plan. However, the Town of Lake Lure has adopted a parks, recreation, trails, and open space plan.
- Transylvania County and the City of Brevard have adopted a joint comprehensive parks and recreation master plan.

Stormwater Management Plan: A stormwater management plan is designed to address flooding associated with stormwater runoff. The stormwater management plan is typically focused on design and construction measures that are intended to reduce the impact of more frequently occurring minor urban flooding.

- Henderson County and the City of Brevard are the only participating jurisdictions that have stormwater management plans in place; however, the following jurisdictions have adopted stormwater management regulations through various ordinances: Henderson County, the City of Hendersonville, the Town of Laurel Park, and the Town of Forest City.

7.3.5 Administrative and Technical Capability

The ability of a local government to develop and implement mitigation projects, policies, and programs is directly tied to its ability to direct staff time and resources for that purpose. Administrative capability can be evaluated by determining how mitigation-related activities are assigned to local departments and if there are adequate personnel resources to complete these activities. The degree of intergovernmental coordination among departments will also affect administrative capability for the implementation and success of proposed mitigation activities.

Technical capability can generally be evaluated by assessing the level of knowledge and technical expertise of local government employees, such as personnel skilled in using Geographic Information Systems (GIS) to analyze and assess community hazard vulnerability. The Capability Assessment Survey was used to capture information on administrative and technical capability through the identification of available staff and personnel resources.

Table 7.4 provides a summary of the capability assessment results for the South Mountains Region with regard to relevant staff and personnel resources. A checkmark (✓) indicates the presence of a staff member(s) in that jurisdiction with the specified knowledge or skill.

TABLE 7.4: RELEVANT STAFF / PERSONNEL RESOURCES

Staff / Personnel Resource	HENDERSON COUNTY	Flat Rock	Fletcher	Hendersonville	Laurel Park	Mills River	POLK COUNTY	Columbus	Saluda	Tryon	RUTHERFORD COUNTY	Bostic	Chimney Rock Village	Ellenboro	Forest City	Lake Lure	Ruth	Rutherfordton	Spindale	TRANSYLVANIA COUNTY	Brevard	Rosman
Planners with knowledge of land development / land management practices	✓		✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Staff / Personnel Resource	HENDERSON COUNTY	Flat Rock	Fletcher	Hendersonville	Laurel Park	Mills River	POLK COUNTY	Columbus	Saluda	Tryon	RUTHERFORD COUNTY	Bostic	Chimney Rock Village	Ellenboro	Forest City	Lake Lure	Ruth	Rutherfordton	Spindale	TRANSYLVANIA COUNTY	Brevard	Rosman
Engineers or professionals trained in construction practices related to buildings and/or infrastructure	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Planners or engineers with an understanding of natural and/or human-caused hazards	✓		✓	✓			✓	✓		✓	✓	✓	✓	✓			✓		✓	✓	✓	✓
Emergency Manager	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Floodplain Manager	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓
Land Surveyors																						
Scientists familiar with the hazards of the community	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Staff with education or expertise to assess the community's vulnerability to hazards	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Personnel skilled in GIS and/or Hazus	✓	✓	✓	✓	✓	✓	✓				✓					✓				✓	✓	✓
Resource development staff or grant writers																						

Credit for having a floodplain manager was given to those jurisdictions that have a flood damage prevention ordinance, and therefore an appointed floodplain administrator, regardless of whether the appointee was dedicated solely to floodplain management. Credit was given for having a scientist familiar with the hazards of the community if a jurisdiction has a Cooperative Extension Service or Soil and Water Conservation Department. Credit was also given for having staff with education or expertise to assess the community's vulnerability to hazards if a staff member from the jurisdiction was a participant on the existing hazard mitigation plan's planning committee.

7.3.6 Fiscal Capability

The ability of a local government to take action is often closely associated with the amount of money available to implement policies and projects. This may take the form of outside grant funding awards or locally-based revenue and financing. The costs associated with mitigation policy and project implementation vary widely. In some cases, policies are tied primarily to staff time or administrative costs associated with the creation and monitoring of a given program. In other cases, direct expenses are linked to an actual project, such as the acquisition of flood-prone homes, which can require a substantial commitment from local, state, and federal funding sources.

The Capability Assessment Survey was used to capture information on the region's fiscal capability through the identification of locally available financial resources.

Table 7.5 provides a summary of the results for the South Mountains Region with regard to relevant fiscal resources. A checkmark (✓) indicates that the given fiscal resource is locally available for hazard mitigation purposes (including match funds for state and federal mitigation grant funds) according to the previous county hazard mitigation plans.

TABLE 7.5: RELEVANT FISCAL RESOURCES

Fiscal Tool / Resource	HENDERSON COUNTY	Flat Rock	Fletcher	Hendersonville	Laurel Park	Mills River	POLK COUNTY	Columbus	Saluda	Tryon	RUTHERFORD COUNTY	Bostic	Chimney Rock Village	Ellenboro	Forest City	Lake Lure	Ruth	Rutherfordton	Spindale	TRANSYLVANIA COUNTY	Brevard	Rosman
Capital Improvement Programming	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Community Development Block Grants (CDBG)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Special Purpose Taxes (or taxing districts)	✓	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Gas / Electric Utility Fees																						
Water / Sewer Fees																						
Stormwater Utility Fees																						
Development Impact Fees																						
General Obligation, Revenue, and/or Special Tax Bonds																						
Partnering Arrangements or Intergovernmental Agreements	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Other: HMGP, FMA, PDM, PA, SBA, other federal grants, etc.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

7.3.7 Political Capability

One of the most difficult capabilities to evaluate involves the political will of a jurisdiction to enact meaningful policies and projects designed to reduce the impact of future hazard events. Hazard mitigation may not be a local priority or may conflict with or be seen as an impediment to other goals of the community, such as growth and economic development. Therefore, the local political climate must be considered in designing mitigation strategies as it could be the most difficult hurdle to overcome in accomplishing their adoption and implementation.

The Capability Assessment Survey was used to capture information on political capability of the South Mountains Region. Previous county-level hazard mitigation plans were reviewed for general examples of local political capability, such as guiding development away from identified hazard areas, restricting public investments or capital improvements within hazard areas, or enforcing local development standards that go beyond minimum state or federal requirements (i.e., building codes, floodplain management, etc.).

- The previous county hazard mitigation plans identified existing ordinances that address natural hazards or are related to hazard mitigation such as emergency management, flood damage prevention, watershed protection, erosion and sedimentation control, zoning, and subdivision.
- Opposition to mitigation measures is not evident in Henderson County or its incorporated municipalities. In fact, Henderson County has taken a proactive approach to mitigation through the development of governing documents which promote the mitigation process. The Henderson County Governing Board is well educated on the hazards that threaten the county and has advisory boards that specialize in specific areas of hazard reduction. The county (its governing board, staff, and citizenry) appears highly capable and willing to promote the economic efficiency and social utility of the mitigation measures contained in this plan. In addition, they appear willing to assist all local municipalities in the implementation of strategies identified herein and specific to municipal jurisdictions.
- Mitigation strategies have been presented to the Polk County Planning Board on various occasions. The results have included an effort to map all county water sources in GIS, an updated and adopted flood prevention ordinance, adopting a soil and erosion ordinance, and recommended changes to the subdivision ordinance incorporating changes to road requirements and emergency apparatus. This demonstrates favorable political support and a willingness to adopt hazard mitigation efforts in an active manner.
- Rutherford County has experienced the devastating effects of natural hazards (i.e., recent hurricanes and ice storms). The citizens, property owners, business owners, and elected officials of the county are committed to implementing a hazard mitigation plan in order to reduce community vulnerability. The Rutherford County Board of Commissioners, the professional staff, and the citizens of the county are continually striving to make Rutherford County a safer community in which to live, work, and play. The county recognizes that implementation of a hazard mitigation plan is an essential component in helping to achieve these goals.
- Opposition to mitigation measures is not evident in Transylvania County or its incorporated municipalities. In fact, Transylvania County has taken a proactive approach to mitigation through the development of governing documents which promote the mitigation process. The Transylvania County Governing Board is well educated on the hazards that threaten the county and has advisory boards that specialize in specific areas of hazard reduction. The county (its governing board, staff, and citizenry) appears highly capable and willing to promote the economic efficiency and social utility of the mitigation measures contained in this plan. In addition, they appear willing to assist all local municipalities in the implementation of strategies identified herein and specific to municipal jurisdictions.

7.4 CONCLUSIONS ON LOCAL CAPABILITY

In order to form meaningful conclusions on the assessment of local capability, a quantitative scoring methodology was designed and applied to results of the Capability Assessment Survey. This methodology, further described in Appendix B, attempts to assess the overall level of capability of the South Mountains Region to implement hazard mitigation actions.

The overall capability to implement hazard mitigation actions varies among the participating jurisdictions. For planning and regulatory capability, the majority of the jurisdictions are in the moderate range. There is more variation in the administrative and technical capability among the jurisdictions with larger jurisdictions generally having greater staff and technical resources. Almost all of jurisdictions are in the limited range for fiscal capability.

Table 7.6 shows the results of the capability assessment using the designed scoring methodology. The capability score is based solely on the information found in existing hazard mitigation plans and readily available on the jurisdictions' government websites. According to the assessment, the average local capability score for all jurisdictions is 30.7, which falls into the moderate capability ranking.

TABLE 7.6: CAPABILITY ASSESSMENT RESULTS

Jurisdiction	Overall Capability Score	Overall Capability Rating
HENDERSON COUNTY	42	High
Flat Rock	28	Moderate
Fletcher	35	Moderate
Hendersonville	41	High
Laurel Park	32	Moderate
Mills River	24	Moderate
POLK COUNTY	37	Moderate
Columbus	30	Moderate
Saluda	25	Moderate
Tryon	28	Moderate
RUTHERFORD COUNTY	36	Moderate
Bostic	24	Moderate
Chimney Rock Village	29	Moderate
Ellenboro	17	Limited
Forest City	33	Moderate
Lake Lure	34	Moderate
Ruth	17	Limited
Rutherfordton	28	Moderate
Spindale	27	Moderate
TRANSYLVANIA COUNTY	41	High
Brevard	41	High
Rosman	26	Moderate

As previously discussed, one of the reasons for conducting a Capability Assessment is to examine local capabilities to detect any existing gaps or weaknesses within ongoing government activities that could hinder proposed mitigation activities and possibly exacerbate community hazard vulnerability. These gaps or weaknesses have been identified for each jurisdiction in the tables found throughout this section. The participating jurisdictions used the Capability Assessment as part of the basis for the Mitigation Actions that are identified in Section 9; therefore, each jurisdiction addresses their ability to expand on and improve their existing capabilities through the identification of their Mitigation Actions.

7.4.1 Linking the Capability Assessment with the Risk Assessment and the Mitigation Strategy

The conclusions of the Risk Assessment and Capability Assessment serve as the foundation for the development of a meaningful hazard mitigation strategy. During the process of identifying specific mitigation actions to pursue, the Regional Hazard Mitigation Planning Team considered not only each jurisdiction's level of hazard risk, but also their existing capability to minimize or eliminate that risk.

SECTION 8
MITIGATION STRATEGY

This section of the Plan provides the blueprint for the participating jurisdictions in the South Mountains Region to follow in order to become less vulnerable to its identified hazards. It is based on general consensus of the South Mountains Regional Hazard Mitigation Planning Team and the findings and conclusions of the *Capability Assessment* and *Risk Assessment*. It consists of the following five subsections:

- 8.1 Introduction
- 8.2 Mitigation Goals
- 8.3 Identification and Analysis of Mitigation Techniques
- 8.4 Selection of Mitigation Techniques for the South Mountains Region
- 8.5 Plan Update Requirement

8.1 INTRODUCTION

The intent of the Mitigation Strategy is to provide the South Mountains Region communities with the goals that will serve as guiding principles for future mitigation policy and project administration, along with an analysis of mitigation techniques available to meet those goals and reduce the impact of identified hazards. It is designed to be comprehensive, strategic, and functional in nature:

- In being *comprehensive*, the development of the strategy includes a thorough review of all hazards and identifies extensive mitigation measures intended to not only reduce the future impacts of high risk hazards, but also to help the region achieve compatible economic, environmental, and social goals.
- In being *strategic*, the development of the strategy ensures that all policies and projects proposed for implementation are consistent with pre-identified, long-term planning goals.
- In being *functional,* each proposed mitigation action is linked to established priorities and assigned to specific departments or individuals responsible for their implementation with target completion deadlines. When necessary, funding sources are identified that can be used to assist in project implementation.

The first step in designing the Mitigation Strategy includes the identification of mitigation goals. Mitigation goals represent broad statements that are achieved through the implementation of more specific mitigation actions. These actions include both hazard mitigation policies (such as the regulation of land in known hazard areas through a local ordinance) and hazard mitigation projects that seek to address specifically targeted hazard risks (such as the acquisition and relocation of a repetitive loss structure).

The second step involves the identification, consideration, and analysis of available mitigation measures to help achieve the identified mitigation goals. This is a long-term, continuous process sustained through the development and maintenance of this Plan. Alternative mitigation measures will continue to be considered as future mitigation opportunities are identified, as data and technology improve, as mitigation funding becomes available, and as this Plan is maintained over time.

The third and last step in designing the Mitigation Strategy is the selection and prioritization of specific mitigation actions for the South Mountains Region (provided separately in Section 9: *Mitigation Action Plan*). Each county and participating jurisdiction has its own Mitigation Action Plan (MAP) that reflects the needs and concerns of that jurisdiction. The MAP represents an unambiguous and functional plan for action and is considered to be the most essential outcome of the mitigation planning process.

The MAP includes a prioritized listing of proposed hazard mitigation actions (policies and projects) for the participating counties and municipalities to complete. Each action has accompanying information, such as those departments or individuals assigned responsibility for implementation, potential funding sources, and an estimated target date for completion. The MAP provides those departments or individuals responsible for implementing mitigation actions with a clear roadmap that also serves as an important tool for monitoring success or progress over time. The cohesive collection of actions listed in the MAP can also serve as an easily understood menu of mitigation policies and projects for those local decision makers who want to quickly review the recommendations and proposed actions of the Regional Hazard Mitigation Plan.

In preparing each Mitigation Action Plan for the South Mountains Region, officials considered the overall hazard risk and capability to mitigate the effects of hazards as recorded through the risk and capability assessment process, in addition to meeting the adopted mitigation goals and unique needs of the community.

8.1.1 Mitigation Action Prioritization

In the previous versions of the participating jurisdictions' hazard mitigation plans, not all actions were prioritized. In addition, there needed to be consistency among the counties and jurisdiction regarding how they prioritized their actions. Therefore, for the 2014 South Mountains Regional plan, the Regional Hazard Mitigation Planning Team members were tasked with establishing a priority for each action at the second Planning Team meeting. Prioritization of the proposed mitigation actions was based on the following six factors:

- Effect on overall risk to life and property
- Ease of implementation
- Political and community support
- A general economic cost/benefit review[1]
- Funding availability
- Continued compliance with the NFIP

[1] Only a general economic cost/benefit review was considered by the Regional Hazard Mitigation Planning Committee through the process of selecting and prioritizing mitigation actions. Mitigation actions with "high" priority were determined to be the most cost effective and most compatible with the participating jurisdictions' unique needs. Actions with a "moderate" priority were determined to be cost-effective and compatible with jurisdictional needs, but may be more challenging to complete administratively or fiscally than "high" priority actions. Actions with a "low" priority were determined to be important community needs, but the community likely identified several potential challenges in terms of implementation (e.g. lack of funding, technical obstacles). A more detailed cost/benefit analysis will be applied to particular projects prior to the application for or obligation of funding, as appropriate.

The point of contact for each county helped coordinate the prioritization process by reviewing each action and working with the lead agency/department responsible to determine a priority for each action using the six factors listed above.

Using these criteria, actions were classified as high, moderate, or low priority by the participating jurisdiction officials.

8.2 MITIGATION GOALS

44 CFR Requirement
44 CFR Part 201.6(c)(3)(i): The mitigation strategy shall include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

The primary goal of all local governments is to promote the public health, safety, and welfare of its citizens. In keeping with this standard, the South Mountains counties and the participating municipalities have developed goal statements for local hazard mitigation planning in the region. In developing these goals, the previous four county hazard mitigation plans were reviewed to determine areas of consistency. The project consultant reviewed the goals from each of the four existing plans that were combined to form this regional plan. Many of the goals were similar and regional goals were formulated based on commonalities found between the goals in each plan. These proposed regional goals and their corresponding goals or objectives from the previous plans are presented in **Table 8.1**.

The proposed regional goals were presented, reviewed, voted on, and accepted by the Planning Team at the second Regional Hazard Mitigation Planning Team meeting. This process of combining goals from the previous plans served to highlight the planning process that had occurred in each county prior to joining this regional planning effort. Each goal, purposefully broad in nature, serves to establish parameters that were used in developing more mitigation actions. The South Mountains Regional Mitigation Goals are presented in **Table 8.2**. Consistent implementation of actions over time will ensure that community goals are achieved.

TABLE 8.1: PROPOSED MITIGATION GOALS

		Former Plan Reference			
	Proposed Goal	Henderson County	Polk County	Rutherford County	Transylvania County
Goal #1	Improve public education/awareness	Goal 1	Goal 2		Goal 1
Goal #2	Protect human life, safety and welfare by minimizing the potential for damage to personal property, infrastructure, and loss of life due to natural and human caused hazards.	Goal 3, Goal 4, Goal 5, Goal 6, Goal 7, Goal 8, Goal 9, Goal 10, Goal 13, Goal 15, Goal 16	Goal 1	Goal 1	Goal 2, Goal 3

		Former Plan Reference			
	Proposed Goal	Henderson County	Polk County	Rutherford County	Transylvania County
Goal #3	Protect and maintain emergency services infrastructure and equipment to support emergency responders and improve disaster response time/operations.	Goal 2, Goal 12, Goal 16	Goal 4	Goal 3, Goal 4	Goal 4
Goal #4	Improve technical, legal, and institutional capability to respond to and recover from disasters.	Goal 11, Goal 14, Goal 16, Goal 17	Goal 3	Goal 5	Goal 4
Goal #5	Reduce or eliminate the risk of natural disasters.	Goal 3, Goal 4, Goal 5, Goal 6, Goal 7, Goal 8, Goal 9, Goal 10, Goal 13, Goal 15		Goal 2	

TABLE 8.2: SOUTH MOUNTAINS REGIONAL MITIGATION GOALS

	Goal
Goal #1	Improve public education/awareness
Goal #2	Protect human life, safety and welfare by minimizing the potential for damage to personal property, infrastructure, and loss of life due to natural and human caused hazards.
Goal #3	Protect and maintain emergency services infrastructure and equipment to support emergency responders and improve disaster response time/operations.
Goal #4	Improve technical, legal, and institutional capability to respond to and recover from disasters.
Goal #5	Reduce or eliminate the risk of natural disasters.

8.3 IDENTIFICATION AND ANALYSIS OF MITIGATION TECHNIQUES

44 CFR Requirement
44 CFR Part 201.6(c)(3)(ii): The mitigation strategy shall include a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effect of each hazard, with particular emphasis on new and existing buildings and infrastructure.

In formulating the Mitigation Strategy for the South Mountains Region, a wide range of activities were considered in order to help achieve the established mitigation goals, in addition to addressing any specific hazard concerns. These activities were discussed during the South Mountains Regional Hazard Mitigation Planning Team meetings. In general, all activities considered by the Regional Hazard Mitigation Planning Team can be classified under one of the following six broad categories of mitigation techniques: Prevention, Property Protection, Natural Resource Protection, Structural Projects, Emergency Services, and Public Awareness and Education. These are discussed in detail below.

8.3.1 Prevention

Preventative activities are intended to keep hazard problems from getting worse, and are typically administered through government programs or regulatory actions that influence the way land is developed and buildings are built. They are particularly effective in reducing a community's future vulnerability, especially in areas where development has not occurred or capital improvements have not been substantial. Examples of preventative activities include:

- Planning and zoning
- Building codes
- Open space preservation
- Floodplain regulations
- Stormwater management regulations
- Drainage system maintenance
- Capital improvements programming
- Riverine / fault zone setbacks

8.3.2 Property Protection

Property protection measures involve the modification of existing buildings and structures to help them better withstand the forces of a hazard, or removal of the structures from hazardous locations. Examples include:

- Acquisition
- Relocation
- Building elevation
- Critical facilities protection
- Retrofitting (e.g., windproofing, floodproofing, seismic design techniques, etc.)
- Safe rooms, shutters, shatter-resistant glass
- Insurance

8.3.3 Natural Resource Protection

Natural resource protection activities reduce the impact of natural hazards by preserving or restoring natural areas and their protective functions. Such areas include floodplains, wetlands, steep slopes, and sand dunes. Parks, recreation, or conservation agencies and organizations often implement these protective measures. Examples include:

- Floodplain protection
- Watershed management
- Riparian buffers
- Forest and vegetation management (e.g., fire resistant landscaping, fuel breaks, etc.)

- Erosion and sediment control
- Wetland preservation and restoration
- Habitat preservation
- Slope stabilization

8.3.4 Structural Projects

Structural mitigation projects are intended to lessen the impact of a hazard by modifying the environmental natural progression of the hazard event through construction. They are usually designed by engineers and managed or maintained by public works staff. Examples include:

- Reservoirs
- Dams / levees / dikes / floodwalls
- Diversions / detention / retention
- Channel modification
- Storm sewers

8.3.5 Emergency Services

Although not typically considered a "mitigation" technique, emergency service measures do minimize the impact of a hazard event on people and property. These commonly are actions taken immediately prior to, during, or in response to a hazard event. Examples include:

- Warning systems
- Evacuation planning and management
- Emergency response training and exercises
- Sandbagging for flood protection
- Installing temporary shutters for wind protection

8.3.6 Public Education and Awareness

Public education and awareness activities are used to advise residents, elected officials, business owners, potential property buyers, and visitors about hazards, hazardous areas, and mitigation techniques they can use to protect themselves and their property. Examples of measures to educate and inform the public include:

- Outreach projects
- Speaker series / demonstration events
- Hazard map information
- Real estate disclosure
- Library materials
- School children educational programs

- Hazard expositions

8.4 SELECTION OF MITIGATION TECHNIQUES FOR THE SOUTH MOUNTAINS REGION

In order to determine the most appropriate mitigation techniques for the communities in the South Mountains Region, the Regional Hazard Mitigation Planning Team members thoroughly reviewed and considered the findings of the *Capability Assessment* and *Risk Assessment* to determine the best activities for their respective communities. Other considerations included the effect of each mitigation action on overall risk to life and property, its ease of implementation, its degree of political and community support, its general cost-effectiveness, and funding availability (if necessary).

8.5 PLAN UPDATE REQUIREMENT

In keeping with FEMA requirements for plan updates, the Mitigation Actions identified in the previous South Mountains Region county plans were evaluated to determine their 2014 implementation status. Updates on the implementation status of each action are provided. The mitigation actions provided in Section 9: *Mitigation Action Plan* include the mitigation actions from the previous plans as well as any new mitigation actions proposed through the 2014 planning process.

SECTION 9
MITIGATION ACTION PLAN

This section includes the listing of the mitigation actions proposed by the participating jurisdictions in the South Mountains Region. It consists of the following two subsections:

- 9.1 Overview
- 9.2 Mitigation Action Plans

44 CFR Requirement
44 CFR Part 201.6(c)(3)(iii): The mitigation strategy shall include an action plan describing how the actions identified in paragraph (c)(2)(ii) of this section will be prioritized, implemented, and administered by the local jurisdiction.

9.1 OVERVIEW

As described in the previous section, the Mitigation Action Plan, or MAP, provides a functional plan of action for each jurisdiction. It is designed to achieve the mitigation goals established in Section 8: *Mitigation Strategy* and will be maintained on a regular basis according to the plan maintenance procedures established in Section 10: *Plan Maintenance*.

Each proposed mitigation action has been identified as an effective measure (policy or project) to reduce hazard risk for the South Mountains Region. Each action is listed in the MAP in conjunction with background information such as hazard(s) addressed and relative priority. Other information provided in the MAP includes potential funding sources to implement the action should funding be required (not all proposed actions are contingent upon funding). Most importantly, implementation mechanisms are provided for each action, including the designation of a lead agency or department responsible for carrying the action out as well as a timeframe for its completion. These implementation mechanisms ensure that the South Mountains Regional Hazard Mitigation Plan remains a functional document that can be monitored for progress over time. The proposed actions are not listed in priority order, though each has been assigned a priority level of “high,” “moderate,” or “low” as described below and in Section 8 (page 8.2).

The Mitigation Action Plan is organized by mitigation strategy category (Prevention, Property Protection, Natural Resource Protection, Structural Projects, Emergency Services, or Public Education and Awareness). The following are the key elements described in the Mitigation Action Plan:

- Hazard(s) Addressed—Hazard which the action addresses.
- Relative Priority—High, moderate, or low priority as assigned by the jurisdiction.
- Lead Agency/Department—Department responsible for undertaking the action.
- Potential Funding Sources—Local, State, or Federal sources of funds are noted here, where applicable.
- Implementation Schedule—Date by which the action the action should be completed. More information is provided when possible.

- Implementation Status (2014)—Indication of completion, progress, deferment, or no change since the previous plan. If the action is new, that will be noted here.

9.2 MITIGATION ACTION PLANS

The mitigation actions proposed by each of the participating jurisdictions are listed in 22 individual MAPs on the following pages. **Table 9.1** shows the location of each jurisdiction's MAP within this section as well as the number of mitigation actions proposed by each jurisdiction.

TABLE 9.1: INDIVIDUAL MAP LOCATIONS

Location	Page	Number of Mitigation Actions
Henderson County	**9:3**	**26**
Flat Rock	9:8	6
Fletcher	9:10	6
Hendersonville	9:12	12
Laurel Park	9:15	7
Mills River	9:17	5
Polk County	**9:19**	**23**
Columbus	9:24	15
Saluda	9:27	15
Tryon	9:30	14
Rutherford County	**9:33**	**22**
Bostic	9:38	8
Chimney Rock Village	9:40	9
Ellenboro	9:43	5
Forest City	9:45	5
Lake Lure	9:47	5
Ruth	9:49	6
Rutherfordton	9:51	5
Spindale	9:53	6
Transylvania County	**9:55**	**8**
Brevard	9:59	16
Rosman	9:64	10

Henderson County Mitigation Action Plan

Henderson County Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Develop a County Stormwater Management Plan.	FL	Moderate	General Revenue		Engineering Department	Completed	Adopted Stormwater Ordinance 9-1-2010
P-2	Incorporate into the County Zoning and Subdivision Ordinances construction standards for privately owned bridges.	All	Moderate	General Revenue		Engineering Department	Completed	Private Bridge Standards are included in Land Development Code 200A-105F.
P-3	Monitor water and sewer lines in the floodplain through GIS processes.	FL	High	General Revenue		GIS	Completed	A GIS layer has been developed that includes water and sewer lines.
P-4	Install stream gauges on major waterways throughout the County to collect data on stream water height and velocity (this will also assist in mitigating erosion hazards).	FL/ER	Moderate	General Revenue and Grants		County EMA	2019	Stream gauges have been installed on all major streams in Henderson County through private donations and the NC FIMAN project. However, more stream gauges would increase the size of the network and improve monitoring so this action is still in progress
P-5	Implement scaling as a method of preventative maintenance to reduce the amount of loose debris that could lead to landslides during high precipitation events or seismic events.	LS	Moderate	General Revenue and Grants		NC Department of Transportatio n	2018	NCDOT has implemented scaling in some problem areas in the Hickory Nut Gorge area. However, this could be implemented in additional areas
P-6	Develop a dam/levee structural database with the County GIS system with the assistance of the North Carolina Dam Safety Program.	D	High	General Revenue		GIS Department/ County EMA	Completed	Henderson County has developed a dam/levee structural database with the assistance of the NC Department of Environment and Natural Resources, Dam Safety Division.

Henderson County Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
P-7	Develop a stand-by acquisition grant application that lists properties with a high potential for damage or destruction due to a dam/levee failure.	D	Low	General Revenue and Grants		County EMA	2019	Properties have been identified through the GIS layer development. No funding has been awarded for acquisition, so this will remain an action going forward.
P-8	Develop a stand-by acquisition grant application that lists properties located in multi-hazard areas specifically those properties located near US HWY 74 and NC HWY 9 (Bat Cave) which are prone not only to flash flooding but also to severe landslides .	FL/LS	Low	General Revenue and Grants		County EMA	2019	Properties have been identified; landowners are unwilling to sell at this time. Will continue to pursue this action as possible
Property Protection								
PP-1	Incorporate development and construction standards into the Zoning and Subdivision Ordinances to further regulate construction in areas prone to landslides.	LS/FL	High	General Revenue		Planning Dept	2018	NCDENR made presentation to Board of Commissioners. Incorporating standards still needs to be achieved.
PP-2	Circulate an assessment survey to determine what methods or devices County agencies have in place for securing equipment and furniture during earthquake events.	EQ	Low	General Revenue		IT Dept	2018	More expensive equipment has been located to reduce damage from an earthquake. Some smaller and less expensive equipment remains unsecured.
PP-3	Establish policy to assure all computer equipment and furniture is secured in a manner to avoid toppling during an earthquake.	EQ	Low	General Revenue		Information Technology	Completed	IT policy in place to ensure computer equipment is secured to a desk or rack mounted.

Henderson County Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
PP-4	Incorporate GIS modeling to show areas of the County prone to more serious damage during earthquake conditions.	EQ	High	General Revenue and Grants		GIS Department	Completed	HAZUS run completed during the 2014 Hazard Mitigation Regional Planning Update.
Natural Resource Protection								
NRP-1	Develop a plan, which will include annual monitoring of sediment transport and erosion, to address the long – term issue of river and stream erosion in the County.	ER	High	General Revenue and Grants		Engineering Department	Completed	Completed; This was accomplished by adding erosion division in October 2007.
NRP-2	Support State enforcement of sedimentation and erosion control regulations.	ER	High	General Revenue and Grants		Engineering Department	Completed	This has been accomplished and will continue to maintain and support.
NRP-3	Coordinate efforts with the U.S. Forestry Service to enforce banning burns.	WF	High	General Revenue		County EMA	Completed	USFS is notified when burning bans are in place and during red flag burning days. This will be continued going forward.
NRP-4	Encourage development and enlargement of buffers and green areas.	WF	High	General Revenue		Planning Dept	Completed	Land Development Code addresses buffers and green areas.

Henderson County Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
Emergency Services								
ES-1	Establish two – way radio communication for key personnel (i.e. County Manager, Emergency Services providers, Shelter Teams, etc.).	All	High	General Revenue and Grants		County EMA	Completed	New communications system will be installed by September 2014
ES-2	Include 311 systems, pre-scripted messaging in communications system.	All	Moderate	General Revenue and Grants		County EMA	Completed	3-1-1 is not available to Henderson County through AT&T. We have implemented a reverse 9-1-1 mass notification system so this action is complete.
ES-3	Establish auxiliary power systems via portable generators for all primary County buildings and schools. Make certain to include the wiring closets to accommodate technology routing.	All	High	General Revenue and Grants		Engineering Dept	2019	Several county facilities have been upgraded to include emergency power. Installation of transfer switches will continue as the budget allows.
ES-4	Assure adequate training for emergency personnel to respond to HAZMAT events is on-going.	HM	Moderate	General Revenue		County EMA	Completed	Hazardous Materials training is provided on an annual basis through Blue Ridge Community College
ES-5	Incorporate procedures for handling hazardous materials into GIS modeling.	HM	High	General Revenue		GIS Department	Completed	CAMEO, Aloha and other plume modeling products are available and in use.
ES-6	Reaffirm plans with emergency service agencies and providers for isolation and evacuation during HAZMAT events.	HM	Moderate	General Revenue and Grants		County EMA	2015, Annually review and update	Hazardous Materials plans for fixed facilities have been updated to include evacuation routes. However, these plans will need to be re-evaluated annually.
Structural Projects								
SP-1								

Henderson County Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
Public Education and Awareness								
PEA-1	Hold a County sponsored hazard mitigation seminar for the county residents, including information on preparedness for all hazards significant to Henderson County.	All	Low	General Revenue		County EMA	Completed	Preparedness information included as a regular article in county monthly newsletter. Preparedness Fair held October 2013 at Jackson Park.
PEA-2	Educate contractors about principles for quality redevelopment and safe housing development through written materials or a County sponsored workshop.	All	Low	General Revenue		Planning Department	2019	Contractors have been educated to some degree, but more outreach is needed and the program needs to be re-evaluated. This action will be carried out going forward.
PEA-3	Provide new home and property buyers with information on quality redevelopment and safe housing development. The information is probably most efficiently dispersed at the County and local administration buildings.	All	Low	General Revenue		Planning Department	2018	The county has developed a brochure to provide information on safe housing development. However, further means of outreach need to be integrated.
PEA-4	Manually disperse and have a website posting which provides information about the Henderson County Multi-Jurisdictional Hazard Mitigation Plan and relevant mitigation measures the public can take. In addition, provide a response/reply section where residents can comment on the effectiveness of the current plan and where they can make suggestions for future revisions on then plan.	All	High	General Revenue		County EMA	2015, Annually review and update materials	County EMA website has links to preparedness and mitigation measures along with link to the current Hazard Mitigation Plan. This information will need to be reviewed and updated on an annual basis.

FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake
LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees County EMA = Henderson County Emergency Management

Village of Flat Rock Mitigation Action Plan

Village of Flat Rock Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Encourage Village participation in the National Flood Insurance Program and subsequent participation in the Community Rating System Program.	FL	High	General Revenue		Village Council	Completed	Completed and in the program where residents have purchased NFIP as required by their lenders.
P-2	Develop a local Flood Damage Presentation Ordinance.	FL	High	General Revenue and Grants		Village Council	Completed	The Flood Damage Ordinance was adopted December 11, 2008. Ordinance last amended November 2013
P-3	Hire and educate a permanent Building Inspector/Code Enforcement Officer to enforce the Village's current Zoning Ordinance, Subdivision Ordinance, and the North Carolina State Building Codes within the planning jurisdiction of the Village of Flat Rock.	All	High	General Revenue		Village Council	Completed	This was achieved by contracting with Henderson County to provide a Building Inspector and the Village has a Code Enforcement officer. Zoning and Planning handled in house. County enforces building codes.
P-4	Convene the Planning Board to identify recommendations to reduce the vulnerability to landslides in the developed areas of Flat Rock and present them to the Village Council.	LS	High	General Revenue		Village Council	2018	This is an upcoming project for the next 5 years to utilize the State of North Carolina Landslide Study that will be utilized to develop the Village Ordinance.
Property Protection								
PP-1								

Village of Flat Rock Existing Mitigation Actions								
Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
Natural Resource Protection								
NRP-1								
Emergency Services								
ES-1								
Structural Projects								
SP-1								
Public Education and Awareness Activities								
PEA-1	Educate contractors about principles for quality redevelopment and safe housing development through written materials or a County sponsored workshop.	All	Low	General Revenue		Planning Department	2019	Contractors have been educated to some degree, but more outreach is needed and the program needs to be re-evaluated. This action will be carried out going forward.
PEA-2	Provide new home and property buyers with information on quality redevelopment and safe housing development. The information is probably most efficiently dispersed at the County and local administration buildings.	All	Low	General Revenue		Planning Department	2018	The county has developed a brochure to provide information on safe housing development. However, further means of outreach need to be integrated.
FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees County EMA = Henderson County Emergency Management Village = Village of Flat Rock								

Town of Fletcher Mitigation Action Plan

Town of Fletcher Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Develop a Floodplain Management Plan. The Floodplain Management Plan is included in Land Development Code adopted March 2006.	FL	High	General Revenue and Grants		Town Council	Completed	The Floodplain Management Plan is included in Land Development Code adopted March 2006.
P-2	Develop a Stormwater Management Ordinance. Encourage Town participation in the Community Rating System.	FL	High	General Revenue and Grants		Town Council	Completed	Complete The Storm water Management plan is included in Land Development Code adopted March 2006.
P-3	Develop a stand-by acquisition grant application that lists properties located in the floodplain.	FL	Moderate	Grants		Town Council	2019	Properties have been identified through the GIS layer development. No funding has been awarded for acquisition, so this will remain an action going forward.
P-4	Identify properties adjacent to the railroad tracks and post in a GIS system for potential buyout of highly vulnerable structures.	HM	Moderate	General Revenue and Grants		Town Council	2019	Properties have been identified through the GIS layer development. No funding has been awarded for acquisition, so this will remain an action going forward.
Property Protection								
PP-1								
Natural Resource Protection								
NRP-1								

Town of Fletcher Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
Emergency Services								
ES-1								
Structural Projects								
SP-1								
Public Education and Awareness Activities								
PEA-1	Educate contractors about principles for quality redevelopment and safe housing development through written materials or a County sponsored workshop.	All	Low	General Revenue		Planning Department	2019	Contractors have been educated to some degree, but more outreach is needed and the program needs to be re-evaluated. This action will be carried out going forward.
PEA-2	Provide new home and property buyers with information on quality redevelopment and safe housing development. The information is probably most efficiently dispersed at the County and local administration buildings.	All	Low	General Revenue		Planning Department	2018	The county has developed a brochure to provide information on safe housing development. However, further means of outreach need to be integrated.

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LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees County EMA = Henderson County Emergency Management Town = Town of Fletcher

City of Hendersonville Mitigation Action Plan

City of Hendersonville Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Encourage community to participate in the CRS program.	FL	Moderate	General Revenue and Grants		Engineering Department	2018	The city is still considering CRS participation, but this is pending Building Inspections score
P-2	Develop a Stormwater Management Plan.	FL	High	General Revenue and Grants		Engineering Department	Completed	Henderson County participates in the State Stormwater Mgmt Plan.
P-3	Develop a stand-by acquisition grant application that lists properties identified as repetitive loss properties due to water events.	FL	Moderate	Federal Grant		Planning Department	2019	Properties have been identified through the GIS layer development. No funding has been awarded for acquisition, so this will remain an action going forward.
P-4	Develop a stand-by acquisition grant application that lists properties adjacent to the railroad tracks.	HM	Moderate	Grants		Zoning Department	2019	Properties have been identified through the GIS layer development. No funding has been awarded for acquisition, so this will remain an action going forward.
P-5	Update and revise the local Land Use and Development Plan. The most recent plan was approved in 1980.	All	High	General Revenue and Grants		Planning Department	Completed	This has been completed by the implementation of the 2030 Hendersonville Comprehensive Plan in April of 2009. Comp. Plan approved in April of 2009.

City of Hendersonville Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
P-6	Update and revise the local Subdivision Ordinance.	All	High	General Revenue and Grants		Planning Department	Completed	This has been completed by the implementation of the 2030 Hendersonville Comprehensive Plan in April of 2009.
P-7	Work with local governments (especially Henderson County) to develop local Water Shortage Response Guidelines (in different phases) as a part of the Henderson County Emergency Operations Plan.	DR	High	General Revenue		Planning Department	Completed	Drought plan developed and included into Henderson County Emergency Operations Plan
Property Protection								
PP-1								
Natural Resource Protection								
NRP-1								
Emergency Services								
ES-1	Provide additional capacity to the current communications system during emergency situations to improve response capability. Built a new communications center to provide the necessary operational capacity required by the City.	All	High	General Revenue and Grants		Police Department	Completed	Communications System and center updated
ES-2	Provide a two – way communication system for emergency services. Continue to provide two-way communications for emergency services.	All	High	Grants		Police and Fire Department s	Completed	A two-way communications system is in place for emergency services.

City of Hendersonville Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
ES-3	Purchase generators to use as an emergency power supply for water and sewer treatment plants if power is lost during a disaster.	All	High	General Revenue and Grants		Water and Sewer Department	2018	Some generators have been purchased and installed, but more are needed so this action will be carried out going forward.
ES-4	Purchase generators to use at the operations center that controls information technology, communications and protection for fiber optic cable.	All	High	General Revenue and Grants		Information Technology	Completed	New ops center with generator back-up is in place
ES-5	Develop an action plan to reroute and control traffic during emergency situations. Remote control capability has been implemented throughout the City.	All	High	General Revenue and Grants		Police Department	2018	Remote control capability has been implemented throughout the City, but an action plan has not been developed.
Structural Projects								
SP-1								
Public Education and Awareness Activities								
PEA-1								

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Town of Laurel Park Mitigation Action Plan

Town of Laurel Park Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Develop a Stormwater Management Plan.	FL	High	General Revenue		Town Council	Completed	The Storm Water Management Ordinance was developed and approved January 15, 2008 and is enforced as required
Property Protection								
PP-1	Encourage Town participation in the National Flood Insurance Program and subsequent participation in the Community Rating System Program.	FL	High	General Revenue		Town Council	Completed	Completed – Town Participates
Natural Resource Protection								
NRP-1	Monitor trees and branches, at risk of breaking in wind, ice, and snow events. This will be accomplished by Pruning or thinning of trees or branches when they pose an immediate threat to property, utility lines or other significant structures or critical facilities in the community.	All	High	General Revenue		Town Council	Completed	The Town of Laurel Park continues to work with Duke Energy on an annual basis to monitor and remove trees and branches at risk of breaking during high winds, ice, and snow events to minimize power line damage during a storm. The Town also assesses and removes hazardous trees on the ROW to ensure access.

Town of Laurel Park Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
NRP-2	Work in conjunction with the NCFS to create and maintain fire breaks; especially on Town ROW and support efforts with private property owners and HOAs.	Fire	High	General revenue and NCFS	$0; staff time	Town Manager	12/31/2014; maintenance will be ongoing	New Action
Emergency Services								
ES-1	Purchase portable evacuation, detour, and re-route traffic signs for use during an emergency.	All	High	General Revenue and Grants		Town Council	Completed	Signs have been purchased and are ready for use in an emergency.
ES-2	Purchase generators for all local emergency facilities.	All	High	General Revenue and Grants		Town Council	2018	The Town of Laurel Park has purchased and installed natural gas operated generators for the Town Hall and the Public Works Department to facilitate emergency management operations during power outages. Other facilities will be evaluated for generator need going forward.
Structural Projects								
SP-1								
Public Education and Awareness Activities								
PEA-1	Implement a citizen notification system (email, text, automated phone call)	All	Medum	General Revenues	$3,000/yr	Town Council	2015	Contract in review currently and system will need to be updated accordingly.

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LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees County EMA = Henderson County Emergency Management Town = Town of Laurel Park

Town of Mills River Mitigation Action Plan

Town of Mills River Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Encourage Town participation in the National Flood Insurance Program and subsequent participation in the Community Rating System Program.	FL	High			Town Council	2019	Town Council will consider participation
P-2	Develop a Flood Damage Prevention Ordinance.	FL	Moderate			Town Council	2019	Town Council will consider development
P-3	Develop a Stormwater Management Plan.	FL	Moderate			Town Council	2019	Town Council consider development
Property Protection								
PP-1								
Natural Resource Protection								
NRP-1								
Emergency Services								
ES-1								
Structural Projects								
SP-1								

Town of Mills River Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Public Education and Awareness Activities								
PEA-1	Educate contractors about principles for quality redevelopment and safe housing development through written materials or a County sponsored workshop.	All	Low	General Revenue		Planning Department	2019	Contractors have been educated to some degree, but more outreach is needed and the program needs to be re-evaluated. This action will be carried out going forward.
PEA-2	Provide new home and property buyers with information on quality redevelopment and safe housing development. The information is probably most efficiently dispersed at the County and local administration buildings.	All	Low	General Revenue		Planning Department	2018	The county has developed a brochure to provide information on safe housing development. However, further means of outreach need to be integrated.
FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees County EMA = Henderson County Emergency Management Town = Town of Mills River								

Polk County Mitigation Action Plan

Polk County Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Incorporate a GIS to maintain building/parcel data for purposes of conducting more detailed hazard risk assessments and for tracking permitting/land use patterns.	All	Moderate	NCDEM/FEMA/Local Funds		Polk County MIS	2017	A GIS system has been built and includes building and parcel data. However, this data will need to be updated as it is out of date.
P-2	Encourage communities to participate in the Community Rating System (CRS).	All	High	Local Funds		County ES	Deleted	County decided not to pursue this due to lack of staff time.
P-3	Review the subdivision ordinances to determine storm water drainage to minimize flooding potential.	FL	High	Local Funds		Planning and Zoning	2018	The subdivision ordinances examine stormwater drainage, but these ordinances will need to be reviewed and updated.
P-4	Identify, list, and map all available water sources.	WF	High	Local Funds		County ES	Completed	Available water sources have been identified and mapped, so this action is completed.
P-5	Work with the LEPC and emergency services to ensure proper SARA Title III reporting.	HM	Moderate	Local Funds		LEPC	2015, Annually	County Emergency Services meets with the LEPC on a quarterly basis and has reported on SARA Title III over the past 5 years. Going forward, this committee will need to meet and stay up to date on any new requirements that are passed concerning Title III reporting.

Polk County Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
P-6	Municipalities will develop and implement programs to coordinate maintenance and mitigation activities to reduce risk to public infrastructure from severe winter storms.	S/I	Moderate	NCEM/FEMA/Local Funds		County ES	Completed	The municipalities have developed programs for mitigation that work in conjunction with the county.
Property Protection								
PP-1	Review and consider adoption of a storm water wetland requirement when developments with a certain number of acres of hard surfaces are constructed.	FL	Moderate	Local Funds		Planning and Zoning	Completed	Complete and incorporated in zoning ordinance
PP-2	Develop and implement programs to coordinate maintenance and mitigation activities to reduce risk to public infrastructure from severe winter storms.	S/I	Moderate	NCEM/FEMA/Local Funds		Public Works	Completed	The county has a program in place to implement mitigation programs and activities to reduce risk.
PP-3	Implement a program that identifies streams that are impacted by beaver dams and creates a solution to the flooding caused by the dams.	FL	Low	NCEM/FEMA/Local Funds		Public Works	2018	A program that identifies and addresses beaver dams is in the works, but it has not been fully implemented so additional effort will need to be carried out.
PP-4	Create a private bridge registry for bridges built over the county's four major streams.	FL	Low	Local Funds		Public Works	2019	All bridges have been identified, but additional mapping of the bridges would be useful and measures still need to be carried out to mitigate the bridges themselves.

Polk County Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
PP-5	Identify and remove large obstructions in the county's major streams.	FL	Low	NCEM/FEMA/Local Funds		Public Works	2019	In the past, major obstructions have been removed, but this will continue to be an issue and the county will implement this program going forward.
Natural Resource Protection								
NRP-1								
Emergency Services								
ES-1	Develop and implement a Community Emergency Response Team (CERT)	All	Moderate	NCDEM/FEMA/Local Funds		LEPC	Deleted	LEPC has decided not to pursue this due to lack of time/funding.
ES-2	Develop and implement hazard mitigation planning web page on Polk County Emergency Services web site.	All	Moderate	Local		County ES	2017	The county posts its hazard mitigation plan up on the website, but a page dedicated to hazard mitigation plan will still need to be developed.
ES-3	Enhance weather monitoring to attain earlier severe winter and ice storm warnings.	S/I	Moderate	NCDEM/FEMA/Local Funds		Communications Department	2018	Many steps have been taken to enhance weather monitoring over the past several years, but with new advancements in equipment and systems, this program will need to be reviewed and updated.
ES-4	Provide water from the Broad River along the Hwy. 9 corridor in the unincorporated areas of Polk County.	DR	High	Local Funds		County ES	Completed	Water is provided from the Broad River to unincorporated areas of Polk County.

Polk County Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
ES-5	Develop an inventory list of required equipment needed by Emergency Service agencies for hazardous material spills.	HM	Moderate	Local Funds		Polk County Chief's Assoc.	2019	A list has been developed, but there are still items that are needed to complete the inventory to maximize response to spills.
ES-6	Incorporate a Geographic Information System to maintain building/parcel data for purposes of conducting more detailed hazard risk assessments and for tracking permitting/land use patterns.	All	Moderate	NCEM/FEMA/Local Funds		Polk County MIS	Deleted	Same as P-1
ES-7	Install county-wide warning system for all hazards.	All	Moderate	NCEM/FEMA/Local Funds		Polk County Communications	Completed	This system was installed.
Structural Projects								
SP-1	Turner-Shoal Dam Upgrade: Construction updates to strengthen the dam.	FL/D	High	County Funds		County ES, Public Works, DENR	2019	Some updates to the dame have been implemented but the dam is still in need of upgrade in some areas.
Public Education and Awareness								
PEA-1	Promote the availability of flood insurance to property owners by direct mail at least once a year.	FL	High	Local Funds		Planning and Zoning	2015, Annually	Information has been sent out annually on the tax notices in the past. This program will need to be updated in the future and will be evaluated to determine if new outreach mechanisms are needed.

Polk County Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
PEA-2	Provide brochures, flyers, and pamphlets on all hazards that affect Polk County. Information will be placed in departments/agencies that are considered high traffic areas.	All	Low	Local Funds		County ES	2019	Information has been placed in high traffic areas, but the county will continue to look at ways to improve outreach including through online surveys (carried out in this plan) and other means.
PEA-3	Develop and Implement a reverse calling system.	All	Low	NCEM/FEMA/Local Funds		Polk County Communications	Completed	A reverse calling system has been installed and is ready for use.
PEA-4	Provide a booth with hazard mitigation information at all major community events.	All	Low	Local Funds		County ES	2018	The county has provided informational booths at many events including fairs and community gatherings. Information displayed will need to be updated periodically.

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LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees County ES = Polk County Emergency Services

Town of Columbus Mitigation Action Plan

Town of Columbus Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Identify, list and map all water sources available.	WF	High	Local Funds		Fire Departments	Completed	Available water sources have been identified and mapped, so this action is completed.
P-2	Work with the LEPC and emergency services to ensure proper SARA Title III reporting.	HM	Moderate	Local Funds		LEPC	2015, Annually	County Emergency Services meets with the LEPC on a quarterly basis and has reported on SARA Title III over the past 5 years. Going forward, this committee will need to meet and stay up to date on any new requirements that are passed concerning Title III reporting.
P-3	Develop and implement a Community Emergency Response Team (CERT).	All	Moderate	NCDEM/FEMA/Local Funds		LEPC	Deleted	LEPC has decided not to pursue this due to lack of time/funding.
P-4	Municipalities will develop and implement programs to coordinate maintenance and mitigation activities to reduce risk to public infrastructure from severe winter storms.	S/I	Moderate	NCEM/FEMA/Local Funds		County ES	Completed	The municipalities have developed programs for mitigation that work in conjunction with the county.

Town of Columbus Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Property Protection								
PP-1	Implement a program that identifies streams that are impacted by beaver dams and creates a solution to the flooding caused by the dams.	FL	Low	NCEM/FEMA/Local Funds		Polk County Public Works	2018	A program that identifies and addresses beaver dams is in the works, but it has not been fully implemented so additional effort will need to be carried out.
PP-2	Create a private bridge registry for bridges built over the county's four major streams.	FL	Low	Local Funds		Polk County ES	2019	All bridges have been identified, but additional mapping of the bridges would be useful and measures still need to be carried out to mitigate the bridges themselves.
PP-3	Identify and remove large obstructions in the county's major streams.	FL	Low	NCEM/FEMA/Local Funds		Public Works	2019	In the past, major obstructions have been removed, but this will continue to be an issue and the county will implement this program going forward.
Natural Resource Protection								
NRP-1								
Emergency Services								
ES-1	Develop an inventory list of required equipment needed by Emergency Service agencies for hazardous material spills.	HM	Moderate	Local Funds		Polk County Chief's Assoc.	2019	A list has been developed, but there are still items that are needed to complete the inventory to maximize response to spills.

Town of Columbus Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
ES-2	Incorporate a Geographic Information System to maintain building/parcel data for purposes of conducting more detailed hazard risk assessments and for tracking permitting/land use patterns.	All	Moderate	NCEM/FEMA/Local Funds		Polk County MIS	2017	A GIS system has been built and includes building and parcel data. However, this data will need to be updated as it is out of date.
ES-3	Develop and implement hazard mitigation planning web page on Polk County Emergency Services web site.	All	Moderate	Local		County ES	2017	The county posts its hazard mitigation plan up on the website, but a page dedicated to hazard mitigation plan will still need to be developed.
ES-4	Install county-wide warning system for all hazards.	All	Moderate	NCEM/FEMA/Local Funds		Polk County Communications	Completed	This system was installed.
Structural Projects								
SP-1	Complete an emergency waterline from Henderson County.	DR	High	Local Funds		Town Managers	2018	This project has been discussed and is in the works, but is not complete. More work will need to be done going forward
Public Education and Awareness Activities								
PEA-1	Provide brochures, flyers (e.g NFIP), and pamphlets on all hazards that affect Polk County. Information will be placed in departments/agencies that are considered high traffic areas.	All	Low	Local Funds		County ES	2019	Information has been placed in high traffic areas, but the county will continue to look at ways to improve outreach including through online surveys (carried out in this plan) and other means.
PEA-2	Develop and Implement a reverse calling system.	All	Low	NCEM/FEMA/Local Funds		Polk County Communications	Completed	A reverse calling system has been installed and is ready for use.

Town of Columbus Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
PEA-3	Provide a booth with hazard mitigation information at all community.	All	Low	Local Funds		County ES	2018	The county has provided informational booths at many events including fairs and community gatherings. Information displayed will need to be updated periodically.
FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees County ES = Polk County Emergency Services Town = Town of Columbus								

City of Saluda Mitigation Action Plan

City of Saluda Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Work to complete the necessary requirements to join the National Flood Insurance Program.	FL	High	Local Funds		City Public Works	Deleted	Not going to pursue due to lack of staff time.
P-2	Work with the LEPC and emergency services to ensure proper SARA Title III reporting.	HM	Moderate	Local Funds		LEPC	2015, Annually	County Emergency Services meets with the LEPC on a quarterly basis and has reported on SARA Title III over the past 5 years. Going forward, this committee will need to meet and stay up to date on any new requirements that are passed concerning Title III reporting.
P-3	Municipalities will develop and implement programs to coordinate maintenance and mitigation activities to reduce risk to public infrastructure from winter storms.	S/I	Moderate	NCEM/FEMA/Local Funds		County ES	Completed	The municipalities have developed programs for mitigation that work in conjunction with the county.
Property Protection								
PP-1	Implement a program that identifies streams that are impacted by beaver dams and creates a solution to the flooding caused by the dams.	FL	Low	NCEM/FEMA/Local Funds		Polk Cty Public Works	2018	A program that identifies and addresses beaver dams is in the works, but it has not been fully implemented so additional effort will need to be carried out.

City of Saluda Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
PP-2	Create a private bridge registry for bridges built over the county's four major streams.	FL	Low	Local Funds		Public Works	2019	All bridges have been identified, but additional mapping of the bridges would be useful and measures still need to be carried out to mitigate the bridges themselves.
PP-3	Identify and remove large obstructions in the county's major streams.	FL	Low	NCEM/FEMA/Local Funds		Public Works	2019	In the past, major obstructions have been removed, but this will continue to be an issue and the county will implement this program going forward.
Natural Resource Protection								
NRP-1								
Emergency Services								
ES-1	Develop an inventory list of required equipment needed by Emergency Service agencies for hazardous material spills.	HM	Moderate	Local Funds		Polk County Chief's Assoc.	2019	A list has been developed, but there are still items that are needed to complete the inventory to maximize response to spills.
ES-2	Incorporate a Geographic Information System to maintain building/parcel data for purposes of conducting more detailed hazard risk assessments and for tracking permitting/land use patterns.	All	Moderate	NCEM/FEMA/Local Funds		Polk County MIS	Deleted	Same as P-1
ES-3	Develop and implement a Community Emergency Response Team (CERT).	All	Moderate	NCDEM/FEMA/Local Funds		LEPC	Deleted	LEPC has decided not to pursue this due to lack of time/funding.

City of Saluda Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
ES-4	Develop and implement hazard mitigation planning web page on Polk County Emergency Services web site.	All	Moderate	Local		County ES	2017	The county posts its hazard mitigation plan up on the website, but a page dedicated to hazard mitigation plan will still need to be developed.
ES-5	Install county-wide warning system for all hazards.	All	Moderate	NCEM/FEMA/Local Funds		Polk County Communications	Completed	This system was installed.
Structural Projects								
SP-1	Complete an emergency waterline from Henderson County.	DR	High	Local Funds		Town Managers	2018	This project has been discussed and is in the works, but is not complete. More work will need to be done going forward
Public Education and Awareness Activities								
PEA-1	Provide brochures, flyers (e.g NFIP), and pamphlets on all hazards that affect Polk County. Information will be placed in departments/agencies that are considered high traffic areas.	All	Low	Local Funds		County ES	2019	Information has been placed in high traffic areas, but the county will continue to look at ways to improve outreach including through online surveys (carried out in this plan) and other means.
PEA-2	Develop and Implement a reverse calling system.	All	Low	NCEM/FEMA/Local Funds		Polk County Communications	Completed	A reverse calling system has been installed and is ready for use.
PEA-3	Provide a booth with hazard mitigation information at all community.	All	Low	Local Funds		County ES	2018	The county has provided informational booths at many events including fairs and community gatherings. Information displayed will need to be updated periodically.

FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake

City of Saluda Existing Mitigation Actions								
Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees County ES = Polk County Emergency Services City = City of Saluda								

Town of Tryon Mitigation Action Plan

Town of Tryon Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Work with the LEPC and emergency services to ensure proper SARA Title III reporting.	HM	Moderate	Local Funds		LEPC	2015, Annually	County Emergency Services meets with the LEPC on a quarterly basis and has reported on SARA Title III over the past 5 years. Going forward, this committee will need to meet and stay up to date on any new requirements that are passed concerning Title III reporting.
P-2	Municipalities will develop and implement programs to coordinate maintenance and mitigation activities to reduce risk to public infrastructure from severe winter storms.	S/I	Moderate	NCEM/FEMA/Local Funds		County ES	Completed	The municipalities have developed programs for mitigation that work in conjunction with the county.
Property Protection								
PP-1	Implement a program that identifies streams that are impacted by beaver dams and creates a solution to the flooding caused by the dams.	FL	Low	NCEM/FEMA/Local Funds		Polk County Public Works	2018	A program that identifies and addresses beaver dams is in the works, but it has not been fully implemented so additional effort will need to be carried out.

Town of Tryon Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
PP-2	Create a private bridge registry for bridges built over the county's four major streams.	FL	Low	Local Funds		Public Works	2019	All bridges have been identified, but additional mapping of the bridges would be useful and measures still need to be carried out to mitigate the bridges themselves.
PP-3	Identify and remove large obstructions in the county's major streams.	FL	Low	NCEM/FEMA/Local Funds		Public Works	2019	In the past, major obstructions have been removed, but this will continue to be an issue and the county will implement this program going forward.
Natural Resource Protection								
NRP-1								
Emergency Services								
ES-1	Develop an inventory list of required equipment needed by Emergency Service agencies for hazardous material spills.	HM	Moderate	Local Funds		Polk County Chief's Assoc.	2017	The county posts its hazard mitigation plan up on the website, but a page dedicated to hazard mitigation plan will still need to be developed.
ES-2	Incorporate a Geographic Information System to maintain building/parcel data for purposes of conducting more detailed hazard risk assessments and for tracking permitting/land use patterns.	All	Moderate	NCEM/FEMA/Local Funds		Polk County MIS	2017	A GIS system has been built and includes building and parcel data. However, this data will need to be updated as it is out of date.
ES-3	Develop and implement a Community Emergency Response Team (CERT).	All	Moderate	NCDEM/FEMA/Local Funds		LEPC	Deleted	LEPC has decided not to pursue this due to lack of time/funding.

Town of Tryon Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
ES-4	Develop and implement hazard mitigation planning web page on Polk County Emergency Services web site.	All	Moderate	Local		County ES	2017	The county posts its hazard mitigation plan up on the website, but a page dedicated to hazard mitigation plan will still need to be developed.
ES-5	Install county-wide warning system for all hazards.	All	Moderate	NCEM/FEMA/Local Funds		Polk County Communications	Completed	This system was installed.
Structural Projects								
SP-1	Complete an emergency waterline from Henderson County.	DR	High	Local Funds		Town Managers		Ongoing
Public Education and Awareness Activities								
PEA-1	Provide brochures, flyers (e.g NFIP), and pamphlets on all hazards that affect Polk County. Information will be placed in departments/agencies that are considered high traffic areas.	All	Low	Local Funds		County ES	2019	Information has been placed in high traffic areas, but the county will continue to look at ways to improve outreach including through online surveys (carried out in this plan) and other means.
PEA-2	Develop and Implement a reverse calling system.	All	Low	NCEM/FEMA/Local Funds		Polk County Communications	Completed	A reverse calling system has been installed and is ready for use.
PEA-3	Provide a booth with hazard mitigation information at all community.	All	Low	Local Funds		County ES	2018	The county has provided informational booths at many events including fairs and community gatherings. Information displayed will need to be updated periodically.

Town of Tryon Existing Mitigation Actions								
Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status

FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake
LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees County ES = Polk County Emergency Services Town = Town of Tryon

Rutherford County Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
Rutherford County Existing Mitigation Actions								
Prevention								
P-1	Encourage power companies or public utilities to continue to be aggressive in the general maintenance and clearing of utility rights-of-way and easements.	All	Moderate	N/A	N/A	EMD	Completed	Completed 2012 spraying continues annually
P-2	Document the location and prioritization of critical facilities.	All	Moderate	N/A	N/A	EMD	Completed	Completed 2013 mapped by GIS
P-3	Document the location and preparedness of the emergency shelters.	All	High	N/A	N/A	EMD	Completed	Completed 2013 and identified in EOP
P-4	Use future growth projections to present alternative utility layout.	All	Low	N/A	N/A	EMD	Deleted	Deleted, this action was deemed to be not technically feasible
P-5	Plan for debris collection and disposal.	All	Moderate			EMD	Completed	Completed 2013
P-6	Review all aspects of emergency response to ensure that emergency services are more than adequate to protect public health and safety.	All	Moderate	N/A	N/A	EMD	Completed	Completed 2012

Rutherford County Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
P-7	Encourage small communities, towns, fire departments, or neighborhoods to participate in the Fire Wise Program and become certified Fire Wise Communities.	WF	Moderate	Grant Funds		Fire Marshall	2016	Deferred due to funding and a lack of community interest
P-8	Update and enforce subdivision regulations, particularly regarding subjects such as accessibility, density and streets and roads.	All	Moderate			Planning Department	Completed	Completed at this time
P-9	Develop parcel specific land use maps.	All	Moderate			GIS Department	2019	Deferred, the county has not been able to develop parcel specific land use maps due to lack of staff time. It will work to complete this action going forward.
P-10	Utilize drought tolerant farming practices.	DR	Moderate			County Extension Service	Deleted	Deleted, this action was deemed to be outside the scope of the CES.
Property Protection								
PP-1	Encourage power companies or public utilities to continue to place utilities underground in new developments, and to relocate existing overhead utilities underground where feasible.	All	Moderate			EMD	Completed	Completed 2012

Rutherford County Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Natural Resource Protection								
NRP-1	Research and evaluate the possibility of stream buffers along the floodplains.	FL	Moderate			Planning Department	2018	Deferred, the county has not had sufficient staff time and funding to research/evaluate stream buffers, so it will work to complete this action in the next cycle.
NRP-2	Identify open space, greenways, and conservation areas along the floodplains and as soon as feasible should plan for acquisition or easements.	FL	Moderate	Grant Funds		Planning Department	2017	Deferred due to funding constraints. The county will work to complete this action in the next cycle.
NRP-3	Develop buffers along streams and rivers prone to repetitive flooding.	FL	Moderate			Planning Department	2018	Deferred due to funding constraints. The county will work to complete this action in the next cycle.
Emergency Services								
ES-1	Seek training in order to provide capable and quick damage assessment and identify mitigation opportunities presented by disaster events.	All	High	Local Funds		EMD	Completed	Completed 2012

Rutherford County Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
ES-2	All critical facilities that do not have backup power generation capabilities should seek funding in order to obtain these capabilities.	All	Moderate	FEMA/Local Funds/NCEM		EMD	2019	Deferred due to funding constraints. The county would like to equip all critical facilities with backup power generation capabilities in the future, so it will seek funding to do so.
Structural Projects								
SP-1	Encourage the Broad River Water Authority, the Town of Forest City, and the Cleveland County Water District to continue to expand into the rural areas of the county.	DR/WF	Moderate	Local Funds		County Fire Marshall	2018	Completed, but additional extensions are planned for other areas, so this action will be carried over to the next cycle.
SP-2	Build interconnects between the various water systems.	DR	Low			Water System Managers	Completed	Completed
SP-3	Public water suppliers should study the feasibility of water storage, either in the form of extra basins at the intake or treatment facility, or in the form of larger reservoirs.	DR	Low			Water System Managers	2019	Deferred due to lack of funding. The county will work to improve water storage capacity in the future.
Public Education and Awareness								
PEA-1	Create a brochure to be made available to the public, documenting what to do when extended power outages occur.	All	Moderate	Local Funds	$2,500 annually	County EM Staff	2017	Deferred, Not adequate personnel or staff time to create outreach materials. The county will work to complete this in the next several years.

Rutherford County Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
PEA-2	Create brochures or handouts that would be available to the public regarding a host of issues related to fire and burning.	WF	Moderate	Local Funds	$2,500 annually	County Fire Marshall	2017	Deferred, Not adequate on personnel or staff time to create outreach materials. The county will work to complete this in the next several years.
PEA-3	Provide information to citizens regarding drought, heat, and shortage of water. Information could be available as brochures, notification on water bills, public service announcements, newspaper articles, etc.	WF/DR	High			Water System Managers	2017	Deferred although some information has been provided to customers, additional information should be developed and sent out to the public.
FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees EMD = Rutherford County Emergency Management Department								

Town of Bostic Mitigation Action Plan

Town of Bostic Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Participate in and enforce the National Flood Insurance Program.	FL	Moderate			Floodplain Administrator	Completed	The town currently participates in the NFIP.
P-2	Encourage small communities, towns, fire departments, or neighborhoods to participate in the Fire Wise Program and become certified Fire Wise Communities.	WF	Moderate	Grant Funds		Fire Chief	2016	Deferred due to lack of community interest. The town will work to become more involved in the Firewise program going forward.
Property Protection								
PP-1								
Natural Resource Protection								
NRP-1								
Emergency Services								
ES-1	Provide additional capacity to the current communications system during emergency situations to improve response capability. Built a new communications center to provide the necessary operational capacity required by the City.	All	High	General Revenue and Grants		Police Department	2017	Although improvements have been made to the communication center's capacity, there are still further improvements that should be made in the future. This action will be worked on going forward.

Town of Bostic Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
ES-2	Provide a two – way communication system for emergency services. Continue to provide two-way communications for emergency services.	All	High	Grants		Police and Fire Departments	Completed	Two-way communication systems have been implemented and are in place.
ES-3	Purchase generators to use as an emergency power supply for water and sewer treatment plants if power is lost during a disaster.	All	High	General Revenue and Grants		Water and Sewer Department	Completed	Generators have been purchased for water and sewer treatment plants
ES-4	Purchase generators to use at the operations center that controls information technology, communications and protection for fiber optic cable.	All	High	General Revenue and Grants		Information Technology	Completed	Completed
ES-5	Develop an action plan to reroute and control traffic during emergency situations.	All	High	General Revenue and Grants		Police Department	Completed	Remote control capability has been implemented throughout the City.
ES-6	Seek training in order to provide capable and quick damage assessment and identify mitigation opportunities presented by disaster events.	All	High	Local Funds		EM Staff	2018	Some training on damage assessments have been completed, but more are necessary to improve the overall process and efficiency.
Structural Projects								
SP-1								
Public Education and Awareness Activities								
PEA-1								

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LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees EMD = Rutherford County Emergency Management Department Town = Town of Bostic

Chimney Rock Village Mitigation Action Plan

Chimney Rock Village Existing Mitigation Actions								
Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
Prevention								
P-1	Develop a Floodplain Management Plan.	FL	High	General Revenue and Grants		Town Council	Completed	The Floodplain Management Plan is included in Land Development Code adopted March 2006.
P-2	Develop a Stormwater Management Ordinance. Encourage Town participation in the Community Rating System.	FL	High	General Revenue and Grants		Town Council	2018	The Storm water Management plan is included in Land Development Code adopted March 2006. Completed Plan but no funding to implement. The village will need to work on developing an implementation plan.
P-3	Develop a stand-by acquisition grant application that lists properties located in the floodplain.	FL	Moderate	Grants		Town Council	2019	Deferred due to lack of funding and staff time to create the application and develop a list of eligible properties
P-4	Identify properties adjacent to the railroad tracks and post in a GIS system for potential buyout of highly vulnerable structures.	HM	Moderate	General Revenue and Grants		Town Council	Deleted	This action was determined to not be applicable so it has been deleted.

Chimney Rock Village Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
P-5	Initiate a storm water study to determine if storm water is exacerbating flooding along waterways, and provide solutions or alternatives to manage this problem.	FL	Moderate	General Revenue		Public Works	2018	Deferred due to lack of funding to complete stormwater study. A comprehensive stormwater study should be completed in the future.
P-6	Encourage small communities, towns, fire departments, or neighborhoods to participate in the Fire Wise Program and become certified Fire Wise Communities.	WF	Moderate	Grant Funds		Fire Chief	2016	Deferred due to lack of funding. The town will work to become more involved in the Firewise program going forward.
Property Protection								
PP-1								
Natural Resource Protection								
NRP-1								
Emergency Services								
ES-1	Seek training in order to provide capable and quick damage assessment and identify mitigation opportunities presented by disaster events.	All	High	Local Funds		EM Staff	Completed	Completed 2012
ES-2	All critical facilities that do not have backup power generation capabilities should seek funding in order to obtain these capabilities.	All	Moderate	FEMA/Local Funds/NCEM		EMD	2019	Deferred due to funding constraints. The county would like to equip all critical facilities with backup power generation capabilities in the future, so it will seek funding to do so.

Chimney Rock Village Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
Structural Projects								
SP-1								
Public Education and Awareness Activities								
PEA-1	Create a brochure to be made available to the public, documenting what to do when extended power outages occur.	All	Moderate	Local Funds	$2,500 annually	County EM Staff	2017	Deferred, Not adequate personnel or staff time to create outreach materials. The county will work to complete this in the next several years.

FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake
LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees EMD = Rutherford County Emergency Management Department Village = Chimney Rock Village

Town of Ellenboro Mitigation Action Plan

Town of Ellenboro Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Participate in and enforce the National Flood Insurance Program.	FL	Moderate			Floodplain Administrator	Deleted	No Floodplain in jurisdiction
P-2	Encourage small communities, towns, fire departments, or neighborhoods to participate in the Fire Wise Program and become certified Fire Wise Communities.	WF	Moderate	Grant Funds		Fire Chief	2016	Deferred due to lack of community interest. The town will work to become more involved in the Firewise program going forward.
Property Protection								
PP-1								
Natural Resource Protection								
NRP-1								
Emergency Services								
ES-1	Seek training in order to provide capable and quick damage assessment and identify mitigation opportunities presented by disaster events.	All	High	Local Funds		EM Staff	Completed	Completed 2012

Town of Ellenboro Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
ES-2	All critical facilities that do not have backup power generation capabilities should seek funding in order to obtain these capabilities.	All	Moderate	FEMA/Local Funds/NC EM		EMD	2019	Deferred due to funding constraints. The county would like to equip all critical facilities with backup power generation capabilities in the future, so it will seek funding to do so.
Structural Projects								
SP-1								
Public Education and Awareness Activities								
PEA-1	Create a brochure to be made available to the public, documenting what to do when extended power outages occur.	All	Moderate	Local Funds	$2,500 annually	County EM Staff	2017	Deferred, Not adequate personnel or staff time to create outreach materials. The county will work to complete this in the next several years.

FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake
LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees EMD = Rutherford County Emergency Management Department Town = Town of Ellenboro

Town of Forest City Mitigation Action Plan

Town of Forest City Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Enforce general and nuisance Ordinances to clear brush and debris.	WF	Moderate			Code Enforcement	Completed	Completed. These ordinances have been put in place and are being enforced.
P-2	Initiate a storm water study to determine if storm water is exacerbating flooding along waterways, and provide solutions or alternatives to manage this problem.	FL	Moderate	General Revenue		Public Works	2018	Deferred due to lack of funding to complete stormwater study. A comprehensive stormwater study should be completed in the future.
P-3	Encourage small communities, towns, fire departments, or neighborhoods to participate in the Fire Wise Program and become certified Fire Wise Communities.	WF	Moderate	Grant Funds		Fire Chief	2016	New Action
Property Protection								
PP-1								
Natural Resource Protection								
NRP-1								

Town of Forest City Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Emergency Services								
ES-1	Seek training in order to provide capable and quick damage assessment and identify mitigation opportunities presented by disaster events.	All	High	Local Funds		EM Staff	Completed	Completed 2012
ES-2	All critical facilities that do not have backup power generation capabilities should seek funding in order to obtain these capabilities.	All	Moderate	FEMA/Local Funds/NCEM		EMD	2019	Deferred due to funding constraints. The county would like to equip all critical facilities with backup power generation capabilities in the future, so it will seek funding to do so.
Structural Projects								
SP-1								
Public Education and Awareness Activities								
PEA-1	Create a brochure to be made available to the public, documenting what to do when extended power outages occur.	All	Moderate	Local Funds	$2,500 annually	County EM Staff	2017	Deferred, Not adequate personnel or staff time to create outreach materials. The county will work to complete this in the next several years.

FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees EMD = Rutherford County Emergency Management Department Town = Town of Forest City

Town of Lake Lure Mitigation Action Plan

Town of Lake Lure Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Enforce general and nuisance Ordinances to clear brush and debris.	WF	Moderate			Code Enforcement	Completed	Completed. These ordinances have been put in place and are being enforced.
P-2	Initiate a storm water study to determine if storm water is exacerbating flooding along waterways, and provide solutions or alternatives to manage this problem.	FL	Moderate	General Revenue		Public Works	2018	Deferred due to lack of funding to complete stormwater study. A comprehensive stormwater study should be completed in the future.
P-3	Encourage small communities, towns, fire departments, or neighborhoods to participate in the Fire Wise Program and become certified Fire Wise Communities.	WF	Moderate	Grant Funds		Fire Chief	2016	New Action
Property Protection								
PP-1								
Natural Resource Protection								
NRP-1								

Town of Lake Lure Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
Emergency Services								
ES-1	Seek training in order to provide capable and quick damage assessment and identify mitigation opportunities presented by disaster events.	All	High	Local Funds		EM Staff	Completed	Completed 2012
ES-2	All critical facilities that do not have backup power generation capabilities should seek funding in order to obtain these capabilities.	All	Moderate	FEMA/Local Funds/NCEM		EMD	2019	Deferred due to funding constraints. The county would like to equip all critical facilities with backup power generation capabilities in the future, so it will seek funding to do so.
Structural Projects								
SP-1								
Public Education and Awareness Activities								
PEA-1	Create a brochure to be made available to the public, documenting what to do when extended power outages occur.	All	Moderate	Local Funds	$2,500 annually	County EM Staff	2017	Deferred, Not adequate personnel or staff time to create outreach materials. The county will work to complete this in the next several years.

FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake
LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees EMD = Rutherford County Emergency Management Department Town = Town of Lake Lure

Town of Ruth Mitigation Action Plan

Town of Ruth Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Encourage Town participation in the National Flood Insurance Program and subsequent participation in the Community Rating System Program.	FL	High			Town Council	2019	Town Council will consider participation
P-2	Encourage small communities, towns, fire departments, or neighborhoods to participate in the Fire Wise Program and become certified Fire Wise Communities.	WF	Moderate	Grant Funds		Fire Chief	2016	Deferred due to lack of community interest. The town will work to become more involved in the Firewise program going forward.
Property Protection								
PP-1								
Natural Resource Protection								
NRP-1								
Emergency Services								
ES-1	Seek training in order to provide capable and quick damage assessment and identify mitigation opportunities presented by disaster events.	All	High	Local Funds		EM Staff	Completed	Completed 2012

Town of Ruth Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
ES-2	All critical facilities that do not have backup power generation capabilities should seek funding in order to obtain these capabilities.	All	Moderate	FEMA/Local Funds/NCEM		EMD	2019	Deferred due to funding constraints. The county would like to equip all critical facilities with backup power generation capabilities in the future, so it will seek funding to do so.
Structural Projects								
SP-1	Encourage the Broad River Water Authority, the Town of Forest City, and the Cleveland County Water District to continue to expand into the rural areas of the county.	DR/WF	Moderate	Local Funds		County Fire Marshall	2018	Completed, but additional extensions are planned for other areas, so this action will be carried over to the next cycle.
Public Education and Awareness Activities								
PEA-1	Create a brochure to be made available to the public, documenting what to do when extended power outages occur.	All	Moderate	Local Funds	$2,500 annually	County EM Staff	2017	Deferred, Not adequate personnel or staff time to create outreach materials. The county will work to complete this in the next several years.
FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees EMD = Rutherford County Emergency Management Department Town = Town of Ruth								

Town of Rutherfordton Mitigation Action Plan

Town of Rutherfordton Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Enforce general and nuisance Ordinances to clear brush and debris.	WF	Moderate			Code Enforcement	Completed	Completed
P-2	Encourage small communities, towns, fire departments, or neighborhoods to participate in the Fire Wise Program and become certified Fire Wise Communities.	WF	Moderate	Grant Funds		Fire Chief	2016	Deferred due to funding and a lack of community interest
Property Protection								
PP-1								
Natural Resource Protection								
NRP-1								
Emergency Services								
ES-1	Seek training in order to provide capable and quick damage assessment and identify mitigation opportunities presented by disaster events.	All	High	Local Funds		EM Staff	Completed	Completed 2012

Town of Rutherfordton Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
ES-2	All critical facilities that do not have backup power generation capabilities should seek funding in order to obtain these capabilities.	All	Moderate	FEMA/Local Funds/NCEM		EMD	2019	Deferred due to funding constraints. The county would like to equip all critical facilities with backup power generation capabilities in the future, so it will seek funding to do so.
Structural Projects								
SP-1								
Public Education and Awareness Activities								
PEA-1	Create a brochure to be made available to the public, documenting what to do when extended power outages occur.	All	Moderate	Local Funds	$2,500 annually	County EM Staff	2017	Deferred, Not adequate personnel or staff time to create outreach materials. The county will work to complete this in the next several years.

FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees EMD = Rutherford County Emergency Management Department Town = Town of Rutherfordton

Town of Spindale Mitigation Action Plan

Town of Spindale Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Enforce general and nuisance Ordinances to clear brush and debris.	WF	Moderate			Code Enforcement	Completed	Completed. These ordinances have been put in place and are being enforced.
P-2	Initiate a storm water study to determine if storm water is exacerbating flooding along waterways, and provide solutions or alternatives to manage this problem.	FL	Moderate	General Revenue		Public Works	2018	Deferred due to lack of funding to complete stormwater study. A comprehensive stormwater study should be completed in the future.
P-3	Encourage small communities, towns, fire departments, or neighborhoods to participate in the Fire Wise Program and become certified Fire Wise Communities.	WF	Moderate	Grant Funds		Fire Chief	2016	Deferred due to lack of community interest. The town will work to become more involved in the Firewise program going forward.
Property Protection								
PP-1								
Natural Resource Protection								
NRP-1								

Town of Spindale Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Emergency Services								
ES-1	Seek training in order to provide capable and quick damage assessment and identify mitigation opportunities presented by disaster events.	All	High	Local Funds		EM Staff	Completed	Completed 2012
ES-2	All critical facilities that do not have backup power generation capabilities should seek funding in order to obtain these capabilities.	All	Moderate	FEMA/Local Funds/NCEM		EMD	2019	Deferred due to funding constraints. The county would like to equip all critical facilities with backup power generation capabilities in the future, so it will seek funding to do so.
Structural Projects								
SP-1								
Public Education and Awareness Activities								
PEA-1	Create a brochure to be made available to the public, documenting what to do when extended power outages occur.	All	Moderate	Local Funds	$2,500 annually	County EM Staff	2017	Deferred, Not adequate personnel or staff time to create outreach materials. The county will work to complete this in the next several years.

FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake
LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees EMD = Rutherford County Emergency Management Department Town = Town of Spindale

Transylvania County Mitigation Action Plan

Transylvania County Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Perform a County Building Inspection Residential Home Plan Review.	FL	Moderate	Local Funds		Building Inspections/ Board of Commissioners	Completed	This action is in place, each new building permit request is reviewed by the county building department to ensure current building codes are in place. The owner is given printed material in reference to exterior preparation concerning urban fire interface, water mitigation measures, etc.
Property Protection								
PP-1								
Natural Resource Protection								
NRP-1								

Transylvania County Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Emergency Services								
ES-1	Obtain inundation maps for high hazard dams that pose the greatest risk to life and property.	FL/D	Low			ES	2019	The emergency management office continues to work with local dam owners and engineers in the preparation of inundation maps and preplanning based on NC DENR recommendations and protocols. As plans are approved by DENR, copies are submitted to the local emergency management office and the inundation mapping is incorporated into the GIS system. The county will continue to work on this action going forward.
ES-2	Install a new reverse 911 system.	All	High	Local Funds	$30,000	County Communications Director	Completed	The county has updated the community notification system to incorporate the latest technology trends such as cell phone sms, email, calling, etc. The latest system was installed in 2012.

Transylvania County Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Structural Projects								
SP-1	Elevate Green Road Bridge.	FL/HU	High		$1,000,000	County Manager	Aim for 2019	No funding has been located for this project as yet. The project is on hold until funding can be located.
Public Education and Awareness								
PEA-1	Hold a hazard mitigation seminar, including information on preparedness for all hazards significant to Transylvania County, Brevard, and Rosman and promotion of participation in FireWise.	All	High	NCEM and Local Funds		County Manager	2016	The event was held on June 18, 2012. Several agencies participated in the event with educational material and speakers for the public to learn about things they could do around their own home to mitigate dangers to themselves and others. The county will look to hold additional seminars going forward.
PEA-2	Educate contractors about principles for quality redevelopment and safe housing development through written materials or a County sponsored workshop.	All	High	Local Funds		Building Inspections	2015, Annual review and update	Printed material was developed and is distributed through the county building department. This material is reviewed and updated annually.

Transylvania County Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
PEA-3	Provide new home and property buyers with information on quality redevelopment, safe housing development, and FireWise Communities. The information is probably most efficiently dispersed at the community administration buildings.	All	High	Local Funds		Building Inspector	2015, Annual review and update	The printed material was developed and is distributed through the county building department, county administrative offices, city of Brevard administrative offices, and the town of Rosman administrative offices. This material is reviewed and updated annually.
PEA-4	Manually disperse and have a website posting on the County and City websites, which provides information about the Multi-Jurisdictional Hazard Mitigation Plan for Transylvania County, and relevant mitigation measures the public can take. In addition, provide a response/reply section where residents can comment on the effectiveness of the current plan and where they can make suggestions for future revisions on the plan.	All	High	Local Funds		County Manager	2015, Annual review and update	The plan is linked on all the local government websites and a feedback channel through the website is monitored for comment and suggestion. The county evaluates and updates its outreach plan on an annual basis

FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake
LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees TH = Thunderstorms ES = Transylvania County Emergency Services

City of Brevard Mitigation Action Plan

City of Brevard Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Continue participation in the Community Rating System Program	FL/ER/HU/T	High	Local Funds		CRS Coordinator-Planning Dept.	Completed	Complete, the city participates in the CRS program and will continue to do so.
P-2	Update components of existing Storm water Management Plan.	FL	High	Local Funds		Floodplain Manager-Planning Department	2014	Although a Stormwater Management Plan is in place, a review and update of the plan is necessary.
P-3	Perform a County Building Inspection Residential Home Plan Review.	FL/HU	Moderate	Local Funds		Building Inspections	Completed	This action is in place, each new building permit request is reviewed by the county building department to ensure current building codes are in place. The owner is given printed material in reference to exterior preparation concerning urban fire interface, water mitigation measures, etc.
P-4	Increase the culvert at Cherry Street and Old Hendersonville Highway.	FL/HU	Moderate	State Funds	$70,000	NCDOT	2016	The culvert increase has not been completed, but is on schedule to be completed by 2016.

City of Brevard Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
Property Protection								
PP-1	Continue enforcement of "No Adverse Impact" requirements for all development in designated Special Flood Hazard Areas.	FL	High	Local Funds		Planning Department	Completed	This requirement is in place and is being enforced. It will continue to be enforced going forward.
Natural Resource Protection								
NRP-1	Continue Enforcement of "Steep Slope" development regulations	LS	High	Local Funds		Planning Department	Completed	This regulation is in place and is being enforced. It will continue to be enforced going forward.
NRP-2	Continue Enforcement of Sedimentation and Erosion Control regulations	ES/LS	High	Local Funds		Planning Department	Completed	This regulation is in place and is being enforced. It will continue to be enforced going forward.
NRP-3	Continue Enforcement of Surface Water Protection Areas	FL	High	Local Funds		Planning Department	Completed	This regulation is in place and is being enforced. It will continue to be enforced going forward.
NRP-1								

City of Brevard Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
ES-1	Obtain inundation maps for high hazard dams that pose the greatest risk to life and property.	FL/D	Low			ES	2019	The emergency management office continues to work with local dam owners and engineers in the preparation of inundation maps and preplanning based on NC DENR recommendations and protocols. As plans are approved by DENR, copies are submitted to the local emergency management office and the inundation mapping is incorporated into the GIS system. The county will continue to work on this action going forward.
ES-2	Install a new reverse 911 system.	All	High	Local Funds	$30,000	County Communications Director	Completed	The county has updated the community notification system to incorporate the latest technology trends such as cell phone sms, email, calling, etc. The latest system was installed in 2012.

City of Brevard Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Structural Projects								
SP-1	Elevate Old Hendersonville HWY between Osborne Road and Cherry Street and between Cherry Street and Dodson Flats.	FL/HU	Low		$1,500,000	NCDOT	2019	This action is the responsibility of NCDOT and is being evaluated/carried out through the NCSTIP. The project has not been completed, but will continue to be worked on through the NCSTIP.
SP-2	Elevate Island Ford Road between Walnut Hollow Road and S. County Club Road.	FL/HU	High		$1,000,000	City Manager	Deleted	This action is being deleted from the city's action plan as it is not a city responsibility.
Public Education and Awareness Activities								
PEA-1	Hold a hazard mitigation seminar, including information on preparedness for all hazards significant to Transylvania County, Brevard, and Rosman and promotion of participation in FireWise.	All	High	NCEM and Local Funds		City Manager	Completed	The event was held on June 18, 2012. Several agencies participated in the event with educational material and speakers for the public to learn about things they could do around their own home to mitigate dangers to themselves and others.
PEA-2	Educate contractors about principles for quality redevelopment and safe housing development through written materials or a County sponsored workshop.	All	High	Local Funds		Building Inspections	2015, Annual review and update	Printed material was developed and is distributed through the county building department. This material is reviewed and updated annually.

City of Brevard Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
PEA-3	Provide new home and property buyers with information on quality redevelopment, safe housing development, and FireWise Communities. The information is probably most efficiently dispersed at the community administration buildings.	All	High	Local Funds		Planning Department	2015, Annual review and update	The printed material was developed and is distributed through the county building department, county administrative offices, city of Brevard administrative offices, and the town of Rosman administrative offices. This material is reviewed and updated annually.
PEA-4	Manually disperse and have a website posting on the County and City websites, which provides information about the Multi-Jurisdictional Hazard Mitigation Plan for Transylvania County, and relevant mitigation measures the public can take. In addition, provide a response/reply section where residents can comment on the effectiveness of the current plan and where they can make suggestions for future revisions on the plan.	All	High	Local Funds		City Manager	2015, Annual review and update	The plan is linked on all the local government websites and a feedback channel through the website is monitored for comment and suggestion. The county evaluates and updates its outreach plan on an annual basis

FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake
LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees TH = Thunderstorms ES = Transylvania County Emergency Services City = City of Brevard

Town of Rosman Mitigation Action Plan

Town of Rosman Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Develop a Stormwater Management Plan.	FL	Low	Local Funds		Floodplain Manager	2018	Funding for the project has not been located yet, so this action will be deferred with more effort pending to complete the plan.
P-2	Perform a County Building Inspection Residential Home Plan Review.	FL	Moderate	Local Funds		Building Inspections	Completed	That action is in place, each new building permit request is reviewed by the county building department to ensure current building codes are in place. The owner is given printed material in reference to exterior preparation concerning urban fire interface, water mitigation measures, etc.
Property Protection								
PP-1								
Natural Resource Protection								
NRP-1								

Town of Rosman Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
Emergency Services								
ES-1	Obtain inundation maps for high hazard dams that pose the greatest risk to life and property.	FL/D	Low			ES	2019	The emergency management office continues to work with local dam owners and engineers in the preparation of inundation maps and preplanning based on NC DENR recommendations and protocols. As plans are approved by DENR, copies are submitted to the local emergency management office and the inundation mapping is incorporated into the GIS system.
ES-2	Install a new reverse 911 system.	All	High	Local Funds	$30,000	County Communications Director	Completed	The county has updated the community notification system to incorporate the latest technology trends such as cell phone sms, email, calling, etc. The latest system was installed in 2012.
ES-3	Purchase and install generators for the Town's four wells.	All	Moderate	NCEM and Local Funds	$60,000	Town Mayor	2018	The town is still attempting to locate grant funds for this project so that it can install the generators. It will work to complete this action in the future.

Town of Rosman Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
Structural Projects								
SP-1	Elevate Main Street between Depot Street and Old Rosman Highway.	FL	High		$300,000	Town Mayor	2019	The town is trying to locate funding sources for this project. It could be potential split between the state and the town since both maintain the roadway.
Public Education and Awareness Activities								
PEA-1	Hold a hazard mitigation seminar, including information on preparedness for all hazards significant to Transylvania County, Brevard, and Rosman and promotion of participation in FireWise.	All	High	NCEM and Local Funds		City Manager	Completed	The event was held on June 18, 2012. Several agencies participated in the event with educational material and speakers for the public to learn about things they could do around their own home to mitigate dangers to themselves and others
PEA-2	Educate contractors about principles for quality redevelopment and safe housing development through written materials or a County sponsored workshop.	All	High	Local Funds		Building Inspections	2015, Annual review and update	Printed material was developed and is distributed through the county building department. This material is reviewed and updated annually.

Town of Rosman Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
PEA-3	Provide new home and property buyers with information on quality redevelopment, safe housing development, and FireWise Communities. The information is probably most efficiently dispersed at the community administration buildings.	All	High	Local Funds		Building Inspector	2015, Annual review and update	The printed material was developed and is distributed through the county building department, county administrative offices, city of Brevard administrative offices, and the town of Rosman administrative offices. This material is reviewed and updated annually.
PEA-4	Manually disperse and have a website posting on the County and City websites, which provides information about the Multi-Jurisdictional Hazard Mitigation Plan for Transylvania County, and relevant mitigation measures the public can take. In addition, provide a response/reply section where residents can comment on the effectiveness of the current plan and where they can make suggestions for future revisions on the plan.	All	High	Local Funds		Town Mayor	2015, Annual review and update	The plan is linked on all the local government websites and a feedback channel through the website is monitored for comment and suggestion. The county evaluates and updates its outreach plan on an annual basis

FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake
LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees TH = Thunderstorms ES = Transylvania County Emergency Services Town = Town of Rosman

SECTION 10
PLAN MAINTENANCE

This section discusses how the South Mountains Region Mitigation Strategy and Mitigation Action Plan will be implemented and how the Regional Hazard Mitigation Plan will be evaluated and enhanced over time. This section also discusses how the public will continue to be involved in a sustained hazard mitigation planning process. It consists of the following four subsections:

- 10.1 Monitoring and Evaluating the Previous Plan
- 10.2 Implementation and Integration
- 10.3 Monitoring, Evaluation, and Enhancement
- 10.4 Continued Public Involvement

44 CFR Requirement
44 CFR Part201.6(c)(4)(i): The plan shall include a plan maintenance process that includes a section describing the method and schedule of monitoring, evaluating and updating the mitigation plan within a five-year cycle. ***44 CFR Part 201.6(c)(4)(ii):*** The plan maintenance process shall include a process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.

10.1 MONITORING AND EVALUATING THE PREVIOUS PLAN

Since the previous four plans were adopted (in 2011), each county has worked to ensure that mitigation was integrated into local activities and that the mitigation plan was appropriately implemented. Each of the counties outlined a process in their previous county-level mitigation plans for monitoring and evaluating the plan throughout the interim period between plan updates.

Each county was ultimately successful in implementing the monitoring and evaluation processes that were outlined in previous plans as all four counties held annual meetings to discuss the mitigation plan and the priorities that were outlined in it. Each county's specific process is outlined below with an explanation of how the monitoring and evaluating process was carried out as well as any changes that were identified by the county or its jurisdictions that would be useful to implement during the next update.

Henderson County

The Henderson County Hazard Mitigation Plan (2011) included an annual review process. This review process was carried out by the Henderson County Monitoring and Evaluation Committee, which consists of representatives from each department within in each governing jurisdiction participating in the plan, every year since the previous plan was approved.

Annual monitoring and evaluation involved the ongoing process of compiling information on the outcomes that result from implementing the hazard mitigation strategies contained in this plan or measuring of success the planning area has seen through the implementation of each strategy. It also provided the planning area with an opportunity to make necessary revisions as local conditions change. Changes in development, technology, or the capability of the planning area to implement the strategies adopted in the plan could necessitate the need for revisions in the plan itself.

Although there were some minor revisions made to the plan during interim update period, there were few major revisions identified during these annual reviews and the Monitoring and Evaluation Committee generally agreed that the plan was on course and that the monitoring and evaluating process itself was sufficient to ensure implementation of the plan.

Polk County

The Polk County Hazard Mitigation Plan (2011) included an annual review process. This process involved collecting annual reports from the agencies involved in implementing mitigation projects or activities identified in the plan or conducting phone calls and meetings with persons responsible for overseeing the mitigation projects in the first quarter of each year. The Hazard Mitigation Committee then discussed the updates at the annual meeting of the planning group and a report summarizing the previously mentioned activities was written and maintained by the Polk County Planning Department. The annual reports provide data for future plan updates. This annual evaluation process was carried out by the Hazard Mitigation Committee, which is led by the Polk County Planning Department and Polk County Emergency Services Department, every year since the previous plan was approved.

Although there were some minor revisions made to the plan during interim update period, there were few major revisions identified during these annual evaluations and the Hazard Mitigation Committee generally agreed that the plan was on course and that the monitoring and evaluating process itself was sufficient to ensure implementation of the plan.

Rutherford County

The Rutherford County Hazard Mitigation Plan (2011) included annual review regarding the implementation of mitigation strategies. A schedule of the implementation of the mitigation strategies was kept by the Rutherford County Emergency Management Director and a written report on the status of the implementation process was provided to the Rutherford County Manager every year since the plan was approved. Upon receiving the recommendation from the County Manager, the Board of Commissioners held a public hearing to review any recommendations from the Emergency Services Director, County Manager, or hazard mitigation review committee.

Although there were some minor revisions made to the plan during interim update period, there were few major revisions identified during these annual reviews and the hazard mitigation review committee generally agreed that the plan was on course and that the monitoring and evaluating process itself was sufficient to ensure implementation of the plan.

Transylvania County

The Transylvania County Hazard Mitigation Plan (2011) included a method to ensure that regular review and update of the plan occurs. The Mitigation Planning Committee was converted to sub-committee of the Transylvania County Local Emergency Planning Committee. The committee consisted of representatives from each department within each governing jurisdiction participating in the plan. The Transylvania County Emergency Management Department was responsible for contacting committee members, organizing, and publicizing the annual meetings.

The annual meetings were held each year following the plan's approval. During these meetings, committee members were responsible for monitoring and evaluating the process of mitigation strategies in the plan. This involved the ongoing process of compiling information on the outcomes that result from implementing the hazard mitigation strategies contained in the plan or measuring of success the planning area has seen through the implementation of each strategy. It also provided the planning area with an opportunity to make necessary revisions as local conditions change. Changes in development, technology, or the capability of the planning area to implement the strategies adopted in the plan could necessitate the need for revisions in the plan itself.

Although there were some minor revisions made to the plan during interim update period, there were few major revisions identified during these annual reviews and the hazard mitigation review committee generally agreed that the plan was on course and that the monitoring and evaluating process itself was sufficient to ensure implementation of the plan.

10.2 IMPLEMENTATION AND INTEGRATION

Each agency, department, or other partner participating under the South Mountains Regional Hazard Mitigation Plan is responsible for implementing specific mitigation actions as prescribed in the Mitigation Action Plan. Every proposed action listed in the Mitigation Action Plan is assigned to a specific "lead" agency or department in order to assign responsibility and accountability and increase the likelihood of subsequent implementation.

In addition to the assignment of a local lead department or agency, an implementation time period or a specific implementation date has been assigned in order to assess whether actions are being implemented in a timely fashion. The counties in the South Mountains Region will seek outside funding sources to implement mitigation projects in both the pre-disaster and post-disaster environments. When applicable, potential funding sources have been identified for proposed actions listed in the Mitigation Action Plan.

The participating jurisdictions will integrate this Hazard Mitigation Plan into relevant city and county government decision-making processes or mechanisms, where feasible. This includes integrating the requirements of the Hazard Mitigation Plan into other local planning documents, processes, or mechanisms, such as comprehensive or capital improvement plans, when appropriate. The members of the South Mountains Regional Hazard Mitigation Planning Team will remain charged with ensuring that the goals and mitigation actions of new and updated local planning documents for their agencies or departments are consistent, or do not conflict with, the goals and actions of the Hazard Mitigation Plan, and will not contribute to increased hazard vulnerability in the South Mountains Region.

Since the previous four plans were adopted, each county and participating jurisdiction have worked to integrate the hazard mitigation plan into other planning mechanisms where applicable/feasible. Examples of how this integration has occurred have been documented in the Implementation Status discussion provided for each of the mitigation actions found in Section 9. Specific examples of how integration has occurred include:

- Integrating the mitigation plan into reviews and updates of floodplain management ordinances;

- Integrating the mitigation plan into reviews and updates of County/local emergency operations plans;
- Integrating the mitigation plan into review and updates of building codes; and
- Integrating the mitigation plan into the capital improvements plan through identification of mitigation actions that require local funding

Opportunities to further integrate the requirements of this Plan into other local planning mechanisms shall continue to be identified through future meetings of the Regional Hazard Mitigation Planning Team, individual county meetings, local staff meetings and the annual review process described herein. Although it is recognized that there are many possible benefits to integrating components of this Plan into other local planning mechanisms, the development and maintenance of this stand-alone Regional Hazard Mitigation Plan is deemed by the South Mountains Regional Hazard Mitigation Planning Team to be the most effective and appropriate method to implement local hazard mitigation actions at this time.

10.3 MONITORING, EVALUATION, AND ENHANCEMENT

Periodic revisions and updates of the Regional Hazard Mitigation Plan are required to ensure that the goals of the Plan are kept current, taking into account potential changes in hazard vulnerability and mitigation priorities. In addition, revisions may be necessary to ensure that the Plan is in full compliance with applicable federal and state regulations. Periodic evaluation of the Plan will also ensure that specific mitigation actions are being reviewed and carried out according to the Mitigation Action Plan.

When determined necessary, the South Mountains Regional Hazard Mitigation Planning Team shall meet in March of every year to evaluate the progress attained and to revise, where needed, the activities set forth in the Plan. The findings and recommendations of the Regional Hazard Mitigation Planning Team shall be documented in the form of a report that can be shared with interested City, and County Council members. The Regional Hazard Mitigation Planning Team will also meet following any disaster events warranting a reexamination of the mitigation actions being implemented or proposed for future implementation. This will ensure that the Plan is continuously updated to reflect changing conditions and needs within the South Mountains Region. The Henderson County Emergency Management Coordinator will be responsible for reconvening the Regional Hazard Mitigation Planning Team for these reviews.

Five Year Plan Review

The Plan will be thoroughly reviewed by the Regional Hazard Mitigation Planning Team every five years to determine whether there have been any significant changes in the South Mountains Region that may, in turn, necessitate changes in the types of mitigation actions proposed. New development in identified hazard areas, an increased exposure to hazards, an increase or decrease in capability to address hazards, and changes to federal or state legislation are examples of factors that may affect the necessary content of the Plan.

The plan review provides participating county/local officials with an opportunity to evaluate those actions that have been successful and to explore the possibility of documenting potential losses avoided due to the implementation of specific mitigation measures. The plan review also provides the opportunity to address mitigation actions that may not have been successfully implemented as assigned. The Henderson County Emergency Management Coordinator will be responsible for reconvening the Regional Hazard Mitigation Planning Team and conducting the five-year review.

During the five-year plan review process, the following questions will be considered as criteria for assessing the effectiveness and appropriateness of the Plan:

- Do the goals address current and expected conditions?
- Has the nature or magnitude of risks changed?
- Are the current resources appropriate for implementing the Plan?
- Are there implementation problems, such as technical, political, legal or coordination issues with other agencies?
- Have the outcomes occurred as expected?
- Did County departments participate in the plan implementation process as assigned?

Following the five-year review, any revisions deemed necessary will be summarized and implemented according to the reporting procedures and plan amendment process outlined herein. Upon completion of the review and update/amendment process, the South Mountains Region Hazard Mitigation Plan will be submitted to the State Hazard Mitigation Officer at the North Carolina Division of Emergency Management (NCDEM) for final review and approval in coordination with the Federal Emergency Management Agency (FEMA).

Because the plan update process can take several months to complete, and because Federal funding may be needed to update the plan, it is recommended that the five-year review process begin at the beginning of the third year after the plan was last approved. This will allow the participants in the South Mountains Regional Hazard Mitigation Plan to organize in order to seek Federal funding if necessary and complete required plan update documentation before the plan expires at the end of the fifth year.

Disaster Declaration
Following a disaster declaration, the South Mountains Regional Hazard Mitigation Plan will be revised as necessary to reflect lessons learned, or to address specific issues and circumstances arising from the event. It will be the responsibility of the Henderson County Emergency Management Coordinator to reconvene the Regional Hazard Mitigation Planning Team and ensure the appropriate stakeholders are invited to participate in the plan revision and update process following declared disaster events.

Reporting Procedures
The results of the five-year review will be summarized by the Regional Hazard Mitigation Planning Team in a report that will include an evaluation of the effectiveness of the Plan and any required or recommended changes or amendments. The report will also include an evaluation of implementation progress for each of the proposed mitigation actions, identifying reasons for delays or obstacles to their completion along with recommended strategies to overcome them.

Plan Amendment Process
Upon the initiation of the amendment process, representatives from the South Mountains counties will forward information on the proposed change(s) to all interested parties including, but not limited to, all directly affected County/local departments, residents, and businesses. Information will also be forwarded to the North Carolina Division of Emergency Management. This information will be disseminated in order to seek input on the proposed amendment(s) for no less than a 45-day review and comment period.

At the end of the 45-day review and comment period, the proposed amendment(s) and all comments will be forwarded to the Regional Hazard Mitigation Planning Team for final consideration. The Planning Team will review the proposed amendment along with the comments received from other parties, and if acceptable, the committee will submit a recommendation for the approval and adoption of changes to the Plan.

In determining whether to recommend approval or denial of a Plan amendment request, the following factors will be considered by the Regional Hazard Mitigation Planning Team:

- There are errors, inaccuracies, or omissions made in the identification of issues or needs in the Plan.
- New issues or needs have been identified which are not adequately addressed in the Plan.
- There has been a change in information, data, or assumptions from those on which the Plan is based.

Upon receiving the recommendation from the Regional Hazard Mitigation Planning Team, and prior to adoption of the Plan, the participating jurisdictions will hold a public hearing, if deemed necessary. The governing bodies of each participating jurisdiction will review the recommendation from the Regional Hazard Mitigation Planning Team (including the factors listed above) and any oral or written comments received at the public hearing. Following that review, the governing bodies will take one of the following actions:

- Adopt the proposed amendments as presented;
- Adopt the proposed amendments with modifications;
- Refer the amendments request back to the Regional Hazard Mitigation Planning Team for further revision; or
- Defer the amendment request back to the Regional Hazard Mitigation Planning Team for further consideration and/or additional hearings.

10.4 CONTINUED PUBLIC INVOLVEMENT

44 CFR Requirement
44 CFR Part 201.6(c)(4)(iii): The plan maintenance process shall include a discussion on how the community will continue public participation in the plan maintenance process.

Public participation is an integral component to the mitigation planning process and will continue to be essential as this Plan evolves over time. As described above, significant changes or amendments to the Plan shall require a public hearing prior to any adoption procedures.

Other efforts to involve the public in the maintenance, evaluation, and revision process will be made as necessary. These efforts may include:

- Advertising meetings of the Regional Hazard Mitigation Planning Team in local newspapers, public bulletin boards and/or County and municipal office buildings;

- Designating willing and voluntary citizens and private sector representatives as official members of the Regional Hazard Mitigation Planning Team;
- Utilizing local media to update the public on any maintenance and/or periodic review activities taking place;
- Utilizing the websites of participating jurisdictions to advertise any maintenance and/or periodic review activities taking place; and
- Keeping copies of the Plan in public libraries.

Annex A
Henderson County

This annex includes jurisdiction-specific information for Henderson County and its participating municipalities. It consists of the following five subsections:

- A.1 Henderson County Community Profile
- A.2 Henderson County Risk Assessment
- A.3 Henderson County Vulnerability Assessment
- A.4 Henderson County Capability Assessment
- A.5 Henderson County Mitigation Strategy

A.1 HENDERSON COUNTY COMMUNITY PROFILE

A.1.1 Geography and the Environment

Henderson County is situated along the North Carolina and South Carolina state border. The county is located in the Blue Ridge Mountain Range. It comprises three towns, the Town of Fletcher, the Town of Laurel Park, and the Town of Mills River; one city, the City of Hendersonville; and one village, the Village of Flat Rock.

The county is a typical mountain county consisting of mountain ranges, isolated peaks, rolling plateaus, and valleys. The county's highest elevation reaches 5,200 feet and its lowest elevation is 1,400 feet. The total area of the county is 375 square miles, 1 square mile of which is water area.

Summer temperatures in the valley portion of the county range from highs of about 84˚F to lows in the mid 50s. Winter temperatures in the valley range from highs of 50˚F to lows around 25˚F. Year round, average temperatures in the mountainous areas of the county are typically 10˚F lower than the valley. The county averages five inches of rainfall each month.

A.1.2 Population and Demographics

According to the 2010 Census, Henderson County has a population of 106,740 people. The county has seen nearly 20% growth between 2000 and 2010, and the population density is 286 people per square mile. Population counts from the US Census Bureau for 1990, 2000, and 2010 for the county and participating municipalities (where available) are presented in **Table A.1**.

TABLE A.1: POPULATION COUNTS FOR HENDERSON COUNTY

Jurisdiction	1990 Census Population	2000 Census Population	2010 Census Population	% Change 2000-2010
Henderson County	**69,285**	**89,173**	**106,740**	**19.7%**
Village of Flat Rock	--	2,565	3,114	21.4%
Town of Fletcher	2,787	4,185	7,187	71.7%

Jurisdiction	1990 Census Population	2000 Census Population	2010 Census Population	% Change 2000-2010
City of Hendersonville	7,284	10,420	13,137	26.1%
Town of Laurel Park	1,322	1,835	2,180	18.8%
Town of Mills River	--	--	6,802	--

Source: US Census Bureau

Based on the 2010 Census, the median age of residents of Henderson County is 45.4 years. The racial characteristics of the county are presented in **Table A.2**. Whites make up the majority of the population in the county, accounting for nearly 89 percent of the population.

TABLE A.2: DEMOGRAPHICS OF HENDERSON COUNTY

Jurisdiction	White, Percent (2010)	Black or African American, Percent (2010)	American Indian or Alaska Native, Percent (2010)	Asian, Percent (2010)	Native Hawaiian or Other Pacific Islander, Percent (2010)	Other Race, Percent (2010)	Two or More Races, percent (2010)	Persons of Hispanic Origin, Percent (2010)*
Henderson County	**88.9%**	**3.0%**	**0.4%**	**1.0%**	**0.2%**	**4.6%**	**1.9%**	**9.8%**
Village of Flat Rock	98.2%	0.4%	0.2%	0.4%	0.0%	0.1%	0.8%	1.2%
Town of Fletcher	88.3%	4.1%	0.5%	3.1%	0.1%	2.0%	2.0%	4.8%
City of Hendersonville	79.7%	9.2%	0.4%	1.2%	0.3%	6.9%	2.2%	13.5%
Town of Laurel Park	96.2%	1.6%	0.1%	0.3%	0.1%	0.8%	0.9%	2.6%
Town of Mills River	94.7%	1.7%	0.3%	0.7%	0.0%	1.1%	1.4%	3.9%

*Hispanics may be of any race, so also are included in applicable race categories
Source: US Census Bureau

A.1.3 Housing

According to the 2010 US Census, there are 54,710 housing units in Henderson County, the majority of which are single family homes or mobile homes. Housing information for the county and municipalities is presented in **Table A.3**. As shown in the table, the Village of Flat Rock and the Town of Laurel Park both have a significantly higher percentage of seasonal housing units compared to the unincorporated county.

TABLE A.3: HOUSING CHARACTERISTICS OF HENDERSON COUNTY

Jurisdiction	Housing Units (2000)	Housing Units (2010)	Seasonal Units, Percent (2010)	Median Home Value (2007-2011)
Henderson County	**42,996**	**54,710**	**7.4%**	**$190,700**
Village of Flat Rock	1,459	2,150	19.9%	$416,200
Town of Fletcher	1,816	3,208	0.9%	$180,700
City of Hendersonville	5,181	7,744	3.7%	$161,600
Town of Laurel Park	1,115	1,438	15.0%	$285,400
Town of Mills River	--	3,108	2.6%	$217,500

Source: US Census Bureau

A.1.4 Infrastructure

Transportation

There are several US and state highways that serve Henderson County and link it with other regions of North Carolina as well as the neighboring states of Georgia, South Carolina, and Tennessee. Interstate 26 is a major east-west route connecting South Carolina to Tennessee. I-26 intersects with US Route 74 throughout Henderson County. US Route 74 is a major four-lane highway that travels northwest to southeast through Henderson County and connects Chattanooga, Tennessee; Asheville, North Carolina; Charlotte, North Carolina; and Wilmington North Carolina. This route has alternating names, but it is considered the commercial backbone and main truck route of Western North Carolina. US 64 is a cross-country highway that passes through the county from east to west. The Blue Ridge Parkway also crosses the county and is a National Parkway distinguished for its scenic views. US 25, US 176, NC 280, and NC 191 are additional major arterials within the county.

Henderson County is served by one airport. Asheville Regional/Hendersonville Airport is the largest airport in the mountains area serving the South Mountains Region and all of Western North Carolina. The airport currently offers non-stop commercial flights on four airlines to six major cities.

Within Henderson County, the Apple County Public Transit system provides bus service though the City of Hendersonville, Town of Fletcher and Laurel Park. The transit follows three bus routes operating Monday through Friday throughout the day. Henderson County is served by the Southern Railway Company which provides freight service to North Carolina and surrounding states.

Utilities

Electrical power in Henderson County is provided by one public company, Duke Energy Progress. In addition to the public utility provider, Halifax Electric Membership Corporation is an electricity cooperative that provides service to the county.

Water and sewer service is provided to residents by the county through the Cane Creek Water and Sewer Districts. Private or shared wells and septic systems are also utilized within the county.

Community Facilities

There are a number of buildings and community facilities located throughout Henderson County. According to the data collected for the vulnerability assessment (Section 6.4.1), there are 35 fire/EMS stations, 4 police stations, and 28 public schools located within the county.

There are two hospitals located in Henderson County. The largest is Margaret J. Pardee Memorial Hospital, a 201-bed community hospital center located in the City of Hendersonville. Another hospital in the City of Hendersonville is Park Ridge Health with 62 beds

There are a total of six recreation parks in Henderson County. The largest, Jackson Park, offers multiple fields, picnic facilities, playgrounds, trails, and natural wildlife observation areas. Dana Park contains a community building and picnic shelter that is available for rental. In addition to the six parks, there are three available activity centers for Henderson County residents. The county contains sections of the Blue Ridge Parkway, Carl Sandburg Home National Historic Site, and Pisgah National Forest.

A.1.5 Land Use

The population centers in Henderson County are concentrated along transportation routes and in urban areas where public water and sewer is available. The county will continue to see increased development of more attached homes such as condos and townhouses while single-family home development is projected to decrease. Second home and vacation home development will continue in higher elevation areas throughout the county.

Henderson County has an effective Land Use Regulation Guide that addresses resource protection, economic and community development, public participation, and county/municipal growth areas. The county also maintains a Land Development Code and Official Zoning Map to assist in the guidance of land development for the benefit of county residents. Zoning ordinances are maintained by the local jurisdictions.

A.1.6 Employment and Industry

According to the North Carolina Employment Security Commission, in 2011, Henderson County had an average annual employment of 45,686 workers and an average unemployment rate of 4.4 percent (compared to 9.7 percent for the state). In 2011, the Education and Health Services industry employed 24.7 percent of the county's workforce followed by Manufacturing (9.4%); Retail Trade (12.0%); and Professional, Scientific, and Management, and Administrative and Waste Management Services (9.6%). From 2007 to 2011, the average annual median household income in Henderson County was $47,371 compared to $46,291 for the state of North Carolina.

A.2 HENDERSON COUNTY RISK ASSESSMENT

This subsection includes hazard profiles for each of the significant hazards identified in Section 4: *Hazard Identification* as they pertain to Henderson County. Each hazard profile includes a description of the hazard's location and extent, notable historical occurrences, and the probability of future occurrences. Additional information can be found in Section 5: *Hazard Profiles*.

A.2.1 Drought

Location and Spatial Extent

Drought typically covers a large area and cannot be confined to any geographic or political boundaries. Local areas may experience much more severe and/or frequent drought events than what is represented on the Palmer Drought Severity Index map. Furthermore, it is assumed that the county would be uniformly exposed to drought, making the spatial extent potentially widespread. It is also notable that drought conditions typically do not cause significant damage to the built environment.

Historical Occurrences

According to the North Carolina Drought Monitor, Henderson County has had drought occurrences (including abnormally dry) in 13 of the last 14 years (2000-2013). **Table A.4** shows the most severe drought classification for each year, according to North Carolina Drought Monitor classifications. It should be noted that the North Carolina Drought Monitor also estimates what percentage of the county is in each classification of drought severity. For example, the most severe classification reported may be exceptional but a majority of the county may actually be in a less severe condition.

Table A. 4: Historical Drought Occurrences in Henderson County

Abnormally Dry | Moderate Drought | Severe Drought | Extreme Drought | Exceptional Drought

	Henderson County
2000	EXTREME
2001	EXTREME
2002	EXCEPTIONAL
2003	NORMAL
2004	MODERATE
2005	ABNORMAL
2006	SEVERE
2007	EXCEPTIONAL
2008	EXCEPTIONAL
2009	EXTREME
2010	MODERATE
2011	SEVERE
2012	MODERATE
2013	ABNORMAL

Source: North Carolina Drought Monitor (through Sept. 2013)

Probability of Future Occurrences

Based on historical occurrence information, it is assumed that Henderson County has a probability level of likely (10 to 100 percent annual probability) for future drought events. This hazard may vary slightly by location but each area has an equal probability of experiencing a drought. However, historical information also indicates that there is a much lower probability for extreme, long-lasting drought conditions.

A.2.2 Extreme Heat

Location and Spatial Extent

Excessive heat typically impacts a large area and cannot be confined to any geographic or political boundaries. All of Henderson County is susceptible to extreme heat conditions.

Historical Occurrences

Data from the National Climatic Data Center was used to determine historical extreme heat and heat wave events in Henderson County. There were no events reported.

In addition, information from the State Climate Office of North Carolina was reviewed to obtain historical temperature records in the county. Temperature information has been reported since 1893. The recorded maximum for Henderson County can be found below in **Table A.5**.

Table 5.5: Highest Recorded Temperature in Henderson County

Location	Date	Temperature (°F)
Hendersonville 1 NE	8/23/1983	101
HENDERSON COUNTY MAXIMUM	--	101

Source: State Climate Office of North Carolina

The State Climate Office also reports average maximum temperatures in various locations in the county. The most centralized location is Hendersonville. **Table A.6** shows the average maximum temperatures from 1971 to 2000 at the Hendersonville 1 NE observation station which can be used as a general comparison for the county.

TABLE A.6: AVERAGE MAXIMUM TEMPERATURE IN HENDERSONVILLE 1 NE, HENDERSON COUNTY

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Avg. Max (°F)	46.7	50.7	58.5	67.0	74.3	80.6	84.3	82.5	76.9	67.8	58.4	49.7

Source: State Climate Office of North Carolina

Probability of Future Occurrences

Based on historical occurrence information, it is assumed that all of Henderson County has a probability level of possible (1 to 10 percent annual probability) for future extreme heat events to impact the county.

A.2.3 Hailstorm

Location and Spatial Extent

Hailstorms frequently accompany thunderstorms, so their locations and spatial extents coincide. It is assumed that Henderson County is uniformly exposed to severe thunderstorms; therefore, all areas of the county are equally exposed to hail which may be produced by such storms.

Historical Occurrences

According to the National Climatic Data Center, 107 recorded hailstorm events have affected Henderson County since 1963.[1] **Table A.7** is a summary of the hail events in Henderson County. **Table A.8** provides detailed information about each event that occurred in the county. In all, hail occurrences resulted in over $4.3 million (2013 dollars) in property damages. Hail ranged in diameter from 0.75 inches to 2.5 inches. It should be noted that hail is notorious for causing substantial damage to cars, roofs, and other areas of the built environment that may not be reported to the National Climatic Data Center. Therefore, it is likely that damages are greater than the reported value.

TABLE A.7: SUMMARY OF HAIL OCCURRENCES IN HENDERSON COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Flat Rock	2	0/0	$0
Fletcher	10	0/0	$0
Hendersonville	26	0/0	$2,687,833
Laurel Park	0	0/0	$0
Mills River	11	0/0	$0
Unincorporated Area	58	0/0	$1,640,214

[1] These hail events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is likely that additional hail events have affected Henderson County. In addition to NCDC, the North Carolina Department of Insurance office was contacted for information. As additional local data becomes available, this hazard profile will be amended.

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
HENDERSON COUNTY TOTAL	**107**	**0/0**	**$4,328,047**

Source: National Climatic Data Center

TABLE A.8: HISTORICAL HAIL OCCURRENCES IN HENDERSON COUNTY

	Date	Magnitude	Deaths / Injuries	Property Damage*
Flat Rock				
FLAT ROCK	04-JUL-97	1.75 in.	0/0	$0
FLAT ROCK	26-APR-12	1.00 in.	0/0	$0
Fletcher				
FLETCHER	02-JUN-97	1.00 in.	0/0	$0
FLETCHER	02-MAY-03	1.00 in.	0/0	$0
FLETCHER	03-MAY-03	1.50 in.	0/0	$0
FLETCHER	19-APR-06	0.75 in.	0/0	$0
FLETCHER	24-JUN-07	0.88 in.	0/0	$0
FLETCHER	24-AUG-07	0.75 in.	0/0	$0
FLETCHER	24-AUG-07	0.75 in.	0/0	$0
FLETCHER	24-APR-09	0.75 in.	0/0	$0
FLETCHER	01-MAY-12	2.50 in.	0/0	$0
FLETCHER	01-MAY-12	1.75 in.	0/0	$0
Hendersonville				
Hendersonville	31-MAR-93	0.88 in.	0/0	$0
Hendersonville	13-MAY-93	0.88 in.	0/0	$0
HENDERSONVILLE	19-MAR-96	0.75 in.	0/0	$0
HENDERSONVILLE	24-AUG-96	0.75 in.	0/0	$0
HENDERSONVILLE	11-SEP-97	0.75 in.	0/0	$0
HENDERSONVILLE	24-JUN-98	1.75 in.	0/0	$0
HENDERSONVILLE	13-MAY-00	0.88 in.	0/0	$0
HENDERSONVILLE	24-MAY-01	0.75 in.	0/0	$0
HENDERSONVILLE	04-JUN-01	0.88 in.	0/0	$0
HENDERSONVILLE	02-MAY-03	1.00 in.	0/0	$2,687,833
HENDERSONVILLE	03-MAY-03	0.75 in.	0/0	$0
HENDERSONVILLE	06-JUN-05	0.88 in.	0/0	$0
HENDERSONVILLE	20-JUN-05	0.75 in.	0/0	$0
HENDERSONVILLE	03-APR-06	0.88 in.	0/0	$0
HENDERSONVILLE	19-APR-06	0.75 in.	0/0	$0
HENDERSONVILLE	11-JUN-06	0.75 in.	0/0	$0
HENDERSONVILLE	23-JUN-06	0.88 in.	0/0	$0
HENDERSONVILLE	15-JUL-06	0.88 in.	0/0	$0
HENDERSONVILLE	22-JUL-06	0.75 in.	0/0	$0
HENDERSONVILLE	30-AUG-06	1.00 in.	0/0	$0
HENDERSONVILLE	11-OCT-06	1.00 in.	0/0	$0
HENDERSONVILLE	03-MAY-07	0.75 in.	0/0	$0
HENDERSONVILLE	26-AUG-07	1.00 in.	0/0	$0
HENDERSONVILLE	07-JUL-08	0.75 in.	0/0	$0
HENDERSONVILLE	02-JUN-11	0.75 in.	0/0	$0

	Date	Magnitude	Deaths / Injuries	Property Damage*
HENDERSONVILLE	26-APR-12	0.88 in.	0/0	$0
Laurel Park				
None Reported	--	--	--	--
Mills River				
MILLS RIVER	09-JUL-97	1.75 in.	0/0	$0
MILLS RIVER	13-MAY-99	1.75 in.	0/0	$0
MILLS RIVER	22-AUG-03	0.75 in.	0/0	$0
MILLS RIVER	04-JUL-06	0.75 in.	0/0	$0
MILLS RIVER	22-JUN-08	0.75 in.	0/0	$0
MILLS RIVER	08-JUL-08	1.00 in.	0/0	$0
MILLS RIVER	10-JUN-09	1.75 in.	0/0	$0
MILLS RIVER	09-APR-11	0.88 in.	0/0	$0
MILLS RIVER	05-APR-12	0.75 in.	0/0	$0
MILLS RIVER	26-APR-12	1.75 in.	0/0	$0
MILLS RIVER	01-MAY-12	0.75 in.	0/0	$0
Unincorporated Area				
HENDERSON COUNTY	23-JUL-63	2.00 in.	0/0	$0
HENDERSON COUNTY	14-MAY-66	1.50 in.	0/0	$0
HENDERSON COUNTY	28-JUN-74	0.75 in.	0/0	$0
HENDERSON COUNTY	17-MAY-82	0.75 in.	0/0	$0
HENDERSON COUNTY	30-MAY-82	1.00 in.	0/0	$0
HENDERSON COUNTY	13-JUL-85	1.75 in.	0/0	$0
HENDERSON COUNTY	13-JUL-85	1.75 in.	0/0	$0
HENDERSON COUNTY	08-SEP-85	0.75 in.	0/0	$0
HENDERSON COUNTY	01-MAY-87	0.75 in.	0/0	$0
HENDERSON COUNTY	03-JUN-87	1.25 in.	0/0	$0
HENDERSON COUNTY	16-MAY-88	0.75 in.	0/0	$0
HENDERSON COUNTY	18-JUN-88	0.75 in.	0/0	$0
HENDERSON COUNTY	10-JUL-88	0.75 in.	0/0	$0
HENDERSON COUNTY	15-JUL-88	1.75 in.	0/0	$0
HENDERSON COUNTY	26-JUL-89	0.75 in.	0/0	$0
HENDERSON COUNTY	15-NOV-89	1.25 in.	0/0	$0
HENDERSON COUNTY	21-AUG-90	0.75 in.	0/0	$0
S Portion	31-MAR-93	0.75 in.	0/0	$0
ASHEVILLE AIRPORT	11-SEP-97	2.00 in.	0/0	$1,573,018
BAT CAVE	03-APR-98	1.00 in.	0/0	$0
ASHEVILLE RGNL ARPT	07-MAY-98	1.00 in.	0/0	$0
DANA	13-MAY-99	0.88 in.	0/0	$0
GERTON	20-AUG-99	1.75 in.	0/0	$0
GERTON	13-MAY-00	1.00 in.	0/0	$0
BAT CAVE	04-JUN-01	0.75 in.	0/0	$0
FRUITLAND	03-MAY-03	0.75 in.	0/0	$0
BAT CAVE	15-MAY-03	1.50 in.	0/0	$0
ASHEVILLE RGNL ARPT	16-JUL-03	0.75 in.	0/0	$0
ETOWAH	18-JUL-03	0.75 in.	0/0	$67,196
MOUNTAIN HOME	04-JUL-06	0.88 in.	0/0	$0

	Date	Magnitude	Deaths / Injuries	Property Damage*
MOUNTAIN HOME	21-JUL-06	0.75 in.	0/0	$0
ETOWAH	30-AUG-06	1.00 in.	0/0	$0
ETOWAH	27-JUL-07	0.75 in.	0/0	$0
EAST FLAT ROCK	27-JUN-08	0.75 in.	0/0	$0
MOUNTAIN HOME	06-JUL-08	0.75 in.	0/0	$0
ASHEVILLE RGNL ARPT	06-JUL-08	0.88 in.	0/0	$0
EAST FLAT ROCK	07-JUL-08	0.88 in.	0/0	$0
EAST FLAT ROCK	07-JUL-08	1.00 in.	0/0	$0
EAST FLAT ROCK	07-JUL-08	1.00 in.	0/0	$0
DANA	07-JUL-08	1.00 in.	0/0	$0
GOODLUCK	30-SEP-08	0.88 in.	0/0	$0
DANA	08-JUN-09	0.88 in.	0/0	$0
ETOWAH	25-JUL-09	0.75 in.	0/0	$0
EDNEYVILLE	09-SEP-09	1.00 in.	0/0	$0
BLUE RIDGE	09-SEP-09	1.75 in.	0/0	$0
HOOPERS CREEK	09-SEP-09	1.00 in.	0/0	$0
ETOWAH	02-JUN-11	1.00 in.	0/0	$0
BOWMAN BLUFF	02-JUN-11	0.88 in.	0/0	$0
SMYTH	02-JUN-11	1.75 in.	0/0	$0
VALLEY HILL	09-JUN-11	1.00 in.	0/0	$0
CAROLINA HILLS	10-JUN-11	0.75 in.	0/0	$0
BOWMAN BLUFF	12-JUN-11	0.88 in.	0/0	$0
DRUID HILLS	02-SEP-11	0.75 in.	0/0	$0
HOLLY SPGS	03-APR-12	1.00 in.	0/0	$0
EDNEYVILLE	26-APR-12	0.75 in.	0/0	$0
EDNEYVILLE	01-MAY-12	0.88 in.	0/0	$0
ETOWAH	01-JUL-12	1.00 in.	0/0	$0
DANA	22-AUG-12	0.75 in.	0/0	$0

*Property damage is reported in 2013 dollars; All damage may not have been reported.
Source: National Climatic Data Center

Probability of Future Occurrences

Based on historical occurrence information, it is assumed that the probability of future hail occurrences is highly likely (100 percent annual probability). Since hail is an atmospheric hazard (coinciding with thunderstorms), it is assumed that Henderson County has equal exposure to this hazard. It can be expected that future hail events will continue to cause minor damage to property and vehicles throughout the county.

A.2.4 Hurricane and Tropical Storm

Location and Spatial Extent

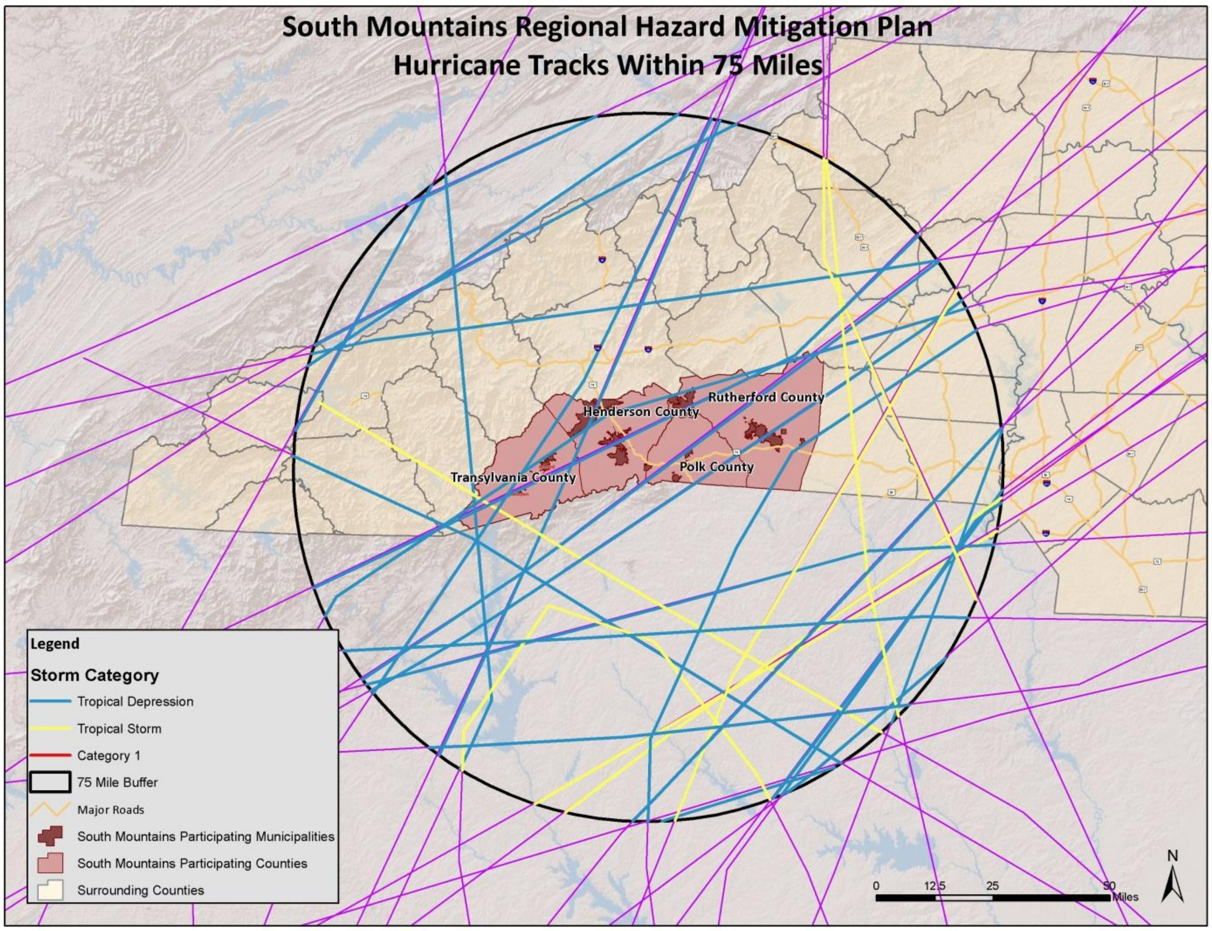
Hurricanes and tropical storms threaten the entire Atlantic and Gulf seaboard of the United States. While coastal areas are most directly exposed to the brunt of landfalling storms, their impact is often felt hundreds of miles inland and they can affect Henderson County. The entire county is equally susceptible to hurricane and tropical storms.

Historical Occurrences

According to the National Hurricane Center's historical storm track records, 30 hurricane or tropical storm tracks have passed within 75 miles of Henderson County since 1850.[2] This includes 7 tropical storms and 23 tropical depressions.

Of the recorded storm events, five tropical depressions have traversed directly through Henderson County as shown in **Figure A.1**. **Table A.9** provides for each event the date of occurrence, name (if applicable), maximum wind speed (as recorded within 75 miles of the South Mountains Region) and maximum Category of the storm based on the Saffir-Simpson Scale.

FIGURE A.1: HISTORICAL HURRICANE STORM TRACKS WITHIN 75 MILES OF HENDERSON COUNTY



Source: National Oceanic and Atmospheric Administration; National Hurricane Center

[2] These storm track statistics do not include extra-tropical storms. Though these related hazard events are less severe in intensity, they may cause significant local impact in terms of rainfall and high winds.

TABLE A.9: HISTORICAL STORM TRACKS WITHIN 75 MILES OF HENDERSON COUNTY (1850–2010)

Date of Occurrence	Storm Name	Maximum Wind Speed (knots)	Storm Category
9/17/1859	NOT NAMED	--	Tropical Depression (TD)
9/24/1886	NOT NAMED	35	Tropical Storm (TS)
8/1/1891	NOT NAMED	35	Tropical Storm (TS)
7/8/1896	NOT NAMED	26	Tropical Depression (TD)
9/28/1901	NOT NAMED	22	Tropical Depression (TD)
10/11/1902	NOT NAMED	31	Tropical Depression (TD)
10/10/1905	NOT NAMED	--	Tropical Depression (TD)
9/18/1906	NOT NAMED	31	Tropical Depression (TD)
9/23/1907	NOT NAMED	40	Tropical Storm (TS)
8/30/1911	NOT NAMED	26	Tropical Depression (TD)
6/17/1912	NOT NAMED	--	Tropical Depression (TD)
9/4/1913	NOT NAMED	26	Tropical Depression (TD)
8/31/1915	NOT NAMED	26	Tropical Depression (TD)
7/15/1916	NOT NAMED	31	Tropical Depression (TD)
8/11/1928	NOT NAMED	35	Tropical Storm (TS)
5/30/1934	NOT NAMED	26	Tropical Depression (TD)
8/28/1949	NOT NAMED	35	Tropical Storm (TS)
9/30/1959	GRACIE	22	Tropical Depression (TD)
8/30/1964	CLEO	22	Tropical Depression (TD)
6/8/1968	CELESTE	53	Tropical Storm (TS)
9/8/1977	BABE	22	Tropical Depression (TD)
8/18/1985	ONE-C	48	Tropical Storm (TS)
9/22/1989	HUGO	22	Tropical Depression (TD)
8/17/1994	BERYL	--	Tropical Depression (TD)
7/24/1997	DANNY	18	Tropical Depression (TD)
7/10/2003	DOLORES	--	Tropical Depression (TD)
9/8/2004	FRANCES	18	Tropical Depression (TD)
9/17/2004	IVAN	13	Tropical Depression (TD)
9/28/2004	JEANNE	18	Tropical Depression (TD)
7/7/2005	CINDY	18	Tropical Depression (TD)

Source: National Hurricane Center

The National Climatic Data Center did not report any events associated with a hurricane or tropical storm in Henderson County between 1950 and 2013. However, federal records indicate that three disaster declarations were made in 1996 (Hurricane Fran) and 2004 (Tropical Storm Frances and Hurricane Ivan) for the county.[3]

[3] All of the participating counties were declared disaster areas for these storms particular storms. A complete listing of historical disaster declarations, including the affected counties, can be found in Section 4: *Hazard Identification*.

Flooding is generally the greatest hazard of concern with hurricane and tropical storm events in Henderson County. Most events do not carry winds that are above that of the winter storms and straight line winds received by the county. Some anecdotal information is available for the major storms that have impacted that area as found below:

Hurricane Fran – September 5, 1996
Just prior to landfall of Hurricane Fran, a small portion of the region, in the Bat Cave (Henderson County), Chimney Rock (Rutherford County), Lake Lure (Rutherford County) areas, received up to 11 inches of rain in a 3 hour period. The rains were the result of nearly stationary, very heavy thunderstorms. Severe damage to property in the immediate area resulted, with about 70 homes and businesses destroyed or significantly damaged. As Hurricane Fran moved inland, it dropped an additional 5 to 10 inches of rain over the area resulting in significant flooding throughout the region.

Tropical Storm Frances – September 7-8, 2004
Tropical Storm Frances was a slow-moving, relatively large storm that dumped heavy rains over the eastern United States. The remnants of Frances produced a swath of 5 to 15 inches of rain across the North Carolina Mountains with reports of 12 to 15 inches of rain along the higher terrain and isolated reports in excess of 18 inches. Wind gusts reached between 40 and 60 mph along the Appalachian Mountains and thousands of trees were downed. Trees fell on structures, vehicles, and power lines. Additionally, the downed trees led to the death of an elderly man in Hendersonville when a tree fell through the resident's structure. Flooding also led to numerous landslides in the area which added to the damage of infrastructure and residential and commercial structures. Frances caused significant crop damages totaling $55 million statewide. North Carolina residents received almost $20.6 million in federal disaster assistance following the storm.

Hurricane Ivan – September 16-17, 2004
Just a week and a half following Tropical Storm Frances, the remnants of Hurricane Ivan hit western North Carolina when many streams and rivers were already well above flood stage. The widespread flooding forced many roads to be closed and landslides were common across the mountain region. Wind gusts reached between 40 and 60 mph across the higher elevations of the Appalachian Mountains resulting in numerous downed trees. More than $13.8 million of federal aid was dispersed across North Carolina following Ivan.

The Hurricane Frances/Ivan combination of events resulted in widespread road closures (including Highways 64, 280, 25, and 276) as well as infrastructure damages (many bridges and roads were completely washed out), residential structure damages, and commercial structure damages due to massive flooding. Trees were blown down and fell on structures, vehicles, and powerlines, adding to the already widespread debris buildup and power outages.

Probability of Future Occurrences
Given the inland location of the county, it is more likely to be affected by remnants of hurricane and tropical storm systems (as opposed to a major hurricane) which may result in flooding or high winds. The probability of being impacted is less than coastal areas, but still remains a real threat to Henderson County due to induced events like flooding and landsliding. Based on historical evidence, the probability level of future occurrence is possible (between 1 and 10 percent annually probability). Given the regional nature of the hazard, all areas in the county are equally exposed to this hazard. However, when the county is impacted, the damage could be catastrophic, threatening lives and property throughout the planning area.

A.2.5 Lightning

Location and Spatial Extent

Lightning occurs randomly, therefore it is impossible to predict where and with what frequency it will strike. It is assumed that all of Henderson County is uniformly exposed to lightning.

Historical Occurrences

According to the National Climatic Data Center, there have been 17 recorded lightning events in Henderson County since 1995, as listed in summary **Table A.10**.[4] These events resulted in nearly $56,000 (2013 dollars) in damages and caused 19 injuries. A complete listing of those events can be found in **Table A.11.** Many of the reported events are those that caused damage, and it should be expected that damages are likely much higher for this hazard than what is reported.

TABLE A.10: SUMMARY OF LIGHTNING OCCURRENCES IN HENDERSON COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Flat Rock	0	0/0	$0
Fletcher	0	0/0	$0
Hendersonville	3	0/0	$64,512
Laurel Park	0	0/0	$0
Mills River	0	0/0	$0
Unincorporated Area	14	0/19	$488,420
HENDERSON COUNTY TOTAL	**17**	**0/19**	**$55,932**

Source: National Climatic Data Center

TABLE A.11: HISTORIC LIGHTNING OCCURRENCES IN HENDERSON COUNTY

	Date	Deaths / Injuries	Property Damage*	Details
Flat Rock				
None Reported	--	--	--	--
Fletcher				
None Reported	--	--	--	--
Hendersonville				
HENDERSONVILLE	18-JUL-03	0/0	$26,878	Lightning ignited a house fire.
HENDERSONVILLE	27-JUN-05	0/0	$25,335	Lightning ignited a house fire near the Laurel Park Shopping center. The fire destroyed much of the roof.
HENDERSONVILLE	27-APR-06	0/0	$12,299	Lightning struck a house, blowing out one of the walls.

[4] These lightning events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is certain that additional lightning events have occurred in Henderson County. The State Fire Marshall's office was also contacted for additional information but none could be provided. As additional local data becomes available, this hazard profile will be amended.

	Date	Deaths / Injuries	Property Damage*	Details
Laurel Park				
None Reported	--	--	--	--
Mills River				
None Reported	--	--	--	--
Unincorporated Area				
Rowan	15-AUG-95	0/00	$33,143	Lightning struck a barn and an abandoned house starting fires.
TUXEDO	14-JUN-96	0/18	$0	
EDNEYVILLE	14-JUL-96	0/0	$0	
HORSE SHOE	13-AUG-98	0/0	$23,233	Lightning struck a house and caused a roof fire.
TUXEDO	12-FEB-00	0/0	$0	A lightning bolt from a morning thunderstorm struck a power line, then traveled into a two story home and ignited a blaze which completely destroyed the home and its contents.
VALLEY HILL	08-MAY-09	0/0	$11,255	Lightning struck a home on Kanuga Rd, igniting a fire in the attic.
FRUITLAND	28-MAY-09	0/0	$33,765	Lightning struck a home on Good View Dr, igniting a fire that rendered the home unlivable. Location is approximate.
SMYTH	06-JUN-11	0/0	$5,305	Lightning started a fire at a barn, destroying the structure.
FRUITLAND	21-JUN-11	0/0	$10,609	Lightning struck a mobile home on McMinn Woods Dr, starting a fire that damaged one room of the home.
BRIGHTWATER	05-JUL-11	0/1	$0	Lightning struck a home on Solomon Circle, igniting a fire that destroyed most of the home. One person received minor injuries from the lightning.
GOODLUCK	05-JUL-11	0/0	$10,609	Lightning struck a home on Locust Grove Rd, igniting a fire that caused some minor damage.
BRIGHTWATER	11-JAN-12	0/0	$103,000	Lightning struck a home on Nimbus Lane, starting a fire that destroyed the structure.
VALLEY HILL	05-APR-12	0/0	$206,000	Lightning struck a gas line at a home on Kanuga Forest Dr, causing an explosion that collapsed the exterior walls and igniting a fire that completely destroyed the structure.
BLUE RIDGE	22-AUG-12	0/0	$51,500	Lightning struck a tree that fell

	Date	Deaths / Injuries	Property Damage*	Details
				on and heavily damaged a home on Toone Town Terrace. An occupant was briefly trapped inside.

*Property Damage is reported in 2013 dollars.
Source: National Climatic Data Center

Probability of Future Occurrences

Although there was not a high number of historical lightning events reported in Henderson County via NCDC data, it is considered a regular occurrence, especially accompanied by thunderstorms. In fact, lightning events will assuredly happen on an annual basis, though not all events will cause damage. According to Vaisala's U.S. National Lightning Detection Network (NLDN®), Henderson County is located in an area of the country that experienced an average of 2 to 4 lightning flashes per square kilometer per year between 1997 and 2010. Therefore, the probability of future events is highly likely (100 percent annual probability). It can be expected that future lightning events will continue to threaten life and cause minor property damages throughout the county.

A.2.6 Thunderstorm Wind / High Wind

Location and Spatial Extent

A wind event is an atmospheric hazard, and thus has no geographic boundaries. It is typically a widespread event that can occur in all regions of the United States. However, thunderstorms are most common in the central and southern states because atmospheric conditions in those regions are favorable for generating these powerful storms. Also, Henderson County typically experiences several straight-line wind events each year. These wind events can and have caused significant damage. It is assumed that Henderson County has uniform exposure to an event and the spatial extent of an impact could be large.

Historical Occurrences

Severe storms have resulted in one disaster declaration in Henderson County in 1977.[5] According to NCDC, there have been 137 reported thunderstorm wind and high wind events since 1959 in Henderson County.[6] These events caused over $2.7 million (2013 dollars) in damages. There were repots of 16 injuries and 3 fatalities. **Table A.12** summarizes this information. **Table A.13** presents detailed thunderstorm wind and high wind event reports including date, magnitude, and associated damages for each event.[7]

[5] A complete listing of historical disaster declarations can be found in Section 4: *Hazard Profiles*.
[6] These thunderstorm events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is certain that additional thunderstorm events have occurred in Henderson County. As additional local data becomes available, this hazard profile will be amended.
[7] The dollar amount of damages provided by NCDC is divided by the number of affected counties to reflect a damage estimate for the county.

TABLE A.12: SUMMARY OF THUNDERSTORM / HIGH WIND OCCURRENCES IN HENDERSON COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Flat Rock	0	0/0	$0
Fletcher	5	0/0	$89,554
Hendersonville	20	0/3	$67,280
Laurel Park	3	0/0	$22,028
Mills River	8	0/0	$37,815
Unincorporated Area	101	1/2	$2,504,734
HENDERSON COUNTY TOTAL	**137**	**1/5**	**$2,721,411**

Source: National Climatic Data Center

TABLE A.13: HISTORICAL THUNDERSTORM / HIGH WIND OCCURRENCES IN HENDERSON COUNTY

	Date	Type	Magnitude	Deaths / Injuries	Property Damage*
Flat Rock					
None Reported	--	--	--	--	--
Fletcher					
Fletcher	11-AUG-95	THUNDERSTORM WINDS	0 kts.	0/0	$0
FLETCHER	21-FEB-97	TSTM WIND	50 kts.	0/0	$0
FLETCHER	02-MAY-03	TSTM WIND	50 kts.	0/0	$0
FLETCHER	10-JUL-07	THUNDERSTORM WIND	55 kts.	0/0	$89,554
FLETCHER	18-JUN-09	THUNDERSTORM WIND	55 kts.	0/0	$0
Hendersonville					
HENDERSONVILLE	26-MAY-96	TSTM WIND	50 kts.	0/0	$0
HENDERSONVILLE	07-JUL-96	TSTM WIND	50 kts.	0/0	$0
HENDERSONVILLE	14-JUN-97	TSTM WIND	50 kts.	0/0	$0
HENDERSONVILLE	04-JUL-97	TSTM WIND	50 kts.	0/1	$0
HENDERSONVILLE	24-JUN-98	TSTM WIND	50 kts.	0/0	$0
HENDERSONVILLE	13-MAY-99	TSTM WIND	50 kts.	0/0	$30,252
HENDERSONVILLE	18-AUG-00	TSTM WIND	50 kts.	0/0	$0
HENDERSONVILLE	22-MAY-01	TSTM WIND	50 kts.	0/0	$0
HENDERSONVILLE	08-JUL-01	TSTM WIND	58 kts.	0/0	$0
HENDERSONVILLE	08-JUL-01	TSTM WIND	60 kts.	0/0	$0
HENDERSONVILLE	10-AUG-01	TSTM WIND	50 kts.	0/2	$35,644
HENDERSONVILLE	24-AUG-02	TSTM WIND	50 kts.	0/0	$1,384
HENDERSONVILLE	11-NOV-02	TSTM WIND	50 kts.	0/0	$0
HENDERSONVILLE	02-MAY-03	TSTM WIND	50 kts.	0/0	$0
HENDERSONVILLE	18-JUL-03	TSTM WIND	55 kts.	0/0	$0
HENDERSONVILLE	11-JUN-06	TSTM WIND	50 kts.	0/0	$0
HENDERSONVILLE	28-SEP-06	TSTM WIND	50 kts.	0/0	$0
HENDERSONVILLE	26-AUG-07	THUNDERSTORM WIND	55 kts.	0/0	$0
HENDERSONVILLE	04-MAR-08	THUNDERSTORM WIND	55 kts.	0/0	$0
HENDERSONVILLE	07-JUL-08	THUNDERSTORM WIND	50 kts.	0/0	$0

	Date	Type	Magnitude	Deaths / Injuries	Property Damage*
Laurel Park					
LAUREL PARK	10-AUG-00	TSTM WIND	50 kts.	0/0	$22,028
LAUREL PARK	12-JUN-11	THUNDERSTORM WIND	50 kts.	0/0	$0
LAUREL PARK	17-JUL-12	THUNDERSTORM WIND	50 kts.	0/0	$0
Mills River					
MILLS RIVER	23-JAN-99	TSTM WIND	60 kts.	0/0	$37,815
MILLS RIVER	02-MAY-02	TSTM WIND	50 kts.	0/0	$0
MILLS RIVER	21-JUL-06	TSTM WIND	50 kts.	0/0	$0
MILLS RIVER	25-JUN-07	THUNDERSTORM WIND	50 kts.	0/0	$0
MILLS RIVER	10-JUN-09	THUNDERSTORM WIND	50 kts.	0/0	$0
MILLS RIVER	11-JUL-10	THUNDERSTORM WIND	55 kts.	0/0	$0
MILLS RIVER	18-JUN-11	THUNDERSTORM WIND	50 kts.	0/0	$0
MILLS RIVER	22-JUN-11	THUNDERSTORM WIND	50 kts.	0/0	$0
Unincorporated Area					
HENDERSON COUNTY	24-MAY-59	TSTM WIND	0 kts.	0/0	$0
HENDERSON COUNTY	06-AUG-62	TSTM WIND	0 kts.	0/0	$0
HENDERSON COUNTY	23-JUL-63	TSTM WIND	0 kts.	0/0	$0
HENDERSON COUNTY	19-JUL-66	TSTM WIND	50 kts.	0/0	$0
HENDERSON COUNTY	02-MAY-67	TSTM WIND	0 kts.	0/0	$0
HENDERSON COUNTY	23-JUN-68	TSTM WIND	0 kts.	0/0	$0
HENDERSON COUNTY	15-JUN-71	TSTM WIND	0 kts.	0/0	$0
HENDERSON COUNTY	20-AUG-73	TSTM WIND	50 kts.	0/0	$0
HENDERSON COUNTY	28-JUN-74	TSTM WIND	0 kts.	0/0	$0
HENDERSON COUNTY	18-FEB-76	TSTM WIND	0 kts.	0/0	$0
HENDERSON COUNTY	06-JUN-77	TSTM WIND	0 kts.	0/0	$0
HENDERSON COUNTY	01-FEB-79	TSTM WIND	0 kts.	0/0	$0
HENDERSON COUNTY	13-JUL-85	TSTM WIND	0 kts.	0/0	$0
HENDERSON COUNTY	13-JUL-85	TSTM WIND	52 kts.	0/0	$0
HENDERSON COUNTY	16-JUL-85	TSTM WIND	0 kts.	0/0	$0
HENDERSON COUNTY	08-SEP-85	TSTM WIND	0 kts.	0/0	$0
HENDERSON COUNTY	08-SEP-85	TSTM WIND	0 kts.	0/0	$0
HENDERSON COUNTY	26-JUL-86	TSTM WIND	0 kts.	0/0	$0
HENDERSON COUNTY	01-JUN-87	TSTM WIND	0 kts.	0/0	$0
HENDERSON COUNTY	03-JUN-87	TSTM WIND	0 kts.	0/0	$0
HENDERSON COUNTY	28-AUG-87	TSTM WIND	0 kts.	0/0	$0
HENDERSON COUNTY	21-JUN-88	TSTM WIND	0 kts.	0/0	$0
HENDERSON COUNTY	16-JUL-88	TSTM WIND	0 kts.	0/0	$0
HENDERSON COUNTY	05-MAY-89	TSTM WIND	0 kts.	0/1	$0
HENDERSON COUNTY	26-MAY-89	TSTM WIND	0 kts.	0/0	$0
HENDERSON COUNTY	26-MAY-89	TSTM WIND	0 kts.	0/0	$0
HENDERSON COUNTY	28-JUN-89	TSTM WIND	0 kts.	0/0	$0
HENDERSON COUNTY	15-NOV-89	TSTM WIND	0 kts.	0/0	$0
HENDERSON COUNTY	15-NOV-89	TSTM WIND	0 kts.	0/0	$0
HENDERSON COUNTY	20-APR-91	TSTM WIND	0 kts.	0/0	$0
HENDERSON COUNTY	27-AUG-92	TSTM WIND	0 kts.	0/0	$0
Balfour	26-JUN-95	THUNDERSTORM WINDS	0 kts.	0/0	$19,886

	Date	Type	Magnitude	Deaths / Injuries	Property Damage*
HENDERSON COUNTY	05-OCT-95	HIGH WINDS	0 kts.	0/0	$1,657,168
HENDERSON COUNTY	18-JAN-96	HIGH WIND	0 kts.	0/0	$5,028
ETOWAH	24-AUG-96	TSTM WIND	50 kts.	0/0	$0
ETOWAH	21-FEB-97	TSTM WIND	50 kts.	0/0	$0
ETOWAH	04-JUL-97	TSTM WIND	50 kts.	0/0	$0
BAT CAVE	16-JUL-97	TSTM WIND	50 kts.	0/0	$0
ETOWAH	22-JUN-98	TSTM WIND	50 kts.	0/0	$0
HENDERSON COUNTY	15-SEP-99	HIGH WIND	45 kts.	0/1	$0
HENDERSON COUNTY	02-NOV-99	HIGH WIND	55 kts.	0/0	$0
HENDERSON COUNTY	08-APR-00	HIGH WIND	50 kts.	0/0	$0
HENDERSON COUNTY	16-FEB-01	HIGH WIND	55 kts.	0/0	$0
HENDERSON COUNTY	06-MAR-01	HIGH WIND	55 kts.	0/0	$0
HENDERSON COUNTY	20-MAR-01	HIGH WIND	55 kts.	0/0	$67,893
HENDERSON COUNTY	13-OCT-01	HIGH WIND	50 kts.	0/0	$0
HENDERSON COUNTY	29-NOV-01	HIGH WIND	50 kts.	0/0	$0
HENDERSON COUNTY	04-FEB-02	HIGH WIND	50 kts.	0/0	$0
HENDERSON COUNTY	10-MAR-02	HIGH WIND	50 kts.	0/0	$1,384
HENDERSON COUNTY	27-SEP-02	HIGH WIND	50 kts.	0/0	$0
HENDERSON COUNTY	13-DEC-02	HIGH WIND	65 kts.	0/0	$0
HENDERSON COUNTY	23-JAN-03	HIGH WIND	60 kts.	0/0	$3,072
ASHEVILLE RGNL ARPT	16-JUL-03	TSTM WIND	58 kts.	0/0	$0
ASHEVILLE RGNL ARPT	21-JUL-03	TSTM WIND	50 kts.	0/0	$1,344
HENDERSON COUNTY	14-OCT-03	HIGH WIND	50 kts.	0/0	$1,512
HENDERSON COUNTY	13-NOV-03	HIGH WIND	50 kts.	0/0	$2,993
HENDERSON COUNTY	07-MAR-04	HIGH WIND	50 kts.	0/0	$9,242
HENDERSON COUNTY	05-JUL-04	HIGH WIND	55 kts.	0/0	$1,305
HENDERSON COUNTY	07-SEP-04	HIGH WIND	50 kts.	0/0	$86,115
HENDERSON COUNTY	16-SEP-04	HIGH WIND	55 kts.	1/0	$168,533
HENDERSON COUNTY	17-SEP-04	HIGH WIND	50 kts.	0/0	$6,116
HENDERSON COUNTY	01-DEC-04	HIGH WIND	50 kts.	0/0	$0
HENDERSON COUNTY	22-JAN-05	HIGH WIND	60 kts.	0/0	$0
HENDERSON COUNTY	02-APR-05	HIGH WIND	60 kts.	0/0	$73,895
EDNEYVILLE	20-MAY-05	TSTM WIND	50 kts.	0/0	$0
ETOWAH	20-MAY-05	TSTM WIND	50 kts.	0/0	$0
DANA	14-AUG-05	TSTM WIND	50 kts.	0/0	$0
HENDERSON COUNTY	14-JAN-06	HIGH WIND	60 kts.	0/0	$1,230
BAT CAVE	23-JUN-06	TSTM WIND	50 kts.	0/0	$0
MOUNTAIN HOME	04-JUL-06	TSTM WIND	50 kts.	0/0	$0
MOUNTAIN HOME	21-JUL-06	TSTM WIND	50 kts.	0/0	$0
ETOWAH	30-AUG-06	TSTM WIND	55 kts.	0/0	$0
EDNEYVILLE	11-OCT-06	THUNDERSTORM WIND	50 kts.	0/0	$0
HENDERSON COUNTY	01-DEC-06	HIGH WIND	55 kts.	0/0	$0
HENDERSON COUNTY	15-APR-07	HIGH WIND	70 kts.	0/0	$0
HENDERSON COUNTY	16-APR-07	HIGH WIND	65 kts.	0/0	$398,017

	Date	Type	Magnitude	Deaths / Injuries	Property Damage*
HENDERSON COUNTY	10-FEB-08	HIGH WIND	55 kts.	0/0	$0
HENDERSON COUNTY	11-MAY-08	HIGH WIND	60 kts.	0/0	$0
ETOWAH	27-JUN-08	THUNDERSTORM WIND	55 kts.	0/0	$0
EAST FLAT ROCK	28-JUN-08	THUNDERSTORM WIND	50 kts.	0/0	$0
HENDERSON COUNTY	31-DEC-08	HIGH WIND	50 kts.	0/0	$0
OTTANOLA	10-JUN-09	THUNDERSTORM WIND	50 kts.	0/0	$0
ETOWAH	18-JUN-09	THUNDERSTORM WIND	55 kts.	0/0	$0
DANA	27-JUL-09	THUNDERSTORM WIND	50 kts.	0/0	$0
EDNEYVILLE	05-AUG-09	THUNDERSTORM WIND	50 kts.	0/0	$0
UPWARD	25-JUN-10	THUNDERSTORM WIND	50 kts.	0/0	$0
DANA	25-JUN-10	THUNDERSTORM WIND	50 kts.	0/0	$0
RUGBY	17-JUL-10	THUNDERSTORM WIND	55 kts.	0/0	$0
BRIGHTWATER	18-JUL-10	THUNDERSTORM WIND	50 kts.	0/0	$0
ETOWAH	25-OCT-10	THUNDERSTORM WIND	55 kts.	0/0	$0
ETOWAH	04-APR-11	THUNDERSTORM WIND	60 kts.	0/0	$0
HORACE	28-APR-11	THUNDERSTORM WIND	55 kts.	0/0	$0
CAROLINA HILLS	10-JUN-11	THUNDERSTORM WIND	50 kts.	0/0	$0
ETOWAH	15-JUN-11	THUNDERSTORM WIND	55 kts.	0/0	$0
GERTON	21-JUN-11	THUNDERSTORM WIND	50 kts.	0/0	$0
HORACE	21-JUN-11	THUNDERSTORM WIND	50 kts.	0/0	$0
ETOWAH	04-JUL-12	THUNDERSTORM WIND	50 kts.	0/0	$0
BRIGHTWATER	27-JUL-12	THUNDERSTORM WIND	55 kts.	0/0	$0
TUXEDO	02-AUG-12	THUNDERSTORM WIND	50 kts.	0/0	$0
HORSE SHOE	09-AUG-12	THUNDERSTORM WIND	50 kts.	0/0	$0
HORACE	14-AUG-12	THUNDERSTORM WIND	50 kts.	0/0	$0

*Property damage is reported in 2013 dollars; All damage may not have been reported.
Source: National Climatic Data Center

Probability of Future Occurrences

Given the high number of previous events, it is certain that wind events, including straight-line wind and thunderstorm wind, will occur in the future. This results in a probability level of highly likely (100 percent annual probability) for future wind events for the entire county.

A.2.7 Tornado

Location and Spatial Extent

Tornadoes occur throughout the state of North Carolina, and thus in Henderson County. Tornadoes typically impact a relatively small area, but damage may be extensive. Event locations are completely random and it is not possible to predict specific areas that are more susceptible to tornado strikes over time. Therefore, it is assumed that Henderson County is uniformly exposed to this hazard.

Historical Occurrences

Tornadoes are a fairly rare occurrence in mountainous areas. However, they have and do occur in Henderson County. According to the National Climatic Data Center, there have been a total of three recorded tornado events in Henderson County since 1975 (**Table A.14**), resulting in over $1.2 million

(2013 dollars) in property damages (**Table A.15**).[8] The magnitude of these tornadoes were F1 in intensity, although an F2 to F5 event is possible. It is important to note that only tornadoes that have been reported are factored into this risk assessment. It is likely that a high number of occurrences have gone unreported over the past 63 years.

TABLE A.14: SUMMARY OF TORNADO OCCURRENCES IN HENDERSON COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Flat Rock	0	0/0	$0
Fletcher	0	0/0	$0
Hendersonville	0	0/0	$0
Laurel Park	0	0/0	$0
Mills River	0	0/0	$0
Unincorporated Area	3	0/0	$1,227,209
HENDERSON COUNTY TOTAL	**3**	**0/0**	**$1,227,290**

Source: National Climatic Data Center

TABLE A.15: HISTORICAL TORNADO IMPACTS IN HENDERSON COUNTY

	Date	Magnitude	Deaths/ Injuries	Property Damage*	Details
Flat Rock					
None Reported	--	--	--	--	--
Fletcher					
None Reported	--	--	--	--	--
Hendersonville					
None Reported	--	--	--	--	--
Laurel Park					
None Reported	--	--	--	--	--
Mills River					
None Reported	--	--	--	--	--
Unincorporated Area					
HENDERSON COUNTY	17-OCT-75	F1	0/0	$11,728	
HENDERSON COUNTY	18-FEB-76	F1	0/0	$1,111,264	
HENDERSON COUNTY	17-AUG-77	F1	0/0	$104,217	

*Property damage is reported in 2013 dollars; All damage may not have been reported.
Source: National Climatic Data Center

Probability of Future Occurrences

According to historical information, tornado events are not an annual occurrence for the county. Furthermore, the mountainous terrain of the county makes tornadoes a rare occurrence. While the majority of the reported tornado events are small in terms of size, intensity, and duration, they do pose a significant threat should Henderson County experience a direct tornado strike. The probability of future tornado occurrences affecting Henderson County is possible (1 to 10 percent annual probability).

[8] These tornado events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is likely that additional tornadoes have occurred in Henderson County. As additional local data becomes available, this hazard profile will be amended.

A.2.8 Winter Storm and Freeze

Location and Spatial Extent

Nearly the entire continental United States is susceptible to winter storm and freeze events. Some ice and winter storms may be large enough to affect several states, while others might affect limited, localized areas. The degree of exposure typically depends on the normal expected severity of local winter weather. Henderson County is accustomed to severe winter weather conditions and frequently receives severe winter weather during the winter months. Given the atmospheric nature of the hazard, the entire county has uniform exposure to a winter storm.

Historical Occurrences

Winter weather has resulted in two disaster declarations in Henderson County. This includes the Blizzard of 1996 and one subsequent 1996 winter storm.[9] According to the National Climatic Data Center, there have been a total of 91 recorded winter storm events in Henderson County since 1993 (**Table A.16**).[10] These events resulted in over $1.2 million (2013 dollars) in damages.[11] Detailed information on the recorded winter storm events can be found in **Table A.17**.

TABLE A.16: SUMMARY OF WINTER STORM EVENTS IN HENDERSON COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Henderson County	91	0/0	$1,209,621

Source: National Climatic Data Center

TABLE A.17: HISTORICAL WINTER STORM IMPACTS IN HENDERSON COUNTY

	Date	Type of Storm	Deaths / Injuries	Property Damage*
Flat Rock				
None Reported	--	--	--	--
Fletcher				
None Reported	--	--	--	--
Hendersonville				
None Reported	--	--	--	--
Laurel Park				
None Reported	--	--	--	--
Mills River				
None Reported	--	--	--	--
Unincorporated Area				
Statewide	12-MAR-93	WINTER STORM	2/10†	$874,516
Northern Interior and	10-FEB-94	ICE STORM	0/0	$0

9 Not all of the participating counties were declared disaster areas for these events. A complete listing of historical disaster declarations, including the affected counties, can be found in Section 4: *Hazard Profiles*.

10 These ice and winter storm events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is certain that additional winter storm conditions have affected Henderson County.

11 The dollar amount of damages provided by NCDC is divided by the number of affected counties to reflect a damage estimate for the county.

	Date	Type of Storm	Deaths / Injuries	Property Damage*
HENDERSON COUNTY	06-JAN-96	WINTER STORM	0/0	$0
HENDERSON COUNTY	11-JAN-96	WINTER STORM	0/0	$0
HENDERSON COUNTY	26-JAN-96	ICE STORM	0/0	$0
HENDERSON COUNTY	01-FEB-96	FREEZING RAIN	0/0	$0
HENDERSON COUNTY	07-FEB-96	SNOW	0/0	$0
HENDERSON COUNTY	11-FEB-96	Other	0/0	$0
HENDERSON COUNTY	16-FEB-96	SNOW	0/0	$0
HENDERSON COUNTY	18-DEC-96	HEAVY SNOW	0/0	$0
HENDERSON COUNTY	08-JAN-97	Snow and sleet	0/0	$0
HENDERSON COUNTY	09-JAN-97	ICE STORM	0/0	$149,811
HENDERSON COUNTY	10-JAN-97	HEAVY SNOW	0/0	$0
HENDERSON COUNTY	13-FEB-97	WINTER STORM	0/0	$0
HENDERSON COUNTY	08-DEC-97	WINTRY MIX	0/0	$0
HENDERSON COUNTY	27-DEC-97	SNOW	0/0	$0
HENDERSON COUNTY	29-DEC-97	HEAVY SNOW	0/0	$0
HENDERSON COUNTY	30-DEC-97	HEAVY SNOW	0/0	$0
HENDERSON COUNTY	18-JAN-98	SNOW	0/0	$0
HENDERSON COUNTY	27-JAN-98	HEAVY SNOW	0/0	$0
HENDERSON COUNTY	03-FEB-98	SNOW	0/0	$0
HENDERSON COUNTY	23-DEC-98	FREEZING RAIN/SLEET	0/0	$0
HENDERSON COUNTY	24-DEC-98	ICE STORM	0/0	$0
HENDERSON COUNTY	24-DEC-98	SNOW	0/0	$0
HENDERSON COUNTY	02-JAN-99	ICE STORM	0/0	$0
HENDERSON COUNTY	31-JAN-99	HEAVY SNOW	0/0	$0
HENDERSON COUNTY	03-MAR-99	SNOW	0/0	$0
HENDERSON COUNTY	09-MAR-99	SNOW AND SLEET	0/0	$0
HENDERSON COUNTY	26-MAR-99	SNOW	0/0	$0
HENDERSON COUNTY	24-DEC-99	SNOW	0/0	$0
HENDERSON COUNTY	16-JAN-00	FREEZING RAIN/SLEET	0/0	$0
HENDERSON COUNTY	22-JAN-00	HEAVY SNOW	0/0	$0
HENDERSON COUNTY	29-JAN-00	ICE STORM	0/0	$0
HENDERSON COUNTY	08-APR-00	SNOW	0/0	$0
HENDERSON COUNTY	19-NOV-00	SNOW	0/0	$0
HENDERSON COUNTY	03-DEC-00	HEAVY SNOW	0/0	$0
HENDERSON COUNTY	13-DEC-00	FREEZING RAIN	0/0	$0
HENDERSON COUNTY	17-DEC-00	SNOW	0/0	$0
HENDERSON COUNTY	19-DEC-00	SNOW	0/0	$0
HENDERSON COUNTY	01-JAN-01	SNOW	0/0	$0
HENDERSON COUNTY	22-FEB-01	SNOW/SLEET	0/0	$0
HENDERSON COUNTY	20-MAR-01	HEAVY SNOW	0/0	$0
HENDERSON COUNTY	17-APR-01	SNOW SHOWERS	0/0	$0
HENDERSON COUNTY	03-JAN-02	HEAVY SNOW	0/0	$0
HENDERSON COUNTY	03-FEB-02	SNOW	0/0	$0
HENDERSON COUNTY	06-FEB-02	WINTER WEATHER	0/0	$0
HENDERSON COUNTY	04-DEC-02	HEAVY SNOW	0/0	$0
HENDERSON COUNTY	16-JAN-03	HEAVY SNOW	0/0	$0

	Date	Type of Storm	Deaths / Injuries	Property Damage*
HENDERSON COUNTY	26-JAN-03	WINTER WEATHER/MIX	0/0	$0
HENDERSON COUNTY	06-FEB-03	HEAVY SNOW	0/0	$0
HENDERSON COUNTY	09-FEB-03	WINTER WEATHER/MIX	0/0	$0
HENDERSON COUNTY	16-FEB-03	WINTER STORM	0/0	$0
HENDERSON COUNTY	27-FEB-03	WINTER WEATHER/MIX	0/0	$0
HENDERSON COUNTY	10-APR-03	HEAVY SNOW	0/0	$0
HENDERSON COUNTY	28-NOV-03	WINTER WEATHER/MIX	0/0	$0
HENDERSON COUNTY	03-DEC-03	WINTER WEATHER/MIX	0/0	$0
HENDERSON COUNTY	14-DEC-03	ICE STORM	0/0	$4,032
HENDERSON COUNTY	25-JAN-04	HEAVY SNOW	0/0	$0
HENDERSON COUNTY	02-FEB-04	WINTER WEATHER/MIX	0/0	$0
HENDERSON COUNTY	02-FEB-04	WINTER WEATHER/MIX	0/0	$0
HENDERSON COUNTY	02-FEB-04	ICE STORM	0/0	$0
HENDERSON COUNTY	05-FEB-04	WINTER WEATHER/MIX	0/0	$0
HENDERSON COUNTY	06-FEB-04	ICE STORM	0/0	$3,914
HENDERSON COUNTY	12-FEB-04	WINTER WEATHER/MIX	0/0	$0
HENDERSON COUNTY	26-FEB-04	HEAVY SNOW	0/0	$0
HENDERSON COUNTY	30-MAR-04	WINTER WEATHER/MIX	0/0	$0
HENDERSON COUNTY	13-APR-04	WINTER WEATHER/MIX	0/0	$0
HENDERSON COUNTY	22-JAN-05	WINTER WEATHER/MIX	0/0	$0
HENDERSON COUNTY	29-JAN-05	WINTER WEATHER/MIX	0/0	$0
HENDERSON COUNTY	29-JAN-05	WINTER STORM	0/0	$0
HENDERSON COUNTY	02-FEB-05	WINTER WEATHER/MIX	0/0	$0
HENDERSON COUNTY	03-FEB-05	ICE STORM	0/0	$0
HENDERSON COUNTY	27-FEB-05	WINTER WEATHER/MIX	0/0	$0
HENDERSON COUNTY	28-FEB-05	HEAVY SNOW	0/0	$0
HENDERSON COUNTY	17-MAR-05	WINTER WEATHER/MIX	0/0	$0
HENDERSON COUNTY	08-DEC-05	WINTER WEATHER	0/0	$0
HENDERSON COUNTY	09-DEC-05	ICE STORM	0/0	$63,339
HENDERSON COUNTY	15-DEC-05	WINTER WEATHER	0/0	$0
HENDERSON COUNTY	15-DEC-05	ICE STORM	0/0	$114,009
HENDERSON COUNTY	16-DEC-05	FREEZING FOG	0/0	$0
HENDERSON COUNTY	08-FEB-06	WINTER WEATHER	0/0	$0
HENDERSON COUNTY	11-FEB-06	WINTER WEATHER	0/0	$0
HENDERSON COUNTY	09-JAN-07	WINTER WEATHER	0/0	$0
HENDERSON COUNTY	18-JAN-07	WINTER WEATHER	0/0	$0
HENDERSON COUNTY	21-JAN-07	WINTER WEATHER	0/0	$0
HENDERSON COUNTY	01-FEB-07	HEAVY SNOW	0/0	$0
HENDERSON COUNTY	08-APR-07	FROST/FREEZE	0/0	$0
HENDERSON COUNTY	16-JAN-08	HEAVY SNOW	0/0	$0
HENDERSON COUNTY	19-JAN-08	WINTER WEATHER	0/0	$0
HENDERSON COUNTY	31-JAN-08	WINTER WEATHER	0/0	$0
HENDERSON COUNTY	01-FEB-08	ICE STORM	0/0	$0

*Property damage is reported in 2013 dollars; All damage may not have been reported.
†Deaths/injuries were not reported at the county level; potentially outside of the county.
Source: National Climatic Data Center

There have been several severe winter weather events in Henderson County. The text below describes one of the major events and associated impacts on the county. Similar impacts can be expected with severe winter weather.

1996 Winter Storm
This storm left two feet of snow and several thousand citizens without power for up to nine days. Although shelters were opened, some roads were impassible for up to four days. This event caused considerable disruption to business, industry, schools, and government services.

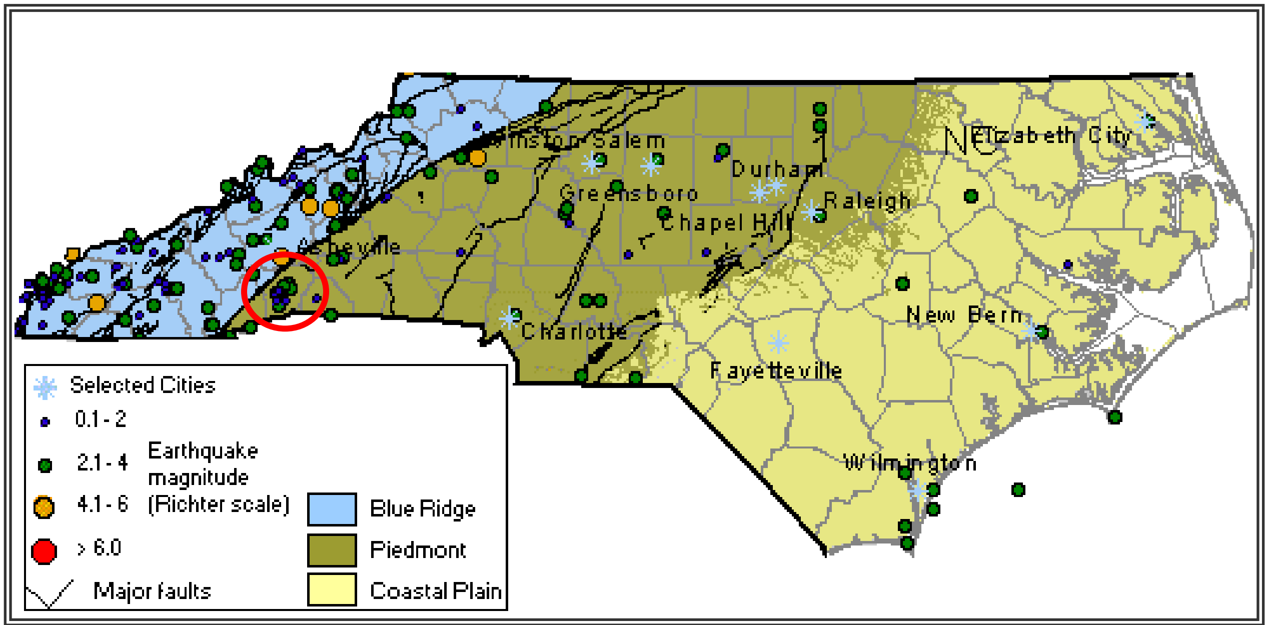
Winter storms throughout the planning area have several negative externalities including hypothermia, cost of snow and debris cleanup, business and government service interruption, traffic accidents, and power outages. Furthermore, citizens may resort to using inappropriate heating devices that could to fire or an accumulation of toxic fumes.

Probability of Future Occurrences
Winter storm events will remain a regular occurrence in Henderson County due to its location in the western part of the state. According to historical information, Henderson County generally experiences several winter storm events each year. Therefore, the annual probability is highly likely (100 percent).

A.2.9 Earthquake

Location and Spatial Extent
Approximately two-thirds of North Carolina is subject to earthquakes, with the western and southeast region most vulnerable to a very damaging earthquake. The state is affected by both the Charleston Fault in South Carolina and New Madrid Fault in Tennessee. Both of these faults have generated earthquakes measuring greater than 8 on the Richter Scale during the last 200 years. In addition, there are several smaller fault lines throughout North Carolina. **Figure A.2** is a map showing geological and seismic information for North Carolina.

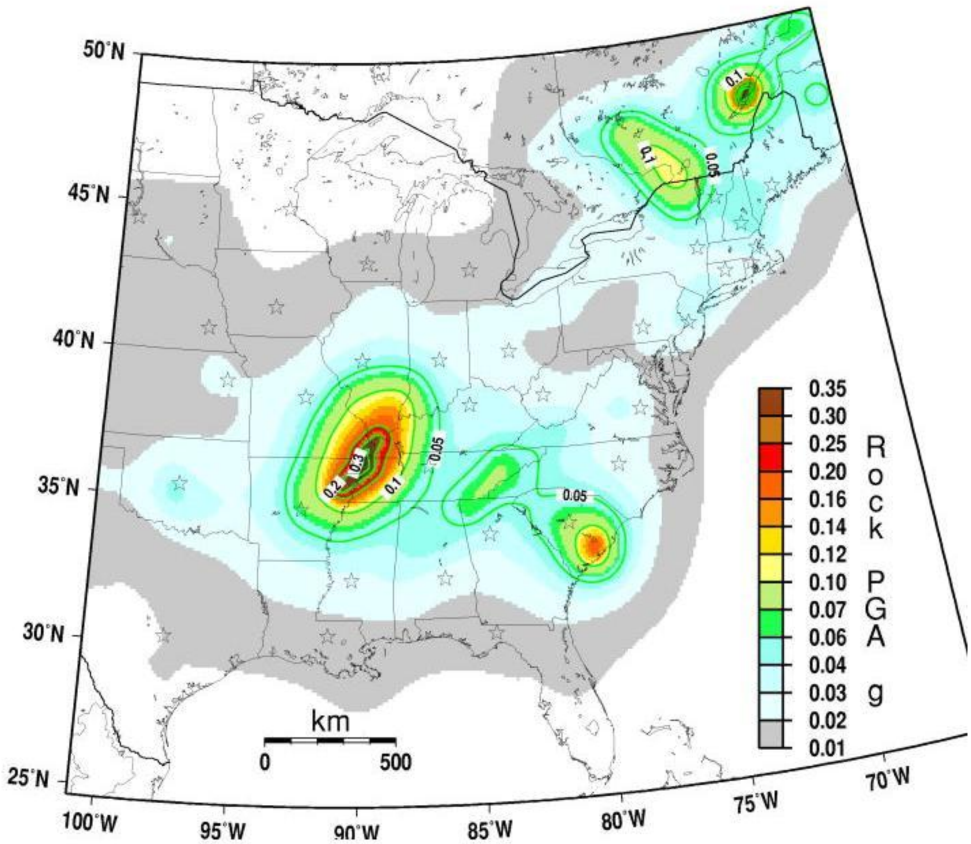
FIGURE A.2: GEOLOGICAL AND SEISMIC INFORMATION FOR NORTH CAROLINA



Source: North Carolina Geological Survey

Figure A.3 shows the intensity level associated with Henderson County, based on the national USGS map of peak acceleration with 10 percent probability of exceedance in 50 years. It is the probability that ground motion will reach a certain level during an earthquake. The data show peak horizontal ground acceleration (the fastest measured change in speed, for a particle at ground level that is moving horizontally due to an earthquake) with a 10 percent probability of exceedance in 50 years. The map was compiled by the U.S. Geological Survey (USGS) Geologic Hazards Team, which conducts global investigations of earthquake, geomagnetic, and landslide hazards. According to this map, Henderson County lies within an approximate zone of level “4” to “6” ground acceleration. This indicates that the county exists within an area of low to moderate seismic risk.

FIGURE A.3: PEAK ACCELERATION WITH 10 PERCENT PROBABILITY OF EXCEEDANCE IN 50 YEARS



Source: USGS, 2008

Historical Occurrences

At least 60 earthquakes are known to have affected Henderson County since 1886. The strongest of these measured a VI on the Modified Mercalli Intensity (MMI) scale. **Table A.18** provides a summary of earthquake events reported by the National Geophysical Data Center between 1638 and 1985. **Table A.19** presents a detailed occurrence of each event including the date, distance for the epicenter, and Modified Mercalli Intensity (if known).[12]

TABLE A.18: SUMMARY OF SEISMIC ACTIVITY IN HENDERSON COUNTY

Location	Number of Occurrences	Greatest MMI Reported	Richter Scale Equivalent
Flat Rock	6	VI	< 5.4
Fletcher	5	IV	< 4.8
Hendersonville	10	VI	< 5.4
Laurel Park	0	--	--
Mills River	1	IV	< 4.8
Unincorporated Area	38	VI	< 5.4

[12] Due to reporting mechanisms, not all earthquakes events were recorded during this time. Furthermore, some are missing data, such as the epicenter location, due to a lack of widely used technology. In these instances, a value of "unknown" is reported.

Location	Number of Occurrences	Greatest MMI Reported	Richter Scale Equivalent
HENDERSON COUNTY TOTAL	60	VI	< 5.4

Source: National Geophysical Data Center

TABLE A.19: SIGNIFICANT SEISMIC EVENTS IN HENDERSON COUNTY (1638 -1985)

Location	Date	Epicentral Distance	Magnitude	MMI
Flat Rock				
Flat Rock	9/1/1886	346.0 km		VI
Flat Rock	10/9/1971	118.0 km	3.4	IV
Flat Rock	11/30/1973	149.0 km	4.7	IV
Flat Rock	8/26/1979	61.0 km	3.7	III
Flat Rock	5/5/1981	6.0 km	3.5	V
Flat Rock	3/25/1983	6.0 km	3.3	IV
Fletcher				
Fletcher	11/20/1969	256.0 km	4.3	IV
Fletcher	11/30/1973	138.0 km	4.7	IV
Fletcher	7/27/1980	329.0 km	5.1	II
Fletcher	5/5/1981	12.0 km	3.5	IV
Fletcher	3/25/1983	10.0 km	3.3	IV
Hendersonville				
Hendersonville	4/20/1911			V
Hendersonville	10/20/1924	37.0 km		V
Hendersonville	11/3/1928	76.0 km		V
Hendersonville	7/2/1957	20.0 km		IV
Hendersonville	11/30/1973	145.0 km	4.7	IV
Hendersonville	5/16/1974			II
Hendersonville	8/26/1979	63.0 km	3.7	IV
Hendersonville	5/5/1981		3.5	VI
Hendersonville	3/25/1983	2.0 km	3.3	V
Hendersonville	3/19/1985	5.0 km	2.1	III
Laurel Park				
None Reported	--	--	--	--
Mills River				
Mills River	3/25/1983	12.0 km	3.3	IV
Unincorporated Area				
Bat Cave	5/13/1957	42.0 km		IV
Edneyville	5/13/1957			III
Mountain Home	5/13/1957			III
Bat Cave	7/2/1957	19.0 km		III
Edneyville	2/8/1960			III
Edneyville	2/8/1960			III
Edneyville	2/9/1960			III
Edneyville	2/9/1960			III
Dana	11/30/1973	153.0 km	4.7	IV
Edneyville	11/30/1973	153.0 km	4.7	V

Location	Date	Epicentral Distance	Magnitude	MMI
Etowah	11/30/1973	134.0 km	4.7	IV
Gerton	11/30/1973	149.0 km	4.7	IV
Horse Shoe	11/30/1973	129.0 km	4.7	III
Mountain Home	11/30/1973	141.0 km	4.7	IV
Tuxedo	11/30/1973	152.0 km	4.7	IV
Horse Shoe	8/26/1979	54.0 km	3.7	IV
Tuxedo	8/26/1979	59.0 km	3.7	III
Zirconia	8/26/1979	61.0 km	3.7	V
Edneyville	4/9/1981	26.0 km	3.2	II
Balfour	5/5/1981		3.5	V
Dana	5/5/1981	4.0 km	3.5	IV
East Flat Rock	5/5/1981	6.0 km	3.5	IV
Edneyville	5/5/1981	10.0 km	3.5	V
Etowah	5/5/1981	15.0 km	3.5	V
Horse Shoe	5/5/1981	19.0 km	3.5	IV
Mountain Home	5/5/1981	6.0 km	3.5	IV
Tuxedo	5/5/1981	10.0 km	3.5	V
Zirconia	5/5/1981	10.0 km	3.5	VI
Balfour	3/25/1983	2.0 km	3.5	III
Bat Cave	3/25/1983	18.0 km	3.3	IV
Dana	3/25/1983	14.0 km	3.3	V
East Flat Rock	3/25/1983	9.0 km	3.3	IV
Edneyville	3/25/1983	12.0 km	3.3	III
Etowah	3/25/1983	13.0 km	3.3	III
Gerton	3/25/1983	17.0 km	3.3	IV
Horse Shoe	3/25/1983	9.0 km	3.3	IV
Mountain Home	3/25/1983	6.0 km	3.3	IV
Tuxedo	3/25/1983	14.0 km	3.3	III

Source: National Geophysical Data Center

Probability of Future Occurrences

The probability of significant, damaging earthquake events affecting Henderson County is unlikely. However, it is likely that future earthquakes resulting in light to moderate perceived shaking and damages ranging from none to very light will affect the county. The annual probability level for the county is estimated between 1 and 10 percent (possible).

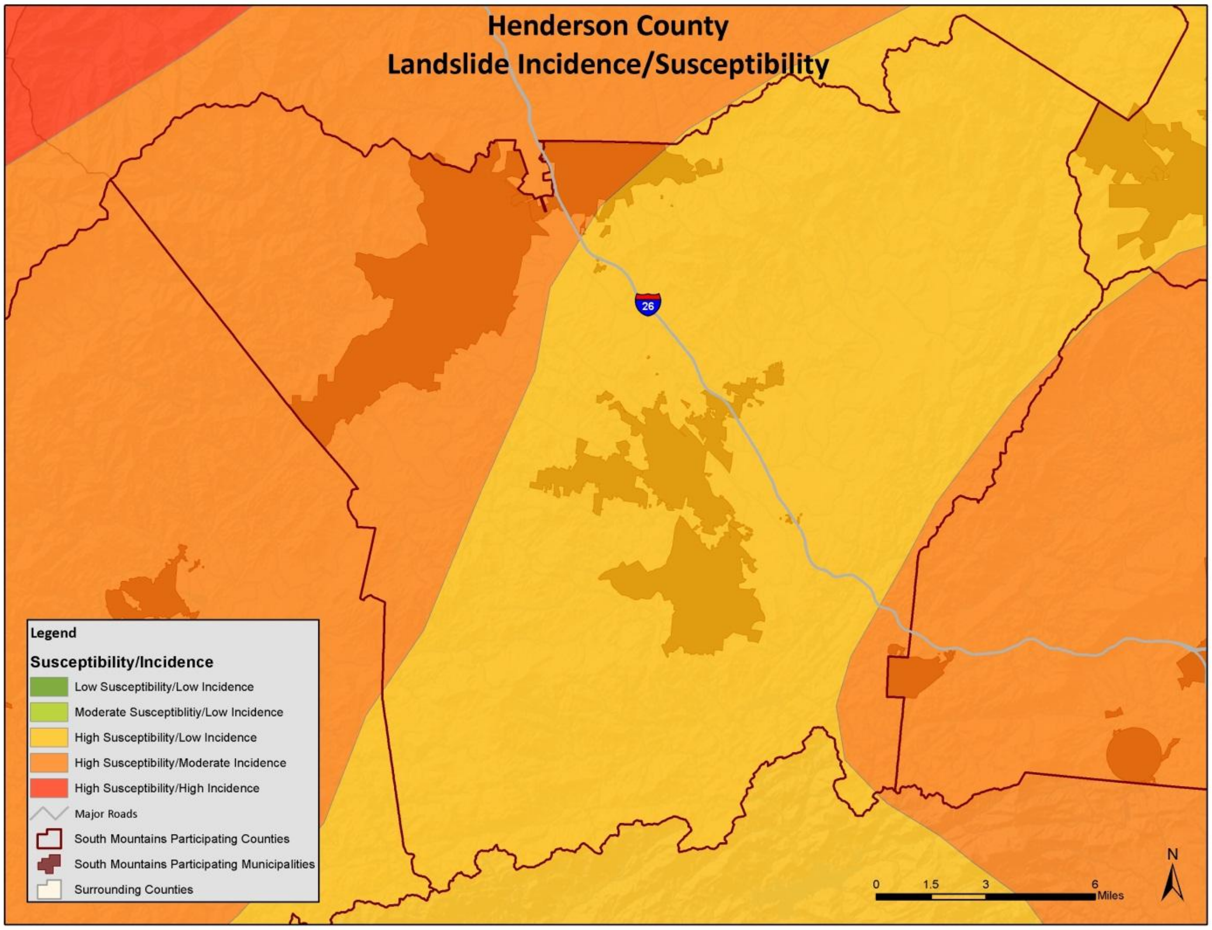
A.2.10 Landslide

Location and Spatial Extent

Landslides occur along steep slopes when the pull of gravity can no longer be resisted (often due to heavy rain). Human development can also exacerbate risk by building on previously undevelopable steep slopes and constructing roads by cutting through mountains. Landslides are possible throughout Henderson County.

According to **Figure A.4** below, much of the county has moderate landslide activity. The remaining portion of the county, along the east and west county boundaries, has a low incidence occurrence rate, but it should be noted that there is high susceptibility throughout the county.

FIGURE A.4: LANDSLIDE SUSCEPTIBILITY AND INCIDENCE MAP OF HENDERSON COUNTY



Source: USGS

Historical Occurrences

Steep topography throughout Henderson County makes the planning area susceptible to landslides. Most landslides are caused by heavy rainfall in the area. Building on steep slopes that was not previously possible also contributes to risk. **Table A.20** presents a summary of the landslide occurrence events as provided by the North Carolina Geological Survey[13]. The georeferenced locations of the landslide events presented in the aforementioned tables are presented in **Figure A.5**. Some incidence mapping has also been completed throughout the western portion of North Carolina though it is not complete. Therefore, it should be noted that many more incidents than what is reported are likely to have occurred in Henderson County.

TABLE A.20: SUMMARY OF LANDSLIDE ACTIVITY IN HENDERSON COUNTY

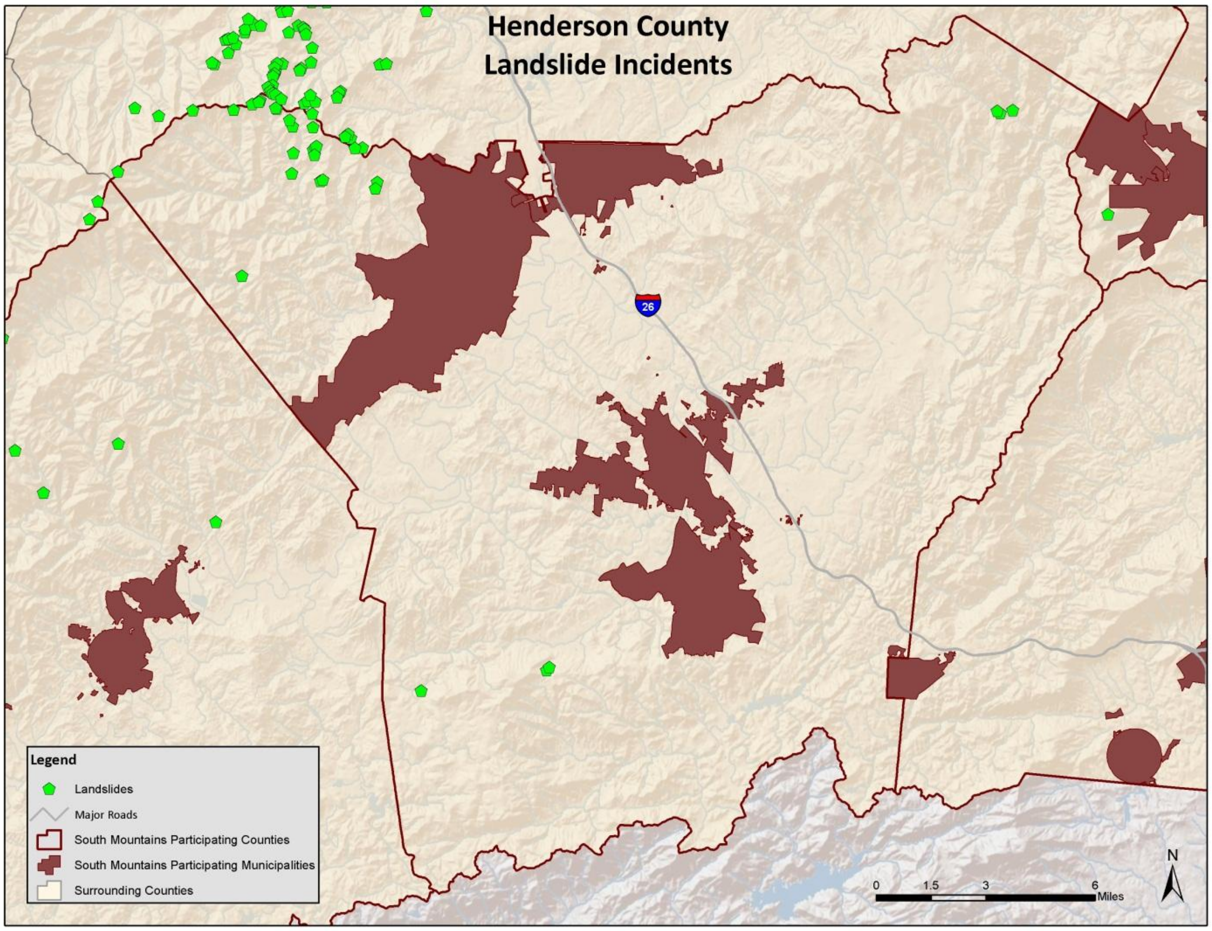
Location	Number of Occurrences
Flat Rock	0

[13] It should be noted that the North Carolina Geological Survey (NCGS) emphasized the dataset provided was incomplete. Therefore, there may be additional historical landslide occurrences. Furthermore, dates were not included for every event. The earliest date reported was 1940. No damage information was provided by NCGS.

Location	Number of Occurrences
Fletcher	0
Hendersonville	0
Laurel Park	0
Mills River	0
Unincorporated Area	28
HENDERSON COUNTY TOTAL	**28**

Source: North Carolina Geological Survey

FIGURE A.5: LOCATION OF PREVIOUS LANDSLIDE OCCURRENCES IN HENDERSON COUNTY



Source: North Carolina Geological Survey

The National Climatic Data Center also reported two landslide events in Henderson County.

September 8, 2004

The remnants of Hurricane Frances brought very heavy rainfall to western North Carolina, resulting in widespread severe flooding across the mountains and foothills. Flooding developed along Shaws Creek in Henderson County. Flooding was widespread and severe across much of the area, with most creeks and streams in flood. Hundreds of homes and businesses were damaged or destroyed across the area, necessitating a number of evacuations and rescues. Numerous roads and bridges were washed out as well. Resulting landslides caused $1,522,235 (2013 dollars) of property damage in Henderson County.

December 1, 2010
After 6 to 10 inches of rain fell in around 24 hours, a landslide developed near the Holiday Drive area, pushing a small house off its foundation. There was a total of $81,955 (2013 dollars) of property damage.

The information below identifies additional historical information reported in the previous county hazard mitigation plan.

Henderson County
In the past in the unincorporated areas of the county, there have been major injuries resulting from landslides but no deaths. Additionally, there has been damage to property and infrastructure and a loss of utilities. However, this damage has been limited to a small portion of the county known as Bat Cave. The Town of Laurel Park also has areas identified as having landslide events and areas prone to landslides; however, there has been no major damage to property, no loss of life, and no major injuries. There has been no landslide damage in any of the other incorporated areas of Henderson County.

During September 2004 when Hurricane Frances and Tropical Storm Ivan moved through Henderson County, landsides caused significant infrastructure damage and the rerouting of neighborhood access. The most significant of the sections identified is the area near US Highway 74 and NC Highway 9 (Bat Cave). Bear Rock Estates was also heavily damaged by a 1,200-foot landside that resulted from Hurricane Frances. $2.3 million in federal and state money was used to repair approximately 130 sites across the county, including the Bear Rock slide.

In 1995, excessive rains from a severe thunderstorm/windstorm caused a mudslide which led to the destruction of a home that was not built to county code according to emergency officials. Two people received minor injuries during this incident. Additionally, there was mud and debris that covered parts of US Highway 74 and NC Highway 9 as well as the bridge that led to Chimney Rock. According to the utility company, debris from the slide and storm downed power lines and led to power outages. The storm and slide caused a total of approximately $2 million in property and infrastructure damage in the area.

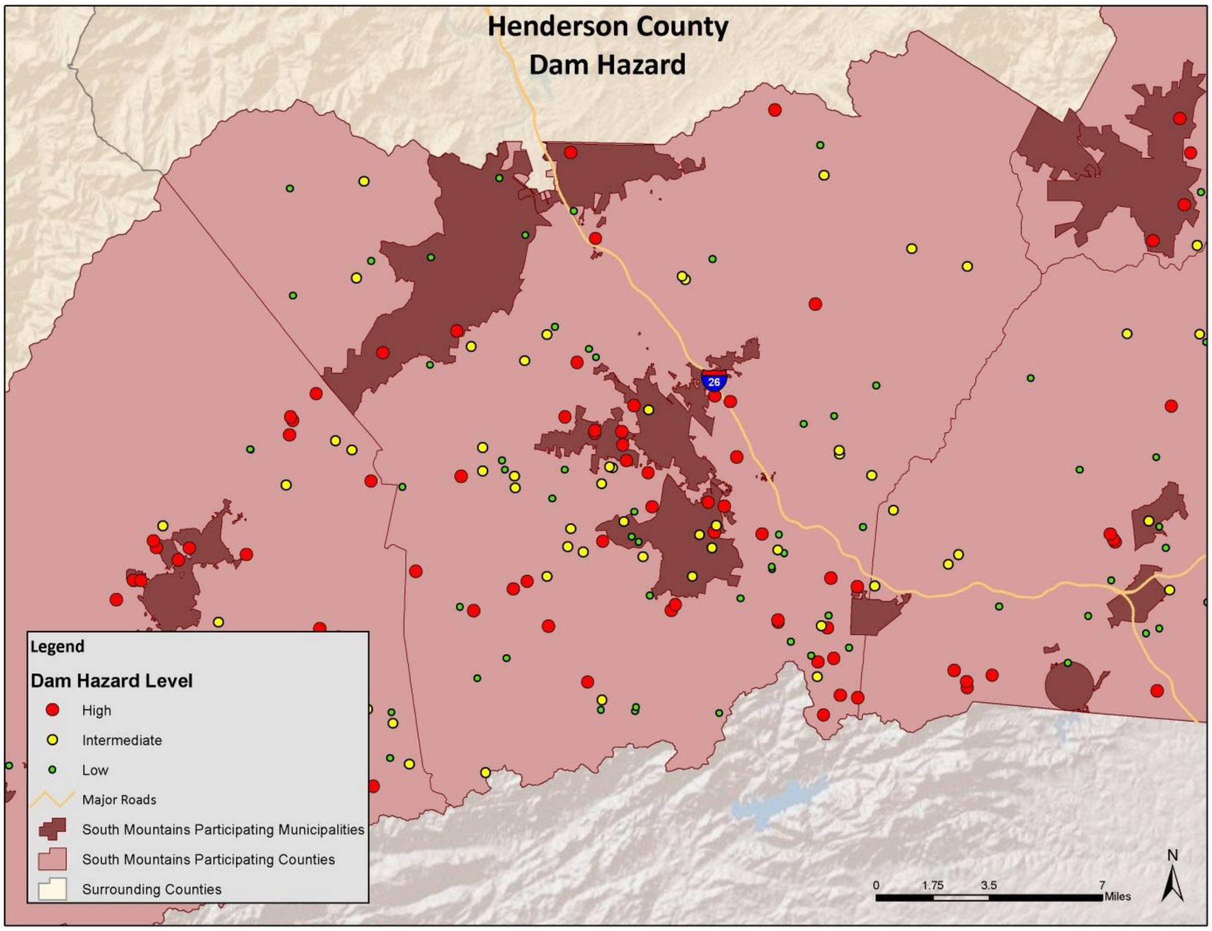
Probability of Future Occurrences
Based on historical information and the USGS susceptibility index, the probability of future landslide events is likely (10 to 100 percent probability). Local conditions may become more favorable for landslides due to heavy rain, for example. This would increase the likelihood of occurrence. It should also be noted that some areas in Henderson County have greater risk than others given factors such as steepness on slope and modification of slopes.

A.2.11 Dam and Levee Failure

Location and Spatial Extent

According to the North Carolina Division of Land Management there are 122 dams in Henderson County.[14] **Figure A.6** shows the dam location and the corresponding hazard ranking for each. Of these dams, 43 are classified as high hazard potential. These high hazard dams are listed in **Table A.21**.

FIGURE A.6: HENDERSON COUNTY DAM LOCATION AND HAZARD RANKING



Source: North Carolina Division of Land Resources, 2012

TABLE A.21: HENDERSON COUNTY HIGH HAZARD DAMS

Dam Name	Hazard Potential	Surface Area (acres)	Max Capacity (Ac-ft)	Owner Type
Henderson County				
Osceola Lake Dam	High	32.0	500	Private
Feeny Dam	High	10.0	225	Private

[14] The February 8, 2012 list of high hazard dams obtained from the North Carolina Division of Energy, Mineral, and Land Resources (http://portal.ncdenr.org/web/lr/dams) was reviewed and amended by local officials to the best of their knowledge.

Dam Name	Hazard Potential	Surface Area (acres)	Max Capacity (Ac-ft)	Owner Type
Blue Star Dam Upper	High	9.6	407	Private
Blue Star Dam Lower	High	5.0	85	Private
Orchard Lake Dam	High	6.0	60	Private
Crooked Creek Lake Dam	High	10.0	123	Private
Forge Mountain Grist Mill Dam	High	5.0	32	Private
Rhett Mill Dam	High	23.8	361	Private
Wolf Lake Dam	High	30.0	300	Private
Sky Lake Estate Dam	High	3.3	40	Private
Briar Lake Dam	High	2.0	12	Private
Star Lake Dam	High		0	Private
Jordan Mill Pond Dam	High	3.5	30	Private
Echo Lake Dam	High	4.0	27	Private
Meditation Lake Dam	High	4.0	15	Private
Laurel Park Lake Dam	High	4.0	0	Private
Lake Sheila Dam	High	40.0	1,024	Private
Camp Pinewood Lake Dam	High	6.0	25	Private
Rainbow Spring Lake Dam	High	3.0	13	Private
Sizemore Dam	High		25	Private
Camp Judaea Dam	High	2.5	15	Private
Spring Farm Pond Dam	High	1.0	10	Private
Hendersonville Country Club Dam	High	3.0	22	Private
Frady Dam	High	3.5	25	Private
Pettit Pond Dam	High	2.0	17	Private
Briggs Lake	High	2.0	0	Private
Hidden Valley Campground Dam	High	2.0	15	Private
Wolf Weinhold Dam	High	8.0	120	Private
Wilkes Dam	High	1.5	15	Private
Freeman Dam	High	4.4	67	Private
Delorenzo Dam	High	2.0	0	Private
Macedonia Lake Dam	High	7.8	130	Private
Little Lake Dam	High	2.4	43	Private
Carriage Park Dam	High	4.8	127	Private
General Electric Lighting Systems Dam	High	5.0	30	Private
Highland Lake SWDP Dam	High	0.0	0	Private
Bullings Creek Dam	High			Private
Perkins Dam	High	0.3	0	Private
Valmont Dam	High	1.1	0	Private
Blue Ridge Community College Dam	High	4.0	40	State
Tuxedo Dam Lake Summit	High	290.0	15,840	Utility
Tuxedo Saddle Dam	High	0.0	15,840	Utility
Lake Hosea Dam	High	6.4	77	

Source: North Carolina Division of Land Resources, 2012

It should also be noted that the North Carolina dam classification regulations were recently updated. As a result of the change, more dams are generally classified as high hazard.

Historical Occurrences

There has been one dam breach reported in the county, though it did not result in any injuries, deaths, or significant damage. However, it should be noted that several breach scenarios in the county could be catastrophic.

The information below identifies additional historical information reported in the previous county hazard mitigation plan.

Henderson County

There has been one incident of dam failure in Henderson County over the last 10 years. In 1995, this incident was located off Highway 64 E in Hendersonville and spilled onto Fruitland Road. The dam in question was a Class A dam and did not cause any damage to personal property. The water flowed from the dam onto Fruitland Road causing the road to be closed for a brief period. There were no injuries or deaths reported during this incident and there was no interruption to critical facilities.

Probability of Future Occurrences

Given the current dam inventory and historic data, a dam breach is unlikely (less than 1 percent annual probability) in the future. However, as has been demonstrated in the past, regular monitoring is necessary to prevent these events.

A.2.12 Erosion

Location and Spatial Extent

Erosion in Henderson County is typically caused by flash flooding events. Unlike coastal areas, where the soil is mainly composed of fine grained particles such as sand, Henderson County soils have much greater organic matter content. Furthermore, vegetation also helps to prevent erosion in the area. Erosion occurs in the county, particularly along the banks of rivers and streams, but it is not an extreme threat. No areas of concern were reported by the planning committee.

Historical Occurrences

Several sources were vetted to identify areas of erosion in Henderson County. This includes searching local newspapers, interviewing local officials, and reviewing the previous hazard mitigation plan. Erosion was addressed in the previous Henderson County hazard mitigation plan; however, it was found to be a relatively low-risk hazard. The information below identifies historical information presented in the plan.

Henderson County

There is no recorded history of injuries, deaths, or critical facilities loss due to erosion.

Probability of Future Occurrences

Erosion remains a natural, dynamic, and continuous process for Henderson County, and it will continue to occur. The annual probability level assigned for erosion is likely (between 10 and 100 percent).

A.2.13 Flood

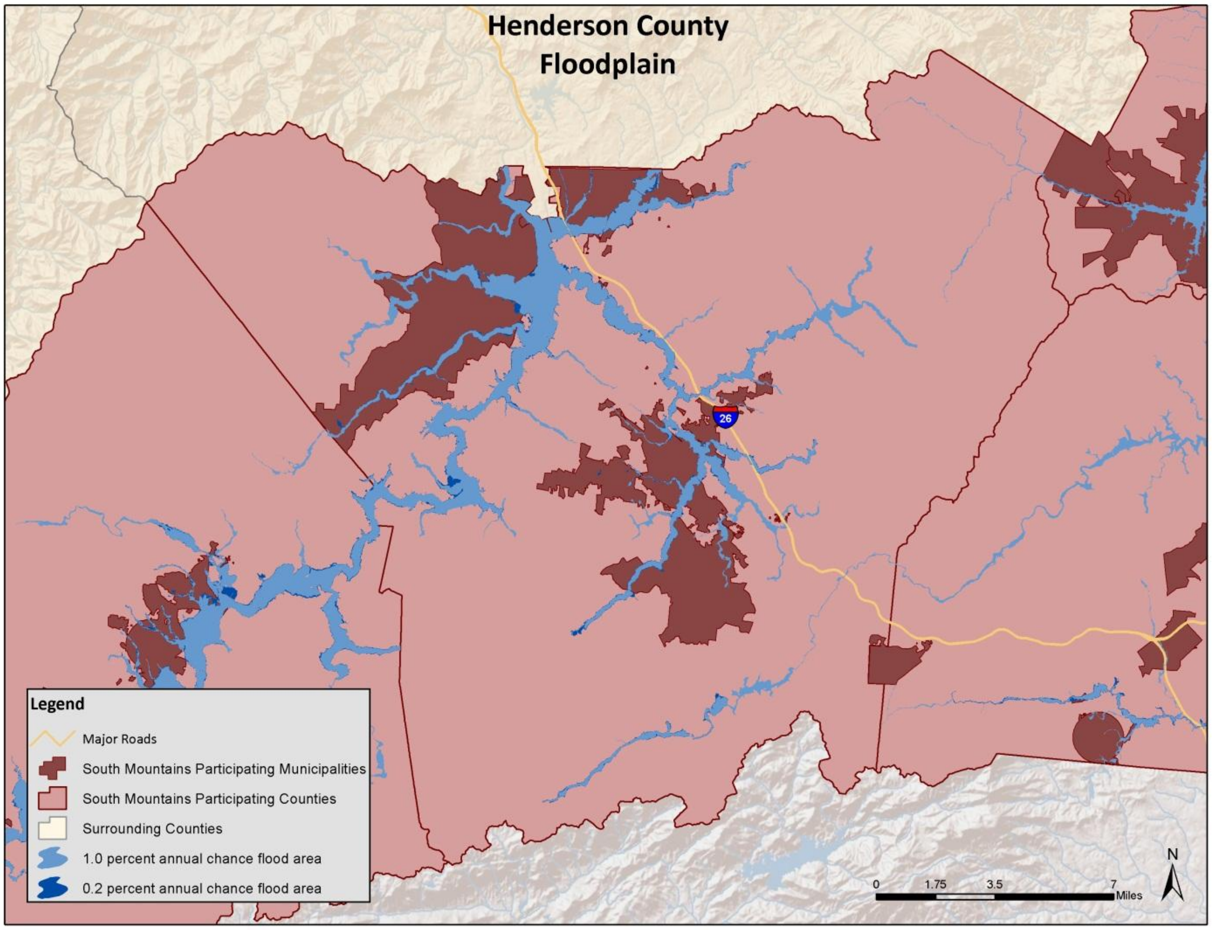
Location and Spatial Extent

There are areas in Henderson County that are susceptible to flood events. Special flood hazard areas in the county were mapped using Geographic Information System (GIS) and FEMA Digital Flood Insurance Rate Maps (DFIRM).[15] This includes Zone A (1-percent annual chance floodplain), Zone AE (1-percent annual chance floodplain with elevation), Zone X500 (0.2-percent annual chance floodplain). According to GIS analysis, of the 373 square miles that make up Henderson County, there are 31.46 square miles of land in zones A and AE (1-percent annual chance floodplain/100-year floodplain) and 2.15 square miles of land in zone X500 (0.2-percent annual chance floodplain/500-year floodplain).

These flood zone values account for 9.0 percent of the total land area in Henderson County. It is important to note that while FEMA digital flood data is recognized as best available data for planning purposes, it does not always reflect the most accurate and up-to-date flood risk. Flooding and flood-related losses often do occur outside of delineated special flood hazard areas. **Figure A.7**, **Figure A.8**, **Figure A.9**, **Figure A.10**, **Figure A.11**, and **Figure A.12** illustrate the location and extent of currently mapped special flood hazard areas for Henderson County and its municipalities based on best available FEMA Digital Flood Insurance Rate Map (DFIRM) data.

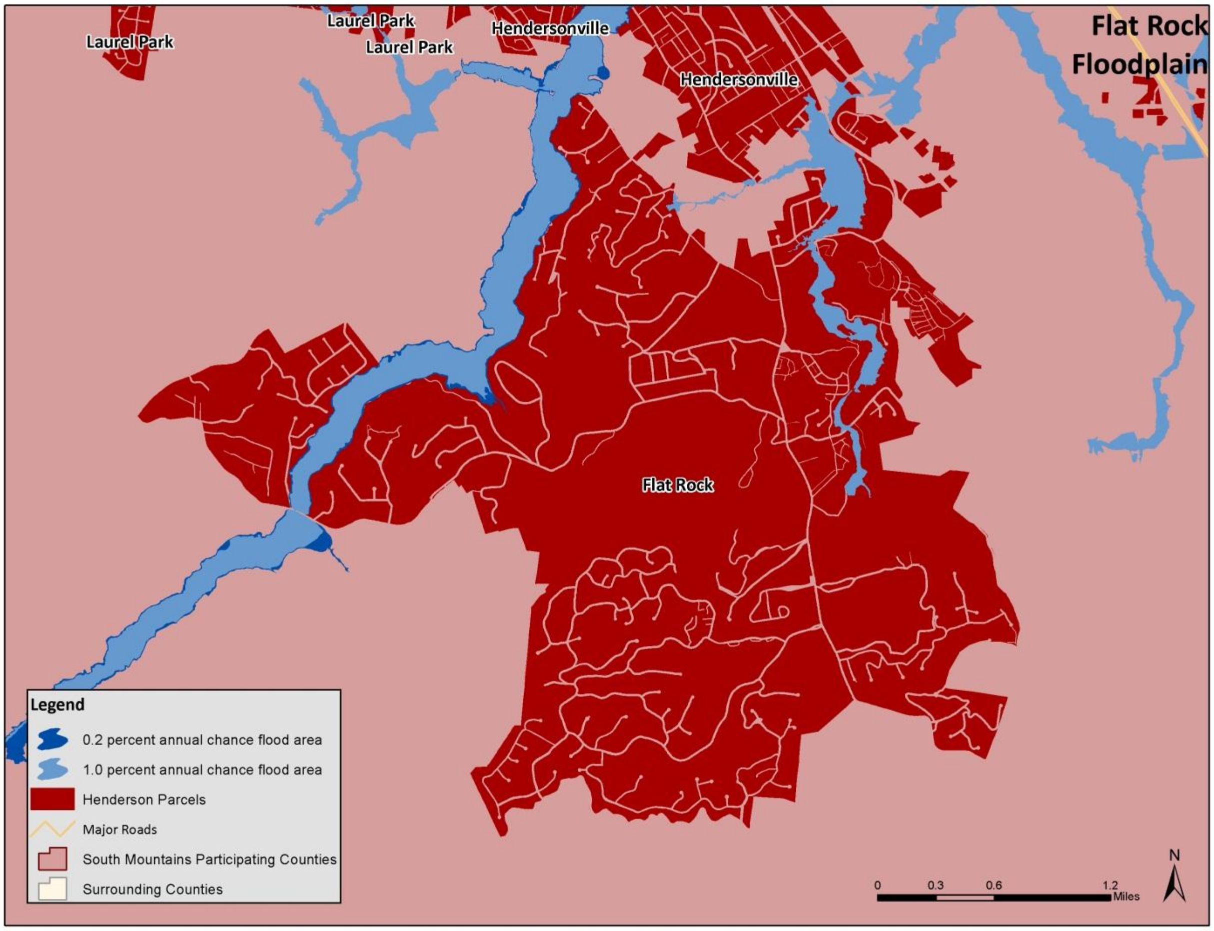
[15] The county-level DFIRM data used for Henderson County were updated in 2010.

FIGURE A.7: SPECIAL FLOOD HAZARD AREAS IN HENDERSON COUNTY



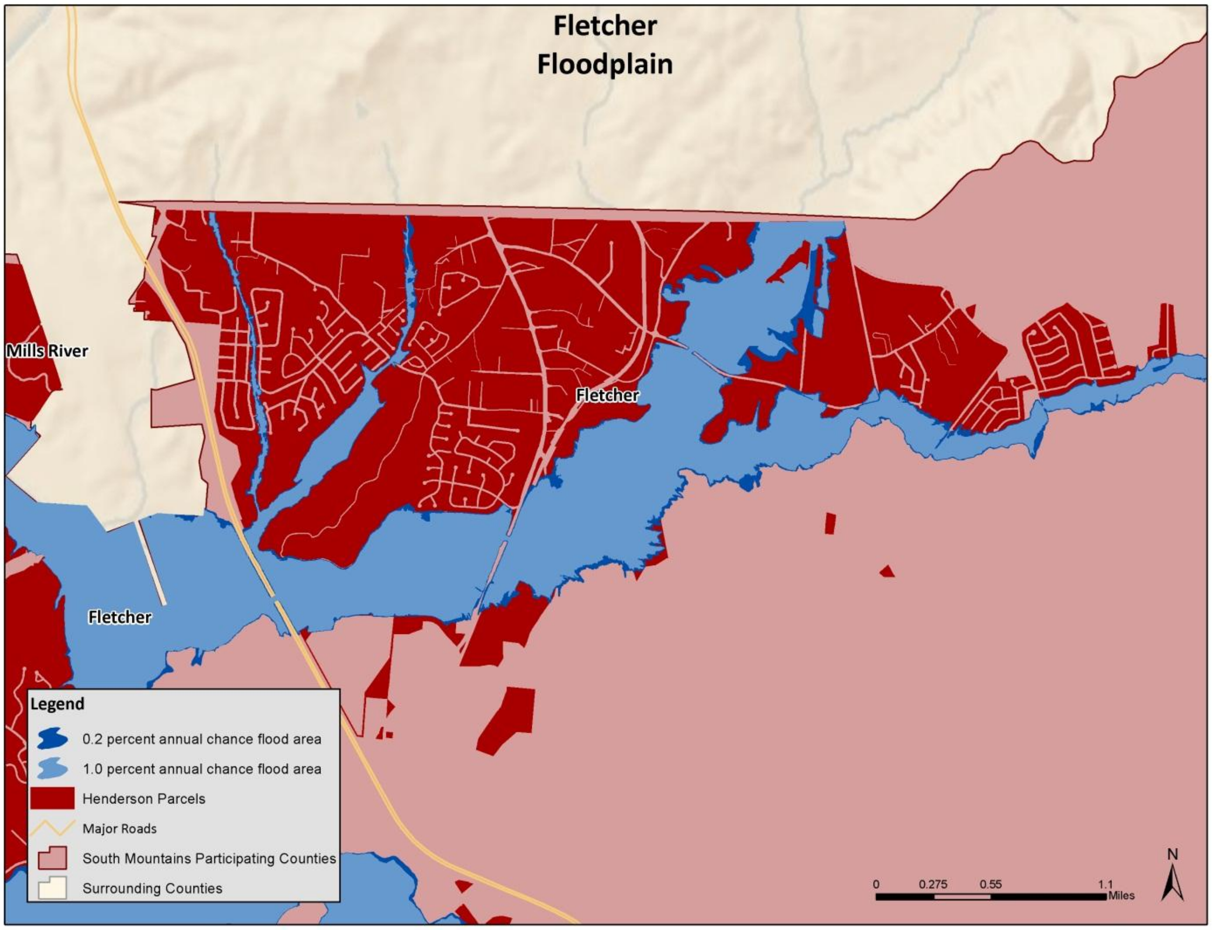
Source: Federal Emergency Management Agency

FIGURE A.8: SPECIAL FLOOD HAZARD AREAS IN FLAT ROCK



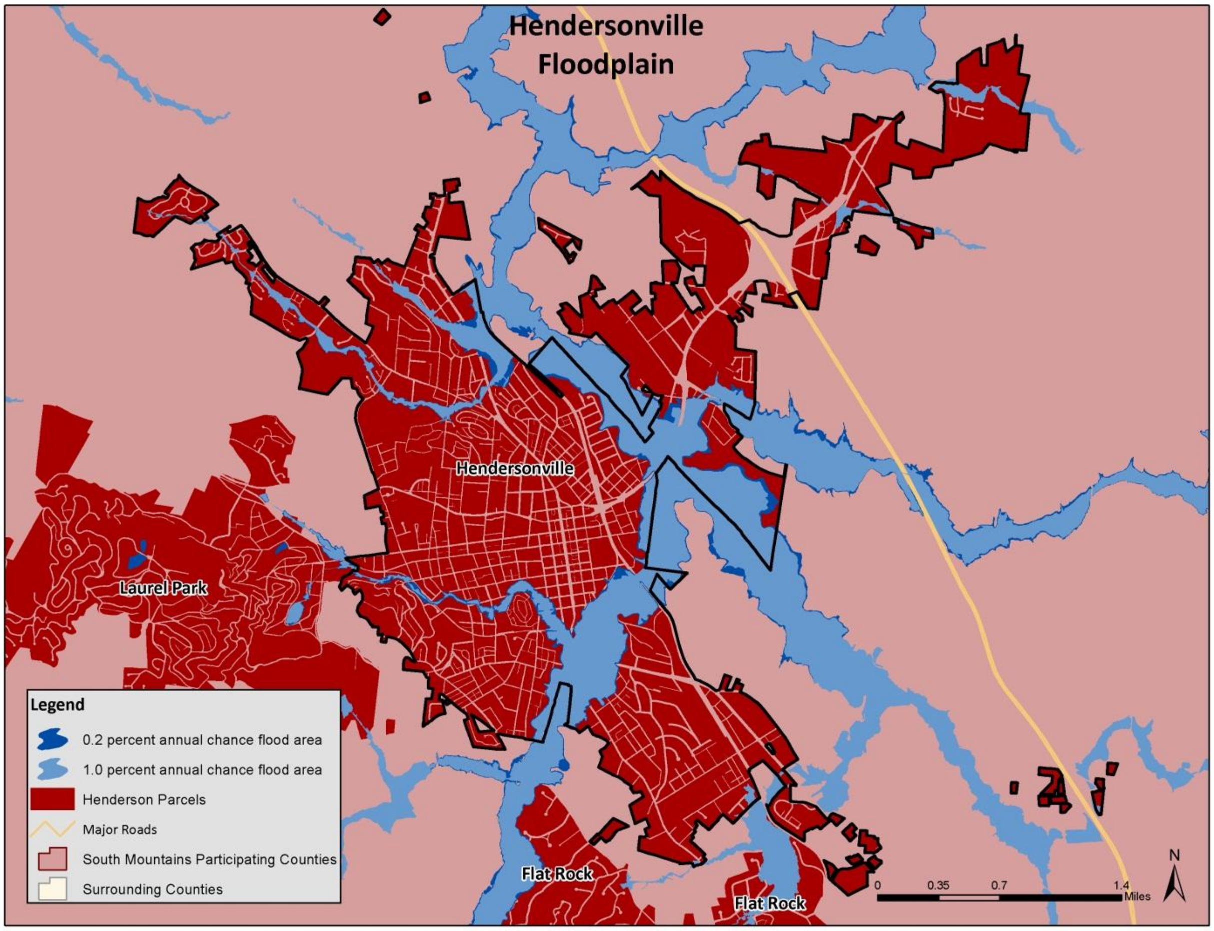
Source: Federal Emergency Management Agency

FIGURE A.9: SPECIAL FLOOD HAZARD AREAS IN FLETCHER



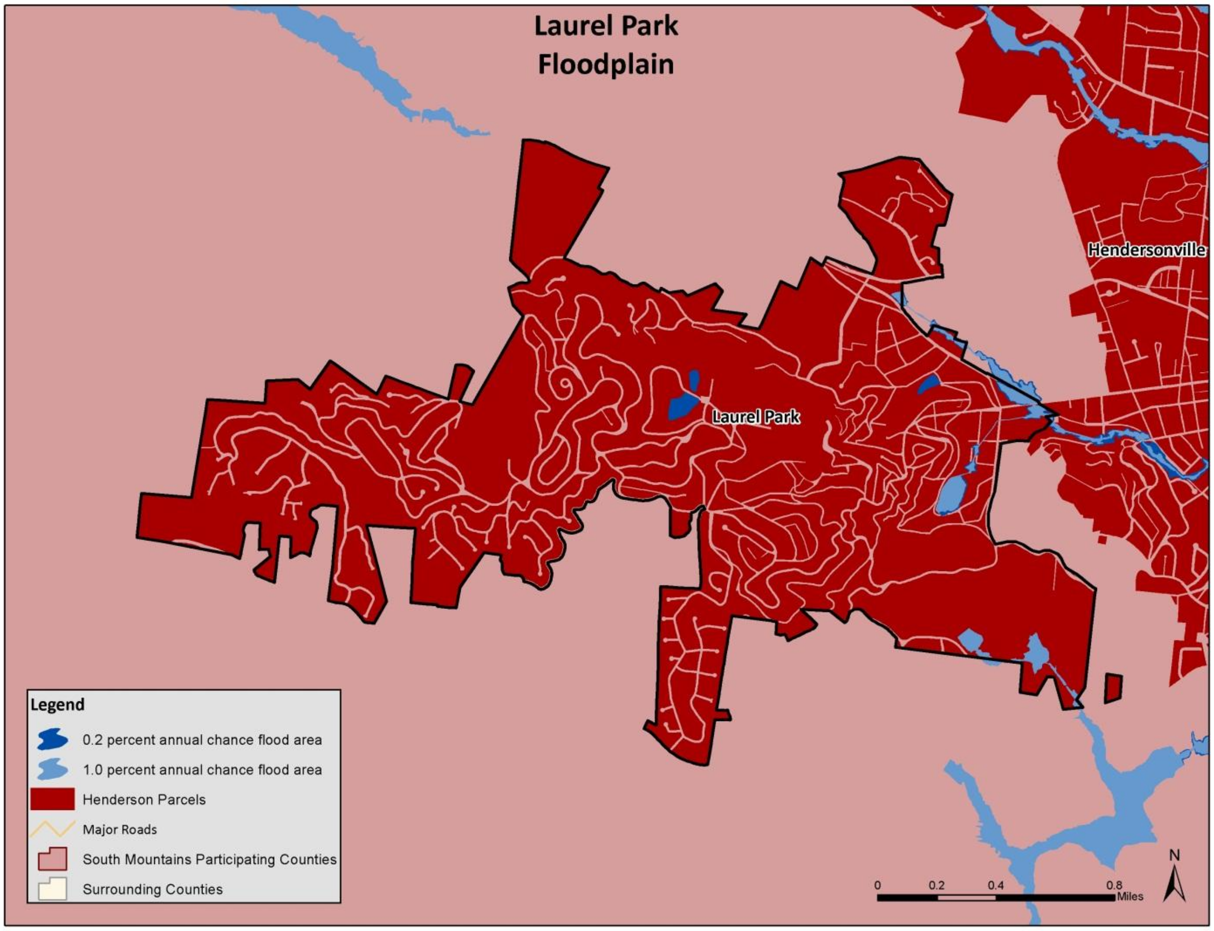
Source: Federal Emergency Management Agency

FIGURE A.10: SPECIAL FLOOD HAZARD AREAS IN HENDERSONVILLE



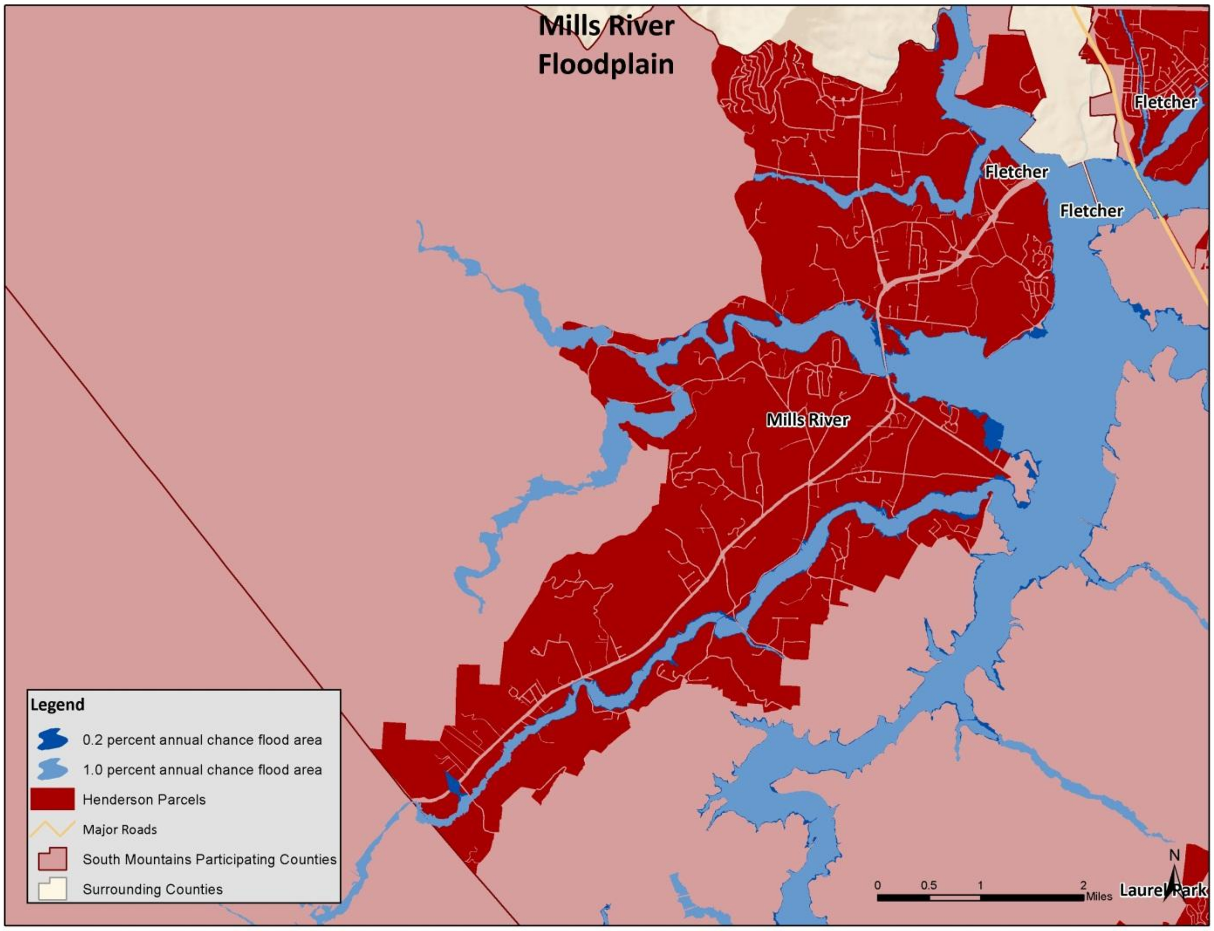
Source: Federal Emergency Management Agency

FIGURE A.11: SPECIAL FLOOD HAZARD AREAS IN LAUREL PARK



Source: Federal Emergency Management Agency

FIGURE A.12: SPECIAL FLOOD HAZARD AREAS IN MILLS RIVER



Source: Federal Emergency Management Agency

Historical Occurrences

Floods have resulted in one disaster declaration in Henderson County in 1977.[16] Information from the National Climatic Data Center was used to ascertain additional historical flood events. The National Climatic Data Center reported a total of 64 events in Henderson County since 1993.[17] A summary of these events is presented in **Table A.22**. These events accounted for over $8.5 million (2013 dollars) in property damage in the county.[18] In addition, one injury was reported. Specific information on flood events, including date, type of flooding, and deaths and injuries, can be found in **Table A.23**.

TABLE A.22: SUMMARY OF FLOOD OCCURRENCES IN HENDERSON COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Flat Rock	0	0/0	$0

[16] A complete listing of historical disaster declarations can be found in Section 4: *Hazard Profiles*.
[17] These events are only inclusive of those reported by NCDC. It is likely that additional occurrences have occurred and have gone unreported.
[18] The total damage amount was averaged over the number of affected counties when multiple counties were involved in the flood event.

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Fletcher	6	0/0	$66,287
Hendersonville	5	0/0	$165,709
Laurel Park	3	0/0	$0
Mills River	6	0/0	$11,091
Unincorporated Area	44	0/1	$8,258,967
HENDERSON COUNTY TOTAL	**64**	**0/1**	**$8,502,054**

Source: National Climatic Data Center

TABLE A.23: HISTORICAL FLOOD EVENTS IN HENDERSON COUNTY

	Date	Type	Deaths / Injuries	Property Damage*
Flat Rock				
None Reported	--	--	--	--
Fletcher				
Fletcher/ Naples	03-JUL-95	FLASH FLOOD	0/0	$66,287
FLETCHER	26-JUN-97	FLASH FLOOD	0/0	$0
FLETCHER	03-FEB-98	FLOOD	0/0	$0
FLETCHER	20-MAR-00	FLASH FLOOD	0/0	$0
FLETCHER	30-NOV-10	FLOOD	0/0	$0
FLETCHER	01-DEC-10	FLOOD	0/0	$0
Hendersonville				
HENDERSONVILLE	17-FEB-98	FLOOD	0/0	$0
HENDERSONVILLE	03-JUL-01	URBAN/SML STREAM FLD	0/0	$0
HENDERSONVILLE	04-AUG-03	FLASH FLOOD	0/0	$6,720
HENDERSONVILLE	05-AUG-03	FLASH FLOOD	0/0	$134,392
HENDERSONVILLE	05-SEP-06	FLASH FLOOD	0/0	$24,597
Laurel Park				
LAUREL PARK	28-NOV-11	FLASH FLOOD	0/0	$0
LAUREL PARK	28-NOV-11	FLASH FLOOD	0/0	$0
LAUREL PARK	22-DEC-11	FLASH FLOOD	0/0	$0
Mills River				
MILLS RIVER	09-JUL-97	FLASH FLOOD	0/0	$0
MILLS RIVER	20-SEP-09	FLOOD	0/0	$0
MILLS RIVER	21-SEP-09	FLOOD	0/0	$0
MILLS RIVER	11-NOV-09	FLASH FLOOD	0/0	$5,628
MILLS RIVER	11-NOV-09	FLOOD	0/0	$0
MILLS RIVER	24-JAN-10	FLOOD	0/0	$5,464
Unincorporated Area				
HENDERSON COUNTY	23-MAR-93	FLASH FLOODS	0	$0
Bat Cave	27-AUG-95	FLASH FLOOD	0	$0
Tuxedo	27-AUG-95	FLASH FLOOD	0	$0
Johnston	28-AUG-95	FLOOD	0	$195,546
Northern	05-OCT-95	FLASH FLOOD	0	$0
Various	05-OCT-95	FLASH FLOOD	0	$0

	Date	Type	Deaths / Injuries	Property Damage*
HENDERSON COUNTY	18-JAN-96	FLOOD	0	$0
HENDERSON COUNTY	26-JAN-96	FLOOD	0	$3,218
BAT CAVE	04-SEP-96	FLASH FLOOD	0/1	$321,822
COUNTYWIDE	01-DEC-96	FLASH FLOOD	0	$0
MOUNTAIN HOME	14-MAR-97	FLOOD	0	$0
COUNTYWIDE	07-JAN-98	FLOOD	0	$774,446
COUNTYWIDE	03-FEB-98	FLOOD	0	$0
CENTRAL PORTION	19-APR-98	FLOOD	0	$0
COUNTYWIDE	24-DEC-02	FLASH FLOOD	0	$0
HENDERSON COUNTY	22-FEB-03	FLOOD	0	$0
HENDERSON COUNTY	10-APR-03	FLOOD	0	$0
CENTRAL PORTION	06-MAY-03	FLASH FLOOD	0	$0
HENDERSON COUNTY	06-FEB-04	FLOOD	0	$0
HENDERSON COUNTY	14-JUN-04	FLOOD	0	$0
SOUTH PORTION	07-SEP-04	FLASH FLOOD	0	$0
HENDERSON COUNTY	07-SEP-04	FLOOD	0	$4,566,706
HENDERSON COUNTY	17-SEP-04	FLOOD	0	$2,028,922
COUNTYWIDE	27-SEP-04	FLASH FLOOD	0	$1,305
COUNTYWIDE	27-JUN-05	FLASH FLOOD	0	$76,006
ETOWAH	04-JUL-05	FLASH FLOOD	0	$0
HENDERSON COUNTY	07-JUL-05	FLOOD	0	$0
BAT CAVE	26-JUN-06	FLOOD	0	$0
COUNTYWIDE	26-JUN-06	FLASH FLOOD	0	$245,975
ASHEVILLE RGNL ARPT	14-MAY-09	FLASH FLOOD	0	$11,255
HOOPERS CREEK	08-JUN-09	FLASH FLOOD	0	$11,255
MOUNTAIN HOME	20-SEP-09	FLASH FLOOD	0	$22,510
FRUITLAND	25-DEC-09	FLASH FLOOD	0	$0
FRUITLAND	24-JAN-10	FLASH FLOOD	0	$0
ETOWAH	06-FEB-10	FLOOD	0	$0
FRUITLAND	30-NOV-10	FLASH FLOOD	0	$0
DRUID HILLS	06-MAR-11	FLASH FLOOD	0	$0
ETOWAH	06-MAR-11	FLOOD	0	$0
DRUID HILLS	06-MAR-11	FLOOD	0	$0
DRUID HILLS	09-MAR-11	FLASH FLOOD	0	$0
DRUID HILLS	09-MAR-11	FLOOD	0	$0
ETOWAH	09-MAR-11	FLOOD	0	$0
DRUID HILLS	16-APR-11	FLASH FLOOD	0	$0
BARKER HGTS	14-MAY-12	FLASH FLOOD	0	$0

*Property damage is reported in 2013 dollars; All damage may not have been reported.
Source: National Climatic Data Center

Historical Summary of Insured Flood Losses

According to FEMA flood insurance policy records as of June 2013, there have been 122 flood losses reported in Henderson County through the National Flood Insurance Program (NFIP) since 1978, totaling nearly $1.6 million in claims payments. A summary of these figures for the county is provided in **Table A.24**. It should be emphasized that these numbers include only those losses to structures that were insured through the NFIP policies, and for losses in which claims were sought and received. It is likely that many additional instances of flood loss in Henderson County were either uninsured, denied claims payment, or not reported.

TABLE A.24: SUMMARY OF INSURED FLOOD LOSSES IN HENDERSON COUNTY

Location	Flood Losses	Claims Payments
Flat Rock	0	$0
Fletcher	1	$14,745
Hendersonville	116	$1,336,191
Laurel Park	1	$2,980
Mills River*	--	--
Unincorporated Area	4	$239,353
HENDERSON COUNTY TOTAL	**122**	**$1,593,269**

*This community does not participate in the National Flood Insurance Program. Therefore, no values are reported.
Source: FEMA, NFIP

Repetitive Loss Properties

FEMA defines a repetitive loss property as any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling 10-year period, since 1978. A repetitive loss property may or may not be currently insured by the NFIP. Currently there are over 140,000 repetitive loss properties nationwide.

As of October 2013, there are 14 non-mitigated repetitive loss property located in Henderson County, which accounted for 55 losses and almost $1 million in claims payments under the NFIP. The average claim amount for these properties is $16,969. There are 3 single family residential properties and 11 non-residential properties. Without mitigation this property will likely continue to experience flood losses. **Table A.25** presents detailed information on repetitive loss properties and NFIP claims and policies for Henderson County.

TABLE A.25: REPETITIVE LOSS PROPERTIES IN HENDERSON COUNTY

Location	Number of Properties	Types of Properties	Number of Losses	Building Payments	Contents Payments	Total Payments	Average Payment
Flat Rock	0	0	0	$0	$0	$0	$0
Fletcher	0	0	0	$0	$0	$0	$0
Hendersonville	14	3 single family, 11 commercial	55	$637,494	$355,807	$993,301	$16,969
Laurel Park	0	0	0	$0	$0	$0	$0
Mills River*	--	--	--	--	--	--	--
Unincorporated Area	0	0	0	$0	$0	$0	$0
HENDERSON COUNTY TOTAL	**14**		**55**	**$637,494**	**$355,807**	**$993,301**	**$16,969**

* These communities do not participate in the National Flood Insurance Program. Therefore, no values are reported.
Source: National Flood Insurance Program

Probability of Future Occurrences

Flood events will remain a threat in areas prone to flooding in Henderson County, and the probability of future occurrences will remain likely (between 10 and 100 percent annual probability). The participating jurisdictions and unincorporated areas of the county have risk to flooding, though not all areas will experience floods. The probability of future flood events based on magnitude and according to best available data is illustrated in the figures above, which indicates those areas susceptible to the 1-percent annual chance flood (100-year floodplain) and the 0.2-percent annual chance flood (500-year floodplain).

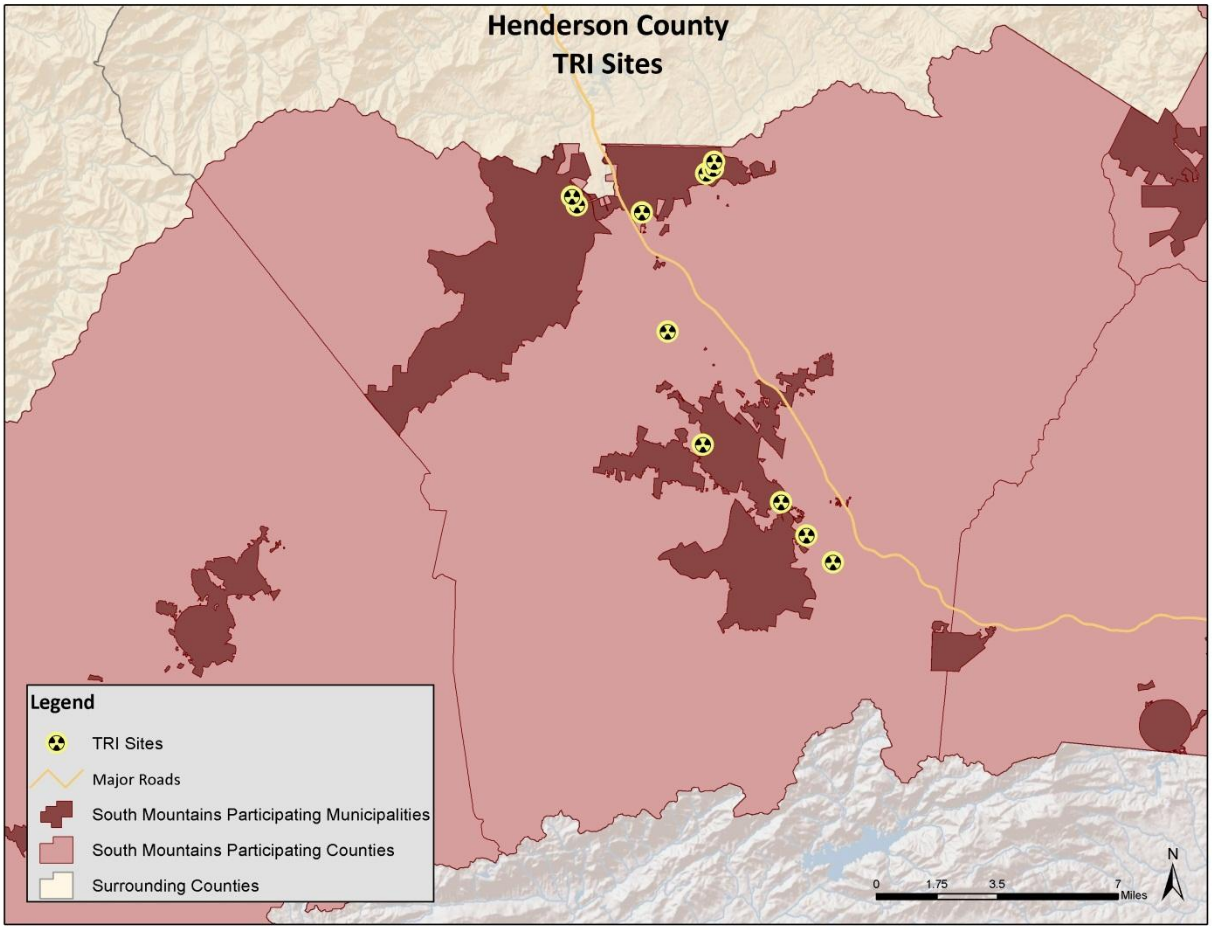
It can be inferred from the floodplain location maps, previous occurrences, and repetitive loss properties that risk varies throughout the county and participating jurisdictions. For example, Hendersonville and Fletcher have more floodplain and thus a higher risk of flood than other municipalities. Flood is not the greatest hazard of concern but will continue to occur and cause damage. Therefore, mitigation actions may be warranted, particularly for repetitive loss properties.

A.2.14 Hazardous Materials Incidents

Location and Spatial Extent

Henderson County has 11 TRI sites. These sites are shown in **Figure A.13.**

FIGURE A.13: TOXIC RELEASE INVENTORY (TRI) SITES IN HENDERSON COUNTY



Source: EPA

In addition to "fixed" hazardous materials locations, hazardous materials may also impact the county via roadways and rail. Many roads in the county are narrow and winding, making hazardous material transport in the area especially treacherous. All roads that permit hazardous material transport are considered potentially at risk to an incident.

Historical Occurrences

There have been a total of 42 recorded HAZMAT incidents in Henderson County since 1983 (**Table A.26**). **Table A.27** presents detailed information on historic HAZMAT incidents in Henderson County as reported by the U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA).

TABLE A.26: SUMMARY OF HAZMAT INCIDENTS IN HENDERSON COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Flat Rock	0	--	--
Fletcher	34	0/0	$0
Hendersonville	1	0/0	$0

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Laurel Park	0	--	--
Mills River	0	--	--
Unincorporated Area	7	0/0	$0
HENDERSON COUNTY TOTAL	**42**	**0/0**	**$0**

Source: USDOT PHMSA

TABLE A.27: HAZMAT INCIDENTS IN HENDERSON COUNTY

Report Number	Date	City	Mode	Serious Incident?	Fatalities / Injuries	Damages ($)*	Quantity Released
Flat Rock							
None Reported	--	--	--	--	--	--	--
Fletcher							
I-1982120305	12/3/1982	FLETCHER	Highway	No	0/0	$0	1 LGA
I-1983110246	11/1/1983	FLETCHER	Highway	No	0/0	$0	5 LGA
I-1986090493	9/11/1986	FLETCHER	Highway	No	0/0	$0	25 LGA
I-1987090207	8/14/1987	FLETCHER	Highway	No	0/0	$0	0
I-1990020456	2/3/1990	FLETCHER	Highway	No	0/0	$0	0.007813 LGA
I-1990020461	2/12/1990	FLETCHER	Highway	No	0/0	$0	0.25 LGA
I-1992060739	6/15/1992	FLETCHER	Highway	No	0/0	$0	0.1875 LGA
I-1994110616	10/30/1994	FLETCHER	Highway	No	0/0	$0	0.5 LGA
I-1999070611	6/25/1999	FLETCHER	Highway	No	0/0	$0	0.25 LGA
I-1999071466	7/7/1999	FLETCHER	Highway	No	0/0	$0	0.25 LGA
I-1999071467	7/7/1999	FLETCHER	Highway	No	0/0	$0	2.3 LGA
I-1999071174	7/14/1999	FLETCHER	Highway	No	0/0	$0	0.25 LGA
I-1999110408	10/26/1999	FLETCHER	Highway	No	0/0	$0	0.023438 LGA
I-2000040787	4/3/2000	FLETCHER	Highway	No	0/0	$0	1 LGA
I-2000070504	6/21/2000	FLETCHER	Highway	No	0/0	$0	0.75 LGA
I-2000120730	12/5/2000	FLETCHER	Highway	No	0/0	$0	0.5 LGA
I-2001070316	6/25/2001	FLETCHER	Highway	No	0/0	$0	0.125 LGA
I-2002061681	6/17/2002	FLETCHER	Highway	No	0/0	$0	0
I-2002100123	9/12/2002	FLETCHER	Highway	No	0/0	$0	0.0625 LGA
I-2003060341	5/29/2003	FLETCHER	Highway	No	0/0	$0	0.015625 LGA
I-2003070187	6/5/2003	FLETCHER	Highway	No	0/0	$0	1 LGA
I-2003110691	11/5/2003	FLETCHER	Highway	No	0/0	$0	0.528344 LGA
I-2004010349	1/5/2004	FLETCHER	Highway	No	0/0	$0	10 SLB
I-2005010945	10/25/2004	FLETCHER	Highway	No	0/0	$0	1 LGA
I-2005080171	4/25/2005	FLETCHER	Highway	No	0/0	$0	0.015625 LGA
I-2005090463	5/19/2005	FLETCHER	Highway	No	0/0	$0	0.007812 LGA
X-2006100367	9/14/2006	FLETCHER	Highway	No	0/0	$0	0.015625 LGA
X-2006120152	10/14/2006	FLETCHER	Highway	No	0/0	$0	1.25 SLB
I-2007010328	12/21/2006	FLETCHER	Highway	No	0/0	$0	0.25 LGA
X-2007080172	8/8/2007	FLETCHER	Highway	No	0/0	$0	1 SLB
X-2008030044	2/27/2008	FLETCHER	Highway	No	0/0	$0	0.023438 LGA
X-2008060114	5/22/2008	FLETCHER	Highway	No	0/0	$0	0.26418 LGA
X-2008080068	7/14/2008	FLETCHER	Highway	No	0/0	$0	0.5 LGA

Report Number	Date	City	Mode	Serious Incident?	Fatalities / Injuries	Damages ($)*	Quantity Released
X-2008100150	9/23/2008	FLETCHER	Highway	No	0/0	$0	0.5 LGA
Hendersonville							
I-2009020080	1/13/2009	HENDERSONVILLE	Highway	No	0/0	$0	0.03125 LGA
Laurel Park							
None Reported	--	--	--	--	--	--	--
Mills River							
None Reported	--	--	--	--	--	--	--
Unincorporated Area							
I-2000061618	2/10/2000	HENDERSON	Highway	No	0/0	$0	0.023438 LGA
X-2009060035	5/19/2009	Horse Shoe	Highway	No	0/0	$0	0.015625 LGA
X-2009060188	5/29/2009	Horse Shoe	Highway	No	0/0	$0	0.26418 LGA
X-2009070249	6/19/2009	Horse Shoe	Highway	No	0/0	$0	0.5 LGA
X-2009080388	8/7/2009	Horse Shoe	Highway	No	0/0	$0	0.25 LGA
X-2009120068	11/14/2009	Horse Shoe	Highway	No	0/0	$0	0.015625 LGA
X-2011080203	7/14/2011	Horse Shoe	Highway	No	0/0	$0	0.52836 LGA

*Property damage is reported in 2013 dollars.
Source: USDOT PHMSA

Probability of Future Occurrences

Given the location of 11 toxic release inventory sites in Henderson County and prior roadway incidents, it is possible that a hazardous material incident may occur in the county (between 1 and 10 percent annual probability). County and town officials are mindful of this possibility and take precautions to prevent such an event from occurring. Furthermore, there are detailed plans in place to respond to an occurrence. The county may also be impacted by neighboring counties which also face risk due to TRI sites.

A.2.15 Wildfire

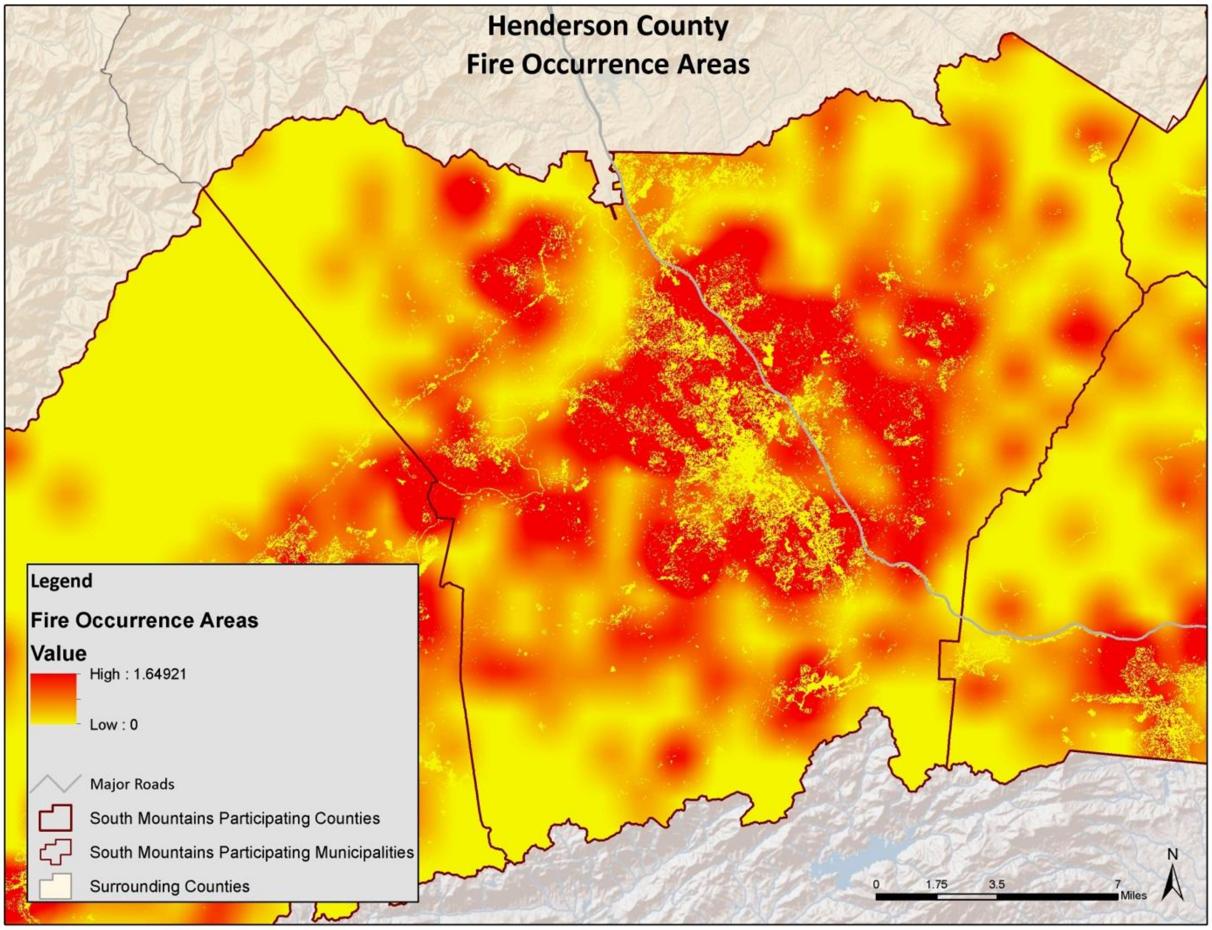
Location and Spatial Extent

The entire county is at risk to a wildfire occurrence. However, several factors such as drought conditions or high levels of fuel on the forest floor, may make a wildfire more likely. Furthermore, areas in the urban-wildland interface are particularly susceptible to fire hazard as populations abut formerly undeveloped areas. The Fire Occurrence Areas in the figure below give an indication of historic location.

Historical Occurrences

Figure A.14 shows the Fire Occurrence Areas (FOA) in Henderson County based on data from the Southern Wildfire Risk Assessment. This data is based on historical fire ignitions and is reported as the number of fires that occur per 1,000 acres each year.

FIGURE A.14: HISTORIC WILDFIRE EVENTS IN HENDERSON COUNTY



Source: Southern Wildfire Risk Assessment

Based on data from the North Carolina Division of Forest Resources from 2003 to 2012, Henderson County experienced an average of 51 wildfires annually which burn an average of 99 acres per year. The data indicates that most of these fires are small, averaging 2 acres per fire. **Table A.28** lists the number of reported wildfire occurrences in the county between the years 2003 and 2012.

TABLE A.28: HISTORICAL WILDFIRE OCCURRENCES IN HENDERSON COUNTY

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Henderson County										
Number of Fires	29	46	45	77	72	53	35	43	54	49
Number of Acres	31.1	134.0	66.1	220.8	186.4	55.6	55.2	55.2	44.2	145.8

Source: North Carolina Division of Forest Resources

Probability of Future Occurrences

Wildfire events will be an ongoing occurrence in Henderson County. The likelihood of wildfires increases during drought cycles and abnormally dry conditions. Fires are likely to stay small in size but could increase due to local climate and ground conditions. Dry, windy conditions with an accumulation of forest floor fuel (potentially due to ice storms or lack of fire) could create conditions for a large fire that spreads quickly. It should also be noted that some areas do vary somewhat in risk. For example, highly developed areas are less susceptible unless they are located near the urban-wildland boundary. The risk will also vary due to assets. Areas in the urban-wildland interface will have much more property at risk, resulting in increased vulnerability and need to mitigate compared to rural, mainly forested areas. In this case, the participating jurisdictions appear to have a similar risk to the surrounding areas. The probability assigned to Henderson County for future wildfire events is likely (10 to 100 percent annual probability).

A.2.16 Conclusions on Hazard Risk

The hazard profiles presented above were developed using best available data and result in what may be considered principally a qualitative assessment as recommended by FEMA in its "How-to" guidance document titled *Understanding Your Risks: Identifying Hazards and Estimating Losses* (FEMA Publication 386-2). It relies heavily on historical and anecdotal data, stakeholder input, and professional and experienced judgment regarding observed and/or anticipated hazard impacts. It also carefully considers the findings in other relevant plans, studies, and technical reports.

Hazard Extent

Table A.29 describes the extent of each natural hazard identified for Henderson County. The extent of a hazard is defined as its severity or magnitude, as it relates to the planning area.

TABLE A.29: EXTENT OF HENDERSON COUNTY HAZARDS

Atmospheric Hazards	
Drought	Drought extent is defined by the North Carolina Drought Monitor Classifications which include Abnormally Dry, Moderate Drought, Severe Drought, Extreme Drought, and Exceptional Drought (page 5:6). According to the North Carolina Drought Monitor Classifications, the most severe drought condition is Exceptional. Henderson County has received this ranking three times over the fourteen-year reporting period.
Extreme Heat	The extent of extreme heat can be defined by the maximum temperature reached. The highest temperature recorded in Henderson County is 101 degrees Fahrenheit on August 23, 1983.
Hailstorm	Hail extent can be defined by the size of the hail stone. The largest hail stone reported in Henderson County was 2.5 inches (reported on May 1, 2012). It should be noted that future events may exceed this.
Hurricane and Tropical Storm	Hurricane extent is defined by the Saffir-Simpson Scale which classifies hurricanes into Category 1 through Category 5 (Table 5.9). The greatest classification of hurricane to traverse directly through Henderson County were 2 unnamed storms in 1901 and 1902. These storms carried tropical force winds of 31 knots. Although the county is much more likely to be impacted by the remnants of a hurricane or tropical storm, these events demonstrate that Category 2 or 3 storms can and have impacted the county.
Lightning	According to the Vaisala flash density map (Figure 5.5), Henderson County is located in an area that experiences 2 to 4 lightning flashes per square kilometer per year. It should be noted that future lightning occurrences may exceed these figures.

Thunderstorm Wind / High Wind	Thunderstorm extent is defined by the number of thunder events and wind speeds reported. According to a 63-year history from the National Climatic Data Center, the strongest recorded wind event in Henderson County was reported on April 15, 2007 at 70 knots (approximately 81 mph). It should be noted that future events may exceed these historical occurrences.
Tornado	Tornado hazard extent is measured by tornado occurrences in the US provided by FEMA (Figure 5.6) as well as the Fujita/Enhanced Fujita Scale (Tables 5.14 and 5.15). The greatest magnitude reported in the county was an F1 (last reported on August 17, 1977).
Winter Storm and Freeze	The extent of winter storms can be measured by the amount of snowfall received (in inches). The greatest 24-hour snowfall reported in Henderson County was 22 inches on March 2, 1942. Due to extreme variations in elevation throughout the county, extent totals will vary for each participating jurisdiction and reliable data on snowfall totals is not available.
Geologic Hazards	
Earthquake	Earthquake extent can be measured by the Richter Scale (Table 5.18) and the Modified Mercalli Intensity (MMI) scale (Table 5.19) and the distance of the epicenter from Henderson County. According to data provided by the National Geophysical Data Center, the greatest MMI to impact the county was VI (strong) with a correlating Richter Scale measurement of approximately 5.4 (last reported on May 5, 1981). The epicenter of this earthquake was located 10.0 km away.
Landslide	As noted above in the landslide profile, the landslide data provided by the North Carolina Geological survey is incomplete. This provides a challenge when trying to determine an accurate extent for the landslide hazard. However, when using the USGS landslide susceptibility index, extent can be measured with incidence, which is between low and moderate in Henderson County. There is also high susceptibility throughout the county.
Hydrologic Hazards	
Dam Failure	Dam failure extent is defined using the North Carolina Division of Land Resources criteria (Table 5.23). Of the 122 dams in Henderson County, 43 are classified as high-hazard.
Erosion	The extent of erosion can be defined by the measurable rate of erosion that occurs. There are no erosion rate records located in Henderson County.
Flood	Flood extent can be measured by the amount of land and property in the floodplain as well as flood height and velocity. The amount of land in the floodplain accounts for 9.0 percent of the total land area in Henderson County. Flood depth and velocity are recorded via United States Geological Survey stream gages throughout the region. While a gage does not exist for each participating jurisdiction, there is one at or near many areas. The greatest peak discharge recorded for the county was at the French Broad River near Fletcher on September 8, 2004. Water reached a discharge of 25,500 cubic feet per second and the stream gage height was recorded at 20.13 feet.
Other Hazards	
Hazardous Materials Incident	According to USDOT PHMSA, the largest hazardous materials incident reported in the county was 25 LGA released on the highway in Fletcher on September 11, 1986. It should be noted that larger events are possible.

Wildfire	Wildfire data was provided by the North Carolina Division of Forest Resources and is reported annually by county from 2003-2012. The greatest number of fires to occur in Henderson County in any year was 77 in 2006. The greatest number of acres to burn in the county in a single year occurred in 2006 when 221 acres were burned. Although this data lists the extent that has occurred, larger and more frequent wildfires are possible throughout the county.

Priority Risk Index Results

In order to draw some meaningful planning conclusions on hazard risk for Henderson County, the results of the hazard profiling process were used to generate countywide hazard classifications according to a "Priority Risk Index" (PRI). More information on the PRI and how it was calculated can be found in Section 5.18.2.

Table A.30 summarizes the degree of risk assigned to each category for all initially identified hazards based on the application of the PRI. Assigned risk levels were based on the detailed hazard profiles developed for this section, as well as input from the Regional Hazard Mitigation Planning Committee. The results were then used in calculating PRI values and making final determinations for the risk assessment.

TABLE A.30: SUMMARY OF PRI RESULTS FOR HENDERSON COUNTY

Hazard	Category/Degree of Risk					
	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Atmospheric Hazards						
Drought	Likely	Minor	Large	More than 24 hours	More than 1 week	**2.5**
Extreme Heat	Possible	Minor	Large	More than 24 hours	Less than 1 week	**2.1**
Hailstorm	Highly Likely	Limited	Moderate	Less than 6 hours	Less than 6 hours	**2.9**
Hurricane and Tropical Storm	Possible	Limited	Large	More than 24 hours	Less than 24 hours	**2.3**
Lightning	Highly Likely	Minor	Negligible	Less than 6 hours	Less than 6 hours	**2.2**
Thunderstorm / High Wind	Highly Likely	Critical	Moderate	6 to 12 hours	Less than 6 hours	**3.1**
Tornado	Possible	Critical	Small	Less than 6 hours	Less than 6 hours	**2.4**
Winter Storm and Freeze	Highly Likely	Critical	Large	More than 24 hours	Less than 1 week	**3.3**
Geologic Hazards						
Earthquake	Possible	Minor	Moderate	Less than 6 hours	Less than 6 hours	**2.0**
Landslide	Likely	Critical	Small	Less than 6 hours	Less than 6 hours	**2.5**
Hydrologic Hazards						
Dam and Levee Failure	Unlikely	Critical	Moderate	Less than 6 hours	Less than 6 hours	**2.3**
Erosion	Likely	Minor	Small	More than 24 hours	More than 1 week	**2.1**
Flood	Likely	Critical	Moderate	6 to 12 hours	Less than 1 week	**3.0**
Other Hazards						
Hazardous Materials Incident	Possible	Limited	Small	Less than 6 hours	Less than 24 hours	**2.2**
Wildfire	Likely	Minor	Moderate	Less than 6 hours	Less than 1 week	**2.6**

A.2.17 Final Determinations on Hazard Risk

The conclusions drawn from the hazard profiling process for Henderson County, including the PRI results and input from the Regional Hazard Mitigation Planning Committee, resulted in the classification of risk for each identified hazard according to three categories: High Risk, Moderate Risk, and Low Risk (**Table A.31**). For purposes of these classifications, risk is expressed in relative terms according to the estimated impact that a hazard will have on human life and property throughout all of Henderson County. A more quantitative analysis to estimate potential dollar losses for each hazard has been performed separately, and is described in Section 6: *Vulnerability Assessment* and below in Section A.3. It should be noted that although some hazards are classified below as posing low risk, their occurrence of varying or unprecedented magnitudes is still possible in some cases and their assigned classification will continue to be evaluated during future plan updates.

TABLE A.31: CONCLUSIONS ON HAZARD RISK FOR HENDERSON COUNTY

HIGH RISK	Winter Storm and Freeze Thunderstorm Wind / High Wind Flood Hailstorm
MODERATE RISK	Landslide Wildfire Drought Tornado Hurricane and Tropical Storm Dam and Levee Failure
LOW RISK	Lightning Hazardous Material Incident Extreme Heat Erosion Earthquake

A.3 HENDERSON COUNTY VULNERABILITY ASSESSMENT

This subsection identifies and quantifies the vulnerability of Henderson County to the significant hazards previously identified. This includes identifying and characterizing an inventory of assets in the county and assessing the potential impact and expected amount of damages caused to these assets by each identified hazard event. More information on the methodology and data sources used to conduct this assessment can be found in Section 6: *Vulnerability Assessment*.

A.3.1 Asset Inventory

Table A.32 lists the number of parcels, total value of parcels, total number of parcels with improvements, and the total assessed value of improvements for Henderson County and its participating jurisdictions (study area of vulnerability assessment).[19]

TABLE A.32: IMPROVED PROPERTY IN HENDERSON COUNTY

Location	Number of Parcels	Total Assessed Value of Parcels	Estimated Number of Buildings	Total Assessed Value of Improvements
Flat Rock	2,606	$758,010,392	2,010	$589,718,500
Fletcher	3,013	$591,563,653	2,681	$447,841,700
Hendersonville	6,171	$1,239,785,324	5,251	$1,008,549,200
Laurel Park	1,752	$320,468,100	1,230	$247,351,500
Mills River	3,751	$651,179,503	2,647	$495,320,800
Unincorporated Area	48,814	$6,835,769,067	31,737	$4,950,768,206
HENDERSON COUNTY TOTAL	**66,107**	**$10,396,776,039**	**45,556**	**$7,739,549,906**

Table A.33 lists the fire stations, police stations, emergency operations centers (EOCs), medical care facilities, schools and other critical facilities located in Henderson County. Local governments at the county level provided a majority of the data for this analysis; however gaps in the data were filled using Hazus 2.1 to obtain the location of some critical facilities for which spatial data was not available. In addition, **Figure A.15** shows the locations of essential facilities in Henderson County. **Table A.45**, near the end of this section, shows a complete list of the critical facilities by name, as well as the hazards that affect each facility. As noted previously, this list is not all-inclusive and only includes information provided by the county.

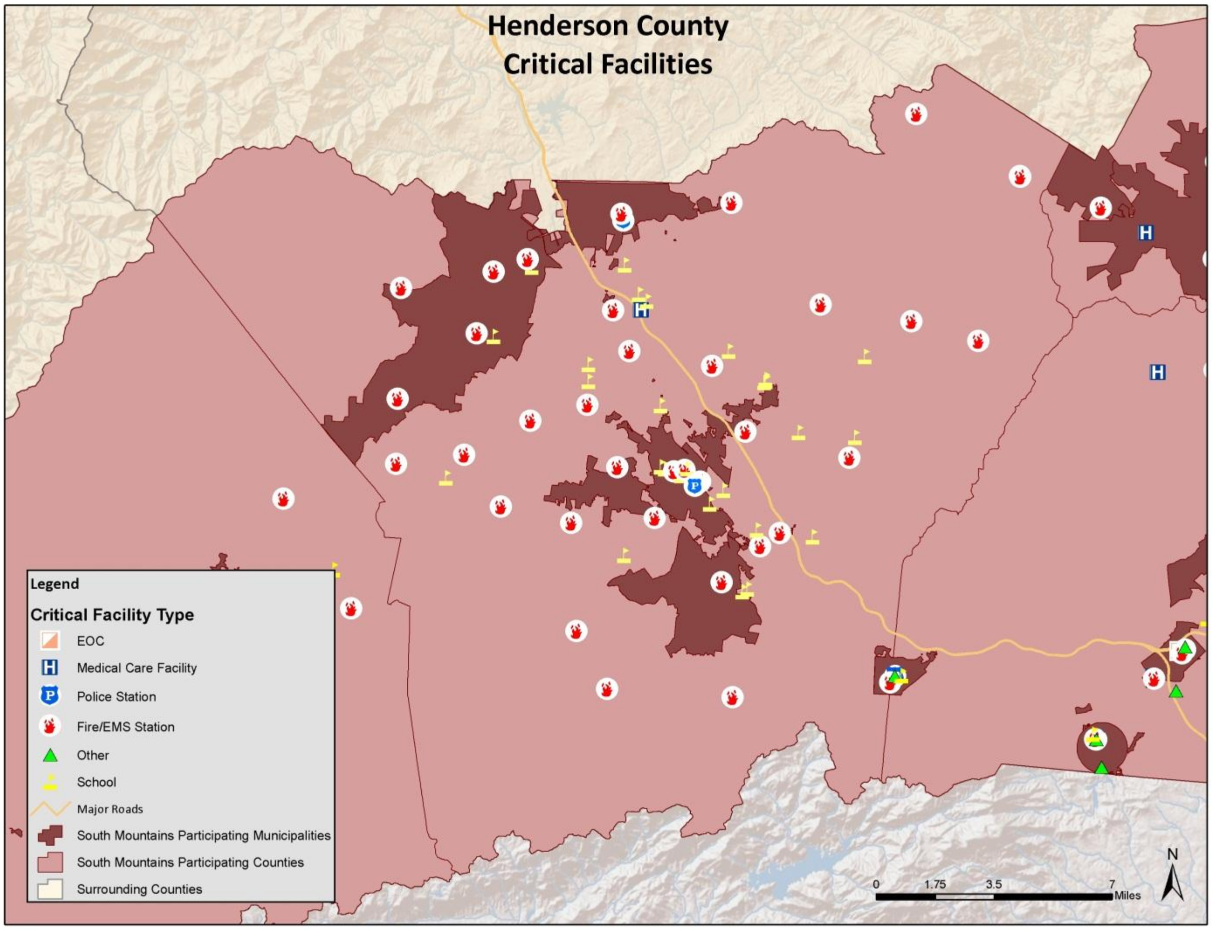
TABLE A.33: CRITICAL FACILITY INVENTORY IN HENDERSON COUNTY

Location	Fire Stations	Police Stations	Medical Care Facilities	EOC	Schools	Other
Flat Rock	1	0	0	0	0	0
Fletcher	1	1	0	0	0	0
Hendersonville	3	3	1	0	6	0
Laurel Park	1	0	0	0	0	0
Mills River	5	0	0	0	2	0
Unincorporated Area	24	0	1	0	20	0
HENDERSON COUNTY TOTAL	**35**	**4**	**2**	**0**	**28**	**0**

Source: Hazus-MH

[19] Total assessed values for improvements is based on tax assessor records as joined to digital parcel data. This data does not include dollar figures for tax-exempt improvements such as publicly-owned buildings and facilities. It should also be noted that, due to record keeping, some duplication is possible thus potentially resulting in an inflated value exposure for an area.

FIGURE A.15: CRITICAL FACILITY LOCATIONS IN HENDERSON COUNTY



Source: Hazus-MH 2.1

A.3.2 Social Vulnerability

In addition to identifying those assets potentially at risk to identified hazards, it is important to identify and assess those particular segments of the resident population in Henderson County that are potentially at risk to these hazards.

Table A.34 lists the population by jurisdiction according to U.S. Census 2010 population estimates. Unfortunately, estimates were not available at the census block level, limited the results to county-wide estimates. The total population in Henderson County according to Census data is 106,740 persons. Additional population estimates are presented above in Section A.1.

TABLE A.34: TOTAL POPULATION IN HENDERSON COUNTY

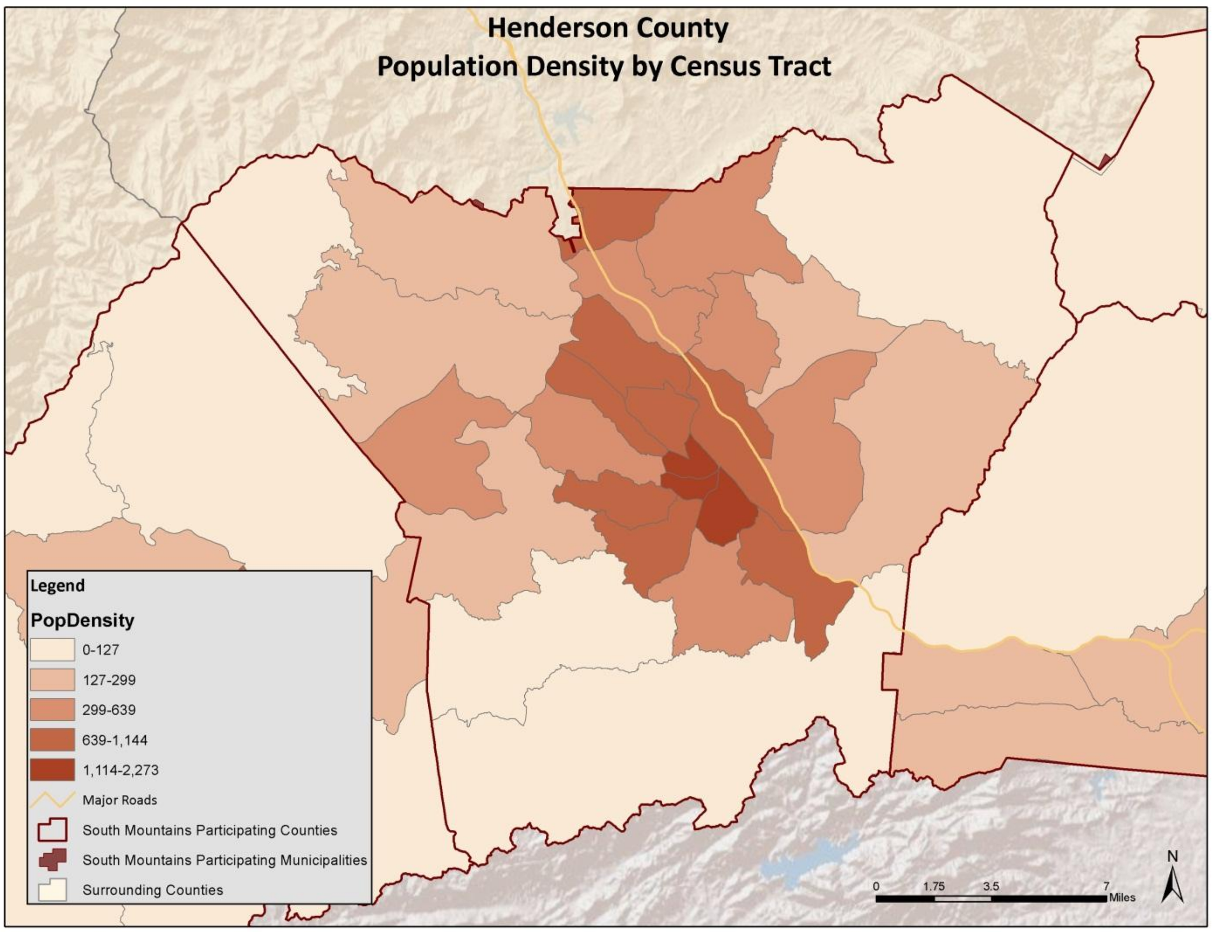
Jurisdiction	2010 Census Population
Henderson County	**106,740**

Jurisdiction	2010 Census Population
Village of Flat Rock	3,114
Town of Fletcher	7,187
City of Hendersonville	13,137
Town of Laurel Park	2,180
Town of Mills River	6,802

Source: U.S. Census 2010

In addition, **Figure A.16** illustrates the population density by census tract as it was reported by the U.S. Census Bureau in 2010.[20]

FIGURE A.16: POPULATION DENSITY IN HENDERSON COUNTY



Source: U.S. Census Bureau, 2010

[20] Population by census block was not available at the time this plan was completed.

A.3.3 Vulnerability Assessment Results

As noted in Section 6: *Vulnerability Assessment*, only hazards with a specific geographic boundary, modeling tool, or sufficient historical data allow for further analysis. Those results, specific to Henderson County, are presented here. All other hazards are assumed to impact the entire planning region (drought, hailstorm, lightning, thunderstorm wind, tornado, and winter storm and freeze) or, due to lack of data, analysis would not lead to credible results (erosion, dam and levee failure). The total county exposure, and thus risk, was presented in **Table A.32**.

The annualized loss estimate for all hazards is presented at the end of this section in **Table A.45.**

The hazards presented in this section include: hurricane and tropical storm winds, earthquake, landslide, flood, hazardous materials incident, and wildfire.

<u>Hurricane and Tropical Storm</u>

Historical evidence indicates that Henderson County has some risk to the hurricane and tropical storm hazard. Several tracks have come near or traversed through the county, as shown and discussed in Section A.3.3.

Hurricanes and tropical storms can cause damage through numerous additional hazards such as flooding, erosion, tornadoes, and high winds and precipitation, thus it is difficult to estimate total potential losses from these cumulative effects. The current Hazus-MH hurricane model only analyzes hurricane winds and is not capable of modeling and estimating cumulative losses from all hazards associated with hurricanes; therefore only hurricane winds are analyzed in this section. It can be assumed that all existing and future buildings and populations are at risk to the hurricane and tropical storm hazard. Hazus-MH 2.1 was used to determine annualized losses for the county as shown below in **Table A.35.** Only losses to buildings are reported, in order to best match annualized losses reported for other hazards. Hazus-MH reports losses at the U.S. Census tract level, so determining participating jurisdiction losses was not possible.

TABLE A.35: ANNUALIZED LOSS ESTIMATIONS FOR HURRICANE WIND HAZARD

Location	Total Annualized Loss
Henderson County	$151,000

Source: Hazus-MH 2.1

In addition, probable peak wind speeds were calculated in Hazus. These are shown below in **Table A.36.**

TABLE A.36: PROBABLE PEAK HURRICANE / TROPICAL STORM WIND SPEEDS (MPH)

Location	50-year event	100-year event	500-year event	1,000-year event
Flat Rock	54	63	82	90
Fletcher	53	62	81	88
Hendersonville	54	63	82	90
Laurel Park	53	62	81	89
Mills River	52	61	80	88
MAXIMUM WIND SPEED REPORTED	**54**	**63**	**82**	**90**

Source: Hazus-MH 2.1

Social Vulnerability
Given equal susceptibility across the county, it is assumed that the total population is at risk to the hurricane and tropical storm hazard.

Critical Facilities
Given equal vulnerability across Henderson County, all critical facilities are considered to be at risk. Some buildings may perform better than others in the face of such an event due to construction and age, among other factors. Determining individual building response is beyond the scope of this plan. However, this plan will consider mitigation actions for vulnerable structures, including critical facilities, to reduce the impacts of the hurricane wind hazard. A list of specific critical facilities and their associated risk can be found in **Table A.45** at the end of this section.

In conclusion, a hurricane event has the potential to impact many existing and future buildings, critical facilities, and populations in Henderson County. Hurricane events can cause substantial damage in their wake including fatalities, extensive debris clean-up, and extended power outages.

Earthquake
For the earthquake hazard vulnerability assessment, a probabilistic scenario was created to estimate the annualized loss for Henderson County. The results of the analysis reported at the U.S. Census tract level do not make it feasible to estimate losses at the jurisdiction level. Since the scenario is annualized, no building counts are provided. Losses reported included losses due to building damage and do not include losses to contents, inventory, or business interruption. **Table A.37** summarizes the findings.

TABLE A.37: ANNUALIZED LOSS ESTIMATIONS FOR EARTHQUAKE HAZARD

Location	Total Annualized Loss
Henderson County	$51,000

Source: Hazus-MH 2.1

Social Vulnerability
It can be assumed that all existing future populations are at risk to the earthquake hazard.

Critical Facilities
The Hazus probabilistic analysis indicated that no critical facilities would sustain measurable damage in an earthquake event. However, all critical facilities should be considered at-risk to minor damage, should an event occur. A list of individual critical facilities and their risk can be found in **Table A.45**.

In conclusion, an earthquake has the potential to impact all existing and future buildings, facilities, and populations in Henderson County. Minor earthquakes may rattle dishes and cause minimal damage while stronger earthquakes will result in structural damage as indicated in the Hazus scenario above. Impacts of earthquakes include debris clean-up, service disruption and, in severe cases, fatalities due to building collapse. Specific vulnerabilities for assets will be greatly dependent on their individual design and the mitigation measures in place, where appropriate. Such site-specific vulnerability determinations are outside the scope of this assessment but will be considered during future plan updates if data becomes available. Furthermore, mitigation actions to address earthquake vulnerability will be considered.

Landslide

In order to complete the vulnerability assessment for landslides in Henderson County, GIS analysis was used. The potential dollar value of exposed land and property total can be determined using the USGS Landslide Susceptibility Index (detailed in Section A.3.9), county level tax parcel data, and GIS analysis. **Table A.38** presents the potential at-risk property where available. Much of Henderson County is identified as moderate incidence areas by the USGS landslide data. All areas are also of high landslide susceptibility. The incidence levels (high and moderate) were used to identify different areas of concern for the analysis below.

TABLE A.38: TOTAL POTENTIAL AT-RISK PARCELS FOR THE LANDSLIDE HAZARD

Location	Number of Parcels At Risk		Number of Improvements At Risk		Total Value of Improvements At Risk ($)	
Incidence Level	Moderate	High	Moderate	High	Moderate	High
Flat Rock	0	0	0	0	$0	$0
Fletcher	2,261	0	2,009	0	$338,940,400	$0
Hendersonville	0	0	0	0	$0	$0
Laurel Park	0	0	0	0	$0	$0
Mills River	3,758	0	2,647	0	$495,320,800	$0
Unincorporated Area	8,652	0	5,453	0	$879,508,700	$0
HENDERSON COUNTY TOTAL	**14,671**	**0**	**10,109**	**0**	**$1,713,769,900**	**$0**

Source: USGS

Social Vulnerability

Given high susceptibility across the entire county, it is assumed that the total population is at risk.

Critical Facilities

All critical facilities are located in a high susceptibility area. Eleven facilities in Henderson County are located in the moderate incidence area (high susceptibility). No critical facilities are located in the high landslide incidence/susceptibility area. A list of specific critical facilities and their associated risk can be found in **Table A.45** at the end of this section.

In conclusion, a landslide has the potential to impact all existing and future buildings, facilities, and populations in Henderson County, though some areas are at a higher risk than others due to a variety of factors. For example, steep slopes and modified slopes bear a greater risk than flat areas. Specific vulnerabilities for county assets will be greatly dependent on their individual design and the mitigation measures in place, where appropriate. Such site-specific vulnerability determinations are outside the scope of this assessment but will be considered during future plan updates if data becomes available.

Flood

Historical evidence indicates that Henderson County is susceptible to flood events. A total of 64 flood events have been reported by the National Climatic Data Center resulting in $8.5 million dollars in damages. On an annualized level, these damages amounted to $428,371 for Henderson County.

In order to assess flood risk, a GIS-based analysis was used to estimate exposure to flood events using Digital Flood Insurance Rate Map (DFIRM) data in combination with local tax assessor records for the county. The determination of assessed value at-risk (exposure) was calculated using GIS analysis by summing the total assessed building values for only those improved properties that were confirmed to be located within an identified floodplain. **Table A.39** presents the potential at-risk property. Both the number of parcels and the approximate value are presented.

TABLE A.39: ESTIMATED EXPOSURE OF PARCELS TO THE FLOOD HAZARD

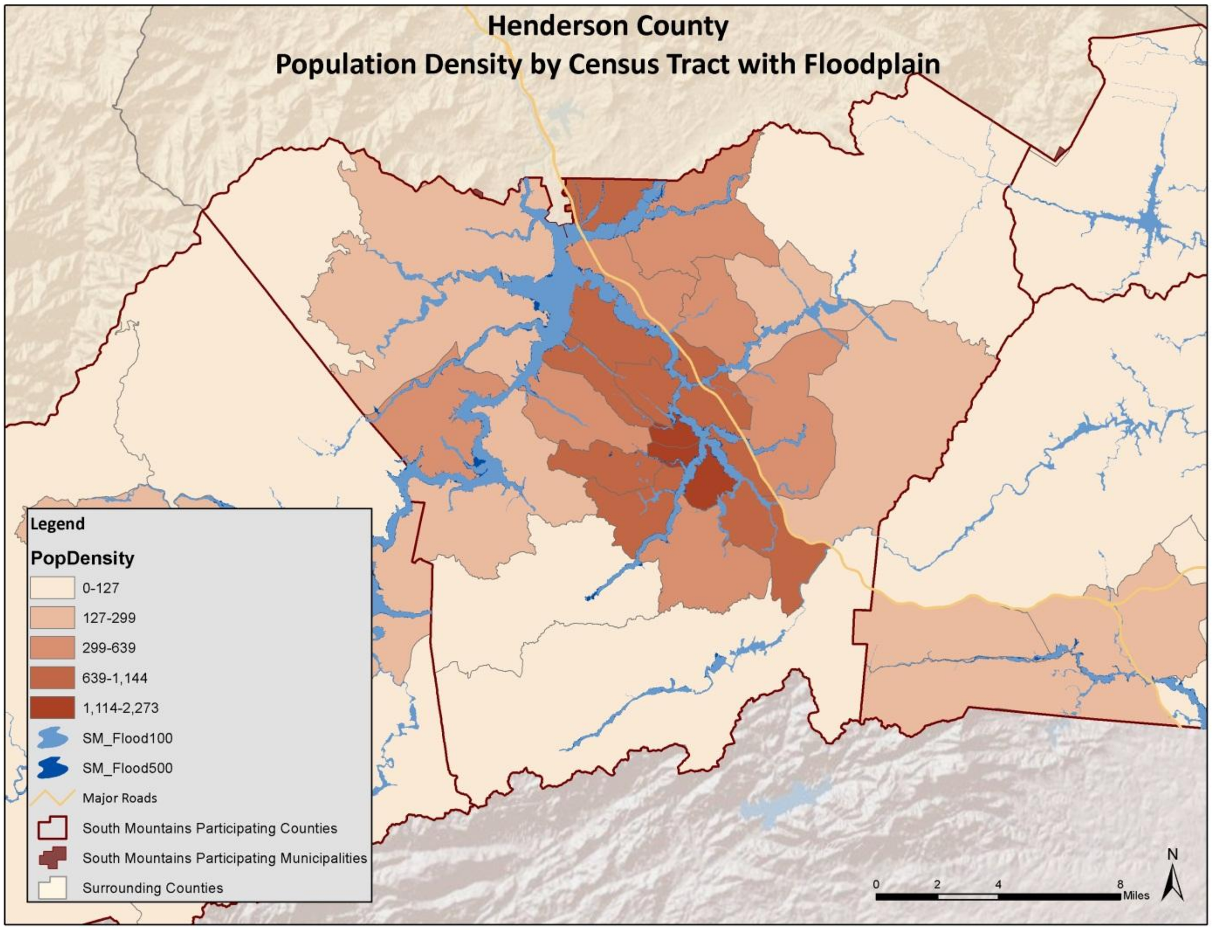
	1.0-percent ACF			0.2-percent ACF		
Location	**Approx. Number of Parcels**	**Approx. Number Improved Buildings**	**Approx. Improved Value of Buildings**	**Approx. Number of Parcels**	**Approx. Number Improved Buildings**	**Approx. Improved Value of Buildings**
Flat Rock	117	83	$28,171,600	8	5	$1,082,800
Fletcher	557	498	$104,945,200	66	61	$9,351,500
Hendersonville	659	531	$125,910,400	129	105	$17,061,200
Laurel Park	47	32	$5,387,800	35	29	$4,491,800
Mills River	326	190	$51,923,800	49	28	$8,065,900
Unincorporated Area	3,230	2,031	$425,538,200	472	363	$51,597,600
HENDERSON COUNTY TOTAL	**4,936**	**3,365**	**$741,877,000**	**759**	**591**	**$91,650,800**

Source: FEMA DFIRM

Social Vulnerability

Since 2010 population was only available at the tract level, it was difficult to determine a reliable figure on population at-risk to flood due to tract level population data. **Figure A.17** is presented to gain a better understanding of at risk population.

FIGURE A.17 : POPULATION DENSITY NEAR FLOODPLAINS



Source: FEMA DFIRM, U.S. Census 2010

Critical Facilities

The critical facility analysis revealed that there are two critical facilities located in the Henderson County 1.0-percent annual chance floodplain and 0.2-percent annual chance floodplain based on FEMA DFIRM boundaries and GIS analysis. A list of specific critical facilities and their associated risk can be found in **Table A.45** at the end of this section.

In conclusion, a flood has the potential to impact many existing and future buildings and populations in Henderson County, though some areas are at a higher risk than others. All types of structures in a floodplain are at-risk, though elevated structures will have a reduced risk. As noted, the floodplains used in this analysis include the 100-year and 500-year FEMA regulated floodplain boundaries. It is certainly possible that more severe events could occur beyond these boundaries or urban (flash) flooding could impact additional structures. Such site-specific vulnerability determinations are outside the scope of this assessment but will be considered during future plan updates. Furthermore, areas subject to repetitive flooding should be analyzed for potential mitigation actions.

Hazardous Materials Incident

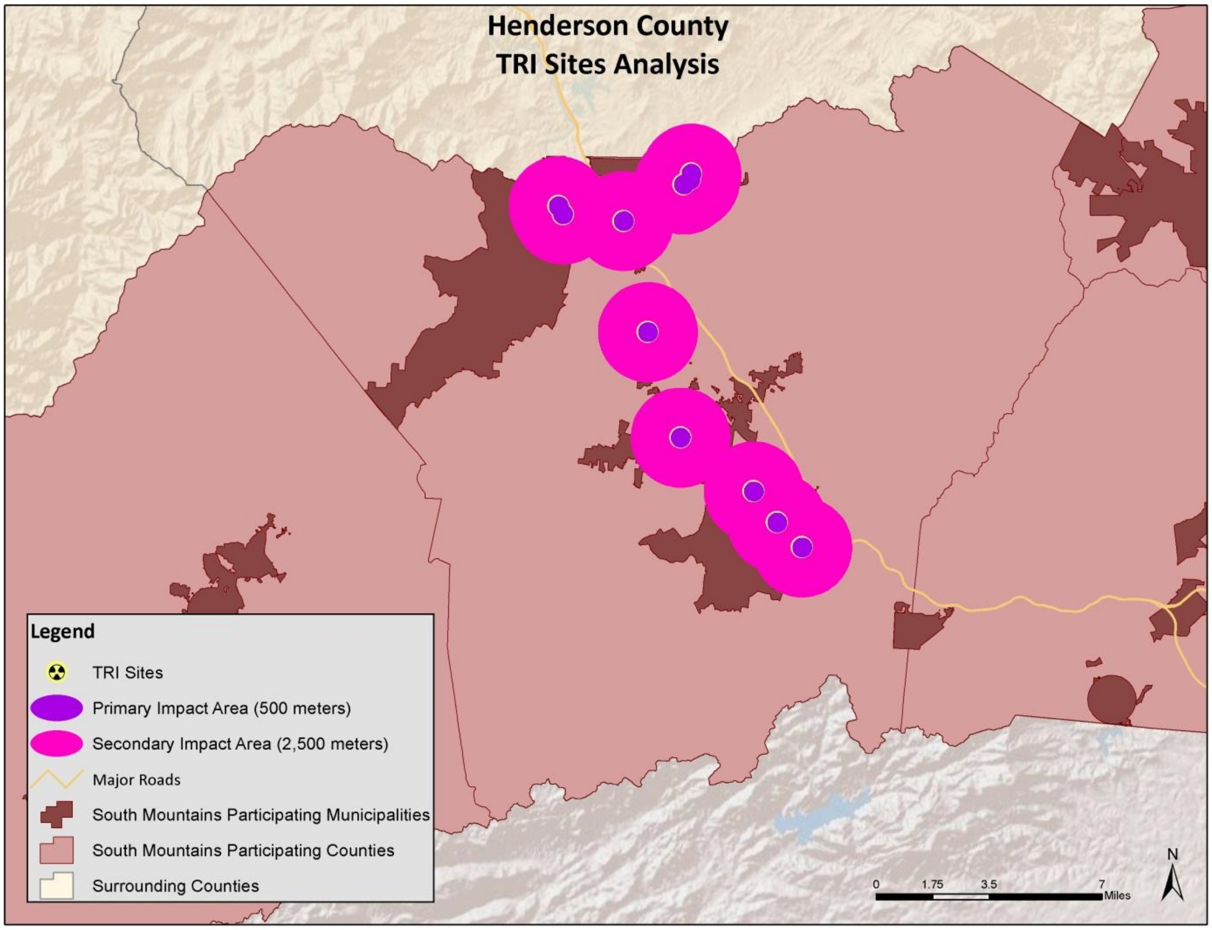
Although historical evidence and existing Toxic Release Inventory sites indicate that Henderson County is susceptible to hazardous materials events, there are few reports of damage. Therefore, it is difficult to calculate a reliable annualized loss figure. It is assumed that while one major event could result in significant losses, annualizing structural losses over a long period of time would most likely yield a negligible annualized loss estimate for Henderson County.

Most hazardous materials incidents that occur are contained and suppressed before destroying any property or threatening lives. However, they can have a significant negative impact. Such events can cause multiple deaths, completely shut down facilities for 30 days or more, and cause more than 50 percent of affected properties to be destroyed or suffer major damage. In a hazardous materials incident, solid, liquid, and/or gaseous contaminants may be released from fixed or mobile containers. Weather conditions will directly affect how the hazard develops. Certain chemicals may travel through the air or water, affecting a much larger area than the point of the incidence itself. Non-compliance with fire and building codes, as well as failure to maintain existing fire and containment features, can substantially increase the damage from a hazardous materials release. The duration of a hazardous materials incident can range from hours to days. Warning time is minimal to none.

In order to conduct the vulnerability assessment for this hazard, GIS intersection analysis was used for fixed and mobile areas and parcels.[21] In both scenarios, two sizes of buffers—500 and 2,500 meters—were used. These areas are assumed to respect the different levels of effect: immediate (primary) and secondary. Primary and secondary impact sites were selected based on guidance from FEMA 426, Reference Manual to Mitigate Potential Terrorist Attacks against Buildings and engineering judgment. For the fixed site analysis, geo-referenced TRI listed toxic sites in Henderson County, along with buffers, were used for analysis as shown in **Figure A.18.** For the mobile analysis, the major roads (Interstate highway, U.S. highway, and State highway) and railroads, where hazardous materials are primarily transported that could adversely impact people and buildings, were used for the GIS buffer analysis. **Figure A.19** shows the areas used for mobile toxic release buffer analysis. The results indicate the approximate number of parcels, improved value, as shown in **Table A.40** (fixed sites), **Table A.41** (mobile road sites) and **Table A.42** (mobile railroad sites).[22]

[21] This type of analysis will likely yield inflated results (generally higher than what is actually reported after an event).
[22] Note that parcels included in the 2,500 meter analysis are also included in the 500 meter analysis.

FIGURE A.18 : TRI SITES WITH BUFFERS IN HENDERSON COUNTY



Source: EPA

TABLE A.40: EXPOSURE OF IMPROVED PROPERTY TO HAZARDOUS MATERIALS (FIXED SITES)

	500-meter buffer			2,500-meter buffer		
Location	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value
Flat Rock	115	102	$20,635,700	1,205	930	$210,844,100
Fletcher	46	37	$35,438,000	2,455	2,165	$362,888,800
Hendersonville	255	211	$44,682,000	5,183	4,415	$779,074,700
Laurel Park	0	0	$0	1,088	847	$146,970,400
Mills River	21	11	$19,901,200	980	689	$148,943,100
Unincorporated Area	742	572	$100,450,700	11,254	8,493	$1,360,406,506
HENDERSON COUNTY TOTAL	**1,179**	**933**	**$221,107,600**	**22,165**	**17,539**	**$3,009,127,606**

FIGURE A.19 : MOBILE HAZMAT BUFFERS IN HENDERSON COUNTY

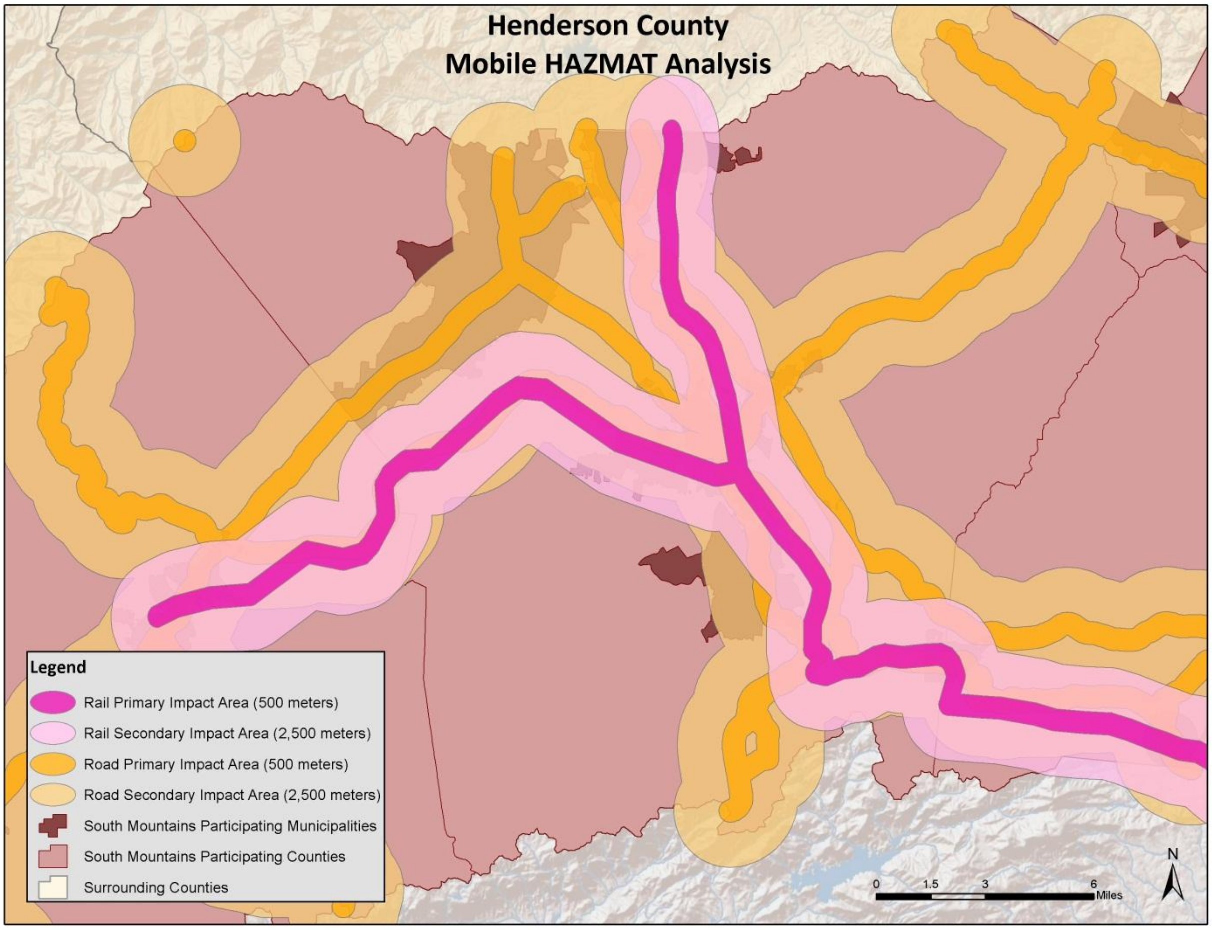


TABLE A.41: EXPOSURE OF IMPROVED PROPERTY TO HAZARDOUS MATERIALS SPILL (MOBILE ANALYSIS - ROAD)

	500-meter buffer			2,500-meter buffer		
Location	**Approx. Number of Parcels**	**Approx. Number Improved**	**Approx. Improved Value**	**Approx. Number of Parcels**	**Approx. Number Improved**	**Approx. Improved Value**
Flat Rock	777	613	$142,105,300	2,209	1,697	$497,135,400
Fletcher	1,176	1,011	$161,700,700	2,272	2,015	$345,905,800
Hendersonville	4,896	4,146	$870,805,400	6,171	5,251	$1,008,549,200
Laurel Park	271	240	$50,248,200	1,674	1,195	$237,329,100
Mills River	1,706	1,258	$234,334,500	3,687	2,609	$490,774,000
Unincorporated Area	13,334	9,586	$1,580,699,406	34,359	23,941	$3,702,627,306
HENDERSON COUNTY TOTAL	**22,160**	**16,854**	**$3,039,893,506**	**50,372**	**36,708**	**$6,282,320,806**

TABLE A.42: EXPOSURE OF IMPROVED PROPERTY TO HAZARDOUS MATERIALS SPILL (MOBILE ANALYSIS - RAILROAD)

Location	500-meter buffer			2,500-meter buffer		
	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value
Flat Rock	262	221	$45,274,800	1,313	1,024	$242,793,800
Fletcher	95	62	$32,794,300	1,401	1,160	$219,115,600
Hendersonville	2,500	2,046	$325,273,100	5,577	4,740	$885,634,000
Laurel Park	708	578	$90,903,200	1,752	1,230	$247,351,500
Mills River	0	0	$0	50	38	$6,053,500
Unincorporated Area	4,217	3,134	$546,776,500	20,558	15,053	$2,351,228,206
HENDERSON COUNTY TOTAL	**7,782**	**6,041**	**$1,041,021,900**	**30,651**	**23,245**	**$3,952,176,606**

Social Vulnerability

Given high susceptibility across the entire county, it is assumed that the total population is at risk to a hazardous materials incident. It should be noted that areas of population concentration may be at an elevated risk due to a greater burden to evacuate population quickly.

Critical Facilities

Fixed Site Analysis:

The critical facility analysis for fixed TRI sites revealed that there are thirty-two Henderson County facilities located in a HAZMAT risk zone. The primary impact zone does not include any critical facilities so all at risk facilities are in the secondary, 2,500 meter zone. A list of specific critical facilities and their associated risk can be found in **Table A.45** at the end of this section.

Mobile Analysis:

The critical facility analysis for road and railroad transportation corridors in Henderson County revealed that there are 59 critical facilities located in the primary and secondary mobile HAZMAT buffer areas for roads and 37 critical facilities located in the railroad HAZMAT buffer areas. It should be noted that many of the facilities located in the buffer areas for road are also located in the buffer areas for railroad and/or the fixed site analysis. A list of specific critical facilities and their associated risk can be found in **Table A.45** at the end of this section.

In conclusion, a hazardous material incident has the potential to impact many existing and future buildings, critical facilities, and populations in Henderson County. Those areas in a primary buffer are at the highest risk, though all areas carry some vulnerability due to variations in conditions that could alter the impact area such direction and speed of wind, volume of release, etc. Further, incidents from neighboring counties could also impact the county and participating jurisdictions.

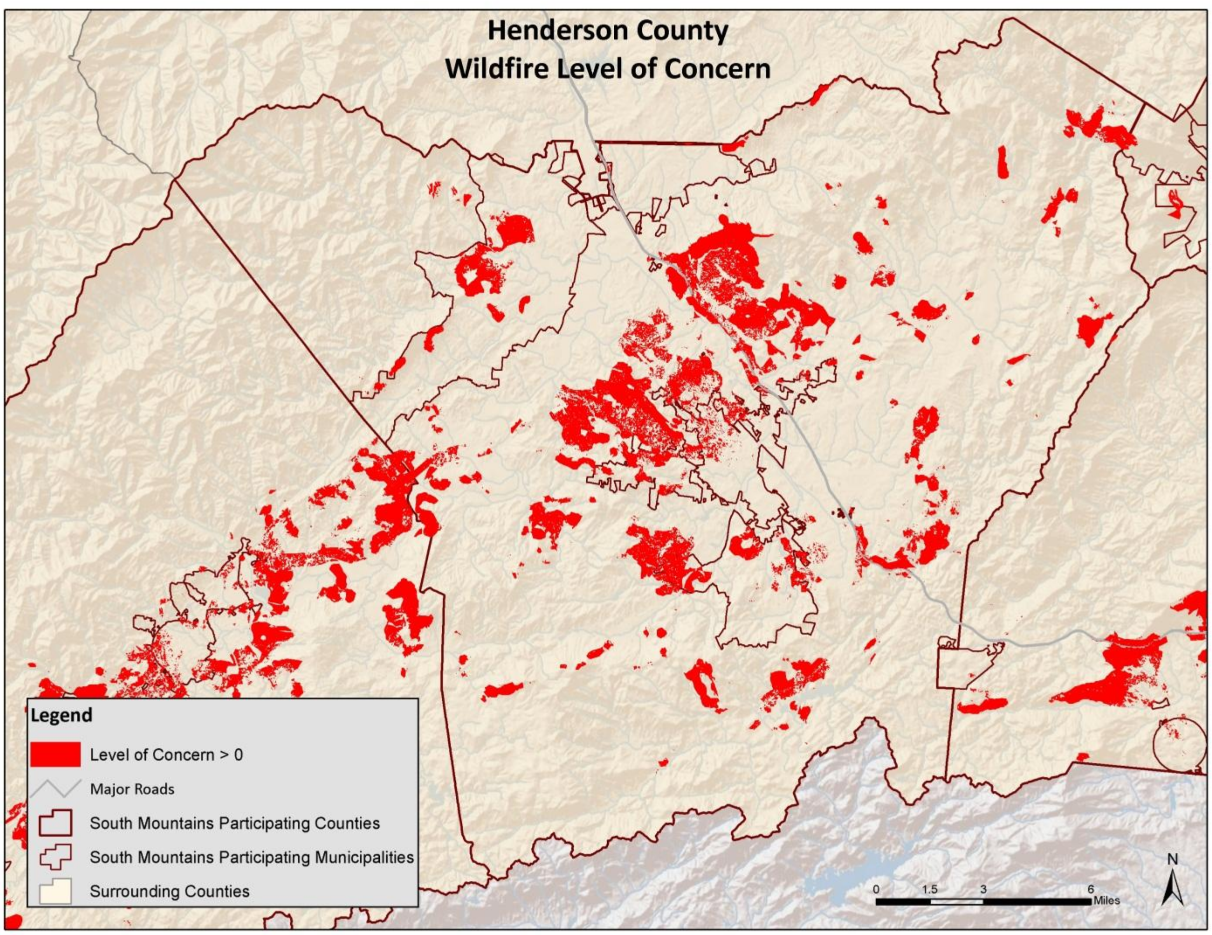
Wildfire

Although historical evidence indicates that Henderson County is susceptible to wildfire events, there are few reports of damage. Therefore, it is difficult to calculate a reliable annualized loss figure. Annualized loss is considered negligible though it should be noted that a single event could result in significant damages throughout the county.

To estimate exposure to wildfire, the approximate number of parcels and their associated improved value was determined using GIS analysis. For the critical facility analysis, areas of concern were intersected with critical facility locations. **Figure A.20**, **Figure A.21**, **Figure A.22**, **Figure A.23**, **Figure A.24**, and **Figure A.25** show the Level of Concern data. Initially provided as raster data, it was converted to a polygon to allow for analysis. The LOC data ranges from 1 – 100 with higher values being most severe (as noted previously, this is only a measure of relative risk). Eight was the highest level recorded in the South Mountains planning area. Therefore, areas with a value above 1 were chosen to be displayed as areas of risk. The region contains some lands where the value falls into the at-risk category, though the region has somewhat less land labeled as at-risk compared to other regions of North Carolina. Since all of this land area is on the lower tenth of the overall LOC scale, there is likely considerably less risk in the region than in other areas of the country.

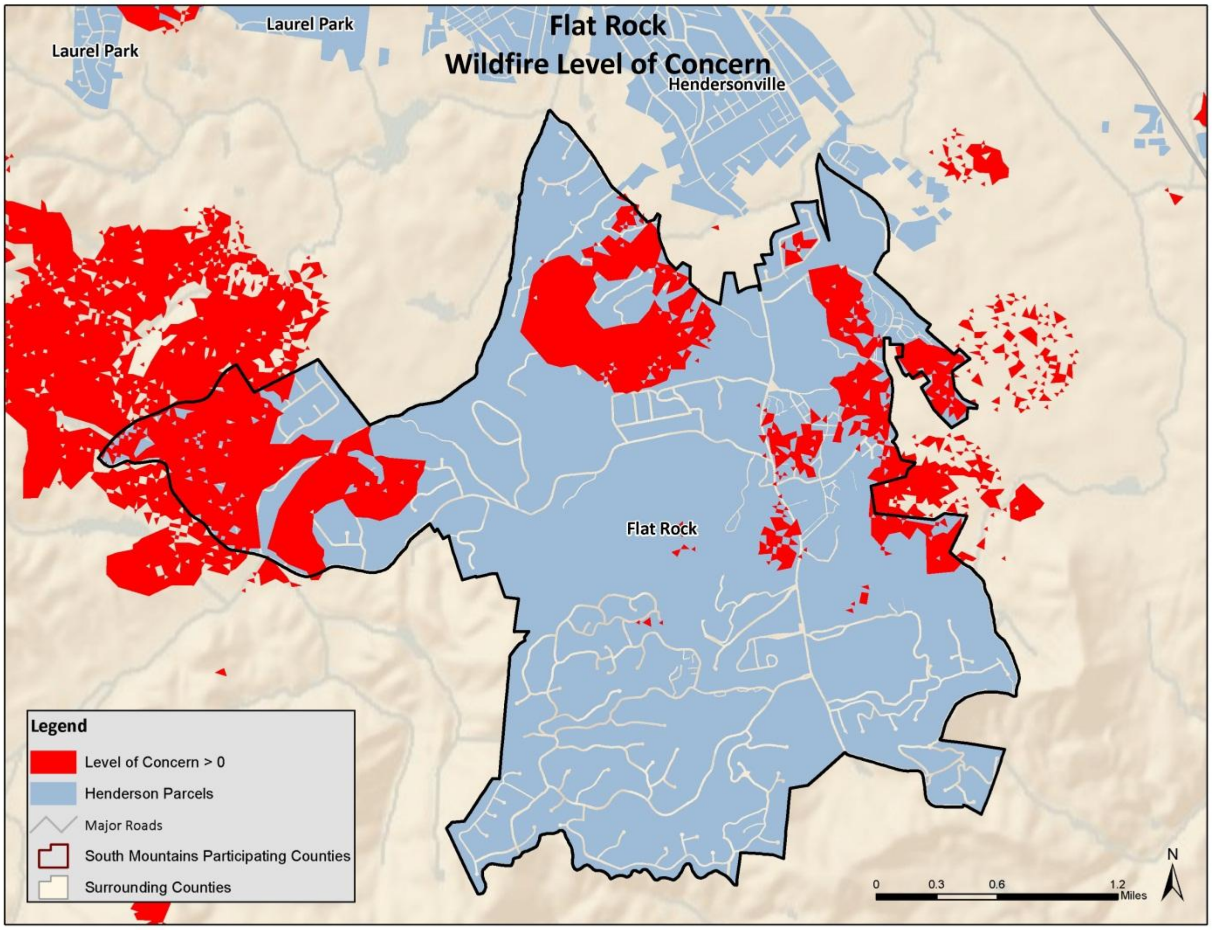
Table A.43 shows the results of the analysis.

FIGURE A.20: WILDFIRE RISK AREAS IN HENDERSON COUNTY



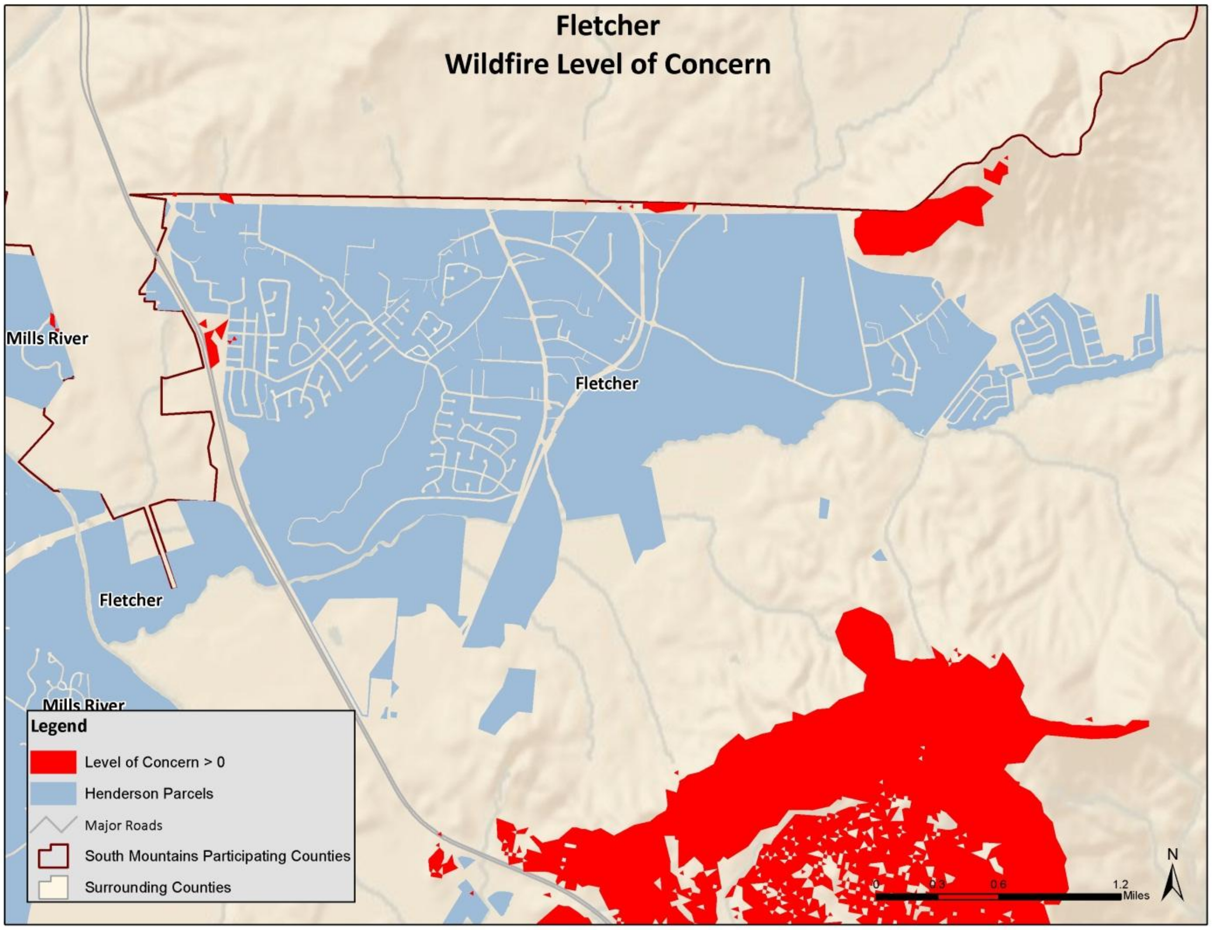
Source: Southern Wildfire Risk Assessment Data

FIGURE A.21: WILDFIRE RISK AREAS IN FLAT ROCK



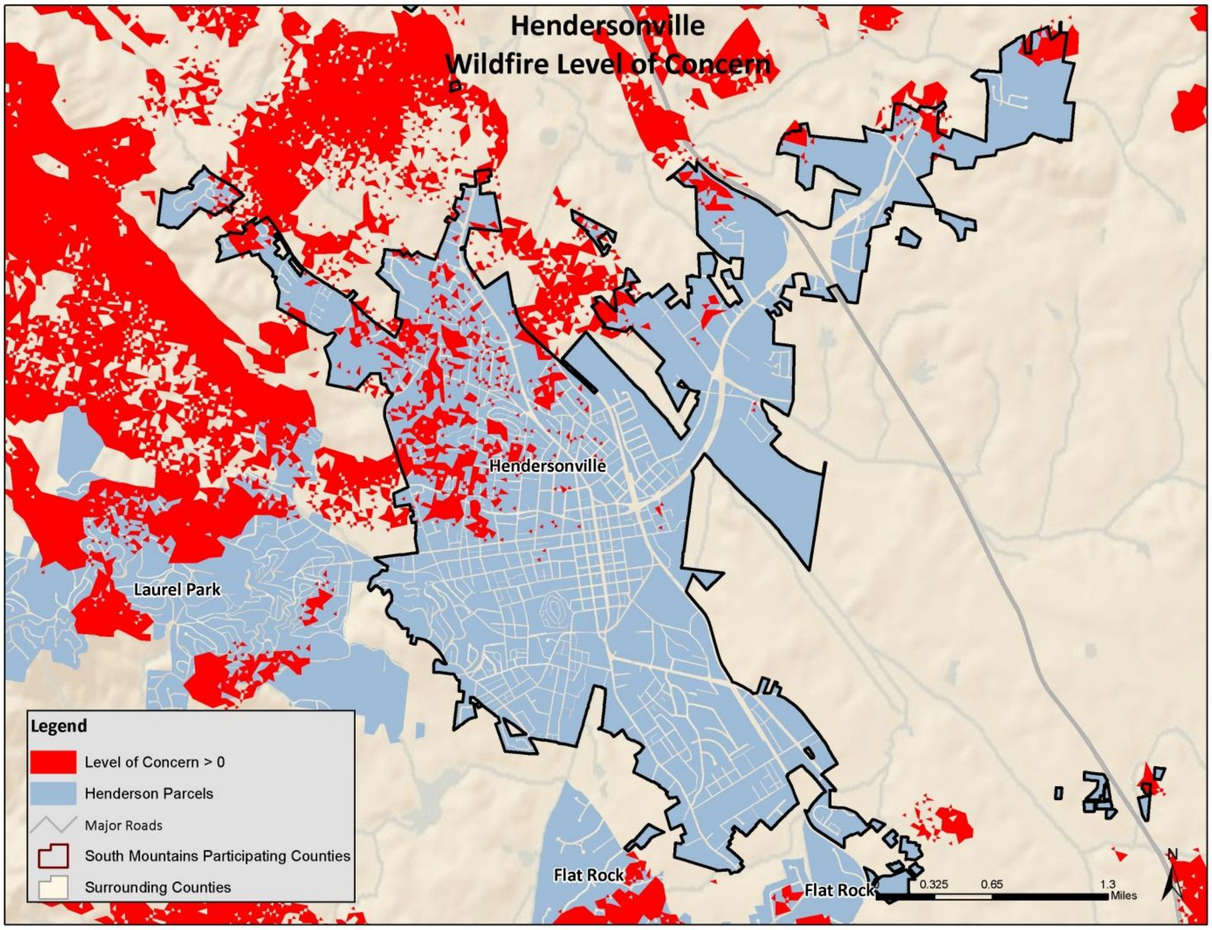
Source: Southern Wildfire Risk Assessment Data

FIGURE A.22: WILDFIRE RISK AREAS IN FLETCHER



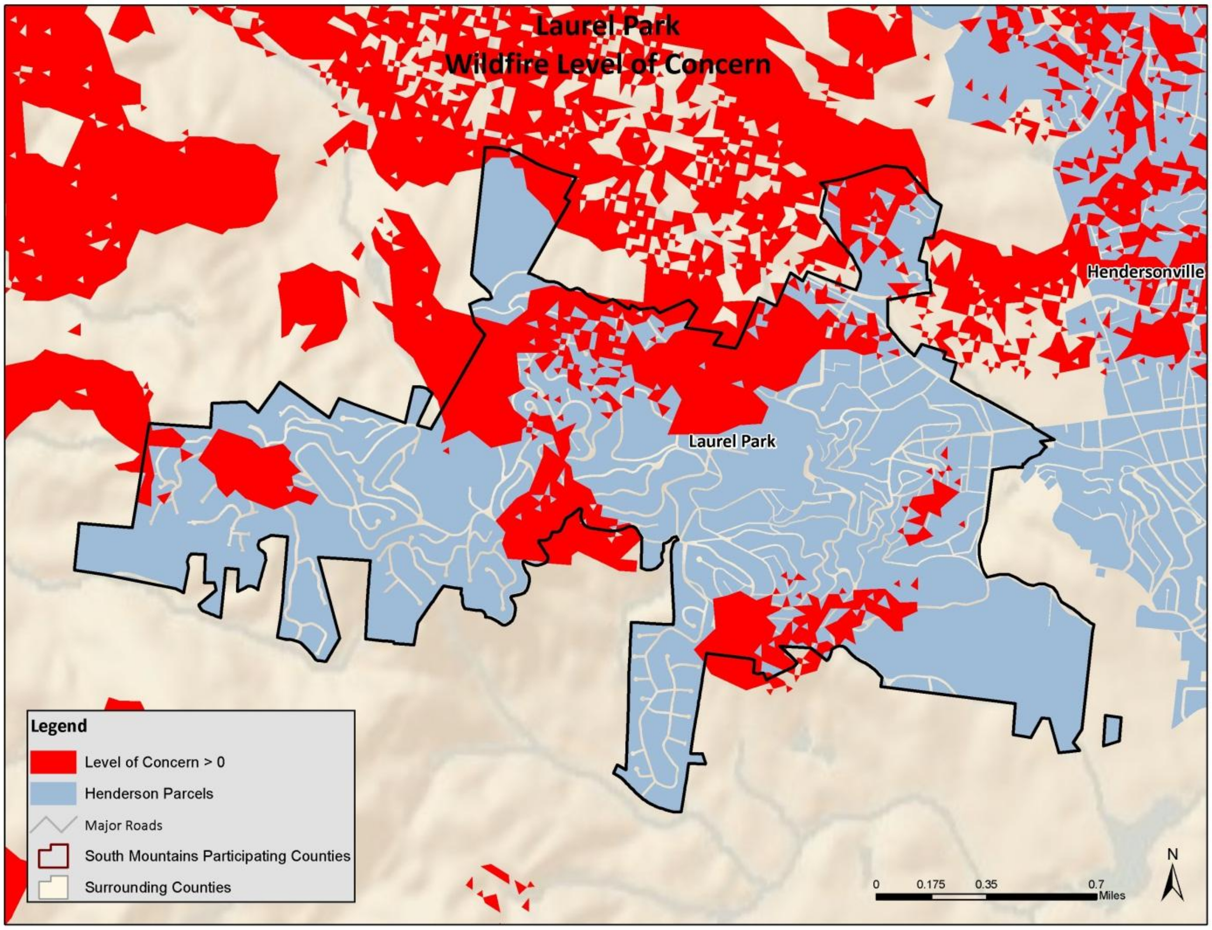
Source: Southern Wildfire Risk Assessment Data

FIGURE A.23: WILDFIRE RISK AREAS IN HENDERSONVILLE



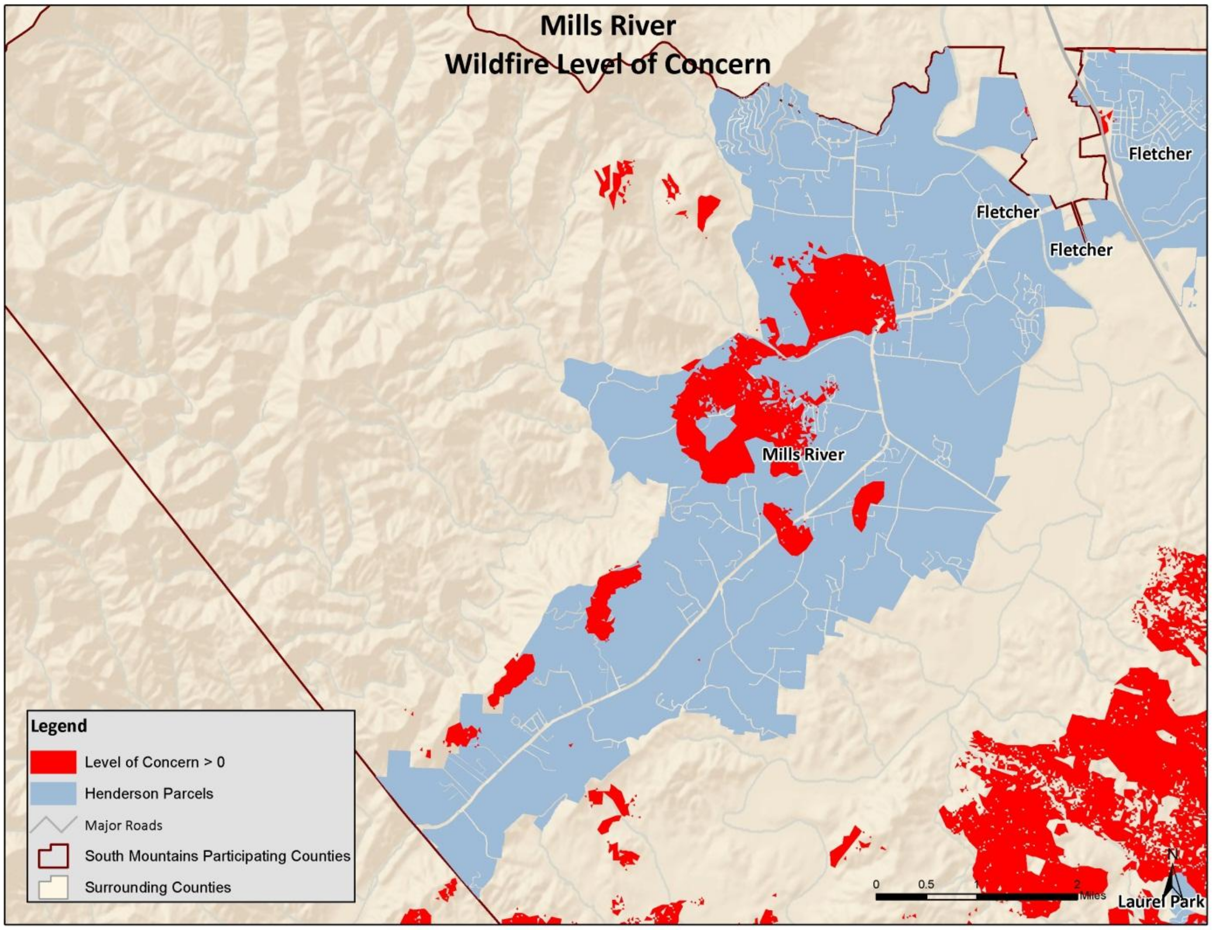
Source: Southern Wildfire Risk Assessment Data

FIGURE A.24: WILDFIRE RISK AREAS IN LAUREL PARK



Source: Southern Wildfire Risk Assessment Data

FIGURE A.25: WILDFIRE RISK AREAS IN MILLS RIVER



Source: Southern Wildfire Risk Assessment Data

TABLE A.43: EXPOSURE OF IMPROVED PROPERTY TO WILDFIRE AREAS OF CONCERN

	HIGH WILDFIRE RISK AREA		
Location	**Approx. Number of Parcels**	**Approx. Number of Buildings**	**Approx. Improved Value**
Flat Rock	866	667	$181,322,800
Fletcher	3	3	$313,400
Hendersonville	1,391	1,205	$225,183,000
Laurel Park	611	425	$101,368,500
Mills River	625	435	$55,416,900
Unincorporated Area	11,111	7,770	$1,413,974,400
HENDERSON COUNTY TOTAL	**14,607**	**10,505**	**$1,977,579,000**

Looking at jurisdictional level, unincorporated areas of the county face the highest level of concern areas. However, some incorporated areas of the county (notably Laurel Park and Flat Rock) have some areas where the level of concern is above 1.

Social Vulnerability

Although not all areas have equal vulnerability, there is some susceptibility across the entire county. It is assumed that the total population is at risk to the wildfire hazard. Determining the exact number of people in certain wildfire zones is difficult with existing data and could be misleading.

Critical Facilities

The critical facility analysis revealed that there are thirteen critical facilities located in wildfire areas of concern. It should also be noted, that several factors could impact the spread of a wildfire putting all facilities at risk. A list of specific critical facilities and their associated risk can be found in **Table A.45** at the end of this section.

In conclusion, a wildfire event has the potential to impact many existing and future buildings, critical facilities, and populations in Henderson County.

Conclusions on Hazard Vulnerability

Table A.44 presents a summary of annualized loss for each hazard in Henderson County. Due to the reporting of hazard damages primarily at the county level, it was difficult to determine an accurate annualized loss estimate for each municipality. Therefore, an annualized loss was determined through the damage reported through historical occurrences at the county level. These values should be used as an additional planning tool or measure risk for determining hazard mitigation strategies throughout the region.

TABLE A.44: ANNUALIZED LOSS FOR HENDERSON COUNTY

Event	Henderson County
Dam Failure	Negligible
Drought	Negligible
Extreme Heat	Negligible
Erosion	Negligible
Hail	$167,196
Hurricane & Tropical Storm	$151,000
Landslide	$178,243
Lightning	$33,586
Thunderstorm Wind/High Wind	$59,712
Tornado	$1,308
Winter Storm & Freeze	$60,481
Flood	$428,371
Earthquake	$51,000
HAZMAT Incident	Negligible
Wildfire	Negligible

As noted previously, all existing and future buildings and populations (including critical facilities) are vulnerable to atmospheric hazards including drought, hailstorm, hurricane and tropical storm, lightning, thunderstorm wind, tornado, and winter storm and freeze. Some buildings may be more vulnerable to these hazards based on locations, construction, and building type. **Table A.45** shows the critical facilities vulnerable to additional hazards analyzed in this section. The table lists those assets that are determined to be exposed to each of the identified hazards (marked with an "**X**").

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TABLE A.45: AT-RISK CRITICAL FACILITIES IN HENDERSON COUNTY

		ATMOSPHERIC							GEOLOGIC			HYDROLOGIC		OTHER						
FACILITY NAME	FACILITY TYPE	Drought	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 500m	Fixed HAZMAT 2,500 meter	Mobile HZMT 500 METER (road)	Mobile HZMT 2,500 meter (road)	Mobile HZMT 500 METER (rail)	Mobile HZMT 2,500 METER (rail)	Wildfire
HENDERSON COUNTY																				
121 SCHOOL HOUSE RD	FIRE STATION	X	X	X	X	X	X	X	X		X					X	X			
GLEN MARLOWE ELEMENTARY	SCHOOL	X	X	X	X	X	X	X	X		X				X		X			
MILLS RIVER STA 4	FIRE STATION	X	X	X	X	X	X	X	X		X									
NEW MILLS RIVER ELEM SCHOOL	SCHOOL	X	X	X	X	X	X	X	X		X						X			
MILLS RIVER STATION 3	FIRE STATION	X	X	X	X	X	X	X	X		X					X	X			
MILLS RIVER FIRE DEPT STA 2	FIRE STATION	X	X	X	X	X	X	X	X		X				X	X	X			
EMS STATION 2	EMS STATION	X	X	X	X	X	X	X	X		X				X	X	X			X
POLICE STATION	POLICE STATION	X	X	X	X	X	X	X	X		X				X	X	X		X	
FLETCHER FIRE DEPT	FIRE STATION	X	X	X	X	X	X	X	X		X				X	X	X		X	
VALLEY HILL FIRE DEPT	FIRE STATION	X	X	X	X	X	X	X	X						X		X		X	
BLUE RIDGE FIRE DEPT STA 2	FIRE STATION	X	X	X	X	X	X	X	X						X	X	X		X	X
800 N JUSTICE ST	HOSPITAL	X	X	X	X	X	X	X	X						X	X	X		X	
HENDERSONVILLE MIDDLE SCHOOL	SCHOOL	X	X	X	X	X	X	X	X						X	X	X		X	
HENDERSONVILLE ELEMENTARY	SCHOOL	X	X	X	X	X	X	X	X						X	X	X		X	

		ATMOSPHERIC							GEOLOGIC			HYDROLOGIC		OTHER						
FACILITY NAME	**FACILITY TYPE**	**Drought**	**Hailstorm**	**Hurricane and Tropical Storm**	**Lightning**	**Thunderstorm**	**Tornado**	**Winter Storm and Freeze**	**Earthquake**	**Landslide – High Incidence**	**Landslide- Mod. Incidence**	**Flood – 100 yr**	**Flood – 500 yr**	**Fixed HAZMAT 500m**	**Fixed HAZMAT 2,500 meter**	**Mobile HZMT 500 METER (road)**	**Mobile HZMT 2,500 meter (road)**	**Mobile HZMT 500 METER (rail)**	**Mobile HZMT 2,500 METER (rail)**	**Wildfire**
311 8TH AVE W	SCHOOL	X	X	X	X	X	X	X	X						X	X	X		X	
EMS STATION 3	EMS STATION	X	X	X	X	X	X	X	X						X	X	X		X	
IMMACULATA CATHOLIC SCHOOL	SCHOOL	X	X	X	X	X	X	X	X						X	X	X		X	
IMPOUND LOT	POLICE STATION	X	X	X	X	X	X	X	X						X	X	X	X	X	
HENDERSON COUNTY RESCUE SQUAD	EMS STATION	X	X	X	X	X	X	X	X						X	X	X	X	X	
802 OLD SPARTANBURG HWY	SCHOOL	X	X	X	X	X	X	X	X						X	X	X	X	X	
HENDERSONVILLE FIRE DEPT	FIRE STATION	X	X	X	X	X	X	X	X						X	X	X		X	
BRUCE DRYSDALE SCHOOL/834 N MAIN ST	SCHOOL	X	X	X	X	X	X	X	X						X	X	X		X	
HENDERSON COUNTY DETENTION CENTER	POLICE STATION	X	X	X	X	X	X	X	X						X	X	X	X	X	
LAW ENFORCEMENT CENTER	POLICE STATION	X	X	X	X	X	X	X	X						X	X	X	X	X	
WEST HENDERSON HIGH SCHOOL	SCHOOL	X	X	X	X	X	X	X	X						X	X	X			
MOUNTAIN HOME FIRE DEPT STA 3	FIRE STATION	X	X	X	X	X	X	X	X						X		X			X
RUGBY MIDDLE SCHOOL	SCHOOL	X	X	X	X	X	X	X	X						X	X	X			X
ETOWAH ELEMENTARY SCHOOL	SCHOOL	X	X	X	X	X	X	X	X		X					X	X		X	
100 HOSPITAL DR	HOSPITAL	X	X	X	X	X	X	X	X							X	X	X	X	X
BALFOUR ELEMENTARY	SCHOOL	X	X	X	X	X	X	X	X							X	X		X	
FLETCHER FIRE DEPT STA 2	FIRE STATION	X	X	X	X	X	X	X	X											

		ATMOSPHERIC							GEOLOGIC			HYDROLOGIC		OTHER						
FACILITY NAME	FACILITY TYPE	Drought	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 500m	Fixed HAZMAT 2,500 meter	Mobile HZMT 500 METER (road)	Mobile HZMT 2,500 meter (road)	Mobile HZMT 500 METER (rail)	Mobile HZMT 2,500 METER (rail)	Wildfire
CAPTAIN GILMER	SCHOOL	X	X	X	X	X	X	X	X							X	X	X	X	
4800 HOWARD GAP RD	SCHOOL	X	X	X	X	X	X	X	X								X		X	X
FLETCHER ELEMENTARY	SCHOOL	X	X	X	X	X	X	X	X						X		X		X	
GREEN RIVER FIRE DEPT STA 2	FIRE STATION	X	X	X	X	X	X	X	X											
GREEN RIVER FIRE DEPARTMENT	FIRE STATION	X	X	X	X	X	X	X	X							X	X		X	X
BLUE RIDGE FIRE DEPT	FIRE STATION	X	X	X	X	X	X	X	X						X	X	X		X	
EAST HENDERSON HIGH SCHOOL	SCHOOL	X	X	X	X	X	X	X	X						X		X		X	
FLAT ROCK MIDDLE SCHOOL	SCHOOL	X	X	X	X	X	X	X	X						X		X		X	
UPWARD ELEMENTARY SCHOOL	SCHOOL	X	X	X	X	X	X	X	X								X			
272 GERTON HWY	FIRE STATION	X	X	X	X	X	X	X	X							X	X			
EMS STATION 3	EMS STATION	X	X	X	X	X	X	X	X						X	X	X		X	
BAT CAVE FIRE DEPT	FIRE STATION	X	X	X	X	X	X	X	X							X	X			
MOUNTAIN HOME FIRE DEPT	FIRE STATION	X	X	X	X	X	X	X	X						X	X	X		X	
EDNEYVILLE FIRE DEPT STA 2	FIRE STATION	X	X	X	X	X	X	X	X								X			X
MOUNTAIN HOME FIRE DEPT STA 2	FIRE STATION	X	X	X	X	X	X	X	X								X		X	
1022 W BLUE RIDGE RD/NEW HILLANDALE ELEM SCHOOL	SCHOOL	X	X	X	X	X	X	X	X						X		X		X	X

		ATMOSPHERIC							GEOLOGIC			HYDROLOGIC		OTHER						
FACILITY NAME	FACILITY TYPE	Drought	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 500m	Fixed HAZMAT 2,500 meter	Mobile HZMT 500 METER (road)	Mobile HZMT 2,500 meter (road)	Mobile HZMT 500 METER (rail)	Mobile HZMT 2,500 METER (rail)	Wildfire
EDNEYVILLE FIRE DEPT	FIRE STATION	X	X	X	X	X	X	X	X							X	X			
NORTH HENDERSON HIGH	SCHOOL	X	X	X	X	X	X	X	X							X	X			
APPLE VALLEY MIDDLE SCHOOL	SCHOOL	X	X	X	X	X	X	X	X							X	X			
ATKINS ELEMENTARY SCHOOL	SCHOOL	X	X	X	X	X	X	X	X											X
DANA ELEMENTARY	SCHOOL	X	X	X	X	X	X	X	X											
EDNYVILLE ELEMENTARY	SCHOOL	X	X	X	X	X	X	X	X							X	X			
CLEAR CREEK ELEMENTARY	SCHOOL	X	X	X	X	X	X	X	X								X			X
EDNEYVILLE FIRE DEPT STA 3	FIRE STATION	X	X	X	X	X	X	X	X								X			
VALLEY HILL FIRE DEPT STA 2	FIRE STATION	X	X	X	X	X	X	X	X											
ETOWAH FIRE DEPT.	FIRE STATION	X	X	X	X	X	X	X	X		X	X				X	X	X	X	
VALLEY HILL FIRE DEPT STA 3	FIRE STATION	X	X	X	X	X	X	X	X											
GERTON FIRE DEPARTMENT	FIRE STATION	X	X	X	X	X	X	X	X							X	X			
613 GLOVER ST	SCHOOL	X	X	X	X	X	X	X	X						X		X		X	
ETOWAH HORSE SHOE STATION 2	FIRE STATION	X	X	X	X	X	X	X	X											
5399 ASHEVILLE HWY	FIRE STATION	X	X	X	X	X	X	X	X			X				X	X		X	
NEW SUGARLOAF SCHOOL LOCATION	SCHOOL	X	X	X	X	X	X	X	X											
FIRE STATION	FIRE STATION	X	X	X	X	X	X	X	X							X	X	X	X	X

		ATMOSPHERIC							GEOLOGIC			HYDROLOGIC		OTHER							
FACILITY NAME	FACILITY TYPE	Drought	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 500m	Fixed HAZMAT 2,500 meter	Mobile HZMT 500 METER (road)	Mobile HZMT 2,500 meter (road)	Mobile HZMT 500 METER (rail)	Mobile HZMT 2,500 METER (rail)	Wildfire
WAITING ON DRIVEWAY TO BE CUT	FIRE STATION	X	X	X	X	X	X	X	X		X						X		X	
VALLEY HILL STA 4	FIRE STATION	X	X	X	X	X	X	X	X						X	X	X		X	X
SCHOOL	SCHOOL	X	X	X	X	X	X	X	X							X	X			
DANA FIRE HOUSE/SERVICE BAY	FIRE STATION	X	X	X	X	X	X	X	X											
FIRE STATION	FIRE STATION	X	X	X	X	X	X	X	X								X			

A.4 HENDERSON COUNTY CAPABILITY ASSESSMENT

This subsection discusses the capability of Henderson County to implement hazard mitigation activities. More information on the purpose and methodology used to conduct the assessment can be found in Section 7: *Capability Assessment*.

A.4.1 Planning and Regulatory Capability

Table A.46 provides a summary of the relevant local plans, ordinances, and programs already in place or under development for Henderson County. A checkmark (✓) indicates that the given item is currently in place and being implemented. An asterisk (*) indicates that the given item is currently being developed for future implementation. Each of these local plans, ordinances, and programs should be considered available mechanisms for incorporating the requirements of the South Mountains Regional Hazard Mitigation Plan.

TABLE A.46: RELEVANT PLANS, ORDINANCES, AND PROGRAMS

Planning Tool/Regulatory Tool	Hazard Mitigation Plan	Comprehensive Land Use Plan	Floodplain Management Plan	Open Space Management Plan (Parks & Rec/Greenway Plan	Stormwater Management Plan/Ordinance	Natural Resource Protection Plan	Flood Response Plan	Emergency Operations Plan	Continuity of Operations Plan	Evacuation Plan	Disaster Recovery Plan	Capital Improvements Plan	Economic Development Plan	Historic Preservation Plan	Flood Damage Prevention Ordinance	Zoning Ordinance	Subdivision Ordinance	Unified Development Ordinance	Post-Disaster Redevelopment Ordinance	Building Code	Fire Code	National Flood Insurance Program (NFIP)	NFIP Community Rating System
HENDERSON COUNTY	✓	✓			✓			✓	✓			✓	✓		✓	✓	✓	✓		✓	✓	✓	
Flat Rock	✓	✓						✓					✓		✓	✓	✓	✓		✓	✓	✓	
Fletcher	✓	✓		✓				✓				✓	✓		✓	✓	✓	✓		✓	✓	✓	
Hendersonville	✓	✓		✓	✓			✓	✓		✓	✓	✓		✓	✓	✓			✓	✓	✓	
Laurel Park	✓	✓		✓	✓			✓				✓	✓		✓	✓	✓			✓	✓	✓	
Mills River	✓	✓		✓				✓				✓	✓			✓	✓	✓		✓	✓		

A more detailed discussion on the county's planning and regulatory capabilities follows.

Emergency Management

Hazard Mitigation Plan
Henderson County has previously adopted a hazard mitigation plan. The Village of Flat Rock, the Town of Fletcher, the City of Hendersonville, the Town of Laurel Park, and the Town of Mills River were also included in this plan.

Disaster Recovery Plan
The City of Hendersonville is the only participating jurisdiction that has adopted a disaster recovery plan.

Emergency Operations Plan
Henderson County maintains an emergency operations plan through its Emergency Management Department. Henderson County coordinates all emergency management operations for the county and its incorporated municipalities.

Continuity of Operations Plan
Only Henderson County and the City of Hendersonville have continuity of operations plans in place.

General Planning

Comprehensive Land Use Plan
Henderson County and its participating municipalities have each adopted a local comprehensive plan.

Capital Improvements Plan
Henderson County, the Town of Fletcher, the City of Hendersonville, the Town of Laurel Park, and the Town of Mills River have capital improvement plans in place.

Zoning Ordinance
Henderson County and each of its participating municipalities administer a zoning ordinance.

Subdivision Ordinance
Henderson County and all of its participating municipalities have adopted and enforce subdivision regulations.

Building Codes, Permitting, and Inspections
North Carolina has a state compulsory building code which applies throughout the state. Henderson County provides building code enforcement for the county and all of its municipalities.

Floodplain Management

Table A.47 provides NFIP policy and claim information for each participating jurisdiction in Henderson County.

TABLE A.47: NFIP POLICY AND CLAIM INFORMATION

Jurisdiction	Date Joined NFIP	Current Effective Map Date	NFIP Policies in Force	Insurance in Force	Closed Claims	Total Payments to Date
HENDERSON COUNTY†	03/01/82	01/06/10	224	$55,227,900	4	$239,353
Flat Rock	12/12/08	01/06/10	25	$5,590,000	0	$0
Fletcher	10/28/03	01/06/10	0	$0	1	$14,745
Hendersonville	01/20/82	01/06/10	163	$37,851,500	116	$1,336,191
Laurel Park	10/02/08	01/06/10	7	$2,135,000	1	$2,980
Mills River*	--	--	--	--	--	--

†Includes unincorporated areas of county only
*Community does not participate in the NFIP
Source: NFIP Community Status information as of 9/5/13; NFIP claims and policy information as of 6/30/13

All jurisdictions listed above that are participants in the NFIP will continue to comply with all required provisions of the program and will work to adequately comply in the future utilizing a number of strategies. For example, the jurisdictions will coordinate with NCEM and FEMA to develop maps and regulations related to special flood hazard areas within their jurisdictional boundaries and, through a consistent monitoring process, will design and improve their floodplain management program in a way that reduces the risk of flooding to people and property.

The Town of Mills River does not participate in the NFIP due to lack of available funding and political support.

Flood Damage Prevention Ordinance

All communities participating in the NFIP are required to adopt a local flood damage prevention ordinance. Henderson County and all of its municipalities participating in this hazard mitigation plan, with the exception of the Town of Mills River, also participate in the NFIP and have adopted flood damage prevention regulations.

Open Space Management Plan

Henderson County does not have an open space management plan in place. However, the Town of Fletcher has a greenway master plan, the City of Hendersonville has a parks and greenspace master plan, the Town of Laurel Park has a parks and greenways plan, and the Town of Mills River has a parks master plan.

Stormwater Management Plan

Henderson County is the only jurisdiction that has a stormwater management plan in place; however, the following jurisdictions have adopted stormwater management regulations through various ordinances: Henderson County, the City of Hendersonville, and the Town of Laurel Park.

A.4.2 Administrative and Technical Capability

Table A.48 provides a summary of the capability assessment results for Henderson County with regard to relevant staff and personnel resources. A checkmark (✓) indicates the presence of a staff member(s) in that jurisdiction with the specified knowledge or skill.

TABLE A.48: RELEVANT STAFF / PERSONNEL RESOURCES

Staff / Personnel Resource	Planners with knowledge of land development/land management practices	Engineers or professionals trained in construction practices related to buildings and/or infrastructure	Planners or engineers with an understanding of natural and/or human-caused hazards	Emergency Manager	Floodplain Manager	Land Surveyors	Scientists familiar with the hazards of the community	Staff with education or expertise to assess the community's vulnerability to hazards	Personnel skilled in GIS and/or Hazus	Resource development staff or grant writers
HENDERSON COUNTY	✓	✓	✓	✓	✓		✓	✓	✓	
Flat Rock		✓		✓	✓		✓	✓	✓	
Fletcher	✓	✓	✓	✓	✓		✓	✓	✓	
Hendersonville	✓	✓	✓	✓	✓		✓	✓	✓	
Laurel Park		✓		✓	✓		✓	✓	✓	
Mills River		✓		✓			✓	✓	✓	

Credit for having a floodplain manager was given to those jurisdictions that have a flood damage prevention ordinance, and therefore an appointed floodplain administrator, regardless of whether the appointee was dedicated solely to floodplain management. Credit was given for having a scientist familiar with the hazards of the community if a jurisdiction has a Cooperative Extension Service or Soil and Water Conservation Department. Credit was also given for having staff with education or expertise to assess the community's vulnerability to hazards if a staff member from the jurisdiction was a participant on the existing hazard mitigation plan's planning committee.

A.4.3 Fiscal Capability

Table A.49 provides a summary of the results for Henderson County with regard to relevant fiscal resources. A checkmark (✓) indicates that the given fiscal resource is locally available for hazard mitigation purposes (including match funds for state and federal mitigation grant funds) according to the previous county hazard mitigation plan.

TABLE A.49: RELEVANT FISCAL RESOURCES

Fiscal Tool / Resource	Capital Improvement Programming	Community Development Block Grants (CDBG)	Special Purpose Taxes (or taxing districts)	Gas/Electric Utility Fees	Water/Sewer Fees	Stormwater Utility Fees	Development Impact Fees	General Obligation, Revenue, and/or Special Tax Bonds	Partnering Arrangements or Intergovernmental Agreements	Other: HMGP, FMA, PDM, PA, SBA, other federal grants, etc.
HENDERSON COUNTY	✓	✓	✓						✓	✓
Flat Rock	✓	✓	✓						✓	✓
Fletcher	✓	✓	✓						✓	✓
Hendersonville	✓	✓	✓						✓	✓
Laurel Park	✓	✓	✓						✓	✓
Mills River	✓	✓	✓						✓	✓

A.4.4 Political Capability

The previous hazard mitigation plan indicates opposition to mitigation measures is not evident in Henderson County or its incorporated municipalities. In fact, Henderson County has taken a proactive approach to mitigation through the development of governing documents which promote the mitigation process. The Henderson County Governing Board is well educated on the hazards that threaten the county and has advisory boards that specialize in specific areas of hazard reduction. The county (its governing board, staff, and citizenry) appears highly capable and willing to promote the economic efficiency and social utility of the mitigation measures contained in this plan. In addition, they appear willing to assist all local municipalities in the implementation of strategies identified herein and specific to municipal jurisdictions.

A.4.5 Conclusions on Local Capability

Table A.50 shows the results of the capability assessment using the designed scoring methodology described in Section 7: *Capability Assessment*. The capability score is based solely on the information found in existing hazard mitigation plans and readily available on the jurisdictions' government websites. According to the assessment, the average local capability score for the county and its municipalities is 33.7, which falls into the moderate capability ranking.

TABLE A.50: CAPABILITY ASSESSMENT RESULTS

Jurisdiction	Overall Capability Score	Overall Capability Rating
HENDERSON COUNTY	42	High
Flat Rock	28	Moderate
Fletcher	35	Moderate
Hendersonville	41	High
Laurel Park	32	Moderate
Mills River	24	Moderate

A.5 HENDERSON COUNTY MITIGATION STRATEGY

This subsection provides the blueprint for Henderson County to follow in order to become less vulnerable to its identified hazards. It is based on general consensus of the Regional Hazard Mitigation Planning Team and the findings and conclusions of the capability assessment and risk assessment. Additional Information can be found in Section 8: *Mitigation Strategy* and Section 9: *Mitigation Action Plan*.

A.5.1 Mitigation Goals

Henderson County developed five mitigation goals in coordination with the other participating South Mountains Region jurisdictions. The regional mitigation goals are presented in **Table A.51**.

TABLE A.51: SOUTH MOUNTAINS REGIONAL MITIGATION GOALS

	Goal
Goal #1	Improve public education/awareness
Goal #2	Protect human life, safety and welfare by minimizing the potential for damage to personal property, infrastructure, and loss of life due to natural and human caused hazards.
Goal #3	Protect and maintain emergency services infrastructure and equipment to support emergency responders and improve disaster response time/operations.
Goal #4	Improve technical, legal, and institutional capability to respond to and recover from disasters.
Goal #5	Reduce or eliminate the risk of natural disasters.

A.5.2 Mitigation Action Plan

The mitigation actions proposed by Henderson County, the Village of Flat Rock, the Town of Fletcher, the City of Hendersonville, the Town of Laurel Park, and the Town of Mills River are listed in the following individual Mitigation Action Plans.

Henderson County Mitigation Action Plan

Henderson County Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Develop a County Stormwater Management Plan.	FL	Moderate	General Revenue		Engineering Department	Completed	Adopted Stormwater Ordinance 9-1-2010
P-2	Incorporate into the County Zoning and Subdivision Ordinances construction standards for privately owned bridges.	All	Moderate	General Revenue		Engineering Department	Completed	Private Bridge Standards are included in Land Development Code 200A-105F.
P-3	Monitor water and sewer lines in the floodplain through GIS processes.	FL	High	General Revenue		GIS	Completed	A GIS layer has been developed that includes water and sewer lines.
P-4	Install stream gauges on major waterways throughout the County to collect data on stream water height and velocity (this will also assist in mitigating erosion hazards).	FL/ER	Moderate	General Revenue and Grants		County EMA	2019	Stream gauges have been installed on all major streams in Henderson County through private donations and the NC FIMAN project. However, more stream gauges would increase the size of the network and improve monitoring so this action is still in progress
P-5	Implement scaling as a method of preventative maintenance to reduce the amount of loose debris that could lead to landslides during high precipitation events or seismic events.	LS	Moderate	General Revenue and Grants		NC Department of Transportation	2018	NCDOT has implemented scaling in some problem areas in the Hickory Nut Gorge area. However, this could be implemented in additional areas
P-6	Develop a dam/levee structural database with the County GIS system with the assistance of the North Carolina Dam Safety Program.	D	High	General Revenue		GIS Department/ County EMA	Completed	Henderson County has developed a dam/levee structural database with the assistance of the NC Department of Environment and Natural Resources, Dam Safety Division.

Henderson County Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
P-7	Develop a stand-by acquisition grant application that lists properties with a high potential for damage or destruction due to a dam/levee failure.	D	Low	General Revenue and Grants		County EMA	2019	Properties have been identified through the GIS layer development. No funding has been awarded for acquisition, so this will remain an action going forward.
P-8	Develop a stand-by acquisition grant application that lists properties located in multi-hazard areas specifically those properties located near US HWY 74 and NC HWY 9 (Bat Cave) which are prone not only to flash flooding but also to severe landslides .	FL/LS	Low	General Revenue and Grants		County EMA	2019	Properties have been identified; landowners are unwilling to sell at this time. Will continue to pursue this action as possible
Property Protection								
PP-1	Incorporate development and construction standards into the Zoning and Subdivision Ordinances to further regulate construction in areas prone to landslides.	LS/FL	High	General Revenue		Planning Dept	2018	NCDENR made presentation to Board of Commissioners. Incorporating standards still needs to be achieved.
PP-2	Circulate an assessment survey to determine what methods or devices County agencies have in place for securing equipment and furniture during earthquake events.	EQ	Low	General Revenue		IT Dept	2018	More expensive equipment has been located to reduce damage from an earthquake. Some smaller and less expensive equipment remains unsecured.
PP-3	Establish policy to assure all computer equipment and furniture is secured in a manner to avoid toppling during an earthquake.	EQ	Low	General Revenue		Information Technology	Completed	IT policy in place to ensure computer equipment is secured to a desk or rack mounted.

Henderson County Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
PP-4	Incorporate GIS modeling to show areas of the County prone to more serious damage during earthquake conditions.	EQ	High	General Revenue and Grants		GIS Department	Completed	HAZUS run completed during the 2014 Hazard Mitigation Regional Planning Update.
Natural Resource Protection								
NRP-1	Develop a plan, which will include annual monitoring of sediment transport and erosion, to address the long – term issue of river and stream erosion in the County.	ER	High	General Revenue and Grants		Engineering Department	Completed	Completed; This was accomplished by adding erosion division in October 2007.
NRP-2	Support State enforcement of sedimentation and erosion control regulations.	ER	High	General Revenue and Grants		Engineering Department	Completed	This has been accomplished and will continue to maintain and support.
NRP-3	Coordinate efforts with the U.S. Forestry Service to enforce banning burns.	WF	High	General Revenue		County EMA	Completed	USFS is notified when burning bans are in place and during red flag burning days. This will be continued going forward.
NRP-4	Encourage development and enlargement of buffers and green areas.	WF	High	General Revenue		Planning Dept	Completed	Land Development Code addresses buffers and green areas.

Henderson County Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
Emergency Services								
ES-1	Establish two – way radio communication for key personnel (i.e. County Manager, Emergency Services providers, Shelter Teams, etc.).	All	High	General Revenue and Grants		County EMA	Completed	New communications system will be installed by September 2014
ES-2	Include 311 systems, pre-scripted messaging in communications system.	All	Moderate	General Revenue and Grants		County EMA	Completed	3-1-1 is not available to Henderson County through AT&T. We have implemented a reverse 9-1-1 mass notification system so this action is complete.
ES-3	Establish auxiliary power systems via portable generators for all primary County buildings and schools. Make certain to include the wiring closets to accommodate technology routing.	All	High	General Revenue and Grants		Engineering Dept	2019	Several county facilities have been upgraded to include emergency power. Installation of transfer switches will continue as the budget allows.
ES-4	Assure adequate training for emergency personnel to respond to HAZMAT events is on-going.	HM	Moderate	General Revenue		County EMA	Completed	Hazardous Materials training is provided on an annual basis through Blue Ridge Community College
ES-5	Incorporate procedures for handling hazardous materials into GIS modeling.	HM	High	General Revenue		GIS Department	Completed	CAMEO, Aloha and other plume modeling products are available and in use.
ES-6	Reaffirm plans with emergency service agencies and providers for isolation and evacuation during HAZMAT events.	HM	Moderate	General Revenue and Grants		County EMA	2015, Annually review and update	Hazardous Materials plans for fixed facilities have been updated to include evacuation routes. However, these plans will need to be re-evaluated annually.
Structural Projects								
SP-1								

Henderson County Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Public Education and Awareness								
PEA-1	Hold a County sponsored hazard mitigation seminar for the county residents, including information on preparedness for all hazards significant to Henderson County.	All	Low	General Revenue		County EMA	Completed	Preparedness information included as a regular article in county monthly newsletter. Preparedness Fair held October 2013 at Jackson Park.
PEA-2	Educate contractors about principles for quality redevelopment and safe housing development through written materials or a County sponsored workshop.	All	Low	General Revenue		Planning Department	2019	Contractors have been educated to some degree, but more outreach is needed and the program needs to be re-evaluated. This action will be carried out going forward.
PEA-3	Provide new home and property buyers with information on quality redevelopment and safe housing development. The information is probably most efficiently dispersed at the County and local administration buildings.	All	Low	General Revenue		Planning Department	2018	The county has developed a brochure to provide information on safe housing development. However, further means of outreach need to be integrated.
PEA-4	Manually disperse and have a website posting which provides information about the Henderson County Multi-Jurisdictional Hazard Mitigation Plan and relevant mitigation measures the public can take. In addition, provide a response/reply section where residents can comment on the effectiveness of the current plan and where they can make suggestions for future revisions on then plan.	All	High	General Revenue		County EMA	2015, Annually review and update materials	County EMA website has links to preparedness and mitigation measures along with link to the current Hazard Mitigation Plan. This information will need to be reviewed and updated on an annual basis.

FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake
LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees County EMA = Henderson County Emergency Management

Village of Flat Rock Mitigation Action Plan

Village of Flat Rock Existing Mitigation Actions								
Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
Prevention								
P-1	Encourage Village participation in the National Flood Insurance Program and subsequent participation in the Community Rating System Program.	FL	High	General Revenue		Village Council	Completed	Completed and in the program where residents have purchased NFIP as required by their lenders.
P-2	Develop a local Flood Damage Presentation Ordinance.	FL	High	General Revenue and Grants		Village Council	Completed	The Flood Damage Ordinance was adopted December 11, 2008. Ordinance last amended November 2013
P-3	Hire and educate a permanent Building Inspector/Code Enforcement Officer to enforce the Village's current Zoning Ordinance, Subdivision Ordinance, and the North Carolina State Building Codes within the planning jurisdiction of the Village of Flat Rock.	All	High	General Revenue		Village Council	Completed	This was achieved by contracting with Henderson County to provide a Building Inspector and the Village has a Code Enforcement officer. Zoning and Planning handled in house. County enforces building codes.
P-4	Convene the Planning Board to identify recommendations to reduce the vulnerability to landslides in the developed areas of Flat Rock and present them to the Village Council.	LS	High	General Revenue		Village Council	2018	This is an upcoming project for the next 5 years to utilize the State of North Carolina Landslide Study that will be utilized to develop the Village Ordinance.
Property Protection								
PP-1								

Village of Flat Rock Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
Natural Resource Protection								
NRP-1								
Emergency Services								
ES-1								
Structural Projects								
SP-1								
Public Education and Awareness Activities								
PEA-1	Educate contractors about principles for quality redevelopment and safe housing development through written materials or a County sponsored workshop.	All	Low	General Revenue		Planning Department	2019	Contractors have been educated to some degree, but more outreach is needed and the program needs to be re-evaluated. This action will be carried out going forward.
PEA-2	Provide new home and property buyers with information on quality redevelopment and safe housing development. The information is probably most efficiently dispersed at the County and local administration buildings.	All	Low	General Revenue		Planning Department	2018	The county has developed a brochure to provide information on safe housing development. However, further means of outreach need to be integrated.

FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake
LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees County EMA = Henderson County Emergency Management Village = Village of Flat Rock

Town of Fletcher Mitigation Action Plan

Town of Fletcher Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Develop a Floodplain Management Plan. The Floodplain Management Plan is included in Land Development Code adopted March 2006.	FL	High	General Revenue and Grants		Town Council	Completed	The Floodplain Management Plan is included in Land Development Code adopted March 2006.
P-2	Develop a Stormwater Management Ordinance. Encourage Town participation in the Community Rating System.	FL	High	General Revenue and Grants		Town Council	Completed	Complete The Storm water Management plan is included in Land Development Code adopted March 2006.
P-3	Develop a stand-by acquisition grant application that lists properties located in the floodplain.	FL	Moderate	Grants		Town Council	2019	Properties have been identified through the GIS layer development. No funding has been awarded for acquisition, so this will remain an action going forward.
P-4	Identify properties adjacent to the railroad tracks and post in a GIS system for potential buyout of highly vulnerable structures.	HM	Moderate	General Revenue and Grants		Town Council	2019	Properties have been identified through the GIS layer development. No funding has been awarded for acquisition, so this will remain an action going forward.
Property Protection								
PP-1								
Natural Resource Protection								
NRP-1								

Town of Fletcher Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
Emergency Services								
ES-1								
Structural Projects								
SP-1								
Public Education and Awareness Activities								
PEA-1	Educate contractors about principles for quality redevelopment and safe housing development through written materials or a County sponsored workshop.	All	Low	General Revenue		Planning Department	2019	Contractors have been educated to some degree, but more outreach is needed and the program needs to be re-evaluated. This action will be carried out going forward.
PEA-2	Provide new home and property buyers with information on quality redevelopment and safe housing development. The information is probably most efficiently dispersed at the County and local administration buildings.	All	Low	General Revenue		Planning Department	2018	The county has developed a brochure to provide information on safe housing development. However, further means of outreach need to be integrated.

FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake
LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees County EMA = Henderson County Emergency Management Town = Town of Fletcher

City of Hendersonville Mitigation Action Plan

City of Hendersonville Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Encourage community to participate in the CRS program.	FL	Moderate	General Revenue and Grants		Engineering Department	2018	The city is still considering CRS participation, but this is pending Building Inspections score
P-2	Develop a Stormwater Management Plan.	FL	High	General Revenue and Grants		Engineering Department	Completed	Henderson County participates in the State Stormwater Mgmt Plan.
P-3	Develop a stand-by acquisition grant application that lists properties identified as repetitive loss properties due to water events.	FL	Moderate	Federal Grant		Planning Department	2019	Properties have been identified through the GIS layer development. No funding has been awarded for acquisition, so this will remain an action going forward.
P-4	Develop a stand-by acquisition grant application that lists properties adjacent to the railroad tracks.	HM	Moderate	Grants		Zoning Department	2019	Properties have been identified through the GIS layer development. No funding has been awarded for acquisition, so this will remain an action going forward.
P-5	Update and revise the local Land Use and Development Plan. The most recent plan was approved in 1980.	All	High	General Revenue and Grants		Planning Department	Completed	This has been completed by the implementation of the 2030 Hendersonville Comprehensive Plan in April of 2009. Comp. Plan approved in April of 2009.

City of Hendersonville Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
P-6	Update and revise the local Subdivision Ordinance.	All	High	General Revenue and Grants		Planning Department	Completed	This has been completed by the implementation of the 2030 Hendersonville Comprehensive Plan in April of 2009.
P-7	Work with local governments (especially Henderson County) to develop local Water Shortage Response Guidelines (in different phases) as a part of the Henderson County Emergency Operations Plan.	DR	High	General Revenue		Planning Department	Completed	Drought plan developed and included into Henderson County Emergency Operations Plan
Property Protection								
PP-1								
Natural Resource Protection								
NRP-1								
Emergency Services								
ES-1	Provide additional capacity to the current communications system during emergency situations to improve response capability. Built a new communications center to provide the necessary operational capacity required by the City.	All	High	General Revenue and Grants		Police Department	Completed	Communications System and center updated
ES-2	Provide a two – way communication system for emergency services. Continue to provide two-way communications for emergency services.	All	High	Grants		Police and Fire Department s	Completed	A two-way communications system is in place for emergency services.

City of Hendersonville Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
ES-3	Purchase generators to use as an emergency power supply for water and sewer treatment plants if power is lost during a disaster.	All	High	General Revenue and Grants		Water and Sewer Department	2018	Some generators have been purchased and installed, but more are needed so this action will be carried out going forward.
ES-4	Purchase generators to use at the operations center that controls information technology, communications and protection for fiber optic cable.	All	High	General Revenue and Grants		Information Technology	Completed	New ops center with generator back-up is in place
ES-5	Develop an action plan to reroute and control traffic during emergency situations. Remote control capability has been implemented throughout the City.	All	High	General Revenue and Grants		Police Department	2018	Remote control capability has been implemented throughout the City, but an action plan has not been developed.
Structural Projects								
SP-1								
Public Education and Awareness Activities								
PEA-1								

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Town of Laurel Park Mitigation Action Plan

Town of Laurel Park Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Develop a Stormwater Management Plan.	FL	High	General Revenue		Town Council	Completed	The Storm Water Management Ordinance was developed and approved January 15, 2008 and is enforced as required
Property Protection								
PP-1	Encourage Town participation in the National Flood Insurance Program and subsequent participation in the Community Rating System Program.	FL	High	General Revenue		Town Council	Completed	Completed – Town Participates
Natural Resource Protection								
NRP-1	Monitor trees and branches, at risk of breaking in wind, ice, and snow events. This will be accomplished by Pruning or thinning of trees or branches when they pose an immediate threat to property, utility lines or other significant structures or critical facilities in the community.	All	High	General Revenue		Town Council	Completed	The Town of Laurel Park continues to work with Duke Energy on an annual basis to monitor and remove trees and branches at risk of breaking during high winds, ice, and snow events to minimize power line damage during a storm. The Town also assesses and removes hazardous trees on the ROW to ensure access.

Town of Laurel Park Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
NRP-2	Work in conjunction with the NCFS to create and maintain fire breaks; especially on Town ROW and support efforts with private property owners and HOAs.	Fire	High	General revenue and NCFS	$0; staff time	Town Manager	12/31/2014; maintenance will be ongoing	New Action
Emergency Services								
ES-1	Purchase portable evacuation, detour, and re-route traffic signs for use during an emergency.	All	High	General Revenue and Grants		Town Council	Completed	Signs have been purchased and are ready for use in an emergency.
ES-2	Purchase generators for all local emergency facilities.	All	High	General Revenue and Grants		Town Council	2018	The Town of Laurel Park has purchased and installed natural gas operated generators for the Town Hall and the Public Works Department to facilitate emergency management operations during power outages. Other facilities will be evaluated for generator need going forward.
Structural Projects								
SP-1								
Public Education and Awareness Activities								
PEA-1	Implement a citizen notification system (email, text, automated phone call)	All	Medum	General Revenues	$3,000/yr	Town Council	2015	Contract in review currently and system will need to be updated accordingly.

FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake
LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees County EMA = Henderson County Emergency Management Town = Town of Laurel Park

Town of Mills River Mitigation Action Plan

Town of Mills River Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Encourage Town participation in the National Flood Insurance Program and subsequent participation in the Community Rating System Program.	FL	High			Town Council	2019	Town Council will consider participation
P-2	Develop a Flood Damage Prevention Ordinance.	FL	Moderate			Town Council	2019	Town Council will consider development
P-3	Develop a Stormwater Management Plan.	FL	Moderate			Town Council	2019	Town Council consider development
Property Protection								
PP-1								
Natural Resource Protection								
NRP-1								
Emergency Services								
ES-1								
Structural Projects								
SP-1								

Town of Mills River Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Public Education and Awareness Activities								
PEA-1	Educate contractors about principles for quality redevelopment and safe housing development through written materials or a County sponsored workshop.	All	Low	General Revenue		Planning Department	2019	Contractors have been educated to some degree, but more outreach is needed and the program needs to be re-evaluated. This action will be carried out going forward.
PEA-2	Provide new home and property buyers with information on quality redevelopment and safe housing development. The information is probably most efficiently dispersed at the County and local administration buildings.	All	Low	General Revenue		Planning Department	2018	The county has developed a brochure to provide information on safe housing development. However, further means of outreach need to be integrated.
FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees County EMA = Henderson County Emergency Management Town = Town of Mills River								

Annex B
Polk County

This annex includes jurisdiction-specific information for Polk County and its participating municipalities. It consists of the following five subsections:

- B.1 Polk County Community Profile
- B.2 Polk County Risk Assessment
- B.3 Polk County Vulnerability Assessment
- B.4 Polk County Capability Assessment
- B.5 Polk County Mitigation Strategy

B.1 POLK COUNTY COMMUNITY PROFILE

B.1.1 Geography and the Environment

Polk County is situated along the North Carolina and South Carolina state border. The county is located in the Blue Ridge Mountain Range. It comprises two towns, the Town of Columbus and the Town of Tryon, and one city, the City of Saluda.

The county is a transitional county whose terrain ranges between mountainous and Piedmont. The county's highest elevation reaches 3,200 feet and its lowest elevation is 800 feet. The total area of the county is 238 square miles, 1 square mile of which is water area. Lake Adger and additional smaller lakes and reservoirs offer recreational opportunities for both residents and visitors.

Summer temperatures in the county range from highs of about 89˚F to lows in the mid 50s. Winter temperatures range from highs of mid 60˚F to lows around 30˚F. Year round, average temperatures in the mountainous areas of the county are typically 10˚F lower than the valley. The county averages over five inches of rainfall each month.

B.1.2 Population and Demographics

According to the 2010 Census, Polk County has a population of 20,510 people. The county has seen almost 12% growth between 2000 and 2010, and the population density is 86 people per square mile. The county and two of the three municipalities experienced population growth from 2000 to 2010. Population counts from the US Census Bureau for 1990, 2000, and 2010 for the county and participating municipalities are presented in **Table B.1**.

TABLE B.1: POPULATION COUNTS FOR POLK COUNTY

Jurisdiction	1990 Census Population	2000 Census Population	2010 Census Population	% Change 2000-2010
Polk County	**14,416**	**18,324**	**20,510**	**11.9%**
Town of Columbus	812	992	999	0.7%
City of Saluda	488	575	713	24.0%
Town of Tryon	1,680	1,760	1,646	-6.5%

Source: US Census Bureau

Based on the 2010 Census, the median age of residents of Polk County is 49.1 years. The racial characteristics of the county are presented in **Table B.2**. Whites make up the majority of the population in the county, accounting for 91 percent of the population. The Town of Columbus has the most diverse population in the county.

TABLE B.2: DEMOGRAPHICS OF POLK COUNTY

Jurisdiction	White, Percent (2010)	Black or African American, Percent (2010)	American Indian or Alaska Native, Percent (2010)	Asian, Percent (2010)	Native Hawaiian or Other Pacific Islander, Percent (2010)	Other Race, Percent (2010)	Two or More Races, percent (2010)	Persons of Hispanic Origin, Percent (2010)*
Polk County	**90.8%**	**4.5%**	**0.4%**	**0.3%**	**0.0%**	**2.6%**	**1.4%**	**5.5%**
Town of Columbus	81.3%	3.6%	2.9%	0.7%	0.0%	9.1%	2.4%	15.4%
City of Saluda	95.7%	2.7%	0.3%	0.3%	0.0%	0.1%	1.0%	2.0%
Town of Tryon	80.0%	16.5%	0.1%	0.4%	0.0%	1.6%	1.6%	4.4%

*Hispanics may be of any race, so also are included in applicable race categories

Source: US Census Bureau

B.1.3 Housing

According to the 2010 US Census, there are 11,432 housing units in Polk County, the majority of which are single family homes or mobile homes. Housing information for the county and municipalities is presented in **Table B.3**. As shown in the table, the City of Saluda has a significantly higher percentage of seasonal housing units compared to the unincorporated county.

TABLE B.3: HOUSING CHARACTERISTICS OF POLK COUNTY

Jurisdiction	Housing Units (2000)	Housing Units (2010)	Seasonal Units, Percent (2010)	Median Home Value (2007-2011)
Polk County	**9,192**	**11,432**	**10.5%**	**$168,800**
Town of Columbus	442	508	2.0%	$125,700
City of Saluda	429	493	28.6%	$223,700
Town of Tryon	985	1,066	6.6%	$157,400

Source: US Census Bureau

B.1.4 Infrastructure

Transportation

There are several US and state highways that serve Polk County and link it with other regions of North Carolina as well as the neighboring states of Georgia, South Carolina, and Tennessee. Interstate 26 is a major east-west route connecting South Carolina to Tennessee. I-26 intersects with US Route 74 in Polk County. US Route 74 is a major four-lane highway that travels northwest to southeast through Polk County and connects Chattanooga, Tennessee; Asheville, North Carolina; Charlotte, North Carolina; and Wilmington North Carolina. This route has alternating names, but it is considered the commercial backbone and main truck route of Western North Carolina. US 176 runs east to west in Polk County and is a spur of US 76 through North and South Carolina. North Carolina 9 and North Carolina 108 are additional major arterials within the county.

Within Polk County, the Polk County Transit Authority is free to residents over the age of 60 and has a minimal user fee for any other residents needing service. The county maintains, operates, and coordinates all public transportation.

Utilities

Electrical power in Polk County is provided by one public company, Duke Energy Progress. In addition to the public utility provider, Rutherford Electric Membership Corporation is an electricity cooperative that provides service to the county.

Water and sewer service is provided by many of the towns in the South Mountains Region, but generally municipal water systems are extremely limited in the mountains and private or shared wells and septic systems are considered the norm. Within Polk County, private or shared wells and septic systems are utilized with limited municipal water systems.

Community Facilities

There are a number of buildings and community facilities located throughout Polk County. According to the data collected for the vulnerability assessment (Section 6.4.1), there are 8 fire/EMS stations, 4 police stations, and 6 public schools located within the county.

There is one hospital located in Polk County. St. Luke's Hospital in the Town of Columbus has 45 beds. St. Luke's provides emergency, rehab/therapy, surgical, and various other services to Polk County and its surrounding areas.

There are a total of two recreation parks and one recreation complex in Polk County. The county also includes access to one pool and gym facility. Recreational programs are provided by the county, when possible.

B.1.5 Land Use

The population centers in Polk County are concentrated along transportation routes. However, rural communities are prevalent throughout the county. The jurisdictions within the county serve as the most populous areas with rural and recreational areas surrounding.

Polk County has an effective Land Use Plan that guides development and identifies areas of mitigation concern. The county has an active Zoning Ordinance that guides development toward non-mountainous or ridgeline areas to protect the natural conditions and respect existing topography while securing public health, safety and general welfare. Saluda and Columbus also maintain individual Zoning Ordinances to assist in the maintenance of land use and its potential environmental impacts.

B.1.6 Employment and Industry

In 2011, Polk County had an average annual employment of 8,596 workers and an average unemployment rate of 7.1 percent. In 2011, the Education and Health Services industry employed the most people, with 23.3 percent of the workforce, followed by Manufacturing (18.9%); Retail Trade (12.6%); and Construction (8.7%). The average annual median household income in Polk County was $43,332 from 2007 to 2011.

B.2 POLK COUNTY RISK ASSESSMENT

This subsection includes hazard profiles for each of the significant hazards identified in Section 4: *Hazard Identification* as they pertain to Polk County. Each hazard profile includes a description of the hazard's location and extent, notable historical occurrences, and the probability of future occurrences. Additional information can be found in Section 5: *Hazard Profiles*.

B.2.1 Drought

Location and Spatial Extent

Drought typically covers a large area and cannot be confined to any geographic or political boundaries. Local areas may experience much more severe and/or frequent drought events than what is represented on the Palmer Drought Severity Index map. Furthermore, it is assumed that the county would be uniformly exposed to drought, making the spatial extent potentially widespread. It is also notable that drought conditions typically do not cause significant damage to the built environment.

Historical Occurrences

According to the North Carolina Drought Monitor, Polk County has had drought occurrences in thirteen of the last fourteen years (2000-2013). **Table B.4** shows the most severe drought classification for each year, according to North Carolina Drought Monitor classifications. It should be noted that the North Carolina Drought Monitor also estimates what percentage of the county is in each classification of drought severity. For example, the most severe classification reported may be exceptional but a majority of the county may actually be in a less severe condition.

TABLE B. 4: HISTORICAL DROUGHT OCCURRENCES IN POLK COUNTY

Abnormally Dry | Moderate Drought | Severe Drought | Extreme Drought | Exceptional Drought

	Polk County
2000	EXTREME
2001	EXTREME
2002	EXCEPTIONAL
2003	NORMAL
2004	MODERATE
2005	ABNORMAL
2006	MODERATE
2007	EXCEPTIONAL
2008	EXCEPTIONAL
2009	EXTREME
2010	MODERATE
2011	SEVERE
2012	MODERATE
2013	MODERATE

Source: North Carolina Drought Monitor (through Sept. 2013)

Probability of Future Occurrences

Based on historical occurrence information, it is assumed that Polk County has a probability level of likely (10 to 100 percent annual probability) for future drought events. This hazard may vary slightly by location but each area has an equal probability of experiencing a drought. However, historical information also indicates that there is a much lower probability for extreme, long-lasting drought conditions.

B.2.2 Extreme Heat

Location and Spatial Extent

Excessive heat typically impacts a large area and cannot be confined to any geographic or political boundaries. All of Polk County is susceptible to extreme heat conditions.

Historical Occurrences

Data from the National Climatic Data Center was used to determine historical extreme heat and heat wave events in Polk County. There were no events reported.

In addition, information from the State Climate Office of North Carolina was reviewed to obtain historical temperature records in the county. Temperature information has been reported since 1917. The recorded maximum for Polk County can be found below in **Table B.5**.

TABLE 5.5: HIGHEST RECORDED TEMPERATURE IN POLK COUNTY

Location	Date	Temperature (F)
Tryon	6/22/1964	105
POLK COUNTY MAXIMUM	**--**	**105**

Source: State Climate Office of North Carolina

The State Climate Office also reports average maximum temperatures at Tryon. **Table B.6** shows the average maximum temperatures from 1971 to 2000 at the Tryon observation station which can be used as a general comparison for the county.

TABLE B.6: AVERAGE MAXIMUM TEMPERATURE IN TRYON, POLK COUNTY

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Avg. Max (°F)	51.9	56.9	65.2	73.9	80.3	86.0	89.1	87.3	81.6	73.0	63.0	54.5

Source: State Climate Office of North Carolina

Probability of Future Occurrences

Based on historical occurrence information, it is assumed that all of Polk County has a probability level of possible (1 to 10 percent annual probability) for future extreme heat events to impact the county.

B.2.3 Hailstorm

Location and Spatial Extent

Hailstorms frequently accompany thunderstorms, so their locations and spatial extents coincide. It is assumed that Polk County is uniformly exposed to severe thunderstorms; therefore, all areas of the county are equally exposed to hail which may be produced by such storms.

Historical Occurrences

According to the National Climatic Data Center, 53 recorded hailstorm events have affected Polk County since 1970.[1] **Table B.7** is a summary of the hail events in Polk County. **Table B.8** provides detailed information about each event that occurred in the county. In all, hail occurrences resulted in slightly more than $4,000 (2013 dollars) in property damages. Hail ranged in diameter from 0.75 inches to 2.75 inches. It should be noted that hail is notorious for causing substantial damage to cars, roofs, and other areas of the built environment that may not be reported to the National Climatic Data Center. Therefore, it is likely that damages are greater than the reported value.

TABLE B.7: SUMMARY OF HAIL OCCURRENCES IN POLK COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Columbus	12	0/0	$4,153
Saluda	9	0/0	$0
Tryon	5	0/0	$0
Unincorporated Area	27	0/0	$0
POLK COUNTY TOTAL	**53**	**0/0**	**$4,153**

Source: National Climatic Data Center

[1] These hail events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is likely that additional hail events have affected Polk County. In addition to NCDC, the North Carolina Department of Insurance office was contacted for information. As additional local data becomes available, this hazard profile will be amended.

TABLE B.8: HISTORICAL HAIL OCCURRENCES IN POLK COUNTY

	Date	Magnitude	Deaths / Injuries	Property Damage*
Columbus				
COLUMBUS	02-JUN-97	0.75 in.	0/0	$0
COLUMBUS	04-JUL-97	1.75 in.	0/0	$0
COLUMBUS	03-MAY-98	0.75 in.	0/0	$0
COLUMBUS	20-AUG-99	1.75 in.	0/0	$0
COLUMBUS	16-MAR-02	0.88 in.	0/0	$4,153
COLUMBUS	02-MAY-03	0.75 in.	0/0	$0
COLUMBUS	15-MAY-03	1.00 in.	0/0	$0
COLUMBUS	20-MAY-06	0.88 in.	0/0	$0
COLUMBUS	19-APR-07	0.88 in.	0/0	$0
COLUMBUS	19-APR-07	0.88 in.	0/0	$0
COLUMBUS	27-JUN-08	0.75 in.	0/0	$0
COLUMBUS	09-SEP-09	0.88 in.	0/0	$0
Saluda				
Saluda	31-MAR-93	0.75 in.	0/0	$0
SALUDA	24-JUN-96	1.00 in.	0/0	$0
SALUDA	04-JUL-97	1.75 in.	0/0	$0
SALUDA	05-JUL-01	0.75 in.	0/0	$0
SALUDA	15-JUL-06	0.88 in.	0/0	$0
SALUDA	11-OCT-06	1.00 in.	0/0	$0
SALUDA	26-APR-08	0.75 in.	0/0	$0
SALUDA	27-JUN-08	0.75 in.	0/0	$0
SALUDA	18-JUL-12	1.00 in.	0/0	$0
Tryon				
TRYON	14-JUN-97	0.88 in.	0/0	$0
TRYON	13-MAY-00	0.75 in.	0/0	$0
TRYON	05-JUL-05	0.75 in.	0/0	$0
TRYON	03-APR-06	0.75 in.	0/0	$0
TRYON	26-OCT-10	1.00 in.	0/0	$0
Unincorporated Area				
POLK COUNTY	05-JUN-70	1.50 in.	0/0	$0
POLK COUNTY	04-JUN-85	2.75 in.	0/0	$0
POLK COUNTY	05-JUN-85	0.88 in.	0/0	$0
POLK COUNTY	05-JUN-85	1.75 in.	0/0	$0
POLK COUNTY	07-JUN-85	1.00 in.	0/0	$0
POLK COUNTY	10-JUL-85	1.00 in.	0/0	$0
POLK COUNTY	10-JUL-85	1.00 in.	0/0	$0
POLK COUNTY	16-JUL-85	0.75 in.	0/0	$0
POLK COUNTY	01-MAY-87	0.75 in.	0/0	$0
POLK COUNTY	17-MAY-88	1.75 in.	0/0	$0
POLK COUNTY	18-JUN-88	0.75 in.	0/0	$0
POLK COUNTY	05-JUN-89	0.75 in.	0/0	$0
POLK COUNTY	01-MAY-90	1.00 in.	0/0	$0
MILL SPG	25-JUN-01	1.00 in.	0/0	$0
MILL SPG	19-APR-06	0.75 in.	0/0	$0

	Date	Magnitude	Deaths / Injuries	Property Damage*
BEULAH	06-JUL-08	0.75 in.	0/0	$0
SUNNY VIEW	30-SEP-08	0.88 in.	0/0	$0
MILL SPG	30-SEP-08	1.00 in.	0/0	$0
SUNNY VIEW	09-JUN-09	0.88 in.	0/0	$0
MC GINNIS XRDS	28-JUL-09	0.75 in.	0/0	$0
MC GINNIS XRDS	27-AUG-09	0.75 in.	0/0	$0
SUNNY VIEW	02-JUN-11	1.00 in.	0/0	$0
COLLINSVILLE	16-JUN-11	0.75 in.	0/0	$0
SUNNY VIEW	01-MAY-12	0.75 in.	0/0	$0
SUNNY VIEW	01-MAY-12	1.75 in.	0/0	$0
SUNNY VIEW	01-MAY-12	0.75 in.	0/0	$0
SUNNY VIEW	01-MAY-12	0.75 in.	0/0	$0

*Property damage is reported in 2013 dollars; All damage may not have been reported.
Source: National Climatic Data Center

Probability of Future Occurrences
Based on historical occurrence information, it is assumed that the probability of future hail occurrences is highly likely (100 percent annual probability). Since hail is an atmospheric hazard (coinciding with thunderstorms), it is assumed that Polk County has equal exposure to this hazard. It can be expected that future hail events will continue to cause minor damage to property and vehicles throughout the county.

B.2.4 Hurricane and Tropical Storm

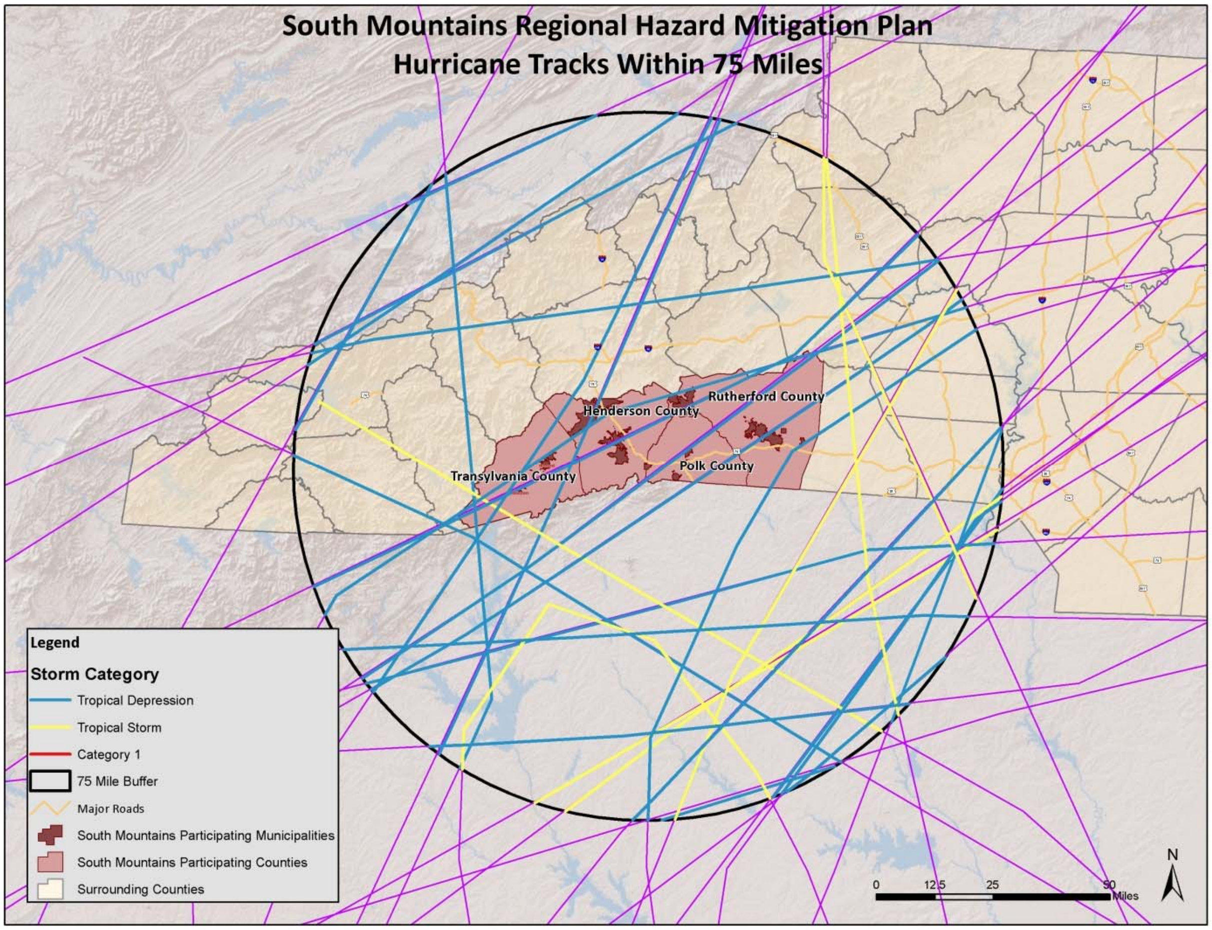
Location and Spatial Extent
Hurricanes and tropical storms threaten the entire Atlantic and Gulf seaboard of the United States. While coastal areas are most directly exposed to the brunt of landfalling storms, their impact is often felt hundreds of miles inland and they can affect Polk County. The entire county is equally susceptible to hurricane and tropical storms.

Historical Occurrences
According to the National Hurricane Center's historical storm track records, 30 hurricane or tropical storm tracks have passed within 75 miles of Polk County since 1850.[2] This includes 7 tropical storms and 23 tropical depressions.

Of the recorded storm events, two tropical depressions have traversed directly through Polk County as shown in **Figure B.1**. **Table B.9** provides for each event the date of occurrence, name (if applicable), maximum wind speed (as recorded within 75 miles of the South Mountains Region) and the Maximum Category of the storm based on the Saffir-Simpson Scale.

[2] These storm track statistics do not include extra-tropical storms. Though these related hazard events are less severe in intensity, they may cause significant local impact in terms of rainfall and high winds.

FIGURE B.1: HISTORICAL HURRICANE STORM TRACKS WITHIN 75 MILES OF POLK COUNTY



Source: National Oceanic and Atmospheric Administration; National Hurricane Center

TABLE B.9: HISTORICAL STORM TRACKS WITHIN 75 MILES OF POLK COUNTY (1850–2010)

Date of Occurrence	Storm Name	Maximum Wind Speed (knots)	Storm Category
9/17/1859	NOT NAMED	--	Tropical Depression (TD)
9/24/1886	NOT NAMED	35	Tropical Storm (TS)
8/1/1891	NOT NAMED	35	Tropical Storm (TS)
7/8/1896	NOT NAMED	26	Tropical Depression (TD)
9/28/1901	NOT NAMED	22	Tropical Depression (TD)
10/11/1902	NOT NAMED	31	Tropical Depression (TD)
10/10/1905	NOT NAMED	--	Tropical Depression (TD)
9/18/1906	NOT NAMED	31	Tropical Depression (TD)
9/23/1907	NOT NAMED	40	Tropical Storm (TS)
8/30/1911	NOT NAMED	26	Tropical Depression (TD)
6/17/1912	NOT NAMED	--	Tropical Depression (TD)
9/4/1913	NOT NAMED	26	Tropical Depression (TD)
8/31/1915	NOT NAMED	26	Tropical Depression (TD)

Date of Occurrence	Storm Name	Maximum Wind Speed (knots)	Storm Category
7/15/1916	NOT NAMED	31	Tropical Depression (TD)
8/11/1928	NOT NAMED	35	Tropical Storm (TS)
5/30/1934	NOT NAMED	26	Tropical Depression (TD)
8/28/1949	NOT NAMED	35	Tropical Storm (TS)
9/30/1959	GRACIE	22	Tropical Depression (TD)
8/30/1964	CLEO	22	Tropical Depression (TD)
6/8/1968	CELESTE	53	Tropical Storm (TS)
9/8/1977	BABE	22	Tropical Depression (TD)
8/18/1985	ONE-C	48	Tropical Storm (TS)
9/22/1989	HUGO	22	Tropical Depression (TD)
8/17/1994	BERYL	--	Tropical Depression (TD)
7/24/1997	DANNY	18	Tropical Depression (TD)
7/10/2003	DOLORES	--	Tropical Depression (TD)
9/8/2004	FRANCES	18	Tropical Depression (TD)
9/17/2004	IVAN	13	Tropical Depression (TD)
9/28/2004	JEANNE	18	Tropical Depression (TD)
7/7/2005	CINDY	18	Tropical Depression (TD)

Source: National Hurricane Center

The National Climatic Data Center did not report any events associated with a hurricane or tropical storm in Polk County between 1950 and 2013. However, federal records indicate that three disaster declarations were made in 1996 (Hurricane Fran) and 2004 (Tropical Storm Frances and Hurricane Ivan) for the county.[3]

Flooding is generally the greatest hazard of concern with hurricane and tropical storm events in Polk County. Most events do not carry winds that are above that of the winter storms and straight line winds received by the county. Some anecdotal information is available for the major storms that have impacted that area as found below:

Hurricane Fran – September 5, 1996
Just prior to landfall of Hurricane Fran, a small portion of the region, in the Bat Cave (Henderson County), Chimney Rock (Rutherford County), Lake Lure (Rutherford County) areas, received up to 11 inches of rain in a 3 hour period. The rains were the result of nearly stationary, very heavy thunderstorms. Severe damage to property in the immediate area resulted, with about 70 homes and businesses destroyed or significantly damaged. As Hurricane Fran moved inland, it dropped an additional 5 to 10 inches of rain over the area resulting in significant flooding throughout the region.

Tropical Storm Frances – September 7-8, 2004
Tropical Storm Frances was a slow-moving, relatively large storm that dumped heavy rains over the eastern United States. The remnants of Frances produced a swath of 5 to 15 inches of rain across the North Carolina Mountains with reports of 12 to 15 inches of rain along the higher terrain and isolated reports in excess of 18 inches. Wind gusts reached between 40 and 60 mph along the Appalachian

[3] All of the participating counties were declared disaster areas for these storms particular storms. A complete listing of historical disaster declarations, including the affected counties, can be found in Section 4: *Hazard Identification*.

Mountains and thousands of trees were downed. Trees fell on structures, vehicles, and power lines. Additionally, the downed trees led to the death of an elderly man in Hendersonville when a tree fell through the resident's structure. Flooding also led to numerous landslides in the area which added to the damage of infrastructure and residential and commercial structures. Frances caused significant crop damages totaling $55 million statewide. North Carolina residents received almost $20.6 million in federal disaster assistance following the storm.

Hurricane Ivan – September 16-17, 2004
Just a week and a half following Tropical Storm Frances, the remnants of Hurricane Ivan hit western North Carolina when many streams and rivers were already well above flood stage. The widespread flooding forced many roads to be closed and landslides were common across the mountain region. Wind gusts reached between 40 and 60 mph across the higher elevations of the Appalachian Mountains resulting in numerous downed trees. More than $13.8 million of federal aid was dispersed across North Carolina following Ivan.

The Hurricane Frances/Ivan combination of events resulted in widespread road closures (including Highways 64, 280, 25, and 276) as well as infrastructure damages (many bridges and roads were completely washed out), residential structure damages, and commercial structure damages due to massive flooding. Trees were blown down and fell on structures, vehicles, and powerlines, adding to the already widespread debris buildup and power outages.

Probability of Future Occurrences

Given the inland location of the county, it is more likely to be affected by remnants of hurricane and tropical storm systems (as opposed to a major hurricane) which may result in flooding or high winds. The probability of being impacted is less than coastal areas, but still remains a real threat to Polk County due to induced events like flooding and landsliding. Based on historical evidence, the probability level of future occurrence is possible (between 1 and 10 percent annual probability). Given the regional nature of the hazard, all areas in the county are equally exposed to this hazard. However, when the county is impacted, the damage could be catastrophic, threatening lives and property throughout the planning area.

B.2.5 Lightning

Location and Spatial Extent

Lightning occurs randomly, therefore it is impossible to predict where and with what frequency it will strike. It is assumed that all of Polk County is uniformly exposed to lightning.

Historical Occurrences

According to the National Climatic Data Center, there have been four recorded lightning events in Polk County since 1996, as listed in summary **Table B.10**.[4] These events resulted in more than $226,000 (2013 dollars) in damages and caused 6 injuries. A complete listing of those events can be found in **Table B.11.** Many of the reported events are those that caused damage, and it should be expected that damages are likely much higher for this hazard than what is reported.

[4] These lightning events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is certain that additional lightning events have occurred in Polk County. The State Fire Marshall's office was also contacted for additional information but none could be provided. As additional local data becomes available, this hazard profile will be amended.

TABLE B.10: SUMMARY OF LIGHTNING OCCURRENCES IN POLK COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Columbus	0	0/0	$0
Saluda	1	0/0	$69,212
Tryon	2	0/0	$157,302
Unincorporated Area	1	0/6	$0
POLK COUNTY TOTAL	**4**	**0/6**	**$226,514**

Source: National Climatic Data Center

TABLE B.11: HISTORIC LIGHTNING OCCURRENCES IN POLK COUNTY

	Date	Deaths / Injuries	Property Damage*	Details
Columbus				
None Reported	--	--	--	--
Saluda				
SALUDA	24-AUG-02	0/0	$69,212	Lightning ignited a fire, destroying a house and much of its contents.
Tryon				
TRYON	14-JUL-96	0/0	$0	A few trees were blown down in a severe thunderstorm. Storms in and near the mountains caused a great deal of lightning, some of which apparently started fires.
TRYON	02-JUN-97	0/0	$157,302	Severe thunderstorms moved in from Upstate South Carolina during the early morning hours becoming more widespread across portions of western North Carolina. Large and damaging hail occurred in many locations, and a number of places were affected by two or three different storms. The hail caused extensive damage and the dollar total will no doubt end up in the millions for both property and crop damage. The counties which were hit hardest were McDowell and Rutherford. At one car dealership in Marion the damage reached $500 thousand quickly. At least one insurance company set up a disaster center to process claims involving many cars and roofs which were hail damaged. Only one downburst was known to have occurred and

	Date	Deaths / Injuries	Property Damage*	Details
				resulted in trees downed across Highway 221 north of Rutherfordton. At Tryon, an historic house and contents including some antiques, burned to the ground. Lightning at Newton struck several residences, causing fire damage.
Unincorporated Area				
MILL SPG	21-JUL-06	0/6	$0	Four children and 2 adults were injured when lightning struck their tent.

*Property Damage is reported in 2013 dollars.
Source: National Climatic Data Center

Probability of Future Occurrences

Although there was not a high number of historical lightning events reported in Polk County via NCDC data, it is considered a regular occurrence, especially accompanied by thunderstorms. In fact, lightning events will assuredly happen on an annual basis, though not all events will cause damage. According to Vaisala's U.S. National Lightning Detection Network (NLDN®), Polk County is located in an area of the country that experienced an average of 3 to 4 lightning flashes per square kilometer per year between 1997 and 2010. Therefore, the probability of future events is highly likely (100 percent annual probability). It can be expected that future lightning events will continue to threaten life and cause minor property damages throughout the county.

B.2.6 Thunderstorm Wind / High Wind

Location and Spatial Extent

A wind event is an atmospheric hazard, and thus has no geographic boundaries. It is typically a widespread event that can occur in all regions of the United States. However, thunderstorms are most common in the central and southern states because atmospheric conditions in those regions are favorable for generating these powerful storms. Also, Polk County typically experiences several straight-line wind events each year. These wind events can and have caused significant damage. It is assumed that Polk County has uniform exposure to an event and the spatial extent of an impact could be large.

Historical Occurrences

Severe storms have resulted in one disaster declaration in Polk County in 1977.[5] According to NCDC, there have been 89 reported thunderstorm wind and high wind events since 1966 in Polk County.[6] These events caused over $272,000 (2013 dollars) in damages. There were reports of two injuries. **Table B.12** summarizes this information. **Table B.13** presents detailed thunderstorm wind and high wind event reports including date, magnitude, and associated damages for each event.[7]

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[5]A complete listing of historical disaster declarations can be found in Section 4: *Hazard Profiles*.
[6] These thunderstorm events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is certain that additional thunderstorm events have occurred in Polk County. As additional local data becomes available, this hazard profile will be amended.
[7] The dollar amount of damages provided by NCDC is divided by the number of affected counties to reflect a damage estimate for the county.

Table B.12: Summary of Thunderstorm / High Wind Occurrences in Polk County

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Columbus	16	0/2	$38,896
Saluda	3	0/0	$0
Tryon	7	0/0	$1,344
Unincorporated Area	63	0/0	$232,176
POLK COUNTY TOTAL	**89**	**0/2**	**$272,416**

Source: National Climatic Data Center

Table B.13: Historical Thunderstorm / High Wind Occurrences in Polk County

	Date	Type	Magnitude	Deaths / Injuries	Property Damage*
Columbus					
COLUMBUS	04-JUL-97	TSTM WIND	50 kts.	0/2	$0
COLUMBUS	11-JUL-00	TSTM WIND	60 kts.	0/0	$0
COLUMBUS	24-AUG-00	TSTM WIND	50 kts.	0/0	$0
COLUMBUS	24-AUG-00	TSTM WIND	50 kts.	0/0	$0
COLUMBUS	13-JUN-01	TSTM WIND	65 kts.	0/0	$0
COLUMBUS	04-JUL-02	TSTM WIND	50 kts.	0/0	$1,384
COLUMBUS	11-NOV-02	TSTM WIND	50 kts.	0/0	$0
COLUMBUS	02-MAY-03	TSTM WIND	55 kts.	0/0	$33,598
COLUMBUS	30-MAY-04	TSTM WIND	55 kts.	0/0	$3,914
COLUMBUS	28-JUL-05	TSTM WIND	50 kts.	0/0	$0
COLUMBUS	19-APR-06	TSTM WIND	50 kts.	0/0	$0
COLUMBUS	11-JUN-06	TSTM WIND	55 kts.	0/0	$0
COLUMBUS	23-JUN-06	TSTM WIND	50 kts.	0/0	$0
COLUMBUS	04-MAR-08	THUNDERSTORM WIND	50 kts.	0/0	$0
COLUMBUS	06-JUL-08	THUNDERSTORM WIND	50 kts.	0/0	$0
COLUMBUS	09-JUL-12	THUNDERSTORM WIND	50 kts.	0/0	$0
Saluda					
SALUDA	14-SEP-02	TSTM WIND	50 kts.	0/0	$0
SALUDA	15-JUN-10	THUNDERSTORM WIND	50 kts.	0/0	$0
SALUDA	04-APR-11	THUNDERSTORM WIND	55 kts.	0/0	$0
Tryon					
TRYON	11-JUL-00	TSTM WIND	50 kts.	0/0	$0
TRYON	22-AUG-03	TSTM WIND	50 kts.	0/0	$1,344
TRYON	27-JUN-05	TSTM WIND	50 kts.	0/0	$0
TRYON	15-JUL-06	TSTM WIND	50 kts.	0/0	$0
TRYON	28-SEP-06	TSTM WIND	50 kts.	0/0	$0
TRYON	21-AUG-07	THUNDERSTORM WIND	50 kts.	0/0	$0
TRYON	04-MAR-08	THUNDERSTORM WIND	50 kts.	0/0	$0
Unincorporated Area					
POLK COUNTY	15-JUL-66	TSTM WIND	0 kts.	0/0	$0

	Date	Type	Magnitude	Deaths / Injuries	Property Damage*
POLK COUNTY	15-MAY-67	TSTM WIND	0 kts.	0/0	$0
POLK COUNTY	05-JUN-85	TSTM WIND	0 kts.	0/0	$0
POLK COUNTY	24-JUN-85	TSTM WIND	0 kts.	0/0	$0
POLK COUNTY	04-JUL-85	TSTM WIND	0 kts.	0/0	$0
POLK COUNTY	16-JUL-88	TSTM WIND	0 kts.	0/0	$0
POLK COUNTY	15-JUN-89	TSTM WIND	0 kts.	0/0	$0
POLK COUNTY	28-JUN-89	TSTM WIND	0 kts.	0/0	$0
POLK COUNTY	15-NOV-89	TSTM WIND	0 kts.	0/0	$0
POLK COUNTY	09-JUN-90	TSTM WIND	0 kts.	0/0	$0
POLK COUNTY	21-AUG-90	TSTM WIND	0 kts.	0/0	$0
POLK COUNTY	15-MAY-94	THUNDERSTORM WINDS	0 kts.	0/0	$0
Mountains and Foothills	11-NOV-95	HIGH WINDS	0 kts.	0/0	$34,524
POLK COUNTY	18-JAN-96	HIGH WIND	0 kts.	0/0	$5,028
MILL SPG	24-JUN-96	TSTM WIND	50 kts.	0/0	$0
MILL SPG	21-AUG-96	TSTM WIND	50 kts.	0/0	$0
POLK COUNTY	05-MAR-97	HIGH WIND	55 kts.	0/0	$0
MILL SPG	28-JUL-97	TSTM WIND	50 kts.	0/0	$0
POLK COUNTY	24-FEB-98	HIGH WIND	50 kts.	0/0	$1,936
POLK COUNTY	16-FEB-01	HIGH WIND	55 kts.	0/0	$0
POLK COUNTY	06-MAR-01	HIGH WIND	55 kts.	0/0	$0
POLK COUNTY	20-MAR-01	HIGH WIND	55 kts.	0/0	$67,893
COUNTYWIDE	21-MAY-01	TSTM WIND	50 kts.	0/0	$0
BEULAH	08-JUL-01	TSTM WIND	50 kts.	0/0	$0
POLK COUNTY	04-FEB-02	HIGH WIND	50 kts.	0/0	$0
COUNTYWIDE	13-MAY-02	TSTM WIND	50 kts.	0/0	$0
SUNNY VIEW	14-SEP-02	TSTM WIND	50 kts.	0/0	$0
POLK COUNTY	23-JAN-03	HIGH WIND	60 kts.	0/0	$3,072
COUNTYWIDE	27-JUN-03	TSTM WIND	50 kts.	0/0	$0
POLK COUNTY	14-OCT-03	HIGH WIND	50 kts.	0/0	$1,512
POLK COUNTY	07-MAR-04	HIGH WIND	60 kts.	0/0	$30,445
MILL SPG	12-JUN-04	TSTM WIND	50 kts.	0/0	$0
POLK COUNTY	05-JUL-04	HIGH WIND	55 kts.	0/0	$1,305
POLK COUNTY	16-SEP-04	HIGH WIND	50 kts.	0/0	$5,219
POLK COUNTY	17-SEP-04	HIGH WIND	50 kts.	0/0	$6,116
POLK COUNTY	22-JAN-05	HIGH WIND	50 kts.	0/0	$0
POLK COUNTY	02-APR-05	HIGH WIND	60 kts.	0/0	$73,895
COUNTYWIDE	06-JUN-05	TSTM WIND	55 kts.	0/0	$0
POLK COUNTY	14-JAN-06	HIGH WIND	60 kts.	0/0	$1,230
POLK COUNTY	01-DEC-06	HIGH WIND	55 kts.	0/0	$0
POLK COUNTY	10-FEB-08	HIGH WIND	55 kts.	0/0	$0
POLK COUNTY	11-MAY-08	HIGH WIND	60 kts.	0/0	$0
POLK COUNTY	12-MAY-08	HIGH WIND	50 kts.	0/0	$0
MILL SPG	27-JUN-08	THUNDERSTORM WIND	50 kts.	0/0	$0
SUNNY VIEW	28-MAY-09	THUNDERSTORM WIND	50 kts.	0/0	$0
SUNNY VIEW	09-JUN-09	THUNDERSTORM WIND	50 kts.	0/0	$0

	Date	Type	Magnitude	Deaths / Injuries	Property Damage*
MILL SPG	09-JUN-09	THUNDERSTORM WIND	50 kts.	0/0	$0
SUNNY VIEW	10-JUN-09	THUNDERSTORM WIND	50 kts.	0/0	$0
SUNNY VIEW	11-JUN-09	THUNDERSTORM WIND	50 kts.	0/0	$0
MILL SPG	23-JUL-09	THUNDERSTORM WIND	50 kts.	0/0	$0
MC GINNIS XRDS	28-JUL-09	THUNDERSTORM WIND	50 kts.	0/0	$0
SANDY PLAINS	05-AUG-09	THUNDERSTORM WIND	50 kts.	0/0	$0
MILL SPG	16-JUN-10	THUNDERSTORM WIND	50 kts.	0/0	$0
SUNNY VIEW	18-JUL-10	THUNDERSTORM WIND	50 kts.	0/0	$0
VALHALLA	27-SEP-10	THUNDERSTORM WIND	60 kts.	0/0	$0
MELROSE	18-JUN-11	THUNDERSTORM WIND	50 kts.	0/0	$0
VALHALLA	14-AUG-11	THUNDERSTORM WIND	50 kts.	0/0	$0
MILL SPG	01-JUL-12	THUNDERSTORM WIND	50 kts.	0/0	$0
MT VLY	27-JUL-12	THUNDERSTORM WIND	50 kts.	0/0	$0
MELVIN HILL	27-JUL-12	THUNDERSTORM WIND	50 kts.	0/0	$0
MILL SPG	14-AUG-12	THUNDERSTORM WIND	50 kts.	0/0	$0
MELVIN HILL	03-SEP-12	THUNDERSTORM WIND	50 kts.	0/0	$0
COLLINSVILLE	03-SEP-12	THUNDERSTORM WIND	50 kts.	0/0	$0

*Property damage is reported in 2013 dollars; All damage may not have been reported.
Source: National Climatic Data Center

Probability of Future Occurrences

Given the high number of previous events, it is certain that wind events, including straight-line wind and thunderstorm wind, will occur in the future. This results in a probability level of highly likely (100 percent annual probability) for future wind events for the entire county.

B.2.7 Tornado

Location and Spatial Extent

Tornadoes occur throughout the state of North Carolina, and thus in Polk County. Tornadoes typically impact a relatively small area, but damage may be extensive. Event locations are completely random and it is not possible to predict specific areas that are more susceptible to tornado strikes over time. Therefore, it is assumed that Polk County is uniformly exposed to this hazard.

Historical Occurrences

Tornadoes are a fairly rare occurrence in mountainous areas. However, they have and do occur in Polk County. According to the National Climatic Data Center, there have been a total of two recorded tornado events in Polk County since 1977 (**Table B.14**), resulting in over $213,000 (2013 dollars) in property damages.[8] No injuries or fatalities were reported (**Table B.15**). The magnitude of these tornadoes ranges from F0 to F1 in intensity, although an F2 to F5 event is possible. It is important to note that only tornadoes that have been reported are factored into this risk assessment. It is likely that a high number of occurrences have gone unreported over the past 63 years.

[8] These tornado events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is likely that additional tornadoes have occurred in Polk County. As additional local data becomes available, this hazard profile will be amended.

TABLE B.14: SUMMARY OF TORNADO OCCURRENCES IN POLK COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Columbus	0	0/0	$0
Saluda	0	0/0	$0
Tryon	0	0/0	$0
Unincorporated Area	2	0/0	$213,490
POLK COUNTY TOTAL	**2**	**0/0**	**$213,490**

Source: National Climatic Data Center

TABLE B.15: HISTORICAL TORNADO IMPACTS IN POLK COUNTY

	Date	Magnitude	Deaths/ Injuries	Property Damage*	Details
Columbus					
None Reported	--	--	--	--	--
Saluda					
None Reported	--	--	--	--	--
Tryon					
None Reported	--	--	--	--	--
Unincorporated Area					
POLK COUNTY	17-AUG-77	F1	0/0	$104,217	
RODDY STORE	26-OCT-10	F0	0/0	$109,273	This tornado touched down in the Sandy Plains Rd area just north of White Oak Creek, breaking off the tops of several trees and some large branches. The tornado then skipped east northeast, snapping and uprooting a small but concentrated area of trees in the Coxe Rd area. One large tree fell on a home on Coxe Rd before the tornado lifted.

*Property damage is reported in 2013 dollars; All damage may not have been reported.
Source: National Climatic Data Center

Probability of Future Occurrences

According to historical information, tornado events are not an annual occurrence for the county. Furthermore, the mountainous terrain of the county makes tornadoes a rare occurrence. While the majority of the reported tornado events are small in terms of size, intensity, and duration, they do pose a significant threat should Polk County experience a direct tornado strike. The probability of future tornado occurrences affecting Polk County is possible (1 to 10 percent annual probability).

B.2.8 Winter Storm and Freeze

Location and Spatial Extent

Nearly the entire continental United States is susceptible to winter storm and freeze events. Some ice and winter storms may be large enough to affect several states, while others might affect limited, localized areas. The degree of exposure typically depends on the normal expected severity of local winter weather. Polk County is accustomed to severe winter weather conditions and frequently receives severe winter weather during the winter months. Given the atmospheric nature of the hazard, the entire county has uniform exposure to a winter storm.

Historical Occurrences

Winter weather has resulted in three disaster declarations in Polk County. This includes the Blizzard of 1996, one subsequent 1996 winter storm, and a severe ice storm in 2002.[9] According to the National Climatic Data Center, there have been a total of 64 recorded winter storm events in Polk County since 1993 (**Table B.16**).[10] These events resulted in nearly $16 million (2013 dollars) in damages.[11] Detailed information on the recorded winter storm events can be found in **Table B.17**.

TABLE B.16: SUMMARY OF WINTER STORM EVENTS IN POLK COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Polk County	64	0/0	$15,988,915

Source: National Climatic Data Center

TABLE B.17: HISTORICAL WINTER STORM IMPACTS IN POLK COUNTY

	Date	Type of Storm	Deaths / Injuries	Property Damage*
Columbus				
None Reported	--	--	--	--
Saluda				
None Reported	--	--	--	--
Tryon				
None Reported	--	--	--	--
Unincorporated Area				
Statewide	12-MAR-93	WINTER STORM	2/10†	$874,516
Northern Interior and	10-FEB-94	ICE STORM	0/0	$0
POLK COUNTY	06-JAN-96	HEAVY SNOW	0/0	$0
POLK COUNTY	11-JAN-96	WINTER STORM	0/0	$0
POLK COUNTY	26-JAN-96	ICE STORM	0/0	$0
POLK COUNTY	02-FEB-96	ICE STORM	0/0	$2,011,388
POLK COUNTY	16-FEB-96	SNOW	0/0	$0
POLK COUNTY	06-DEC-96	Icy Roads	0/0	$0
POLK COUNTY	18-DEC-96	HEAVY SNOW	0/0	$0
POLK COUNTY	08-JAN-97	Snow and sleet	0/0	$0
POLK COUNTY	09-JAN-97	ICE STORM	0/0	$149,811
POLK COUNTY	13-FEB-97	WINTER STORM	0/0	$0
POLK COUNTY	08-DEC-97	WINTRY MIX	0/0	$0
POLK COUNTY	29-DEC-97	SNOW	0/0	$0
POLK COUNTY	27-JAN-98	HEAVY SNOW	0/0	$0

[9] Not all of the participating counties were declared disaster areas for these events. A complete listing of historical disaster declarations, including the affected counties, can be found in Section 4: *Hazard Profiles*.
[10] These ice and winter storm events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is certain that additional winter storm conditions have affected Polk County.
[11] The dollar amount of damages provided by NCDC is divided by the number of affected counties to reflect a damage estimate for the county.

	Date	Type of Storm	Deaths / Injuries	Property Damage*
POLK COUNTY	23-DEC-98	FREEZING RAIN/SLEET	0/0	$0
POLK COUNTY	24-DEC-98	SNOW	0/0	$0
POLK COUNTY	02-JAN-99	ICE STORM	0/0	$0
POLK COUNTY	31-JAN-99	SNOW AND SLEET	0/0	$0
POLK COUNTY	01-FEB-99	FREEZING RAIN	0/0	$0
POLK COUNTY	09-MAR-99	SNOW AND SLEET	0/0	$0
POLK COUNTY	26-MAR-99	SNOW	0/0	$0
POLK COUNTY	24-DEC-99	SNOW	0/0	$0
POLK COUNTY	22-JAN-00	HEAVY SNOW	0/0	$0
POLK COUNTY	29-JAN-00	FREEZING RAIN	0/0	$0
POLK COUNTY	19-NOV-00	SNOW	0/0	$0
POLK COUNTY	03-DEC-00	SNOW	0/0	$0
POLK COUNTY	13-DEC-00	FREEZING RAIN	0/0	$0
POLK COUNTY	19-DEC-00	SNOW	0/0	$0
POLK COUNTY	20-MAR-01	HEAVY SNOW	0/0	$0
POLK COUNTY	17-APR-01	SNOW SHOWERS	0/0	$0
POLK COUNTY	04-DEC-02	ICE STORM	0/0	$12,583,944
POLK COUNTY	16-JAN-03	WINTER WEATHER/MIX	0/0	$0
POLK COUNTY	23-JAN-03	HEAVY SNOW	0/0	$0
POLK COUNTY	06-FEB-03	WINTER WEATHER/MIX	0/0	$0
POLK COUNTY	16-FEB-03	WINTER STORM	0/0	$0
POLK COUNTY	27-FEB-03	WINTER WEATHER/MIX	0/0	$0
POLK COUNTY	30-MAR-03	WINTER WEATHER/MIX	0/0	$0
POLK COUNTY	10-APR-03	WINTER WEATHER/MIX	0/0	$0
POLK COUNTY	04-DEC-03	WINTER WEATHER/MIX	0/0	$0
POLK COUNTY	25-JAN-04	HEAVY SNOW	0/0	$0
POLK COUNTY	25-JAN-04	SLEET STORM	0/0	$0
POLK COUNTY	27-JAN-04	WINTER WEATHER/MIX	0/0	$0
POLK COUNTY	02-FEB-04	WINTER WEATHER/MIX	0/0	$0
POLK COUNTY	26-FEB-04	HEAVY SNOW	0/0	$255,246
POLK COUNTY	27-MAR-04	FROST/FREEZE	0/0	$0
POLK COUNTY	30-MAR-04	WINTER WEATHER/MIX	0/0	$0
POLK COUNTY	22-JAN-05	WINTER WEATHER/MIX	0/0	$0
POLK COUNTY	29-JAN-05	WINTER STORM	0/0	$0
POLK COUNTY	27-FEB-05	WINTER WEATHER/MIX	0/0	$0
POLK COUNTY	17-MAR-05	WINTER WEATHER/MIX	0/0	$0
POLK COUNTY	08-DEC-05	WINTER WEATHER	0/0	$0
POLK COUNTY	15-DEC-05	WINTER WEATHER	0/0	$0
POLK COUNTY	15-DEC-05	ICE STORM	0/0	$114,009
POLK COUNTY	16-DEC-05	FREEZING FOG	0/0	$0
POLK COUNTY	21-JAN-07	WINTER WEATHER	0/0	$0
POLK COUNTY	01-FEB-07	HEAVY SNOW	0/0	$0
POLK COUNTY	01-FEB-07	WINTER STORM	0/0	$0
POLK COUNTY	01-JAN-08	WINTER WEATHER	0/0	$0
POLK COUNTY	16-JAN-08	HEAVY SNOW	0/0	$0
POLK COUNTY	31-JAN-08	WINTER WEATHER	0/0	$0

	Date	Type of Storm	Deaths / Injuries	Property Damage*
POLK COUNTY	01-FEB-08	ICE STORM	0/0	$0
POLK COUNTY	18-DEC-09	WINTER STORM	0/0	$0
POLK COUNTY	10-JAN-11	HEAVY SNOW	0/0	$0

*Property damage is reported in 2013 dollars; All damage may not have been reported.
†Deaths/injuries were not reported at the county level; potentially outside of the county.
Source: National Climatic Data Center

There have been several severe winter weather events in Polk County. The text below describes one of the major events and associated impacts on the county. Similar impacts can be expected with severe winter weather.

1996 Winter Storm
This storm left two feet of snow and several thousand citizens without power for up to nine days. Although shelters were opened, some roads were impassible for up to four days. This event caused considerable disruption to business, industry, schools, and government services.

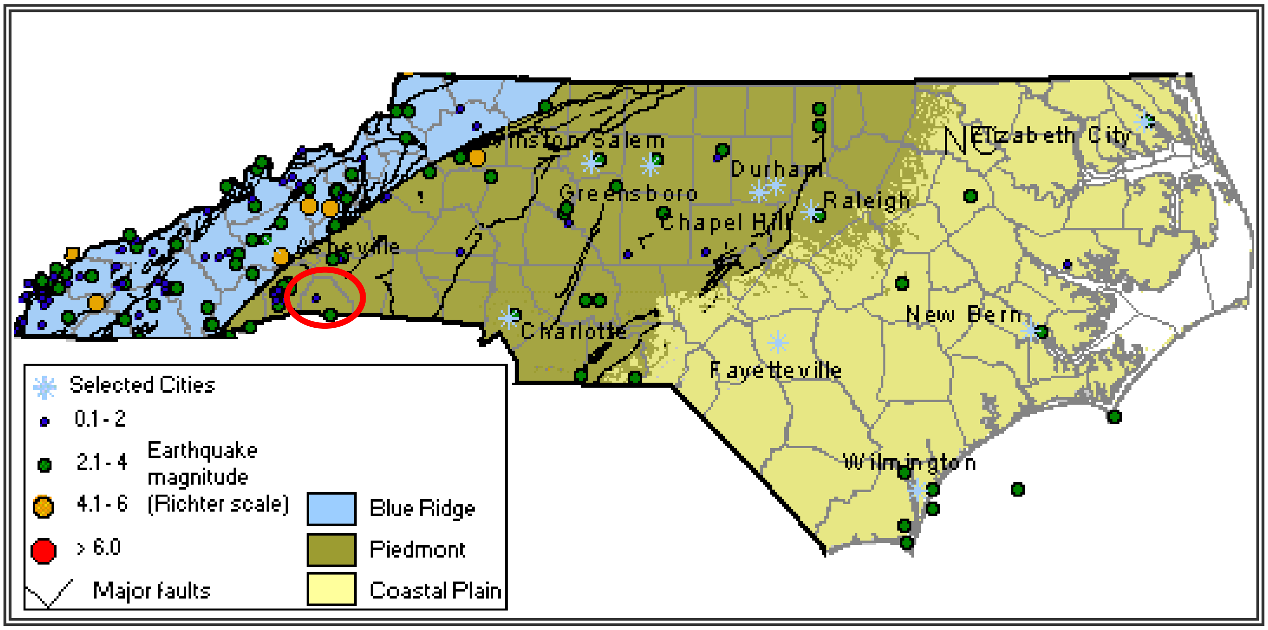
Winter storms throughout the planning area have several negative externalities including hypothermia, cost of snow and debris cleanup, business and government service interruption, traffic accidents, and power outages. Furthermore, citizens may resort to using inappropriate heating devices that could to fire or an accumulation of toxic fumes.

Probability of Future Occurrences
Winter storm events will remain a regular occurrence in Polk County due to its location in the western part of the state. According to historical information, Polk County generally experiences several winter storm events each year. Therefore, the annual probability is highly likely (100 percent).

B.2.9 Earthquake

Location and Spatial Extent
Approximately two-thirds of North Carolina is subject to earthquakes, with the western and southeast region most vulnerable to a very damaging earthquake. The state is affected by both the Charleston Fault in South Carolina and New Madrid Fault in Tennessee. Both of these faults have generated earthquakes measuring greater than 8 on the Richter Scale during the last 200 years. In addition, there are several smaller fault lines throughout North Carolina. **Figure B.2** is a map showing geological and seismic information for North Carolina.

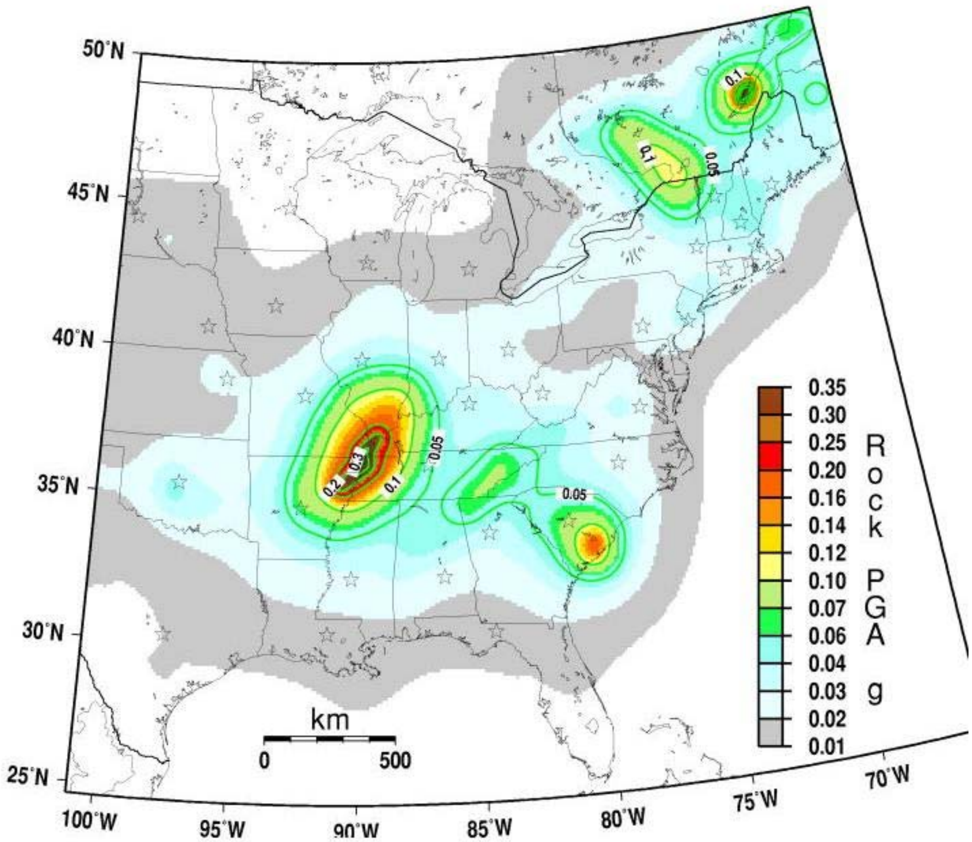
FIGURE B.2: GEOLOGICAL AND SEISMIC INFORMATION FOR NORTH CAROLINA



Source: North Carolina Geological Survey

Figure B.3 shows the intensity level associated with Polk County, based on the national USGS map of peak acceleration with 10 percent probability of exceedance in 50 years. It is the probability that ground motion will reach a certain level during an earthquake. The data show peak horizontal ground acceleration (the fastest measured change in speed, for a particle at ground level that is moving horizontally due to an earthquake) with a 10 percent probability of exceedance in 50 years. The map was compiled by the U.S. Geological Survey (USGS) Geologic Hazards Team, which conducts global investigations of earthquake, geomagnetic, and landslide hazards. According to this map, Polk County lies within an approximate zone of level "4" to "5" ground acceleration. This indicates that the county exists within an area of low to moderate seismic risk.

FIGURE B.3: PEAK ACCELERATION WITH 10 PERCENT PROBABILITY OF EXCEEDANCE IN 50 YEARS



Source: USGS, 2008

Historical Occurrences

At least 18 earthquakes are known to have affected Polk County since 1916. The strongest of these measured a V on the Modified Mercalli Intensity (MMI) scale. **Table B.18** provides a summary of earthquake events reported by the National Geophysical Data Center between 1638 and 1985. **Table B.19** presents a detailed occurrence of each event including the date, distance for the epicenter, magnitude, and Modified Mercalli Intensity (if known). [12]

TABLE B.18: SUMMARY OF SEISMIC ACTIVITY IN POLK COUNTY

Location	Number of Occurrences	Greatest MMI Reported	Richter Scale Equivalent
Columbus	3	IV	< 4.8
Saluda	5	V	< 4.8
Tryon	4	IV	< 4.8
Unincorporated Area	6	IV	< 4.8
POLK COUNTY TOTAL	**18**	**V**	**< 4.8**

Source: National Geophysical Data Center

[12] Due to reporting mechanisms, not all earthquakes events were recorded during this time. Furthermore, some are missing data, such as the epicenter location, due to a lack of widely used technology. In these instances, a value of "unknown" is reported.

TABLE B.19: SIGNIFICANT SEISMIC EVENTS IN POLK COUNTY (1638 -1985)

Location	Date	Epicentral Distance	Magnitude	MMI
Columbus				
Columbus	12/13/1969	74.0 km		III
Columbus	11/30/1973	170.0 km	4.7	IV
Columbus	5/5/1981	22.0 km	3.5	IV
Saluda				
Saluda	2/21/1916	31.0 km		V
Saluda	11/30/1973	158.0 km	4.7	IV
Saluda	5/5/1981	12.0 km	3.5	IV
Saluda	3/25/1983	15.0 km	3.3	IV
Saluda	3/19/1985	16.0 km	2.1	II
Tryon				
Tryon	11/3/1928	93.0 km		
Tryon	5/13/1957	63.0 km		IV
Tryon	5/5/1981	21.0 km	3.5	IV
Tryon	3/25/1983	25.0 km	3.3	IV
Unincorporated Area				
Mill Spring	11/30/1973	172.0 km	4.7	IV
Mill Spring	4/9/1981	21.0 km	3.2	IV
Lynn	5/5/1981		3.5	III
Mill Spring	5/5/1981	24.0 km	3.5	IV
Lynn	3/25/1983	23.0 km	3.3	IV
Mill Spring	3/25/1983	25.0 km	3.3	IV

Source: National Geophysical Data Center

Probability of Future Occurrences

The probability of significant, damaging earthquake events affecting Polk County is unlikely. However, it is likely that future earthquakes resulting in light to moderate perceived shaking and damages ranging from none to very light will affect the county. The annual probability level for the county is estimated between 1 and 10 percent (possible).

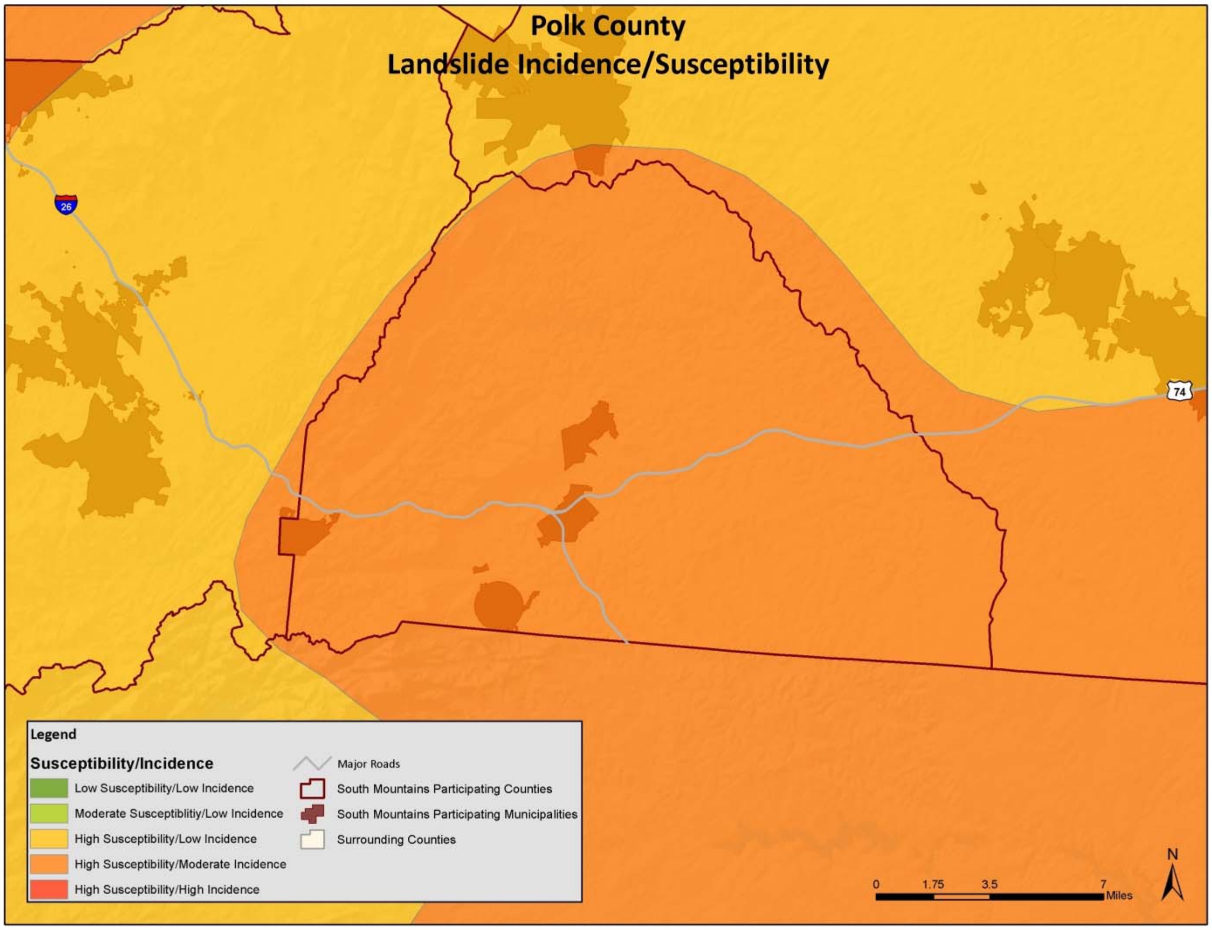
B.2.10 Landslide

Location and Spatial Extent

Landslides occur along steep slopes when the pull of gravity can no longer be resisted (often due to heavy rain). Human development can also exacerbate risk by building on previously undevelopable steep slopes and constructing roads by cutting through mountains. Landslides are possible throughout Polk County.

According to **Figure B.4** below, the majority of the county has moderate landslide activity. There is a very small portion in the northwest part of the county that has a low incidence occurrence rate. There is high susceptibility throughout the county.

FIGURE B.4: LANDSLIDE SUSCEPTIBILITY AND INCIDENCE MAP OF POLK COUNTY



Source: USGS

Historical Occurrences

Steep topography throughout Polk County makes the planning area susceptible to landslides. Most landslides are caused by heavy rainfall in the area. Building on steep slopes that was not previously possible also contributes to risk. **Table B.20** presents a summary of the landslide occurrence events as provided by the North Carolina Geological Survey[13]. The georeferenced locations of the landslide events presented in the aforementioned tables are presented in **Figure B.5**. Some incidence mapping has also been completed throughout the western portion of North Carolina though it is not complete. Therefore, it should be noted that many more incidents than what is reported are likely to have occurred in Polk County.

TABLE B.20: SUMMARY OF LANDSLIDE ACTIVITY IN POLK COUNTY

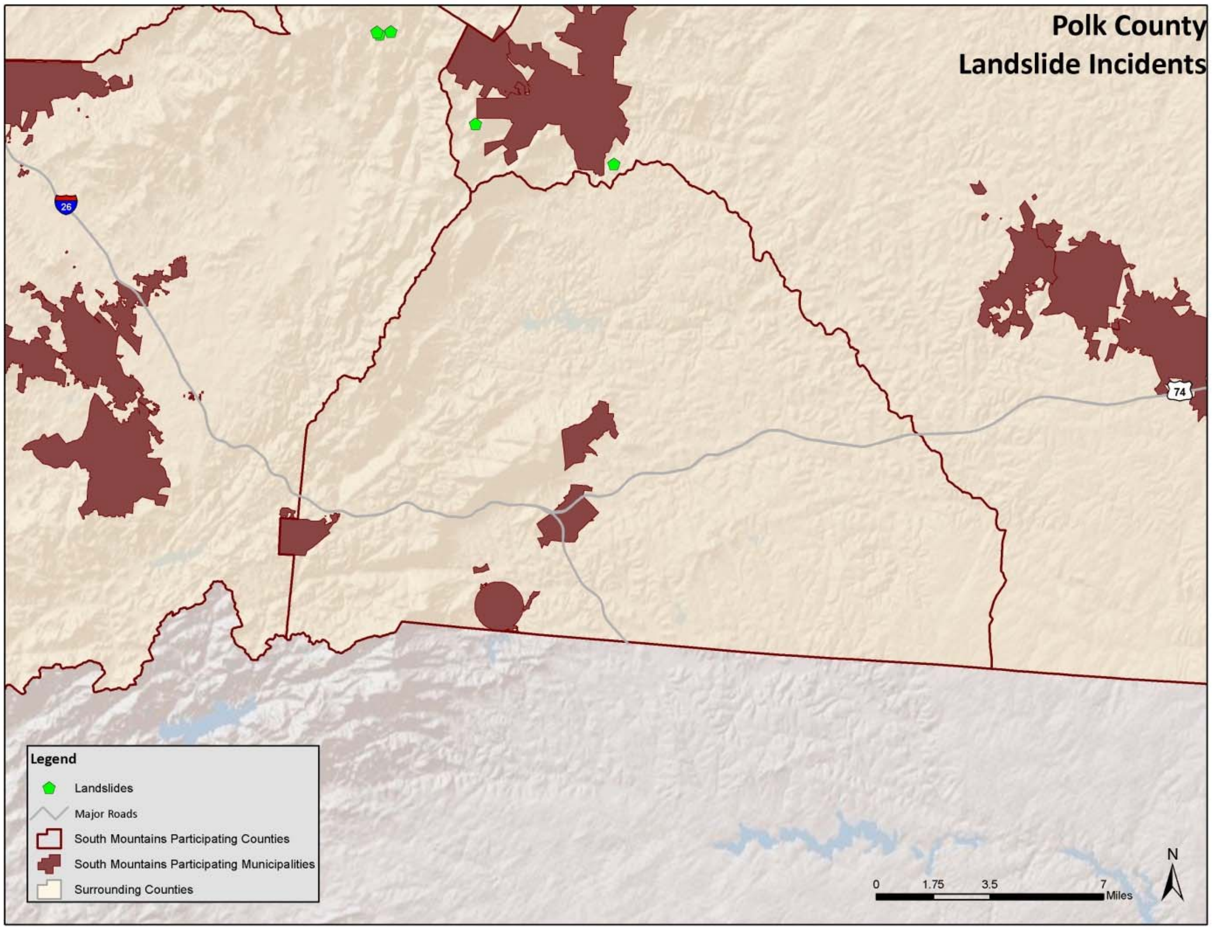
Location	Number of Occurrences
Columbus	0
Saluda	0

[13] It should be noted that the North Carolina Geological Survey (NCGS) emphasized the dataset provided was incomplete. Therefore, there may be additional historical landslide occurrences. Furthermore, dates were not included for every event. The earliest date reported was 1940. No damage information was provided by NCGS.

Location	Number of Occurrences
Tryon	0
Unincorporated Area	0
POLK COUNTY TOTAL	**0**

Source: North Carolina Geological Survey

FIGURE B.5: LOCATION OF PREVIOUS LANDSLIDE OCCURRENCES IN POLK COUNTY



Source: North Carolina Geological Survey

The information below identifies additional historical information reported in the previous county hazard mitigation plan.

Polk County

In 2002 and 2003, heavy rains combined with development on and along steep slopes caused landslides on Hogback Mountain, White Oak Mountain, Holbert's Cove, Green River Cove, and Highway 176. These landslides closed down portions of state roads and cost approximately $210,000 to repair.

Probability of Future Occurrences

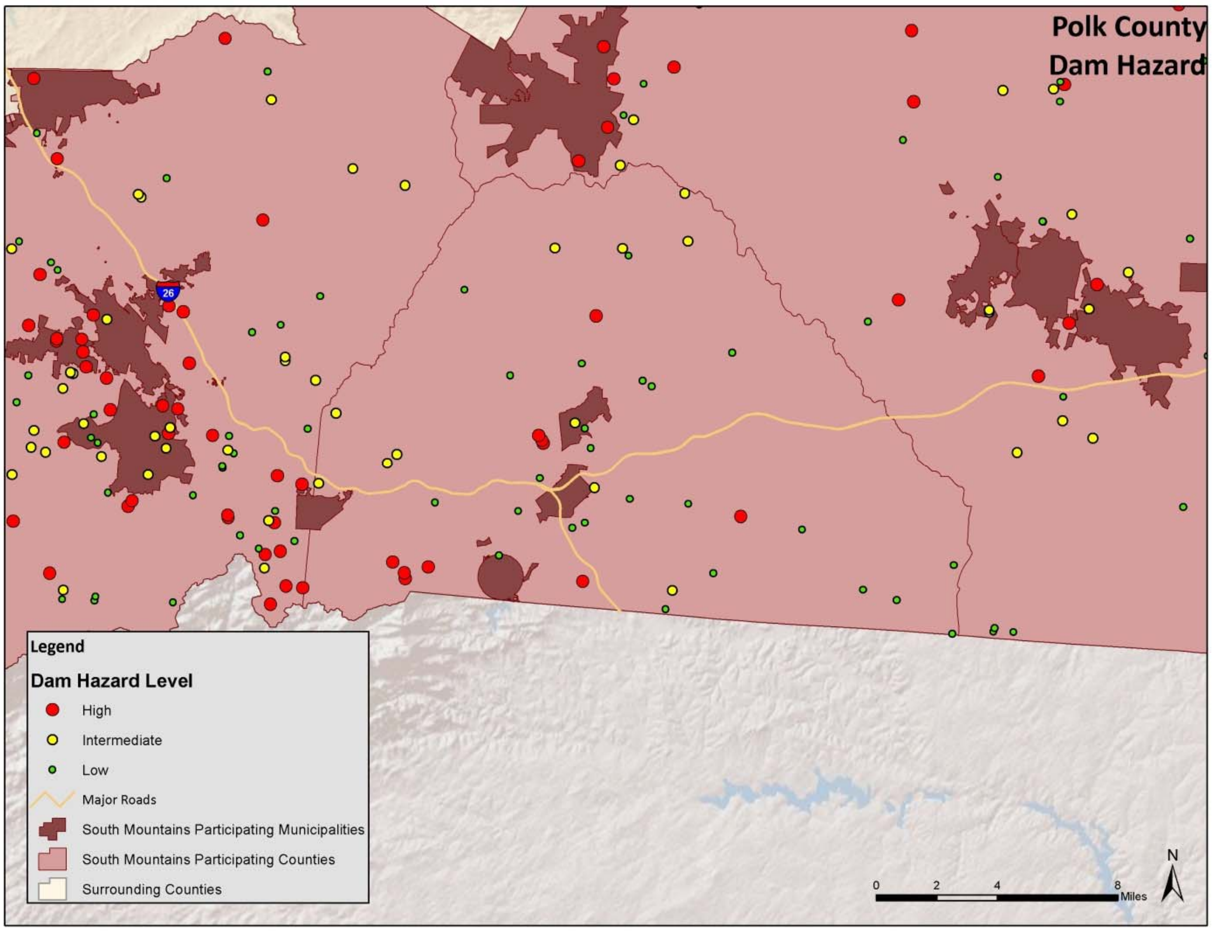
Based on historical information and the USGS susceptibility index, the probability of future landslide events is possible (1 to 10 percent probability). Local conditions may become more favorable for landslides due to heavy rain, for example. This would increase the likelihood of occurrence. It should also be noted that some areas in Polk County have greater risk than others given factors such as steepness on slope and modification of slopes.

B.2.11 Dam and Levee Failure

Location and Spatial Extent

According to the North Carolina Division of Land Management there are 44 dams in Polk County.[14] **Figure B.6** shows the dam location and the corresponding hazard ranking for each. Of these dams, 10 are classified as high hazard potential. These high hazard dams are listed in **Table B.21**.

FIGURE B.6: POLK COUNTY DAM LOCATION AND HAZARD RANKING



Source: North Carolina Division of Land Resources, 2012

[14] The February 8, 2012 list of high hazard dams obtained from the North Carolina Division of Energy, Mineral, and Land Resources (http://portal.ncdenr.org/web/lr/dams) was reviewed and amended by local officials to the best of their knowledge.

TABLE B.21: POLK COUNTY HIGH HAZARD DAMS

Dam Name	Hazard Potential	Surface Area (acres)	Max Capacity (Ac-ft)	Owner Type
Polk County				
Turner Shoals Dam	High	438.0	16,530	Local Gov
Old Tryon Water Supply Dam	High		15	Local Gov
Melrose Mountain Dam #2	High	8.0	157	Private
Melrose Mountain Dam #1	High	4.0	52	Private
Mahler's Pond Dam	High	9.5	110	Private
Derbyshire Dam	High	6.0	75	Private
White Oak Mtn. Dam #1	High	2.5	37	Private
White Oak Mtn. Dam #2	High	2.8	39	Private
White Oak Mtn. Dam #4	High	1.7	22	Private
Robin Smith Dam	High	5.2	119	Private

Source: North Carolina Division of Land Resources, 2012

It should also be noted that the North Carolina dam classification regulations were recently updated. As a result of the change, more dams are generally classified as high hazard.

Historical Occurrences

There has been one dam breach reported in the county, though it did not result in any injuries, deaths, or significant damage. However, it should be noted that several breach scenarios in the county could be catastrophic.

The information below identifies additional historical information reported in the previous county hazard mitigation plan.

Polk County

Polk County has had one dam failure, the 1926 Lake Lanier Dam failure. Lake Lanier is a product of the 1920s boom and is an artificial, man-made lake fed by Vaughn's Creek at the base of Hogback Mountain. Spring rains in 1926 caused a portion of the dam to break off and sent water gushing forward. Property damage and cost are unknown.

Probability of Future Occurrences

Given the current dam inventory and historic data, a dam breach is unlikely (less than 1 percent annual probability) in the future. However, as has been demonstrated in the past, regular monitoring is necessary to prevent these events.

B.2.12 Erosion

Location and Spatial Extent

Erosion in Polk County is typically caused by flash flooding events. Unlike coastal areas, where the soil is mainly composed of fine grained particles such as sand, Polk County soils have much greater organic matter content. Furthermore, vegetation also helps to prevent erosion in the area. Erosion occurs in the county, particularly along the banks of rivers and streams, but it is not an extreme threat. No areas of concern were reported by the planning committee.

Historical Occurrences

Several sources were vetted to identify areas of erosion in Polk County. This includes searching local newspapers, interviewing local officials, and reviewing the previous hazard mitigation plan. Erosion was addressed in the previous Polk County hazard mitigation plan; however, it was found to be a relatively low-risk hazard. The information below identifies historical information presented in the plan.

Polk County

Most recent erosion concerns in Polk County have stemmed from clear-cutting on steep slopes. Heavy erosion from stormwater can lead to large amounts of sedimentation being carried down slopes causing flooding, property damage, road blockage, and in extreme cases the occurrence of mudslides.

Probability of Future Occurrences

Erosion remains a natural, dynamic, and continuous process for Polk County, and it will continue to occur. The annual probability level assigned for erosion is likely (between 10 and 100 percent).

B.2.13 Flood

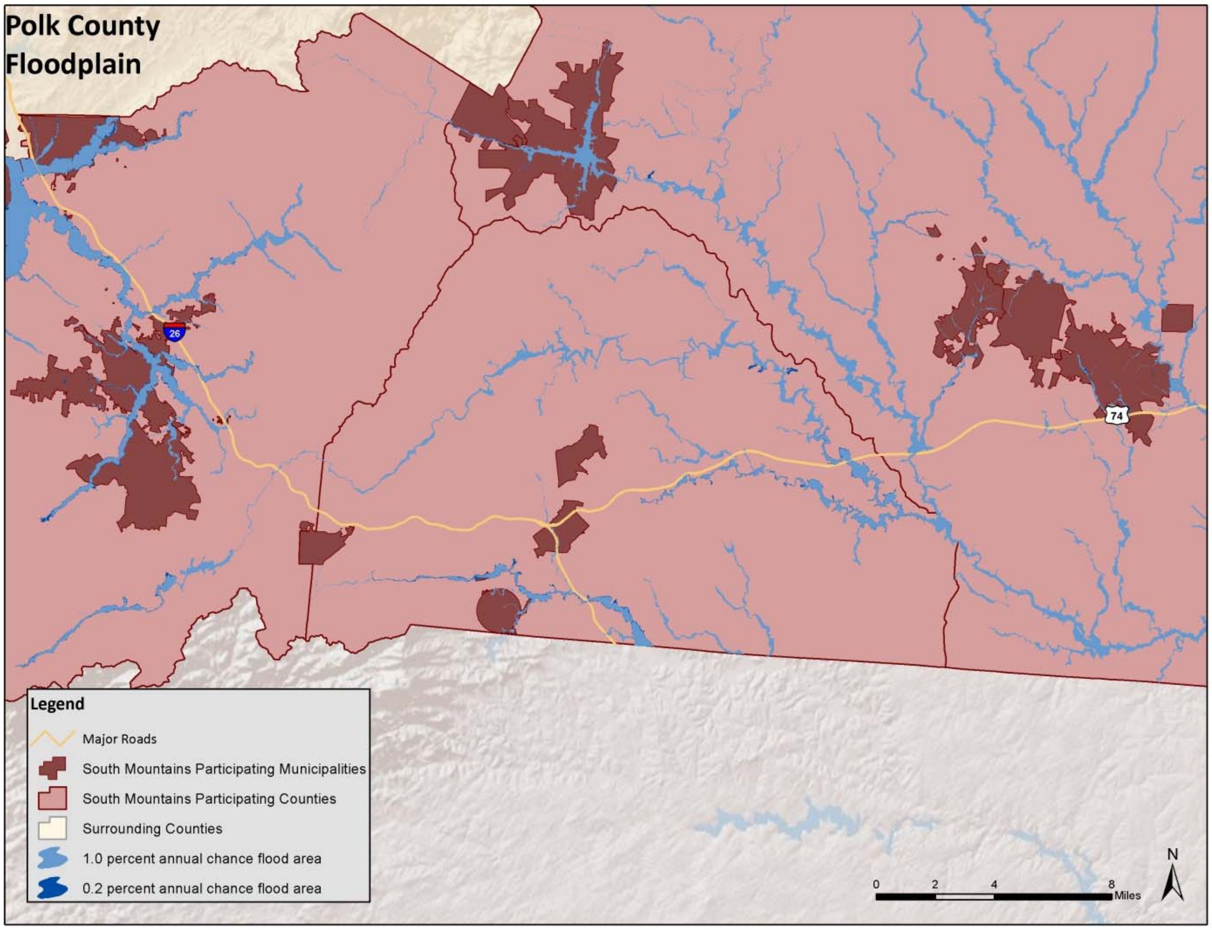
Location and Spatial Extent

There are areas in Polk County that are susceptible to flood events. Special flood hazard areas in the county were mapped using Geographic Information System (GIS) and FEMA Digital Flood Insurance Rate Maps (DFIRM).[15] This includes Zone A (1-percent annual chance floodplain), Zone AE (1-percent annual chance floodplain with elevation), Zone X500 (0.2-percent annual chance floodplain). According to GIS analysis, of the 238 square miles that make up Polk County, there are 12.68 square miles of land in zones A and AE (1-percent annual chance floodplain/100-year floodplain) and 0.75 square miles of land in zone X500 (0.2-percent annual chance floodplain/500-year floodplain).

These flood zone values account for 5.6 percent of the total land area in Polk County. It is important to note that while FEMA digital flood data is recognized as best available data for planning purposes, it does not always reflect the most accurate and up-to-date flood risk. Flooding and flood-related losses often do occur outside of delineated special flood hazard areas. **Figure B.7**, **Figure B.8**, **Figure B.9**, and **Figure B.10** illustrate the location and extent of currently mapped special flood hazard areas for Polk County and its municipalities based on best available FEMA Digital Flood Insurance Rate Map (DFIRM) data.

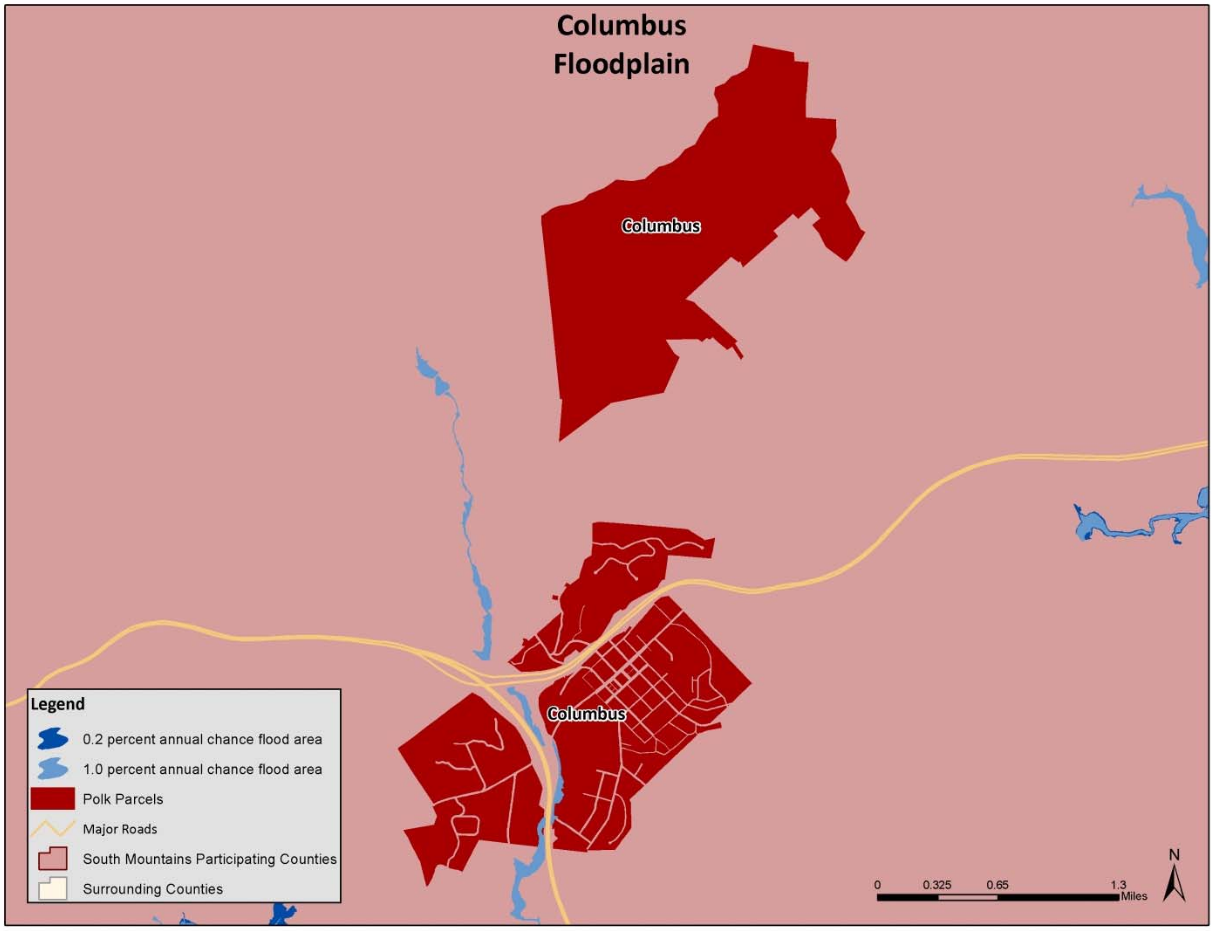
[15] The county-level DFIRM data used for Polk County were updated in 2010..

FIGURE B.7: SPECIAL FLOOD HAZARD AREAS IN POLK COUNTY



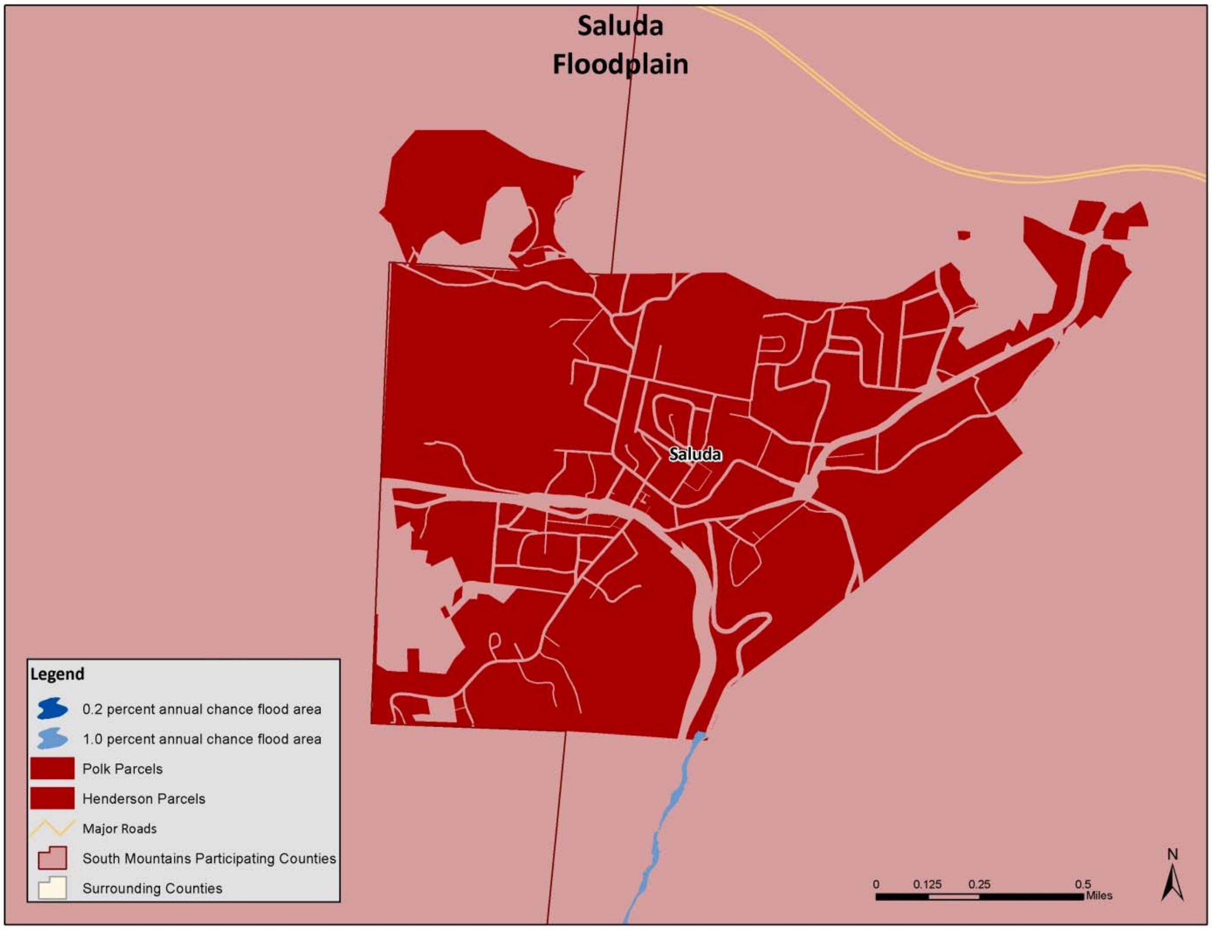
Source: Federal Emergency Management Agency

FIGURE B.8: SPECIAL FLOOD HAZARD AREAS IN COLUMBUS



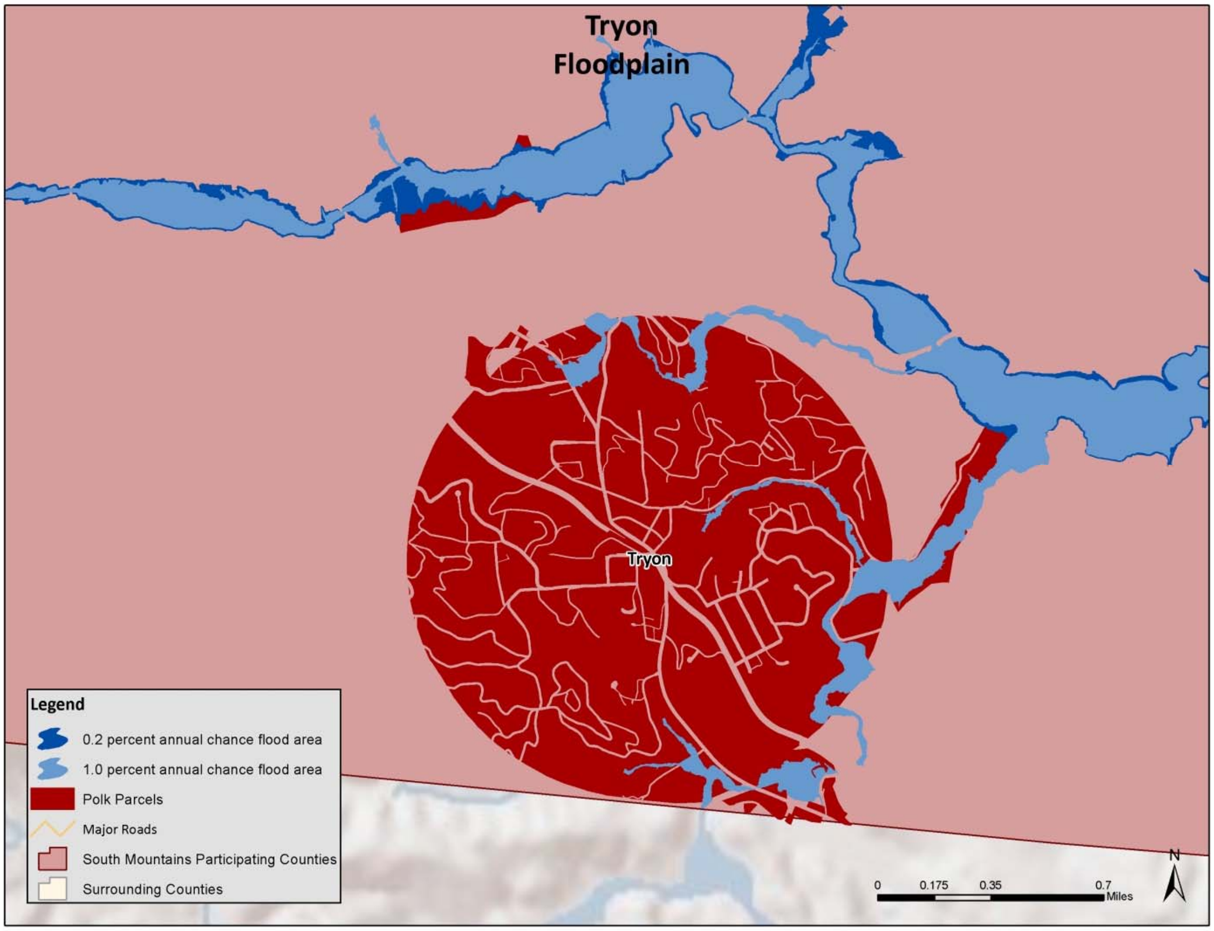
Source: Federal Emergency Management Agency

FIGURE B.9: SPECIAL FLOOD HAZARD AREAS IN SALUDA



Source: Federal Emergency Management Agency

FIGURE B.10: SPECIAL FLOOD HAZARD AREAS IN TRYON



Source: Federal Emergency Management Agency

Historical Occurrences

Floods have resulted in one presidential disaster declaration in Polk County in 1977.[16] Information from the National Climatic Data Center was used to ascertain additional historical flood events. The National Climatic Data Center reported a total of 19 events in Polk County since 1993.[17] A summary of these events is presented in **Table B.22**. These events accounted for over $3.4 million (2013 dollars) in property damage in the county.[18] Specific information on flood events, including date, type of flooding, and deaths and injuries, can be found in **Table B.23**.

TABLE B.22: SUMMARY OF FLOOD OCCURRENCES IN POLK COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Columbus	2	0/0	$0

[16] A complete listing of historical disaster declarations can be found in Section 4: *Hazard Profiles*.
[17] These events are only inclusive of those reported by NCDC. It is likely that additional occurrences have occurred and have gone unreported.
[18] The total damage amount was averaged over the number of affected counties when multiple counties were involved in the flood event.

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Saluda	1	0/0	$0
Tryon	0	0/0	$0
Unincorporated Area	16	0/0	$3,426,657
POLK COUNTY TOTAL	**19**	**0/0**	**$3,426,657**

Source: National Climatic Data Center

TABLE B.23: HISTORICAL FLOOD EVENTS IN POLK COUNTY

	Date	Type	Deaths / Injuries	Property Damage*
Columbus				
COLUMBUS	30-JUL-03	FLASH FLOOD	0/0	$0
COLUMBUS	07-JUL-05	FLASH FLOOD	0/0	$0
Saluda				
SALUDA	22-JUL-06	FLASH FLOOD	0/0	$0
Tryon				
None Reported	--	--	--	--
Unincorporated Area				
POLK COUNTY	23-MAR-93	FLASH FLOODS	0/0	$0
Central	04-MAY-93	FLASH FLOOD	0/0	$87,452
Greenbrier Cove	27-AUG-95	FLASH FLOOD	0/0	$0
POLK COUNTY	26-JAN-96	FLOOD	0/0	$3,218
LAKE LURE	04-SEP-96	FLASH FLOOD	0/0	$0
LAKE LURE	04-SEP-96	FLASH FLOOD	0/0	$0
COUNTYWIDE	07-JAN-98	FLOOD	0/0	$0
COUNTYWIDE	03-FEB-98	FLOOD	0/0	$0
POLK COUNTY	02-JUL-03	FLOOD	0/0	$0
POLK COUNTY	31-JUL-03	FLOOD	0/0	$0
COUNTYWIDE	11-AUG-03	FLASH FLOOD	0/0	$0
POLK COUNTY	07-SEP-04	FLOOD	0/0	$1,239,535
COUNTYWIDE	07-SEP-04	FLASH FLOOD	0/0	$0
POLK COUNTY	17-SEP-04	FLOOD	0/0	$2,028,922
MT VLY	20-SEP-09	FLOOD	0/0	$11,255
MT VLY	20-SEP-09	FLASH FLOOD	0/0	$56,275

*Property damage is reported in 2013 dollars; All damage may not have been reported.
Source: National Climatic Data Center

Historical Summary of Insured Flood Losses

According to FEMA flood insurance policy records as of June 2013, there have been 10 flood losses reported in Polk County through the National Flood Insurance Program (NFIP) since 1978, totaling over $87,000 in claims payments. A summary of these figures for the county is provided in **Table B.24**. It should be emphasized that these numbers include only those losses to structures that were insured through the NFIP policies, and for losses in which claims were sought and received. It is likely that many additional instances of flood loss in Polk County were either uninsured, denied claims payment, or not reported.

TABLE B.24: SUMMARY OF INSURED FLOOD LOSSES IN POLK COUNTY

Location	Flood Losses	Claims Payments
Columbus	0	$0
Saluda	0	$0
Tryon	0	$0
Unincorporated Area	10	$87,286
POLK COUNTY TOTAL	**10**	**$87,286**

Source: FEMA, NFIP

Repetitive Loss Properties

FEMA defines a repetitive loss property as any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling 10-year period, since 1978. A repetitive loss property may or may not be currently insured by the NFIP. Currently there are over 140,000 repetitive loss properties nationwide.

As of October 2013, there is one non-mitigated repetitive loss property located in Polk County, which accounted for three losses and more than $15,000 in claims payments under the NFIP. The average claim amount for this property is $7,910. The property is residential. Without mitigation this property will likely continue to experience flood losses. **Table B.25** presents detailed information on repetitive loss properties and NFIP claims and policies for Polk County.

TABLE B.25: REPETITIVE LOSS PROPERTIES IN POLK COUNTY

Location	Number of Properties	Types of Properties	Number of Losses	Building Payments	Content Payments	Total Payments	Average Payment
Columbus	0	--	0	$0	$0	$0	$0
Saluda	0	--	0	$0	$0	$0	$0
Tryon	0	--	0	$0	$0	$0	$0
Unincorporated Area	1	residential	2	$4,392.84	$11,472.02	$15,819.86	$7,909.93
POLK COUNTY TOTAL	**1**		**3**	**$4,392.84**	**$11,472.02**	**$15,819.86**	**$7,909.93**

Source: National Flood Insurance Program

Probability of Future Occurrences

Flood events will remain a threat in areas prone to flooding in Polk County, and the probability of future occurrences will remain likely (between 10 and 100 percent annual probability). The participating jurisdictions and unincorporated areas of the county have risk to flooding, though not all areas will experience floods. The probability of future flood events based on magnitude and according to best available data is illustrated in the figures above, which indicates those areas susceptible to the 1-percent annual chance flood (100-year floodplain) and the 0.2-percent annual chance flood (500-year floodplain).

It can be inferred from the floodplain location maps, previous occurrences, and repetitive loss properties that risk varies throughout the county and participating jurisdictions. For example, the unincorporated county has more floodplain and thus a higher risk of flood than the municipalities. Flood is not the greatest hazard of concern but will continue to occur and cause damage. Therefore, mitigation actions may be warranted, particularly for repetitive loss properties.

B.2.14 Hazardous Materials Incidents

Location and Spatial Extent

There are no TRI sites located in Polk County, however, in addition to "fixed" hazardous materials locations, hazardous materials may also impact the county via roadways and rail. Many roads in the county are narrow and winding, making hazardous material transport in the area especially treacherous. All roads that permit hazardous material transport are considered potentially at risk to an incident.

Historical Occurrences

There have been a total of two recorded HAZMAT incidents in Polk County since 1998 (**Table B.26**). **Table B.27** presents detailed information on historic HAZMAT incidents in Polk County as reported by the U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA).

TABLE B.26: SUMMARY OF HAZMAT INCIDENTS IN POLK COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Columbus	0	--	--
Saluda	1	0/0	$30,978
Tryon	0	--	--
Unincorporated Area	1	0/0	$20,159
POLK COUNTY TOTAL	**2**	**0/0**	**$51,137**

Source: USDOT PHMSA

TABLE B.27: HAZMAT INCIDENTS IN POLK COUNTY

Report Number	Date	City	Mode	Serious Incident?	Fatalities / Injuries	Damages ($)*	Quantity Released
Columbus							
None Reported	--	--	--	--	--	--	--
Saluda							
I-1999010645	12/6/1998	SALUDA	Highway	Yes	0/0	$30,978	1,687.5 LGA
Tryon							
None Reported	--	--	--	--	--	--	--
Unincorporated Area							
I-2013060366	5/14/2013	MILL SPRING	Highway	Yes	0/0	$20,159	330 LGA

*Property damage is reported in 2013 dollars.
Source: USDOT PHMSA

Probability of Future Occurrences

Given the prior roadway incidents in Polk County, it is possible that a hazardous material incident may occur in the county (between 1 and 10 percent annual probability). County and town officials are mindful of this possibility and take precautions to prevent such an event from occurring. Furthermore, there are detailed plans in place to respond to an occurrence. The county may also be impacted by neighboring counties which also face risk due to TRI sites.

B.2.15 Wildfire

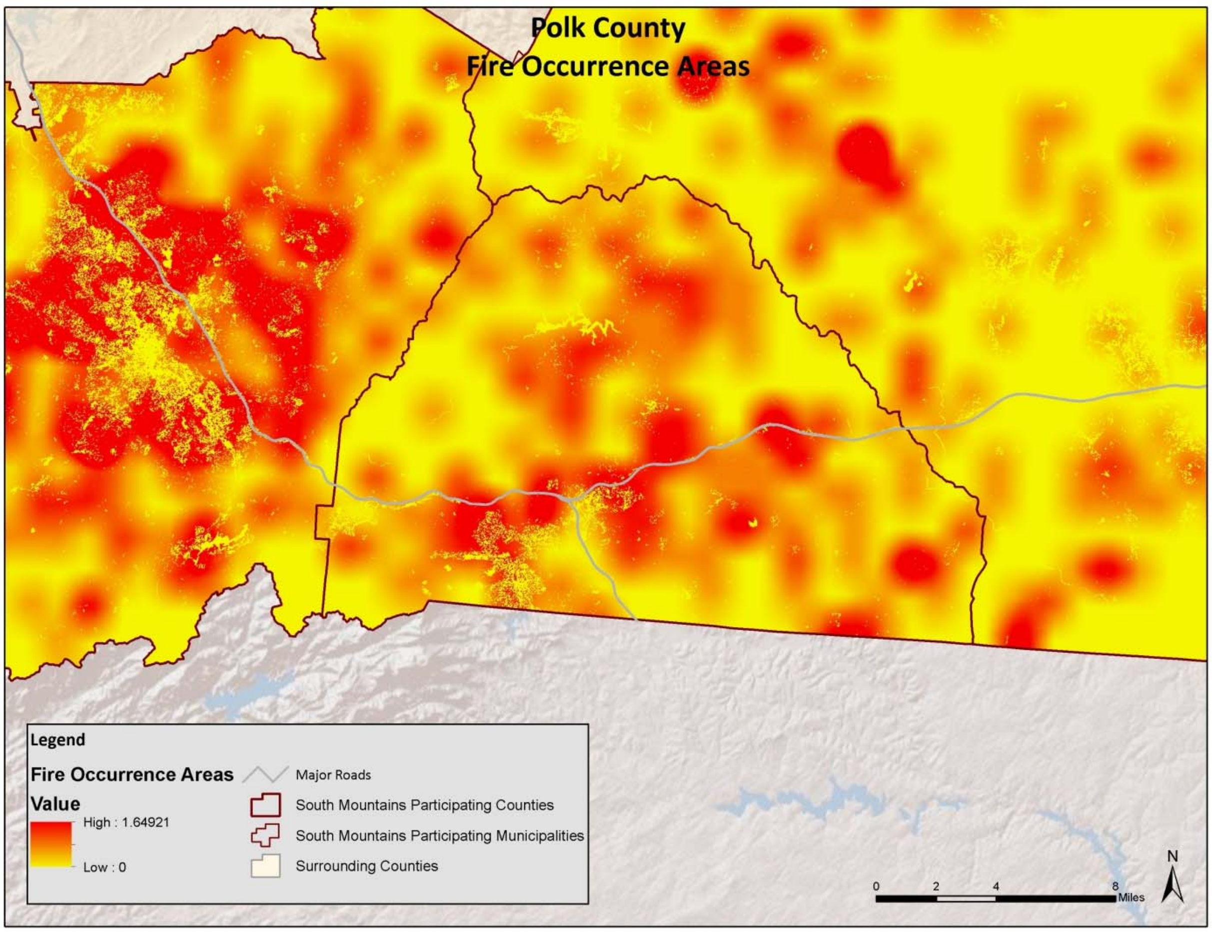
Location and Spatial Extent

The entire county is at risk to a wildfire occurrence. However, several factors such as drought conditions or high levels of fuel on the forest floor, may make a wildfire more likely. Furthermore, areas in the urban-wildland interface are particularly susceptible to fire hazard as populations abut formerly undeveloped areas. The Fire Occurrence Areas in the figure below give an indication of historic location.

Historical Occurrences

Figure B.11 shows the Fire Occurrence Areas (FOA) in Polk County based on data from the Southern Wildfire Risk Assessment. This data is based on historical fire ignitions and is reported as the number of fires that occur per 1,000 acres each year.

FIGURE B.11: HISTORIC WILDFIRE EVENTS IN POLK COUNTY



Source: Southern Wildfire Risk Assessment

Based on data from the North Carolina Division of Forest Resources from 2003 to 2012, Polk County experienced an average of 17 wildfires annually which burn an average of 245 acres per year. The data indicates that most of these fires are relatively small, averaging 14 acre per fire. **Table B.28** lists the number of reported wildfire occurrences in the county between the years 2003 and 2012.

TABLE B.28: HISTORICAL WILDFIRE OCCURRENCES IN POLK COUNTY

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Polk County										
Number of Fires	12	15	17	34	28	14	11	12	15	12
Number of Acres	19.9	25.3	30.9	639.2	38.4	69.1	72.2	14.5	1,506.2	32.2

Source: North Carolina Division of Forest Resources

Probability of Future Occurrences

Wildfire events will be an ongoing occurrence in Polk County. The likelihood of wildfires increases during drought cycles and abnormally dry conditions. Fires are likely to stay small in size but could increase due local climate and ground conditions. Dry, windy conditions with an accumulation of forest floor fuel (potentially due to ice storms or lack of fire) could create conditions for a large fire that spreads quickly. It should also be noted that some areas do vary somewhat in risk. For example, highly developed areas are less susceptible unless they are located near the urban-wildland boundary. The risk will also vary due to assets. Areas in the urban-wildland interface will have much more property at risk, resulting in increased vulnerability and need to mitigate compared to rural, mainly forested areas. In this case, the participating jurisdictions appear to have a similar risk to the surrounding areas. The probability assigned to Polk County for future wildfire events is likely (10 to 100 percent annual probability).

B.2.16 Conclusions on Hazard Risk

The hazard profiles presented above were developed using best available data and result in what may be considered principally a qualitative assessment as recommended by FEMA in its "How-to" guidance document titled *Understanding Your Risks: Identifying Hazards and Estimating Losses* (FEMA Publication 386-2). It relies heavily on historical and anecdotal data, stakeholder input, and professional and experienced judgment regarding observed and/or anticipated hazard impacts. It also carefully considers the findings in other relevant plans, studies, and technical reports.

Hazard Extent

Table B.29 describes the extent of each natural hazard identified for Polk County. The extent of a hazard is defined as its severity or magnitude, as it relates to the planning area.

TABLE B.29: EXTENT OF POLK COUNTY HAZARDS

Atmospheric Hazards	
Drought	Drought extent is defined by the North Carolina Drought Monitor Classifications which include Abnormally Dry, Moderate Drought, Severe Drought, Extreme Drought, and Exceptional Drought (page 5:6). According to the North Carolina Drought Monitor Classifications, the most severe drought condition is Exceptional. Polk County has received this ranking three times over the fourteen-year reporting period.
Extreme Heat	The extent of extreme heat can be defined by the maximum temperature reached. The highest temperature recorded in Polk County is 105 degrees Fahrenheit on June 22, 1964.

Hailstorm	Hail extent can be defined by the size of the hail stone. The largest hail stone reported in Polk County was 2.75 inches (reported on June 4, 1985). It should be noted that future events may exceed this.
Hurricane and Tropical Storm	Hurricane extent is defined by the Saffir-Simpson Scale which classifies hurricanes into Category 1 through Category 5 (Table 5.9). The greatest classification of hurricane to traverse directly through Polk County was an Unnamed Storm in 1902 which reached a maximum wind speed of 31 knots in the county. Although the county is much more likely to be impacted by the remnants of a hurricane or tropical storm, this event demonstrates that larger storms can and have impacted the county directly.
Lightning	According to the Vaisala flash density map (Figure 5.5), Polk County is located in an area that experiences 3 to 4 lightning flashes per square kilometer per year. It should be noted that future lightning occurrences may exceed these figures.
Thunderstorm Wind / High Wind	Thunderstorm extent is defined by the number of thunder events and wind speeds reported. According to a 63-year history from the National Climatic Data Center, the strongest recorded wind event in Polk County was reported on June 13, 2001 at 65 knots (approximately 75 mph). It should be noted that future events may exceed these historical occurrences.
Tornado	Tornado hazard extent is measured by tornado occurrences in the US provided by FEMA (Figure 5.6) as well as the Fujita/Enhanced Fujita Scale (Tables 5.14 and 5.15). The greatest magnitude reported in the county was an F1 (reported on August 17, 1977).
Winter Storm and Freeze	The extent of winter storms can be measured by the amount of snowfall received (in inches). The greatest 24-hour snowfall reported in Polk County was 15 inches on December 4, 1971. Due to extreme variations in elevation throughout the county, extent totals will vary for each participating jurisdiction and reliable data on snowfall totals is not available.
Geologic Hazards	
Earthquake	Earthquake extent can be measured by the Richter Scale (Table 5.18) and the Modified Mercalli Intensity (MMI) scale (Table 5.19) and the distance of the epicenter from Polk County. According to data provided by the National Geophysical Data Center, the greatest MMI to impact the county was V (slightly strong) with a correlating Richter Scale measurement of approximately 4.8 (reported on February 21, 1916). The epicenter of this earthquake was located 31.0 km away.
Landslide	As noted above in the landslide profile, the landslide data provided by the North Carolina Geological survey is incomplete. This provides a challenge when trying to determine an accurate extent for the landslide hazard. However, when using the USGS landslide susceptibility index, extent can be measured with incidence, which is moderate in Polk County. There is also high susceptibility throughout the county.
Hydrologic Hazards	
Dam Failure	Dam failure extent is defined using the North Carolina Division of Land Resources criteria (Table 5.23). Of the 44 dams in Polk County, 10 are classified as high-hazard.
Erosion	The extent of erosion can be defined by the measurable rate of erosion that occurs. There are no erosion rate records located in Polk County.

Flood	Flood extent can be measured by the amount of land and property in the floodplain as well as flood height and velocity. The amount of land in the floodplain accounts for 5.6 percent of the total land area in Polk County. Flood depth and velocity are recorded via United States Geological Survey stream gages throughout the region. While a gage does not exist for any of the participating jurisdictions in Polk County, there is one nearby in Rutherford County. The greatest peak discharge was recorded at Cove Creek near Lake Fletcher on June 5, 1957. Water reached a discharge of 7,050 cubic feet per second and the stream gage height was recorded at 18.53 feet.
Other Hazards	
Hazardous Materials Incident	According to USDOT PHMSA, the largest hazardous materials incident reported in the county was 1,687.5 LGA released on the highway on December 6, 1998. It should be noted that larger events are possible.
Wildfire	Wildfire data was provided by the North Carolina Division of Forest Resources and is reported annually by county from 2003-2012. The greatest number of fires to occur in Polk County in any year was 34 in 2006. The greatest number of acres to burn in the county in a single year occurred in 2011 when 1,506 acres were burned. Although this data lists the extent that has occurred, larger and more frequent wildfires are possible throughout the county.

Priority Risk Index Results

In order to draw some meaningful planning conclusions on hazard risk for Polk County, the results of the hazard profiling process were used to generate countywide hazard classifications according to a "Priority Risk Index" (PRI). More information on the PRI and how it was calculated can be found in Section 5.18.2.

Table B.30 summarizes the degree of risk assigned to each category for all initially identified hazards based on the application of the PRI. Assigned risk levels were based on the detailed hazard profiles developed for this section, as well as input from the Regional Hazard Mitigation Planning Committee. The results were then used in calculating PRI values and making final determinations for the risk assessment.

TABLE B.30: SUMMARY OF PRI RESULTS FOR POLK COUNTY

Hazard	Category/Degree of Risk					
	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Atmospheric Hazards						
Drought	Likely	Minor	Large	More than 24 hours	More than 1 week	**2.5**
Extreme Heat	Possible	Minor	Large	More than 24 hours	Less than 1 week	**2.1**
Hailstorm	Highly Likely	Limited	Moderate	Less than 6 hours	Less than 6 hours	**2.9**
Hurricane and Tropical Storm	Possible	Limited	Large	More than 24 hours	Less than 24 hours	**2.3**
Lightning	Highly Likely	Minor	Negligible	Less than 6 hours	Less than 6 hours	**2.2**
Thunderstorm / High Wind	Highly Likely	Critical	Moderate	6 to 12 hours	Less than 6 hours	**3.1**
Tornado	Possible	Critical	Small	Less than 6 hours	Less than 6 hours	**2.4**
Winter Storm and Freeze	Highly Likely	Critical	Large	More than 24 hours	Less than 1 week	**3.3**

Geologic Hazards						
Earthquake	Possible	Minor	Moderate	Less than 6 hours	Less than 6 hours	**2.0**
Landslide	Possible	Critical	Small	Less than 6 hours	Less than 6 hours	**2.2**
Hydrologic Hazards						
Dam and Levee Failure	Unlikely	Critical	Moderate	Less than 6 hours	Less than 6 hours	**2.3**
Erosion	Likely	Minor	Small	More than 24 hours	More than 1 week	**2.1**
Flood	Likely	Critical	Moderate	6 to 12 hours	Less than 1 week	**3.0**
Other Hazards						
Hazardous Materials Incident	Possible	Limited	Small	Less than 6 hours	Less than 24 hours	**2.2**
Wildfire	Likely	Minor	Moderate	Less than 6 hours	Less than 1 week	**2.6**

B.2.17 Final Determinations on Hazard Risk

The conclusions drawn from the hazard profiling process for Polk County, including the PRI results and input from the Regional Hazard Mitigation Planning Committee, resulted in the classification of risk for each identified hazard according to three categories: High Risk, Moderate Risk, and Low Risk (**Table B.31**). For purposes of these classifications, risk is expressed in relative terms according to the estimated impact that a hazard will have on human life and property throughout all of Polk County. A more quantitative analysis to estimate potential dollar losses for each hazard has been performed separately, and is described in Section 6: *Vulnerability Assessment* and below in Section B.3. It should be noted that although some hazards are classified below as posing low risk, their occurrence of varying or unprecedented magnitudes is still possible in some cases and their assigned classification will continue to be evaluated during future plan updates.

TABLE B.31: CONCLUSIONS ON HAZARD RISK FOR POLK COUNTY

HIGH RISK	Winter Storm and Freeze Thunderstorm Wind / High Wind Flood Hailstorm
MODERATE RISK	Wildfire Drought Tornado Hurricane and Tropical Storm Dam and Levee Failure

LOW RISK	Landslide Lightning Hazardous Material Incident Extreme Heat Erosion Earthquake

B.3 POLK COUNTY VULNERABILITY ASSESSMENT

This subsection identifies and quantifies the vulnerability of Polk County to the significant hazards previously identified. This includes identifying and characterizing an inventory of assets in the county and assessing the potential impact and expected amount of damages caused to these assets by each identified hazard event. More information on the methodology and data sources used to conduct this assessment can be found in Section 6: *Vulnerability Assessment*.

B.3.1 Asset Inventory

Table B.32 lists the number of parcels, total value of parcels, total number of parcels with improvements, and the total assessed value of improvements for Polk County and its participating jurisdictions (study area of vulnerability assessment).[19]

TABLE B.32: IMPROVED PROPERTY IN POLK COUNTY

Location	Number of Parcels	Total Assessed Value of Parcels	Estimated Number of Buildings	Total Assessed Value of Improvements
Columbus	557	$138,070,173	426	$94,219,961
Saluda	684	$90,214,073	461	$61,178,796
Tryon	1,076	$156,252,053	812	$115,486,478
Unincorporated Area	15,222	$2,784,057,055	8,367	$1,402,543,876
POLK COUNTY TOTAL	**17,539**	**$3,168,593,354**	**10,066**	**$1,673,429,111**

Table B.33 lists the fire stations, police stations, emergency operations centers (EOCs), medical care facilities, schools and other critical facilities located in Polk County. Local governments at the county level provided a majority of the data for this analysis; however gaps in the data were filled using Hazus 2.1 to obtain the location of some critical facilities for which spatial data was not available. In addition, **Figure B.12** shows the locations of essential facilities in Polk County. **Table B.45**, near the end of this section, shows a complete list of the critical facilities by name, as well as the hazards that affect each facility. As noted previously, this list is not all-inclusive and only includes information provided by the county.

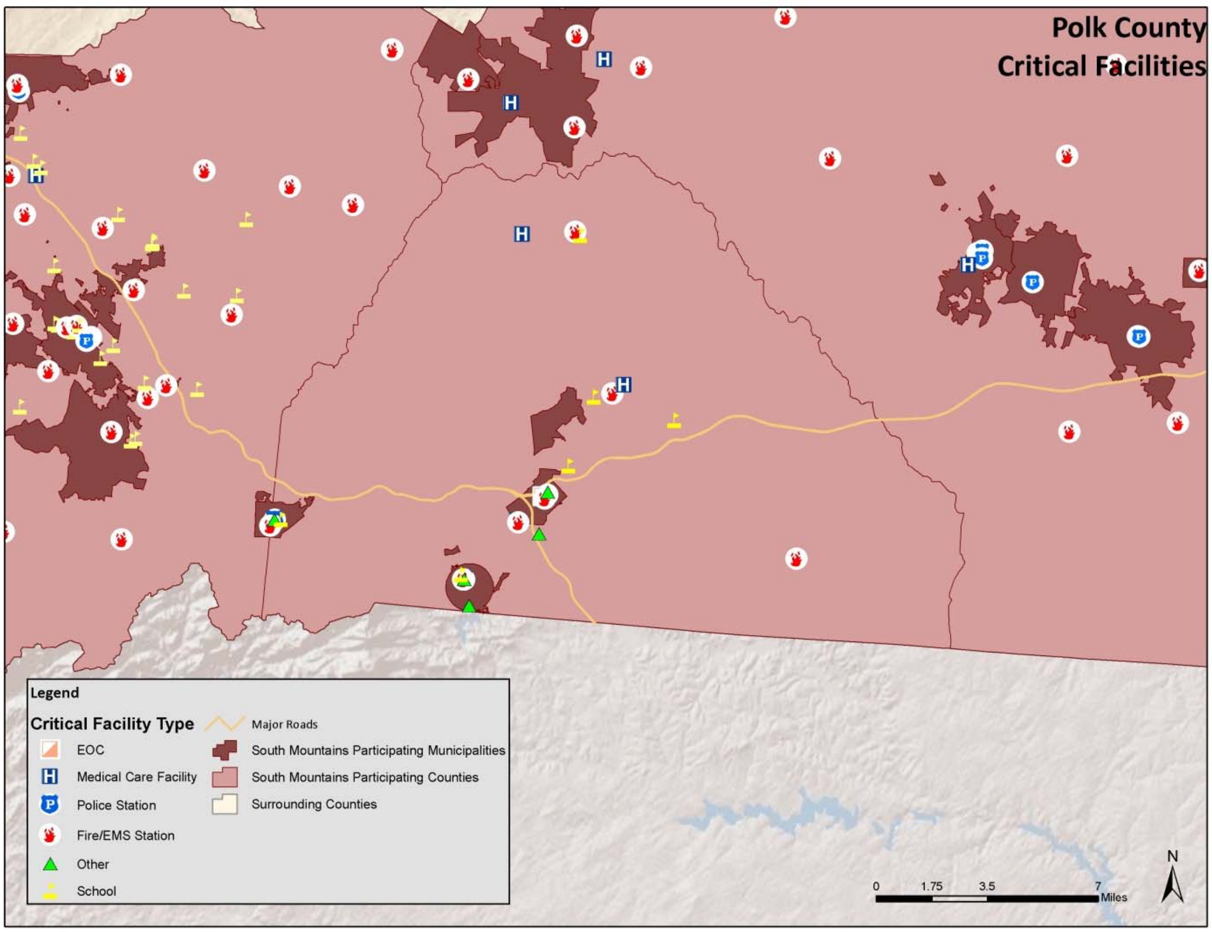
[19] Total assessed values for improvements is based on tax assessor records as joined to digital parcel data. This data does not include dollar figures for tax-exempt improvements such as publicly-owned buildings and facilities. It should also be noted that, due to record keeping, some duplication is possible thus potentially resulting in an inflated value exposure for an area.

TABLE B.33: CRITICAL FACILITY INVENTORY IN POLK COUNTY

Location	Fire Stations	Police Stations	Medical Care Facilities	EOC	Schools	Other
Columbus	3	2	1	1	0	4
Saluda	1	1	0	0	1	1
Tryon	1	1	0	0	1	2
Unincorporated Area	3	0	2	0	4	1
POLK COUNTY TOTAL	**8**	**4**	**3**	**1**	**6**	**8**

Source: Hazus-MH

FIGURE B.12: CRITICAL FACILITY LOCATIONS IN POLK COUNTY



Source: Hazus-MH 2.1

B.3.2 Social Vulnerability

In addition to identifying those assets potentially at risk to identified hazards, it is important to identify and assess those particular segments of the resident population in Polk County that are potentially at risk to these hazards.

Table B.34 lists the population by jurisdiction according to U.S. Census 2010 population estimates. Unfortunately, estimates were not available at the census block level, limited the results to county-wide estimates. The total population in Polk County according to Census data is 20,510persons. Additional population estimates are presented above in Section B.1.

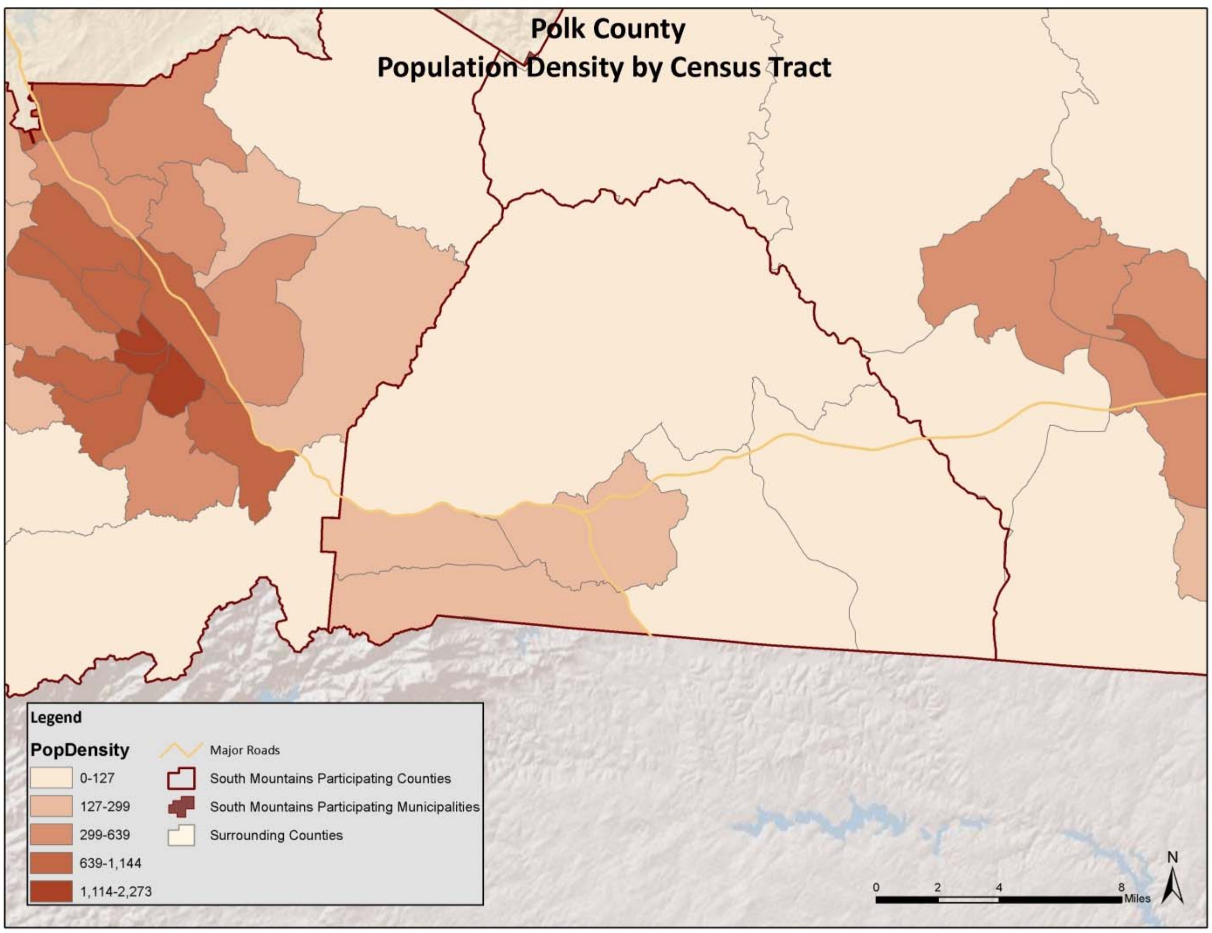
TABLE B.34: TOTAL POPULATION IN POLK COUNTY

Jurisdiction	2010 Census Population
Polk County	**20,510**
Town of Columbus	999
City of Saluda	713
Town of Tryon	1,646

Source: U.S. Census 2010

In addition, **Figure B.13** illustrates the population density by census tract as it was reported by the U.S. Census Bureau in 2010.[20]

FIGURE B.13: POPULATION DENSITY IN POLK COUNTY



[20] Population by census block was not available at the time this plan was completed.

Source: U.S. Census Bureau, 2010

B.3.3 Vulnerability Assessment Results

As noted in Section 6: *Vulnerability Assessment*, only hazards with a specific geographic boundary, modeling tool, or sufficient historical data allow for further analysis. Those results, specific to Polk County, are presented here. All other hazards are assumed to impact the entire planning region (drought, hailstorm, lightning, thunderstorm wind, tornado, and winter storm and freeze) or, due to lack of data, analysis would not lead to credible results (erosion, dam and levee failure). The total county exposure, and thus risk, was presented in **Table B.32**.

The annualized loss estimate for all hazards is presented at the end of this section in **Table B.45.**

The hazards presented in this section include: hurricane and tropical storm winds, earthquake, landslide, flood, hazardous materials incident, and wildfire.

Hurricane and Tropical Storm

Historical evidence indicates that Polk County has a significant risk to the hurricane and tropical storm hazard. Several tracks have come near or traversed through the county, as shown and discussed in Section B.3.3.

Hurricanes and tropical storms can cause damage through numerous additional hazards such as flooding, erosion, tornadoes, and high winds and precipitation, thus it is difficult to estimate total potential losses from these cumulative effects. The current Hazus-MH hurricane model only analyzes hurricane winds and is not capable of modeling and estimating cumulative losses from all hazards associated with hurricanes; therefore only hurricane winds are analyzed in this section. It can be assumed that all existing and future buildings and populations are at risk to the hurricane and tropical storm hazard. Hazus-MH 2.1 was used to determine annualized losses for the county as shown below in **Table B.35.** Only losses to buildings are reported, in order to best match annualized losses reported for other hazards. Hazus-MH reports losses at the U.S. Census tract level, so determining participating jurisdiction losses was not possible.

TABLE B.35: ANNUALIZED LOSS ESTIMATIONS FOR HURRICANE WIND HAZARD

Location	Total Annualized Loss
Polk County	$36,000

Source: Hazus-MH 2.1

In addition, probable peak wind speeds were calculated in Hazus. These are shown below in **Table B.36.**

TABLE B.36: PROBABLE PEAK HURRICANE / TROPICAL STORM WIND SPEEDS (MPH)

Location	50-year event	100-year event	500-year event	1,000-year event
Columbus	55	65	84	92
Saluda	55	64	83	92
Tryon	55	64	83	92
MAXIMUM WIND SPEED REPORTED	**55**	**65**	**84**	**92**

Source: Hazus-MH 2.1

Social Vulnerability
Given equal susceptibility across the county, it is assumed that the total population is at risk to the hurricane and tropical storm hazard.

Critical Facilities
Given equal vulnerability across Polk County, all critical facilities are considered to be at risk. Some buildings may perform better than others in the face of such an event due to construction and age, among other factors. Determining individual building response is beyond the scope of this plan. However, this plan will consider mitigation actions for vulnerable structures, including critical facilities, to reduce the impacts of the hurricane wind hazard. A list of specific critical facilities and their associated risk can be found in **Table B.45** at the end of this section.

In conclusion, a hurricane event has the potential to impact many existing and future buildings, critical facilities, and populations in Polk County. Hurricane events can cause substantial damage in their wake including fatalities, extensive debris clean-up, and extended power outages.

Earthquake
For the earthquake hazard vulnerability assessment, a probabilistic scenario was created to estimate the annualized loss for Polk County. The results of the analysis reported at the U.S. Census tract level do not make it feasible to estimate losses at the jurisdiction level. Since the scenario is annualized, no building counts are provided. Losses reported included losses due to building damage and do not include losses to contents, inventory, or business interruption. **Table B.37** summarizes the findings.

TABLE B.37: ANNUALIZED LOSS ESTIMATIONS FOR EARTHQUAKE HAZARD

Location	Total Annualized Loss
Polk County	$9,000

Source: Hazus-MH 2.1

Social Vulnerability
It can be assumed that all existing future populations are at risk to the earthquake hazard.

Critical Facilities
The Hazus probabilistic analysis indicated that no critical facilities would sustain measurable damage in an earthquake event. However, all critical facilities should be considered at-risk to minor damage, should an event occur. A list of individual critical facilities and their risk can be found in **Table B.45**.

In conclusion, an earthquake has the potential to impact all existing and future buildings, facilities, and populations in Polk County. Minor earthquakes may rattle dishes and cause minimal damage while stronger earthquakes will result in structural damage as indicated in the Hazus scenario above. Impacts of earthquakes include debris clean-up, service disruption and, in severe cases, fatalities due to building collapse. Specific vulnerabilities for assets will be greatly dependent on their individual design and the mitigation measures in place, where appropriate. Such site-specific vulnerability determinations are outside the scope of this assessment but will be considered during future plan updates if data becomes available. Furthermore, mitigation actions to address earthquake vulnerability will be considered.

Landslide

In order to complete the vulnerability assessment for landslides in Polk County, GIS analysis was used. The potential dollar value of exposed land and property total can be determined using the USGS Landslide Susceptibility Index (detailed in Section B.3.9), county level tax parcel data, and GIS analysis. **Table B.38** presents the potential at-risk property where available. Nearly all areas of Polk County are identified as moderate incidence areas by the USGS landslide data. All areas are also of high landslide susceptibility. The incidence levels (high and moderate) were used to identify different areas of concern for the analysis below.

TABLE B.38: TOTAL POTENTIAL AT-RISK PARCELS FOR THE LANDSLIDE HAZARD

Location	Number of Parcels At Risk		Number of Improvements At Risk		Total Value of Improvements At Risk ($)	
Incidence Level	Moderate	High	Moderate	High	Moderate	High
Columbus	557	0	426	0	$94,219,961	$0
Saluda	684	0	461	0	$61,178,796	$0
Tryon	1,076	0	812	0	$115,486,478	$0
Unincorporated Area	15,191	0	8,351	0	$1,401,255,674	$0
POLK COUNTY TOTAL	**17,508**	**0**	**10,050**	**0**	**$1,672,140,909**	**$0**

Source: USGS

Social Vulnerability

Given high susceptibility across the entire county, it is assumed that the total population is at risk.

Critical Facilities

All critical facilities are located in a high susceptibility area. All 30 facilities in Polk County are located in the moderate incidence area (high susceptibility). A list of specific critical facilities and their associated risk can be found in **Table B.45** at the end of this section.

In conclusion, a landslide has the potential to impact all existing and future buildings, facilities, and populations in Polk County, though some areas are at a higher risk than others due to a variety of factors. For example, steep slopes and modified slopes bear a greater risk than flat areas. Specific vulnerabilities for county assets will be greatly dependent on their individual design and the mitigation measures in place, where appropriate. Such site-specific vulnerability determinations are outside the scope of this assessment but will be considered during future plan updates if data becomes available.

Flood

Historical evidence indicates that Polk County is susceptible to flood events. A total of 19 flood events have been reported by the National Climatic Data Center resulting in over $3 million dollars in damages. On an annualized level, these damages amounted to $171,333 for Polk County.

In order to assess flood risk, a GIS-based analysis was used to estimate exposure to flood events using Digital Flood Insurance Rate Map (DFIRM) data in combination with local tax assessor records for the county. The determination of assessed value at-risk (exposure) was calculated using GIS analysis by summing the total assessed building values for only those improved properties that were confirmed to be located within an identified floodplain. **Table B.39** presents the potential at-risk property. Both the number of parcels and the approximate value are presented.

TABLE B.39: ESTIMATED EXPOSURE OF PARCELS TO THE FLOOD HAZARD

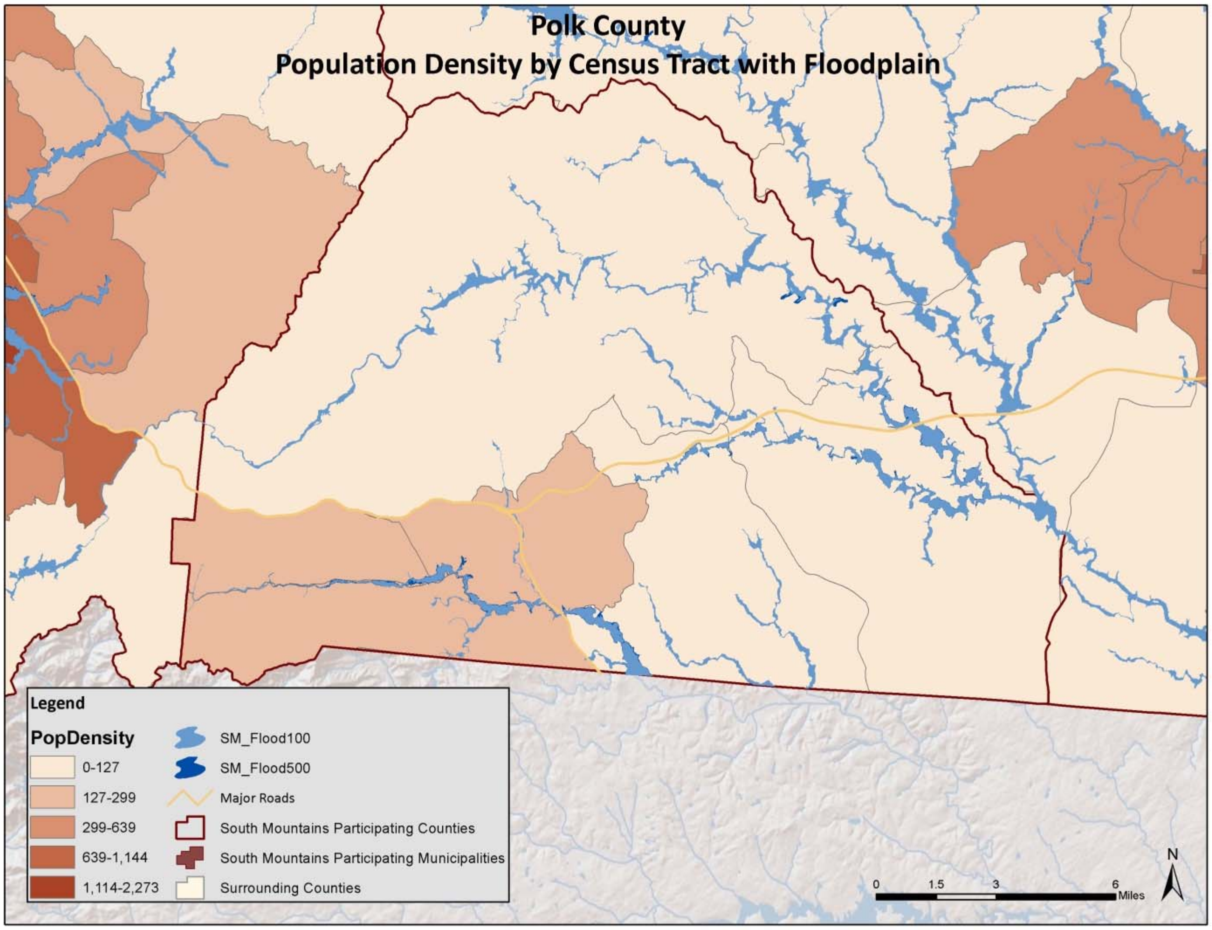
	1.0-percent ACF			0.2-percent ACF		
Location	Approx. Number of Parcels	Approx. Number Improved Buildings	Approx. Improved Value of Buildings	Approx. Number of Parcels	Approx. Number Improved Buildings	Approx. Improved Value of Buildings
Columbus	3	3	$677,362	0	0	$0
Saluda	1	1	$20,486	0	0	$0
Tryon	82	50	$7,891,077	0	0	$0
Unincorporated Area	1,700	805	$165,478,128	63	44	$9,384,918
POLK COUNTY TOTAL	**1,786**	**859**	**$174,067,053**	**63**	**44**	**$9,384,918**

Source: FEMA DFIRM

Social Vulnerability

Since 2010 population was only available at the tract level, it was difficult to determine a reliable figure on population at-risk to flood due to tract level population data. **Figure B.14** is presented to gain a better understanding of at risk population.

FIGURE B.14 : POPULATION DENSITY NEAR FLOODPLAINS



Source: FEMA DFIRM, U.S. Census 2010

Critical Facilities

The critical facility analysis revealed that there are a no critical facilities located in the Polk County 1.0-percent annual chance floodplain and 0.2-percent annual chance floodplain based on FEMA DFIRM boundaries and GIS analysis. A list of specific critical facilities and their associated risk can be found in **Table B.45** at the end of this section.

In conclusion, a flood has the potential to impact many existing and future buildings and populations in Polk County, though some areas are at a higher risk than others. All types of structures in a floodplain are at-risk, though elevated structures will have a reduced risk. As noted, the floodplains used in this analysis include the 100-year and 500-year FEMA regulated floodplain boundaries. It is certainly possible that more severe events could occur beyond these boundaries or urban (flash) flooding could impact additional structures. Such site-specific vulnerability determinations are outside the scope of this assessment but will be considered during future plan updates. Furthermore, areas subject to repetitive flooding should be analyzed for potential mitigation actions.

Hazardous Materials Incident

Although historical evidence and existing Toxic Release Inventory sites indicate that Polk County is susceptible to hazardous materials events, there are few reports of damage. Therefore, it is difficult to calculate a reliable annualized loss figure. It is assumed that while one major event could result in significant losses, annualizing structural losses over a long period of time would most likely yield a negligible annualized loss estimate for Polk County.

Most hazardous materials incidents that occur are contained and suppressed before destroying any property or threatening lives. However, they can have a significant negative impact. Such events can cause multiple deaths, completely shut down facilities for 30 days or more, and cause more than 50 percent of affected properties to be destroyed or suffer major damage. In a hazardous materials incident, solid, liquid, and/or gaseous contaminants may be released from fixed or mobile containers. Weather conditions will directly affect how the hazard develops. Certain chemicals may travel through the air or water, affecting a much larger area than the point of the incidence itself. Non-compliance with fire and building codes, as well as failure to maintain existing fire and containment features, can substantially increase the damage from a hazardous materials release. The duration of a hazardous materials incident can range from hours to days. Warning time is minimal to none.

In order to conduct the vulnerability assessment for this hazard, GIS intersection analysis was used for fixed and mobile areas and parcels.[21] In both scenarios, two sizes of buffers—500 and 2,500 meters—were used. These areas are assumed to respect the different levels of effect: immediate (primary) and secondary. Primary and secondary impact sites were selected based on guidance from FEMA 426, Reference Manual to Mitigate Potential Terrorist Attacks against Buildings and engineering judgment. For the fixed site analysis, there were no TRI sites located in Polk County**.** For the mobile analysis, the major roads (Interstate highway, U.S. highway, and State highway) and railroads, where hazardous materials are primarily transported that could adversely impact people and buildings, were used for the GIS buffer analysis. **Figure B.15** shows the areas used for mobile toxic release buffer analysis. The results indicate the approximate number of parcels, improved value, as shown in **Table B.40** (mobile road sites) and **Table B.41** (mobile railroad sites).[22]

[21] This type of analysis will likely yield inflated results (generally higher than what is actually reported after an event).
[22] Note that parcels included in the 2,500 meter analysis are also included in the 500 meter analysis.

FIGURE B.15 : MOBILE HAZMAT BUFFERS IN POLK COUNTY

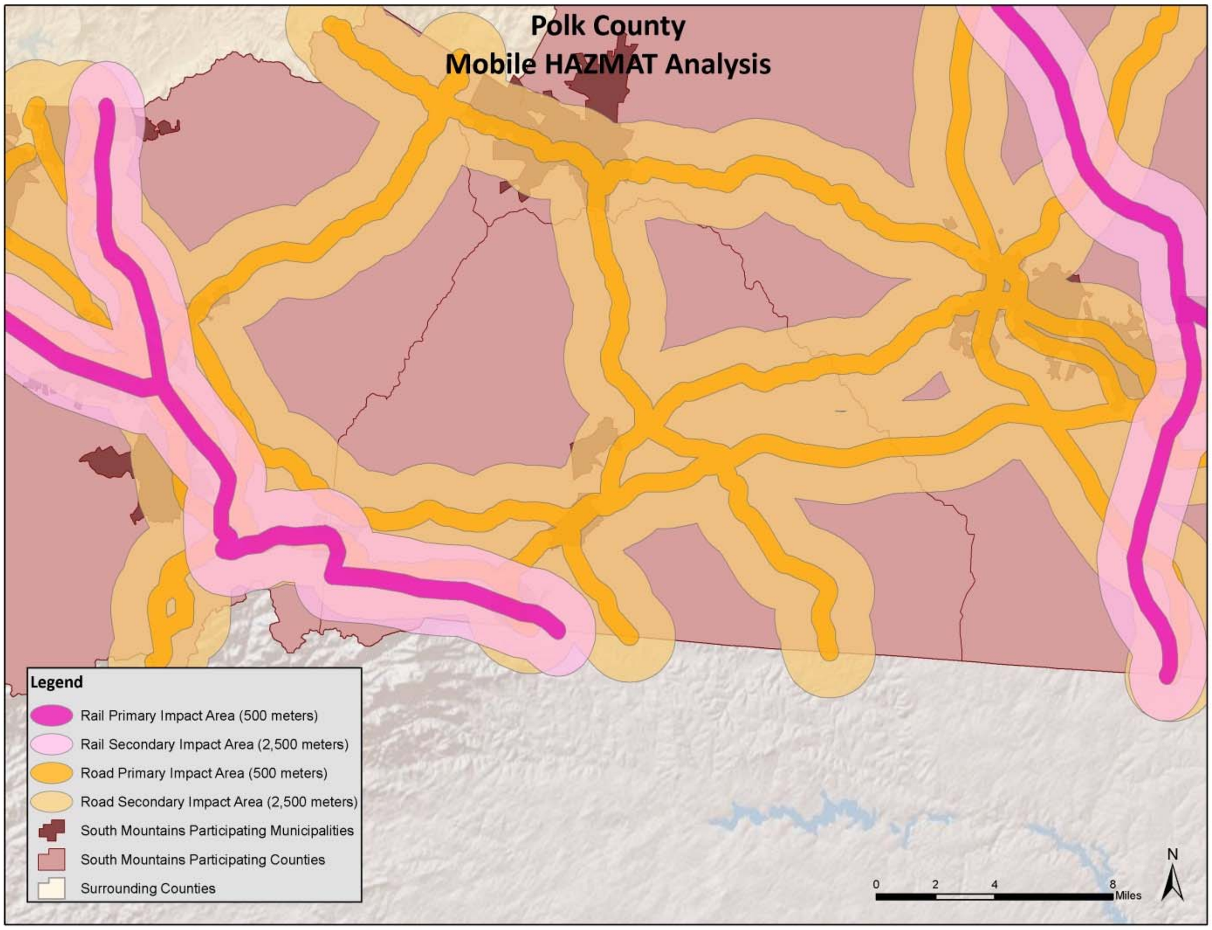


TABLE B.40: EXPOSURE OF IMPROVED PROPERTY TO HAZARDOUS MATERIALS SPILL (MOBILE ANALYSIS - ROAD)

	500-meter buffer			2,500-meter buffer		
Location	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value
Columbus	416	308	$81,841,167	557	426	$94,219,961
Saluda	457	311	$40,301,108	684	461	$61,178,796
Tryon	673	546	$84,966,643	1,076	812	$115,486,478
Unincorporated Area	3,781	2,390	$396,661,338	10,814	6,282	$1,029,267,484
POLK COUNTY TOTAL	**5,327**	**3,555**	**$603,770,256**	**13,131**	**7,981**	**$1,300,152,719**

TABLE B.41: EXPOSURE OF IMPROVED PROPERTY TO HAZARDOUS MATERIALS SPILL (MOBILE ANALYSIS - RAILROAD)

	500-meter buffer			2,500-meter buffer		
Location	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value
Columbus	0	0	$0	0	0	$0
Saluda	376	258	$34,361,083	684	461	$61,178,796
Tryon	561	462	$78,152,255	1,076	812	$115,486,478
Unincorporated Area	503	321	$56,109,535	2,474	1,541	$246,681,317
POLK COUNTY TOTAL	**1,440**	**1,041**	**$168,622,873**	**4,234**	**2,814**	**$423,346,591**

Social Vulnerability
Given high susceptibility across the entire county, it is assumed that the total population is at risk to a hazardous materials incident. It should be noted that areas of population concentration may be at an elevated risk due to a greater burden to evacuate population quickly.

Critical Facilities
Fixed Site Analysis:
The critical facility analysis for fixed TRI sites revealed that there are no Polk County facilities located in a HAZMAT risk zone. A list of specific critical facilities and their associated risk can be found in **Table B.45** at the end of this section.

Mobile Analysis:
The critical facility analysis for road and railroad transportation corridors in Polk County revealed that there are 30 critical facilities located in the primary and secondary mobile HAZMAT buffer areas for roads and 9 critical facilities located in the railroad HAZMAT buffer areas. It should be noted that many of the facilities located in the buffer areas for road are also located in the buffer areas for railroad and/or the fixed site analysis. A list of specific critical facilities and their associated risk can be found in **Table B.45** at the end of this section.

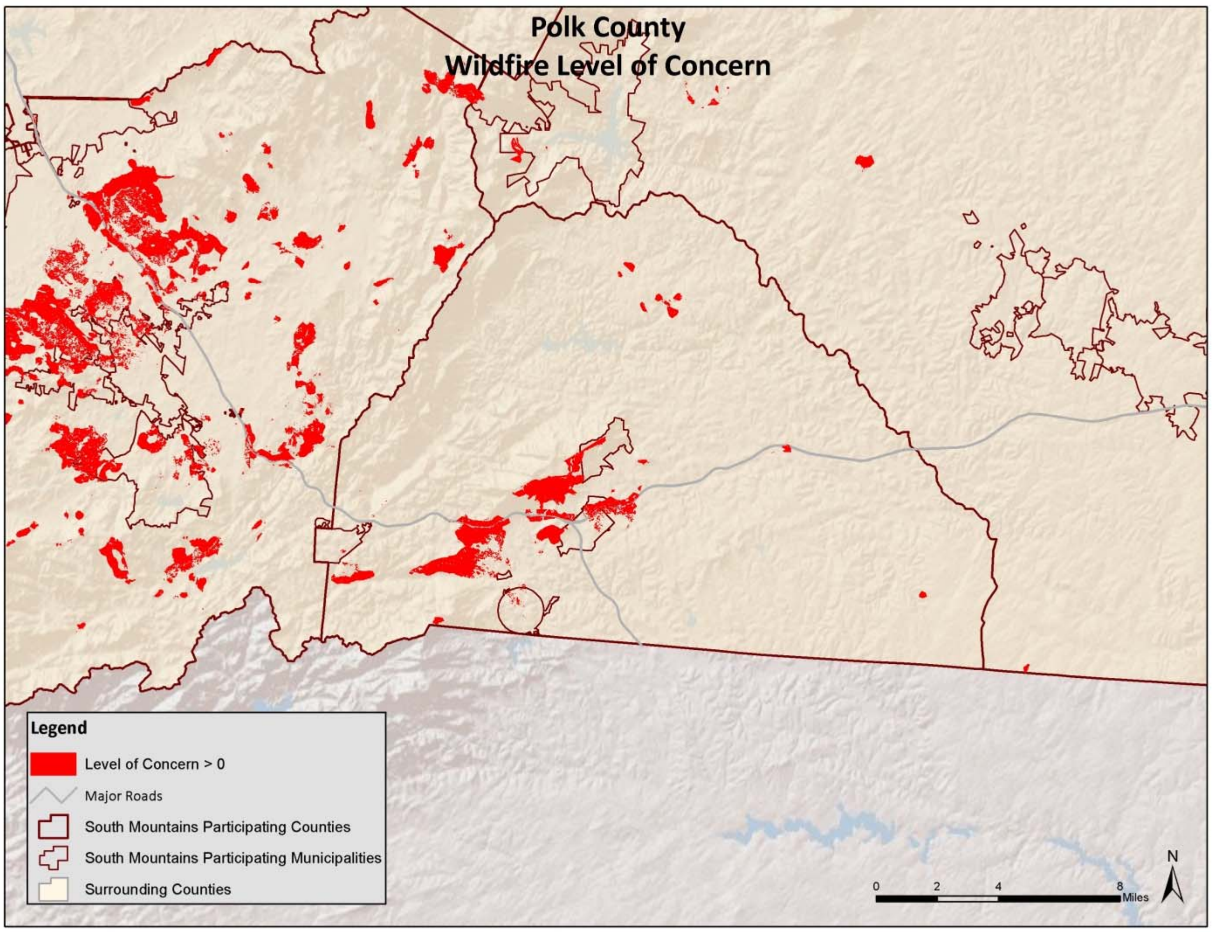
In conclusion, a hazardous material incident has the potential to impact many existing and future buildings, critical facilities, and populations in Polk County. Those areas in a primary buffer are at the highest risk, though all areas carry some vulnerability due to variations in conditions that could alter the impact area such direction and speed of wind, volume of release, etc. Further, incidents from neighboring counties could also impact the county and participating jurisdictions.

Wildfire
Although historical evidence indicates that Polk County is susceptible to wildfire events, there are few reports of damage. Therefore, it is difficult to calculate a reliable annualized loss figure. Annualized loss is considered negligible though it should be noted that a single event could result in significant damages throughout the county.

To estimate exposure to wildfire, the approximate number of parcels and their associated improved value was determined using GIS analysis. For the critical facility analysis, areas of concern were intersected with critical facility locations. **Figure B.16**, **Figure B.17**, **Figure B.18**, and **Figure B.19**show the Level of Concern data. Initially provided as raster data, it was converted to a polygon to allow for analysis. The LOC data ranges from 1 – 100 with higher values being most severe (as noted previously, this is only a measure of relative risk). Eight was the highest level recorded in the Polk County planning area. Therefore, areas with a value above 1 were chosen to be displayed as areas of risk. The region contains some lands where the value falls into the at-risk category, though the region has somewhat less land labeled as at-risk compared to other regions of North Carolina. Since all of this land area is on the lower tenth of the overall LOC scale, there is likely considerably less risk in the region than in other areas of the country.

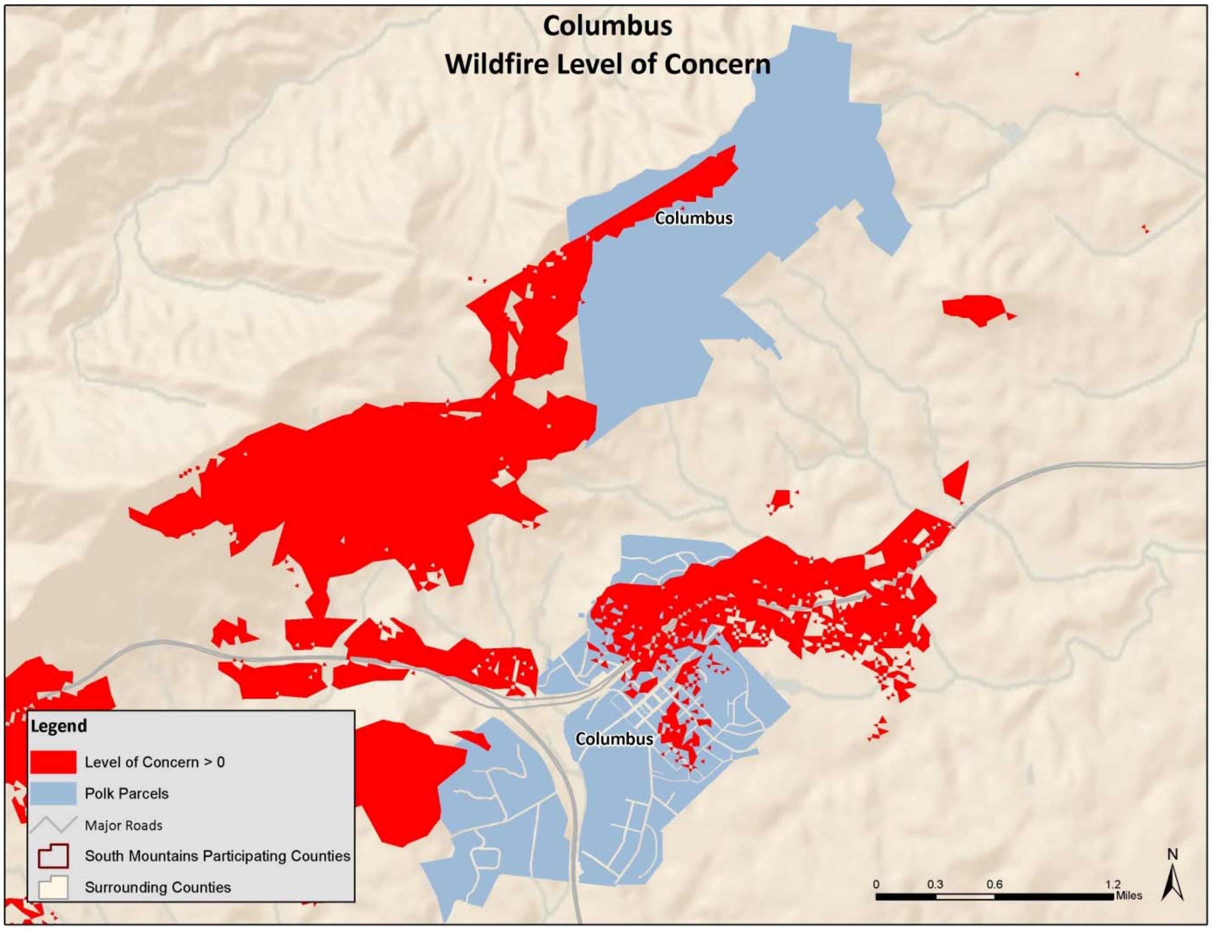
Table B.42 shows the results of the analysis.

FIGURE B.16: WILDFIRE RISK AREAS IN POLK COUNTY



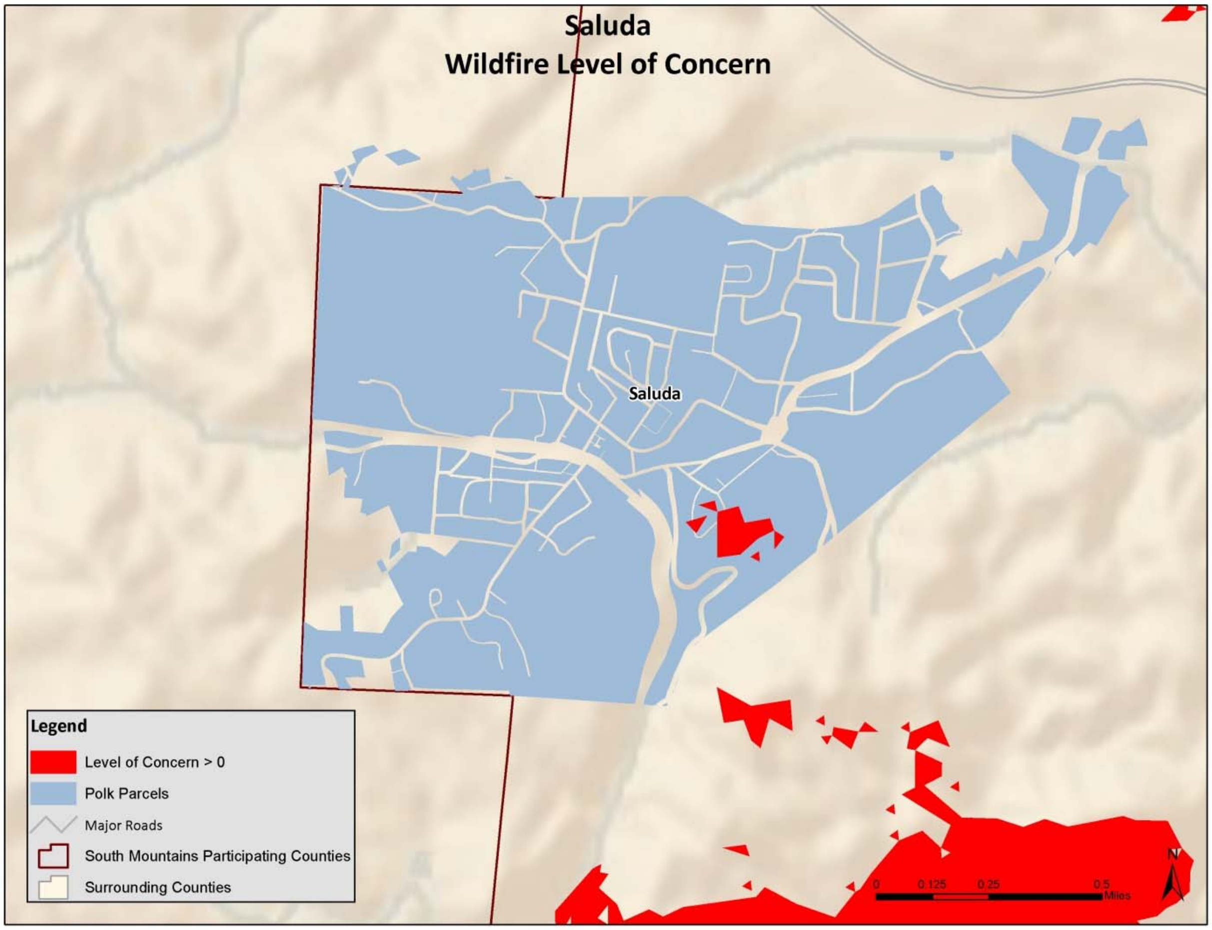
Source: Southern Wildfire Risk Assessment Data

FIGURE B.17: WILDFIRE RISK AREAS IN COLUMBUS



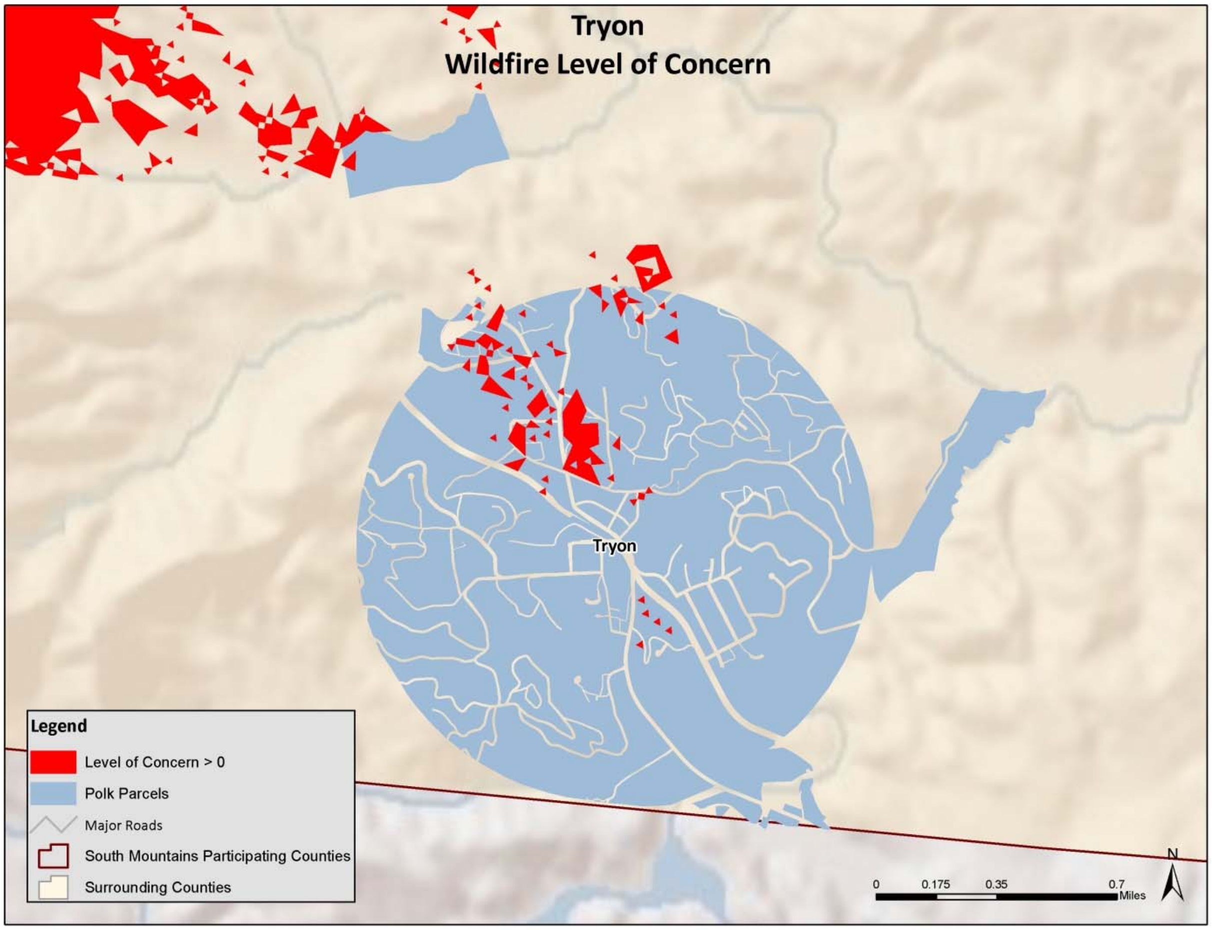
Source: Southern Wildfire Risk Assessment Data

FIGURE B.18: WILDFIRE RISK AREAS IN SALUDA



Source: Southern Wildfire Risk Assessment Data

FIGURE B.19: WILDFIRE RISK AREAS IN TRYON



Source: Southern Wildfire Risk Assessment Data

TABLE B.42: EXPOSURE OF IMPROVED PROPERTY TO WILDFIRE AREAS OF CONCERN

	HIGH WILDFIRE RISK AREA		
Location	Approx. Number of Parcels	Approx. Number of Buildings	Approx. Improved Value
Columbus	186	137	$16,007,159
Saluda	12	9	$1,334,990
Tryon	106	84	$16,664,538
Unincorporated Area	1,133	705	$125,859,143
POLK COUNTY TOTAL	**1,437**	**935**	**$159,865,830**

Looking at jurisdictional level, unincorporated areas of the county face the highest level of concern areas. However, some areas of the county (notably Columbus) have some areas where the level of concern is above 1.

Social Vulnerability

Although not all areas have equal vulnerability, there is some susceptibility across the entire county. It is assumed that the total population is at risk to the wildfire hazard. Determining the exact number of people in certain wildfire zones is difficult with existing data and could be misleading.

Critical Facilities
The critical facility analysis revealed that there are no critical facilities located in wildfire areas of concern. It should also be noted, that several factors could impact the spread of a wildfire putting all facilities at risk. A list of specific critical facilities and their associated risk can be found in **Table B.45** at the end of this section.

In conclusion, a wildfire event has the potential to impact many existing and future buildings, critical facilities, and populations in Polk County.

Conclusions on Hazard Vulnerability
Table B.43 presents a summary of annualized loss for each hazard in Polk County. Due to the reporting of hazard damages primarily at the county level, it was difficult to determine an accurate annualized loss estimate for each municipality. Therefore, an annualized loss was determined through the damage reported through historical occurrences at the county level. These values should be used as an additional planning tool or measure risk for determining hazard mitigation strategies throughout the region.

TABLE B.43: ANNUALIZED LOSS FOR POLK COUNTY

Event	Polk County
Dam Failure	Negligible
Drought	Negligible
Extreme Heat	Negligible
Erosion	Negligible
Hail	$260
Hurricane & Tropical Storm	$36,000
Landslide	Negligible
Lightning	$15,545
Thunderstorm Wind/High Wind	$7,474
Tornado	$5,930
Winter Storm & Freeze	$799,446
Flood	$171,333
Earthquake	$9,000
HAZMAT Incident	Negligible
Wildfire	Negligible

As noted previously, all existing and future buildings and populations (including critical facilities) are vulnerable to atmospheric hazards including drought, hailstorm, hurricane and tropical storm, lightning, thunderstorm wind, tornado, and winter storm and freeze. Some buildings may be more vulnerable to these hazards based on locations, construction, and building type. **Table B.44** shows the critical facilities vulnerable to additional hazards analyzed in this section. The table lists those assets that are determined to be exposed to each of the identified hazards (marked with an "**X**").

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TABLE B.44: AT-RISK CRITICAL FACILITIES IN POLK COUNTY

		ATMOSPHERIC							GEOLOGIC			HYDROLOGIC		OTHER						
FACILITY NAME	FACILITY TYPE	Drought	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 500m	Fixed HAZMAT 2,500 meter	Mobile HZMT 500 METER (road)	Mobile HZMT 2,500 meter (road)	Mobile HZMT 500 METER (rail)	Mobile HZMT 2,500 METER (rail)	Wildfire
POLK COUNTY																				
POLK COUNTY SHERIFF'S OFFICE	Police Station	X	X	X	X	X	X	X	X		X					X	X			
COLUMBUS FIRE DEPARTMENT	Fire/EMS Station	X	X	X	X	X	X	X	X		X					X	X			
ST. LUKES HOSPITAL	Medical Care Facility	X	X	X	X	X	X	X	X		X					X	X			
COLUMBUS POLICE DEPARTMENT	Police Station	X	X	X	X	X	X	X	X		X					X	X			
POLK COUNTY EMS	Fire/EMS Station	X	X	X	X	X	X	X	X		X					X	X			
POLK COUNTY ADMINISTRATION; WOMACK BUILDING	Other	X	X	X	X	X	X	X	X		X					X	X			
POLK COUNTY COURTHOUSE	Other	X	X	X	X	X	X	X	X		X					X	X			
COLUMBUS TOWN HALL	Other	X	X	X	X	X	X	X	X		X					X	X			
EMERGENCY OPERATIONS CENTER; GIS, IT, EDC, TOURISM	EOC	X	X	X	X	X	X	X	X		X					X	X			
POLK COUNTY RESCUE SQUAD	Fire/EMS Station	X	X	X	X	X	X	X	X		X					X	X			
AMERICAN RED CROSS, POLK COUNTY CHAPTER	Other	X	X	X	X	X	X	X	X		X					X	X			
SALUDA POLICE DEPARTMENT	Police Station	X	X	X	X	X	X	X	X		X					X	X	X	X	
SALUDA FIRE DEPARTMENT	Fire/EMS Station	X	X	X	X	X	X	X	X		X					X	X		X	

		ATMOSPHERIC							GEOLOGIC			HYDROLOGIC		OTHER						
FACILITY NAME	FACILITY TYPE	Drought	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 500m	Fixed HAZMAT 2,500 meter	Mobile HZMT 500 METER (road)	Mobile HZMT 2,500 meter (road)	Mobile HZMT 500 METER (rail)	Mobile HZMT 2,500 METER (rail)	Wildfire
SALUDA TOWN HALL	Other	X	X	X	X	X	X	X	X		X					X	X	X	X	
SALUDA ELEMENTARY & MIDDLE SCHOOL	School	X	X	X	X	X	X	X	X		X					X	X	X	X	
TRYON POLICE DEPARTMENT	Police Station	X	X	X	X	X	X	X	X		X					X	X		X	
TRYON FIRE DEPARTMENT	Fire/EMS Station	X	X	X	X	X	X	X	X		X					X	X		X	
TRYON TOWN HALL	Other	X	X	X	X	X	X	X	X		X					X	X		X	
DEPARTMENT OF SOCIAL SERVICES; JERVEY-PALMER	Other	X	X	X	X	X	X	X	X		X					X	X		X	
TRYON ELEMENTARY SCHOOL	School	X	X	X	X	X	X	X	X		X					X	X		X	
GREEN CREEK FIRE DEPARTMENT	Fire/EMS Station	X	X	X	X	X	X	X	X		X					X	X			
MILL SPRING FIRE DEPARTMENT	Fire/EMS Station	X	X	X	X	X	X	X	X		X					X	X			
SUNNY VIEW FIRE DEPARTMENT	Fire/EMS Station	X	X	X	X	X	X	X	X		X					X	X			
THE PAVILLION INTERNATIONAL (TREATMENT CENTER)	Medical Care Facility	X	X	X	X	X	X	X	X		X						X			
COOPER-RIIS (MENTAL HEALTH & ADULT CARE)	Medical Care Facility	X	X	X	X	X	X	X	X		X					X	X			
POLK COUNTY HIGH SCHOOL	School	X	X	X	X	X	X	X	X		X					X	X			
POLK COUNTY MIDDLE SCHOOL	School	X	X	X	X	X	X	X	X		X						X			
POLK CENTRAL	School	X	X	X	X	X	X	X	X		X					X	X			
SUNNY VIEW ELEMENTARY SCHOOL	School	X	X	X	X	X	X	X	X		X					X	X			

		ATMOSPHERIC							GEOLOGIC			HYDROLOGIC		OTHER						
FACILITY NAME	FACILITY TYPE	Drought	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 500m	Fixed HAZMAT 2,500 meter	Mobile HZMT 500 METER (road)	Mobile HZMT 2,500 meter (road)	Mobile HZMT 500 METER (rail)	Mobile HZMT 2,500 METER (rail)	Wildfire
TRYON ESTATES (RETIREMENT CENTER)	Other	X	X	X	X	X	X	X	X		X					X	X			

B.4 POLK COUNTY CAPABILITY ASSESSMENT

This subsection discusses the capability of Polk County to implement hazard mitigation activities. More information on the purpose and methodology used to conduct the assessment can be found in Section 7: *Capability Assessment*.

B.4.1 Planning and Regulatory Capability

Table B.45 provides a summary of the relevant local plans, ordinances, and programs already in place or under development for Polk County. A checkmark (✓) indicates that the given item is currently in place and being implemented. An asterisk (*) indicates that the given item is currently being developed for future implementation. Each of these local plans, ordinances, and programs should be considered available mechanisms for incorporating the requirements of the South Mountains Regional Hazard Mitigation Plan.

TABLE B.45: RELEVANT PLANS, ORDINANCES, AND PROGRAMS

Planning Tool/Regulatory Tool	Hazard Mitigation Plan	Comprehensive Land Use Plan	Floodplain Management Plan	Open Space Management Plan (Parks & Rec/Greenway Plan	Stormwater Management Plan/Ordinance	Natural Resource Protection Plan	Flood Response Plan	Emergency Operations Plan	Continuity of Operations Plan	Evacuation Plan	Disaster Recovery Plan	Capital Improvements Plan	Economic Development Plan	Historic Preservation Plan	Flood Damage Prevention Ordinance	Zoning Ordinance	Subdivision Ordinance	Unified Development Ordinance	Post-Disaster Redevelopment Ordinance	Building Code	Fire Code	National Flood Insurance Program (NFIP)	NFIP Community Rating System
POLK COUNTY	✓	✓						✓				✓	✓			✓	✓	*		✓	✓	✓	
Columbus	✓	✓						✓				✓	✓			✓	✓	✓		✓	✓	✓	
Saluda	✓	✓						✓					✓			✓	✓			✓	✓	✓	
Tryon	✓							✓				✓	✓			✓	✓	✓		✓	✓	✓	

A more detailed discussion on the county's planning and regulatory capabilities follows.

Emergency Management

Hazard Mitigation Plan

Polk County has previously adopted a hazard mitigation plan. The Town of Columbus, the City of Saluda, and the Town of Tryon were also included in this plan.

Emergency Operations Plan
Polk County maintains an emergency operations plan through its Emergency Management Department. All emergency management operations for Polk County are coordinated through the Polk County Emergency Management Agency. Although, the municipalities may choose to have their own emergency management agency, the coordination of resources during an emergency will be managed through the county.

General Planning

Comprehensive Land Use Plan
Polk County, the Town of Columbus, and the City of Saluda have each adopted a local land use plan.

Capital Improvements Plan
Polk County, the Town of Columbus, and the Town of Tryon have capital improvement plans in place.

Zoning Ordinance
Polk County and each of its participating municipalities also administer a zoning ordinance.

Subdivision Ordinance
Polk County and all of its participating municipalities have also adopted and enforce subdivision regulations.

Building Codes, Permitting, and Inspections
North Carolina has a state compulsory building code which applies throughout the state. Polk County Building Inspections enforces the building code within the county.

Floodplain Management

Table B.46 provides NFIP policy and claim information for each participating jurisdiction in Polk County.

TABLE B.46: NFIP POLICY AND CLAIM INFORMATION

Jurisdiction	Date Joined NFIP	Current Effective Map Date	NFIP Policies in Force	Insurance in Force	Closed Claims	Total Payments to Date
POLK COUNTY†	01/01/87	10/02/08	37	$8,536,300	10	$87,286
Columbus	04/24/09	10/02/08	1	$600,000	0	$0
Saluda	02/19/10	10/02/08	1	$175,000	0	$0
Tryon	08/19/86	10/02/08(M)	15	$2,957,000	0	$0

†Includes unincorporated areas of county only
Source: NFIP Community Status information as of 9/5/13; NFIP claims and policy information as of 6/30/13

All jurisdictions listed above that are participants in the NFIP will continue to comply with all required provisions of the program and will work to adequately comply in the future utilizing a number of strategies. For example, the jurisdictions will coordinate with NCEM and FEMA to develop maps and regulations related to special flood hazard areas within their jurisdictional boundaries and, through a consistent monitoring process, will design and improve their floodplain management program in a way that reduces the risk of flooding to people and property.

Flood Damage Prevention Ordinance

All communities participating in the NFIP are required to adopt a local flood damage prevention ordinance. Polk County, the Town of Columbus, the City of Saluda, and the Town of Tryon all participate in the NFIP and have adopted flood damage prevention regulations.

B.4.2 Administrative and Technical Capability

Table B.47 provides a summary of the capability assessment results for Polk County with regard to relevant staff and personnel resources. A checkmark (✓) indicates the presence of a staff member(s) in that jurisdiction with the specified knowledge or skill.

TABLE B.47: RELEVANT STAFF / PERSONNEL RESOURCES

Staff / Personnel Resource	Planners with knowledge of land development/land management practices	Engineers or professionals trained in construction practices related to buildings and/or infrastructure	Planners or engineers with an understanding of natural and/or human-caused hazards	Emergency Manager	Floodplain Manager	Land Surveyors	Scientists familiar with the hazards of the community	Staff with education or expertise to assess the community's vulnerability to hazards	Personnel skilled in GIS and/or Hazus	Resource development staff or grant writers
POLK COUNTY	✓	✓	✓	✓	✓		✓	✓	✓	
Columbus	✓	✓	✓	✓	✓		✓	✓		
Saluda		✓		✓	✓		✓	✓		
Tryon	✓	✓	✓	✓	✓		✓	✓		

Credit for having a floodplain manager was given to those jurisdictions that have a flood damage prevention ordinance, and therefore an appointed floodplain administrator, regardless of whether the appointee was dedicated solely to floodplain management. Credit was given for having a scientist familiar with the hazards of the community if a jurisdiction has a Cooperative Extension Service or Soil and Water Conservation Department. Credit was also given for having staff with education or expertise to assess the community's vulnerability to hazards if a staff member from the jurisdiction was a participant on the existing hazard mitigation plan's planning committee.

B.4.3 Fiscal Capability

Table B.48 provides a summary of the results for Polk County with regard to relevant fiscal resources. A checkmark (✓) indicates that the given fiscal resource is locally available for hazard mitigation purposes (including match funds for state and federal mitigation grant funds) according to the previous county hazard mitigation plan.

TABLE B.48: RELEVANT FISCAL RESOURCES

Fiscal Tool / Resource	Capital Improvement Programming	Community Development Block Grants (CDBG)	Special Purpose Taxes (or taxing districts)	Gas/Electric Utility Fees	Water/Sewer Fees	Stormwater Utility Fees	Development Impact Fees	General Obligation, Revenue, and/or Special Tax Bonds	Partnering Arrangements or Intergovernmental Agreements	Other: HMGP, FMA, PDM, PA, SBA, other federal grants, etc.
POLK COUNTY	✓	✓							✓	✓
Columbus	✓	✓								✓
Saluda	✓	✓							✓	✓
Tryon	✓	✓							✓	✓

B.4.4 Political Capability

The previous hazard mitigation plan indicates that mitigation strategies have been presented to the Polk County Planning Board on various occasions. The results have included an effort to map all county water sources in GIS, an updated and adopted flood prevention ordinance, adopting a soil and erosion ordinance, and recommended changes to the subdivision ordinance incorporating changes to road requirements and emergency apparatus. This demonstrates favorable political support and a willingness to adopt hazard mitigation efforts in an active manner.

B.4.5 Conclusions on Local Capability

Table B.49 shows the results of the capability assessment using the designed scoring methodology described in Section 7: *Capability Assessment*. The capability score is based solely on the information found in existing hazard mitigation plans and readily available on the jurisdictions' government websites. According to the assessment, the average local capability score for the county and its municipalities is 30.0, which falls into the moderate capability ranking.

TABLE B.49: CAPABILITY ASSESSMENT RESULTS

Jurisdiction	Overall Capability Score	Overall Capability Rating
POLK COUNTY	37	Moderate
Columbus	30	Moderate
Saluda	25	Moderate
Tryon	28	Moderate

B.5 POLK COUNTY MITIGATION STRATEGY

This subsection provides the blueprint for Polk County to follow in order to become less vulnerable to its identified hazards. It is based on general consensus of the Regional Hazard Mitigation Planning Committee and the findings and conclusions of the capability assessment and risk assessment. Additional Information can be found in Section 8: *Mitigation Strategy* and Section 9: *Mitigation Action Plan*.

B.5.1 Mitigation Goals

Polk County developed five mitigation goals in coordination with the other participating South Mountains Region jurisdictions. The regional mitigation goals are presented in **Table B.50**.

TABLE B.50: SOUTH MOUNTAINS REGIONAL MITIGATION GOALS

	Goal
Goal #1	Improve public education/awareness
Goal #2	Protect human life, safety and welfare by minimizing the potential for damage to personal property, infrastructure, and loss of life due to natural and human caused hazards.
Goal #3	Protect and maintain emergency services infrastructure and equipment to support emergency responders and improve disaster response time/operations.
Goal #4	Improve technical, legal, and institutional capability to respond to and recover from disasters.
Goal #5	Reduce or eliminate the risk of natural disasters.

B.5.2 Mitigation Action Plan

The mitigation actions proposed by Polk County, the Town of Columbus, the City of Saluda, and the Town of Tryon are listed in the following individual Mitigation Action Plans.

Polk County Mitigation Action Plan

Polk County Existing Mitigation Actions								
Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
Prevention								
P-1	Incorporate a GIS to maintain building/parcel data for purposes of conducting more detailed hazard risk assessments and for tracking permitting/land use patterns.	All	Moderate	NCDEM/FEMA/Local Funds		Polk County MIS	2017	A GIS system has been built and includes building and parcel data. However, this data will need to be updated as it is out of date.
P-2	Encourage communities to participate in the Community Rating System (CRS).	All	High	Local Funds		County ES	Deleted	County decided not to pursue this due to lack of staff time.
P-3	Review the subdivision ordinances to determine storm water drainage to minimize flooding potential.	FL	High	Local Funds		Planning and Zoning	2018	The subdivision ordinances examine stormwater drainage, but these ordinances will need to be reviewed and updated.
P-4	Identify, list, and map all available water sources.	WF	High	Local Funds		County ES	Completed	Available water sources have been identified and mapped, so this action is completed.
P-5	Work with the LEPC and emergency services to ensure proper SARA Title III reporting.	HM	Moderate	Local Funds		LEPC	2015, Annually	County Emergency Services meets with the LEPC on a quarterly basis and has reported on SARA Title III over the past 5 years. Going forward, this committee will need to meet and stay up to date on any new requirements that are passed concerning Title III reporting.

Polk County Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
P-6	Municipalities will develop and implement programs to coordinate maintenance and mitigation activities to reduce risk to public infrastructure from severe winter storms.	S/I	Moderate	NCEM/FEMA/Local Funds		County ES	Completed	The municipalities have developed programs for mitigation that work in conjunction with the county.
Property Protection								
PP-1	Review and consider adoption of a storm water wetland requirement when developments with a certain number of acres of hard surfaces are constructed.	FL	Moderate	Local Funds		Planning and Zoning	Completed	Complete and incorporated in zoning ordinance
PP-2	Develop and implement programs to coordinate maintenance and mitigation activities to reduce risk to public infrastructure from severe winter storms.	S/I	Moderate	NCEM/FEMA/Local Funds		Public Works	Completed	The county has a program in place to implement mitigation programs and activities to reduce risk.
PP-3	Implement a program that identifies streams that are impacted by beaver dams and creates a solution to the flooding caused by the dams.	FL	Low	NCEM/FEMA/Local Funds		Public Works	2018	A program that identifies and addresses beaver dams is in the works, but it has not been fully implemented so additional effort will need to be carried out.
PP-4	Create a private bridge registry for bridges built over the county's four major streams.	FL	Low	Local Funds		Public Works	2019	All bridges have been identified, but additional mapping of the bridges would be useful and measures still need to be carried out to mitigate the bridges themselves.

Polk County Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
PP-5	Identify and remove large obstructions in the county's major streams.	FL	Low	NCEM/FEMA/Local Funds		Public Works	2019	In the past, major obstructions have been removed, but this will continue to be an issue and the county will implement this program going forward.
Natural Resource Protection								
NRP-1								
Emergency Services								
ES-1	Develop and implement a Community Emergency Response Team (CERT)	All	Moderate	NCDEM/FEMA/Local Funds		LEPC	Deleted	LEPC has decided not to pursue this due to lack of time/funding.
ES-2	Develop and implement hazard mitigation planning web page on Polk County Emergency Services web site.	All	Moderate	Local		County ES	2017	The county posts its hazard mitigation plan up on the website, but a page dedicated to hazard mitigation plan will still need to be developed.
ES-3	Enhance weather monitoring to attain earlier severe winter and ice storm warnings.	S/I	Moderate	NCDEM/FEMA/Local Funds		Communications Department	2018	Many steps have been taken to enhance weather monitoring over the past several years, but with new advancements in equipment and systems, this program will need to be reviewed and updated.
ES-4	Provide water from the Broad River along the Hwy. 9 corridor in the unincorporated areas of Polk County.	DR	High	Local Funds		County ES	Completed	Water is provided from the Broad River to unincorporated areas of Polk County.

Polk County Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
ES-5	Develop an inventory list of required equipment needed by Emergency Service agencies for hazardous material spills.	HM	Moderate	Local Funds		Polk County Chief's Assoc.	2019	A list has been developed, but there are still items that are needed to complete the inventory to maximize response to spills.
ES-6	Incorporate a Geographic Information System to maintain building/parcel data for purposes of conducting more detailed hazard risk assessments and for tracking permitting/land use patterns.	All	Moderate	NCEM/FEMA/Local Funds		Polk County MIS	Deleted	Same as P-1
ES-7	Install county-wide warning system for all hazards.	All	Moderate	NCEM/FEMA/Local Funds		Polk County Communications	Completed	This system was installed.
Structural Projects								
SP-1	Turner-Shoal Dam Upgrade: Construction updates to strengthen the dam.	FL/D	High	County Funds		County ES, Public Works, DENR	2019	Some updates to the dame have been implemented but the dam is still in need of upgrade in some areas.
Public Education and Awareness								
PEA-1	Promote the availability of flood insurance to property owners by direct mail at least once a year.	FL	High	Local Funds		Planning and Zoning	2015, Annually	Information has been sent out annually on the tax notices in the past. This program will need to be updated in the future and will be evaluated to determine if new outreach mechanisms are needed.

Polk County Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
PEA-2	Provide brochures, flyers, and pamphlets on all hazards that affect Polk County. Information will be placed in departments/agencies that are considered high traffic areas.	All	Low	Local Funds		County ES	2019	Information has been placed in high traffic areas, but the county will continue to look at ways to improve outreach including through online surveys (carried out in this plan) and other means.
PEA-3	Develop and Implement a reverse calling system.	All	Low	NCEM/FEMA/Local Funds		Polk County Communications	Completed	A reverse calling system has been installed and is ready for use.
PEA-4	Provide a booth with hazard mitigation information at all major community events.	All	Low	Local Funds		County ES	2018	The county has provided informational booths at many events including fairs and community gatherings. Information displayed will need to be updated periodically.

FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake
LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees County ES = Polk County Emergency Services

Town of Columbus Mitigation Action Plan

Town of Columbus Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Identify, list and map all water sources available.	WF	High	Local Funds		Fire Departments	Completed	Available water sources have been identified and mapped, so this action is completed.
P-2	Work with the LEPC and emergency services to ensure proper SARA Title III reporting.	HM	Moderate	Local Funds		LEPC	2015, Annually	County Emergency Services meets with the LEPC on a quarterly basis and has reported on SARA Title III over the past 5 years. Going forward, this committee will need to meet and stay up to date on any new requirements that are passed concerning Title III reporting.
P-3	Develop and implement a Community Emergency Response Team (CERT).	All	Moderate	NCDEM/FEMA/Local Funds		LEPC	Deleted	LEPC has decided not to pursue this due to lack of time/funding.
P-4	Municipalities will develop and implement programs to coordinate maintenance and mitigation activities to reduce risk to public infrastructure from severe winter storms.	S/I	Moderate	NCEM/FEMA/Local Funds		County ES	Completed	The municipalities have developed programs for mitigation that work in conjunction with the county.

Town of Columbus Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Property Protection								
PP-1	Implement a program that identifies streams that are impacted by beaver dams and creates a solution to the flooding caused by the dams.	FL	Low	NCEM/FEMA/Local Funds		Polk County Public Works	2018	A program that identifies and addresses beaver dams is in the works, but it has not been fully implemented so additional effort will need to be carried out.
PP-2	Create a private bridge registry for bridges built over the county's four major streams.	FL	Low	Local Funds		Polk County ES	2019	All bridges have been identified, but additional mapping of the bridges would be useful and measures still need to be carried out to mitigate the bridges themselves.
PP-3	Identify and remove large obstructions in the county's major streams.	FL	Low	NCEM/FEMA/Local Funds		Public Works	2019	In the past, major obstructions have been removed, but this will continue to be an issue and the county will implement this program going forward.
Natural Resource Protection								
NRP-1								
Emergency Services								
ES-1	Develop an inventory list of required equipment needed by Emergency Service agencies for hazardous material spills.	HM	Moderate	Local Funds		Polk County Chief's Assoc.	2019	A list has been developed, but there are still items that are needed to complete the inventory to maximize response to spills.

Town of Columbus Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
ES-2	Incorporate a Geographic Information System to maintain building/parcel data for purposes of conducting more detailed hazard risk assessments and for tracking permitting/land use patterns.	All	Moderate	NCEM/FEMA/Local Funds		Polk County MIS	2017	A GIS system has been built and includes building and parcel data. However, this data will need to be updated as it is out of date.
ES-3	Develop and implement hazard mitigation planning web page on Polk County Emergency Services web site.	All	Moderate	Local		County ES	2017	The county posts its hazard mitigation plan up on the website, but a page dedicated to hazard mitigation plan will still need to be developed.
ES-4	Install county-wide warning system for all hazards.	All	Moderate	NCEM/FEMA/Local Funds		Polk County Communications	Completed	This system was installed.
Structural Projects								
SP-1	Complete an emergency waterline from Henderson County.	DR	High	Local Funds		Town Managers	2018	This project has been discussed and is in the works, but is not complete. More work will need to be done going forward
Public Education and Awareness Activities								
PEA-1	Provide brochures, flyers, and pamphlets on all hazards that affect Polk County. Information will be placed in departments/agencies that are considered high traffic areas.	All	Low	Local Funds		County ES	2019	Information has been placed in high traffic areas, but the county will continue to look at ways to improve outreach including through online surveys (carried out in this plan) and other means.
PEA-2	Develop and Implement a reverse calling system.	All	Low	NCEM/FEMA/Local Funds		Polk County Communications	Completed	A reverse calling system has been installed and is ready for use.

Town of Columbus Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
PEA-3	Provide a booth with hazard mitigation information at all community.	All	Low	Local Funds		County ES	2018	The county has provided informational booths at many events including fairs and community gatherings. Information displayed will need to be updated periodically.

FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees County ES = Polk County Emergency Services Town = Town of Columbus

City of Saluda Mitigation Action Plan

City of Saluda Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Work to complete the necessary requirements to join the National Flood Insurance Program.	FL	High	Local Funds		City Public Works	Deleted	Not going to pursue due to lack of staff time.
P-2	Work with the LEPC and emergency services to ensure proper SARA Title III reporting.	HM	Moderate	Local Funds		LEPC	2015, Annually	County Emergency Services meets with the LEPC on a quarterly basis and has reported on SARA Title III over the past 5 years. Going forward, this committee will need to meet and stay up to date on any new requirements that are passed concerning Title III reporting.
P-3	Municipalities will develop and implement programs to coordinate maintenance and mitigation activities to reduce risk to public infrastructure from winter storms.	S/I	Moderate	NCEM/FEMA/Local Funds		County ES	Completed	The municipalities have developed programs for mitigation that work in conjunction with the county.
Property Protection								
PP-1	Implement a program that identifies streams that are impacted by beaver dams and creates a solution to the flooding caused by the dams.	FL	Low	NCEM/FEMA/Local Funds		Polk Cty Public Works	2018	A program that identifies and addresses beaver dams is in the works, but it has not been fully implemented so additional effort will need to be carried out.

City of Saluda Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
PP-2	Create a private bridge registry for bridges built over the county's four major streams.	FL	Low	Local Funds		Public Works	2019	All bridges have been identified, but additional mapping of the bridges would be useful and measures still need to be carried out to mitigate the bridges themselves.
PP-3	Identify and remove large obstructions in the county's major streams.	FL	Low	NCEM/FEMA/Local Funds		Public Works	2019	In the past, major obstructions have been removed, but this will continue to be an issue and the county will implement this program going forward.
Natural Resource Protection								
NRP-1								
Emergency Services								
ES-1	Develop an inventory list of required equipment needed by Emergency Service agencies for hazardous material spills.	HM	Moderate	Local Funds		Polk County Chief's Assoc.	2019	A list has been developed, but there are still items that are needed to complete the inventory to maximize response to spills.
ES-2	Incorporate a Geographic Information System to maintain building/parcel data for purposes of conducting more detailed hazard risk assessments and for tracking permitting/land use patterns.	All	Moderate	NCEM/FEMA/Local Funds		Polk County MIS	Deleted	Same as P-1
ES-3	Develop and implement a Community Emergency Response Team (CERT).	All	Moderate	NCDEM/FEMA/Local Funds		LEPC	Deleted	LEPC has decided not to pursue this due to lack of time/funding.

City of Saluda Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
ES-4	Develop and implement hazard mitigation planning web page on Polk County Emergency Services web site.	All	Moderate	Local		County ES	2017	The county posts its hazard mitigation plan up on the website, but a page dedicated to hazard mitigation plan will still need to be developed.
ES-5	Install county-wide warning system for all hazards.	All	Moderate	NCEM/FEMA/Local Funds		Polk County Communications	Completed	This system was installed.
Structural Projects								
SP-1	Complete an emergency waterline from Henderson County.	DR	High	Local Funds		Town Managers	2018	This project has been discussed and is in the works, but is not complete. More work will need to be done going forward
Public Education and Awareness Activities								
PEA-1	Provide brochures, flyers, and pamphlets on all hazards that affect Polk County. Information will be placed in departments/agencies that are considered high traffic areas.	All	Low	Local Funds		County ES	2019	Information has been placed in high traffic areas, but the county will continue to look at ways to improve outreach including through online surveys (carried out in this plan) and other means.
PEA-2	Develop and Implement a reverse calling system.	All	Low	NCEM/FEMA/Local Funds		Polk County Communications	Completed	A reverse calling system has been installed and is ready for use.
PEA-3	Provide a booth with hazard mitigation information at all community.	All	Low	Local Funds		County ES	2018	The county has provided informational booths at many events including fairs and community gatherings. Information displayed will need to be updated periodically.
FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake								

City of Saluda Existing Mitigation Actions								
Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees County ES = Polk County Emergency Services City = City of Saluda								

Town of Tryon Mitigation Action Plan

Town of Tryon Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Work with the LEPC and emergency services to ensure proper SARA Title III reporting.	HM	Moderate	Local Funds		LEPC	2015, Annually	County Emergency Services meets with the LEPC on a quarterly basis and has reported on SARA Title III over the past 5 years. Going forward, this committee will need to meet and stay up to date on any new requirements that are passed concerning Title III reporting.
P-2	Municipalities will develop and implement programs to coordinate maintenance and mitigation activities to reduce risk to public infrastructure from severe winter storms.	S/I	Moderate	NCEM/FEMA/Local Funds		County ES	Completed	The municipalities have developed programs for mitigation that work in conjunction with the county.
Property Protection								
PP-1	Implement a program that identifies streams that are impacted by beaver dams and creates a solution to the flooding caused by the dams.	FL	Low	NCEM/FEMA/Local Funds		Polk County Public Works	2018	A program that identifies and addresses beaver dams is in the works, but it has not been fully implemented so additional effort will need to be carried out.

Town of Tryon Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
PP-2	Create a private bridge registry for bridges built over the county's four major streams.	FL	Low	Local Funds		Public Works	2019	All bridges have been identified, but additional mapping of the bridges would be useful and measures still need to be carried out to mitigate the bridges themselves.
PP-3	Identify and remove large obstructions in the county's major streams.	FL	Low	NCEM/FEMA/Local Funds		Public Works	2019	In the past, major obstructions have been removed, but this will continue to be an issue and the county will implement this program going forward.
Natural Resource Protection								
NRP-1								
Emergency Services								
ES-1	Develop an inventory list of required equipment needed by Emergency Service agencies for hazardous material spills.	HM	Moderate	Local Funds		Polk County Chief's Assoc.	2017	The county posts its hazard mitigation plan up on the website, but a page dedicated to hazard mitigation plan will still need to be developed.
ES-2	Incorporate a Geographic Information System to maintain building/parcel data for purposes of conducting more detailed hazard risk assessments and for tracking permitting/land use patterns.	All	Moderate	NCEM/FEMA/Local Funds		Polk County MIS	2017	A GIS system has been built and includes building and parcel data. However, this data will need to be updated as it is out of date.
ES-3	Develop and implement a Community Emergency Response Team (CERT).	All	Moderate	NCDEM/FEMA/Local Funds		LEPC	Deleted	LEPC has decided not to pursue this due to lack of time/funding.

Town of Tryon Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
ES-4	Develop and implement hazard mitigation planning web page on Polk County Emergency Services web site.	All	Moderate	Local		County ES	2017	The county posts its hazard mitigation plan up on the website, but a page dedicated to hazard mitigation plan will still need to be developed.
ES-5	Install county-wide warning system for all hazards.	All	Moderate	NCEM/FEMA/Local Funds		Polk County Communications	Completed	This system was installed.
Structural Projects								
SP-1	Complete an emergency waterline from Henderson County.	DR	High	Local Funds		Town Managers		Ongoing
Public Education and Awareness Activities								
PEA-1	Provide brochures, flyers, and pamphlets on all hazards that affect Polk County. Information will be placed in departments/agencies that are considered high traffic areas.	All	Low	Local Funds		County ES	2019	Information has been placed in high traffic areas, but the county will continue to look at ways to improve outreach including through online surveys (carried out in this plan) and other means.
PEA-2	Develop and Implement a reverse calling system.	All	Low	NCEM/FEMA/Local Funds		Polk County Communications	Completed	A reverse calling system has been installed and is ready for use.
PEA-3	Provide a booth with hazard mitigation information at all community.	All	Low	Local Funds		County ES	2018	The county has provided informational booths at many events including fairs and community gatherings. Information displayed will need to be updated periodically.

Town of Tryon Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**

FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake
LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees County ES = Polk County Emergency Services Town = Town of Tryon

Annex C
Rutherford County

This annex includes jurisdiction-specific information for Rutherford County and its participating municipalities. It consists of the following five subsections:

- C.1 Rutherford County Community Profile
- C.2 Rutherford County Risk Assessment
- C.3 Rutherford County Vulnerability Assessment
- C.4 Rutherford County Capability Assessment
- C.5 Rutherford County Mitigation Strategy

C.1 RUTHERFORD COUNTY COMMUNITY PROFILE

C.1.1 Geography and the Environment

Rutherford County is situated along the North Carolina and South Carolina state border. The county is located along the eastern edge Blue Ridge Mountain Range. It comprises seven towns, the Town of Bostic, the Town of Ellenboro, the Town of Forest City, the Town of Lake Lure, the Town of Ruth, the Town of Rutherfordton, and the Town of Spindale, as well as one village, the Village of Chimney Rock.

The county is a typical mountain county consisting of mountain ranges, isolated peaks, rolling plateaus, and valleys. The county's highest elevation reaches 3,800 feet and its lowest elevation is 800 feet. The total area of the county is 564 square miles, 2 square miles of which is water area. Lake Lure is a popular vacation destination along with various parks, lakes, trails, and forests.

Summer temperatures in the county range from highs of about 89˚F to lows in the 50s. Winter temperatures range from highs of 70˚F to lows around 25˚F. Year round, average temperatures in the county are typically 71˚F to 41˚F. The county averages over four inches of rainfall each month.

C.1.2 Population and Demographics

According to the 2010 Census, Rutherford County has a population of 67,810 people. The county has seen nearly 8% growth between 2000 and 2010, and the population density is 120 people per square mile. Population counts from the US Census Bureau for 1990, 2000, and 2010 for the county and participating municipalities are presented in **Table C.1**.

TABLE C.1: POPULATION COUNTS FOR RUTHERFORD COUNTY

Jurisdiction	1990 Census Population	2000 Census Population	2010 Census Population	% Change 2000-2010
Rutherford County	**56,918**	**62,899**	**67,810**	**7.8%**
Town of Bostic	371	328	386	17.7%
Village of Chimney Rock	--	175	113	-35.4%

Jurisdiction	1990 Census Population	2000 Census Population	2010 Census Population	% Change 2000-2010
Town of Ellenboro	514	479	873	82.3%
Town of Forest City	7,475	7,549	7,476	-1.0%
Town of Lake Lure	691	1,027	1,192	16.1%
Town of Ruth	366	329	440	33.7%
Town of Rutherfordton	3,617	4,131	4,213	2.0%
Town of Spindale	4,040	4,022	4,321	7.4%

Source: US Census Bureau

Based on the 2010 Census, the median age of residents of Rutherford County is 42.5 years. The racial characteristics of the county are presented in **Table C.2**. Whites make up the majority of the population in the county, accounting for 86 percent of the population. The Town of Forest City and the Town of Spindale have the most diverse populations.

TABLE C.2: DEMOGRAPHICS OF RUTHERFORD COUNTY

Jurisdiction	White, Percent (2010)	Black or African American, Percent (2010)	American Indian or Alaska Native, Percent (2010)	Asian, Percent (2010)	Native Hawaiian or Other Pacific Islander, Percent (2010)	Other Race, Percent (2010)	Two or More Races, percent (2010)	Persons of Hispanic Origin, Percent (2010)*
Rutherford County	**85.9%**	**10.1%**	**0.3%**	**0.4%**	**0.0%**	**1.5%**	**1.8%**	**3.5%**
Town of Bostic	92.7%	5.2%	0.0%	1.0%	0.0%	0.0%	1.0%	1.0%
Village of Chimney Rock	98.2%	0.9%	0.0%	0.0%	0.0%	0.0%	0.9%	0.0%
Town of Ellenboro	79.3%	17.1%	0.3%	0.0%	0.0%	1.5%	1.8%	2.1%
Town of Forest City	67.1%	24.0%	0.2%	0.9%	0.0%	4.9%	2.9%	9.0%
Town of Lake Lure	96.3%	1.6%	0.2%	0.6%	0.1%	0.3%	1.0%	1.6%
Town of Ruth	87.5%	6.6%	0.7%	0.0%	0.0%	1.8%	3.4%	2.5%
Town of Rutherfordton	84.9%	10.4%	0.3%	1.6%	0.0%	1.1%	1.8%	3.0%
Town of Spindale	68.8%	26.7%	0.3%	0.7%	0.0%	0.9%	2.5%	3.3%

*Hispanics may be of any race, so also are included in applicable race categories
Source: US Census Bureau

C.1.3 Housing

According to the 2010 US Census, there are 33,878 housing units in Rutherford County, the majority of which are single family homes or mobile homes. Housing information for the county and municipalities is presented in **Table C.3**. As shown in the table, the Village of Chimney Rock and Town of Lake Lure have a significantly higher percentage of seasonal housing units compared to the unincorporated county.

TABLE C.3: HOUSING CHARACTERISTICS OF RUTHERFORD COUNTY

Jurisdiction	Housing Units (2000)	Housing Units (2010)	Seasonal Units, Percent (2010)	Median Home Value (2007-2011)
Rutherford County	**29,535**	**33,878**	**7.9%**	**$104,400**
Town of Bostic	153	187	0.0%	$70,800
Village of Chimney Rock	200	213	62.4%	$171,600
Town of Ellenboro	251	403	1.0%	$65,200
Town of Forest City	3,638	3,658	1.2%	$97,400
Town of Lake Lure	1,957	2,211	61.6%	$346,600
Town of Ruth	155	203	0.0%	$82,800
Town of Rutherfordton	1,765	1,987	1.3%	$189,700
Town of Spindale	1,887	2,051	0.9%	$82,200

Source: US Census Bureau

C.1.4 Infrastructure

Transportation

There are several US and state highways that serve Rutherford County and link it with other regions of North Carolina as well as the neighboring states of Georgia, South Carolina, and Tennessee. US Route 74 is a major four-lane highway that travels northwest to southeast through Rutherford County and connects Chattanooga, Tennessee; Asheville, North Carolina; Charlotte, North Carolina; and Wilmington North Carolina. This route has alternating names, but it is considered the commercial backbone and main truck route of Western North Carolina. US 64 is the longest numbered route in North Carolina and is a major east-west route though the eastern portion of the state. US 176 runs north to south in Rutherford County and continues from Virginia to South Carolina. NC 9, NC 108, and NC 120 are additional major arterials within the county.

Within Rutherford County, the Rutherford County Transit is free to residents over the age of 60, Medicaid transportation, disabled individuals, and general public (fixed route). The county offers shuttles to grocery centers and shopping facilities on a routine basis.

Utilities

Electrical power in Rutherford County is provided by one public company, Duke Energy Progress. In addition to the public utility provider, Rutherford Electric Membership Corporation is an electricity cooperative that provides service to the county.

Water and sewer service is provided by many of the towns in the South Mountains Region, but generally municipal water systems are extremely limited in the mountains and private or shared wells and septic systems are considered the norm. Within Rutherford County, private or shared wells and septic systems are utilized with limited municipal water systems.

Community Facilities

There are a number of buildings and community facilities located throughout Rutherford County. According to the data collected for the vulnerability assessment (Section 6.4.1), there are 23 fire/EMS stations, 4 police stations, and 0 public schools located within the county.

There is one hospital located in Rutherford County. The Rutherford Regional Medical Center in the Town of Rutherfordton has 129 beds and serves both Rutherford County and Cleveland County, east of Rutherford.

There are a multiple recreation parks within Rutherford County. The largest park is Crestview Park in the Town of Rutherfordton which is a 26-acre multi-purpose park with baseball fields, tennis courts, basketball courts, walking trail, playgrounds, and picnic facilities. Chimney Rock State Park, Lake Lure, South Mountains Game Lands, and other areas provide various outdoor recreational activities for residents and visitors.

C.1.5 Land Use

The most populous areas in Rutherford County are concentrated along transportation routes; however, land development for vacation homes is occurring along the eastern slopes of the Blue Ridge Mountains. Rural communities are also located throughout the county.

Rutherford County maintains an adopted Land Use Plan used to establish long-range growth and development policies throughout the county. The goal of the plan is to promote an orderly and efficient land use development pattern allowing a variety of land uses while preserving areas of environmental concern. Planning and Zoning for all Rutherford County townships are regulated by the county.

C.1.6 Employment and Industry

Rutherford County had an average annual employment of 22,155 workers and an average unemployment rate of 13.6 percent in 2011. According to the U.S. Census Bureau, in 2011, the Education and Health Services industry was again the largest employment sector with 26.0 percent of the county's workforce. The other leading industries were Manufacturing (18.6%); Retail Trade (13.1%); and Construction (7.3%). The average annual median household income in Rutherford County was $37,128 from 2007 to 2011.

C.2 RUTHERFORD COUNTY RISK ASSESSMENT

This subsection includes hazard profiles for each of the significant hazards identified in Section 4: *Hazard Identification* as they pertain to Rutherford County. Each hazard profile includes a description of the hazard's location and extent, notable historical occurrences, and the probability of future occurrences. Additional information can be found in Section 5: *Hazard Profiles*.

C.2.1 Drought

Location and Spatial Extent

Drought typically covers a large area and cannot be confined to any geographic or political boundaries. Local areas may experience much more severe and/or frequent drought events than what is represented on the Palmer Drought Severity Index map. Furthermore, it is assumed that the county would be uniformly exposed to drought, making the spatial extent potentially widespread. It is also notable that drought conditions typically do not cause significant damage to the built environment.

Historical Occurrences

According to the North Carolina Drought Monitor, Rutherford County has had drought occurrences in 13 of the last 14 years (2000-2013). **Table C.4** shows the most severe drought classification for each year, according to North Carolina Drought Monitor classifications. It should be noted that the North Carolina Drought Monitor also estimates what percentage of the county is in each classification of drought severity. For example, the most severe classification reported may be exceptional but a majority of the county may actually be in a less severe condition.

TABLE C. 4: HISTORICAL DROUGHT OCCURRENCES IN RUTHERFORD COUNTY

Abnormally Dry **Moderate Drought** **Severe Drought** **Extreme Drought** **Exceptional Drought**

	Rutherford County
2000	EXTREME
2001	EXTREME
2002	EXCEPTIONAL
2003	NORMAL
2004	MODERATE
2005	MODERATE
2006	SEVERE
2007	EXCEPTIONAL
2008	EXCEPTIONAL
2009	EXTREME
2010	MODERATE
2011	SEVERE
2012	SEVERE
2013	MODERATE

Source: North Carolina Drought Monitor (through Sept. 2013)

Probability of Future Occurrences

Based on historical occurrence information, it is assumed that Rutherford County has a probability level of likely (10 to 100 percent annual probability) for future drought events. This hazard may vary slightly by location but each area has an equal probability of experiencing a drought. However, historical information also indicates that there is a much lower probability for extreme, long-lasting drought conditions.

C.2.2 Extreme Heat

Location and Spatial Extent

Excessive heat typically impacts a large area and cannot be confined to any geographic or political boundaries. All of Rutherford County is susceptible to extreme heat conditions.

Historical Occurrences

Data from the National Climatic Data Center was used to determine historical extreme heat and heat wave events in Rutherford County. There were no events reported.

In addition, information from the State Climate Office of North Carolina was reviewed to obtain historical temperature records in the county. Temperature information has been reported since 1900. The recorded maximum for Rutherford County can be found below in **Table C.5**.

TABLE 5.5: HIGHEST RECORDED TEMPERATURE IN RUTHERFORD COUNTY

Location	Date	Temperature (F)
Forest City 6 SW	8/1/1999	107
RUTHERFORD COUNTY MAXIMUM	**--**	**107**

Source: State Climate Office of North Carolina

The State Climate Office also reports average maximum temperatures at Forest City. **Table C.6** shows the average maximum temperatures from 1971 to 2000 at the Forest City 6 SW observation station which can be used as a general comparison for the county.

TABLE C.6: AVERAGE MAXIMUM TEMPERATURE IN FOREST CITY 6 SW, RUTHERFORD COUNTY

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Avg. Max (°F)	49.6	54.2	61.9	71.1	78.4	85.3	89.1	87.2	81.1	71.7	61.8	52.6

Source: State Climate Office of North Carolina

Probability of Future Occurrences

Based on historical occurrence information, it is assumed that all of Rutherford County has a probability level of possible (1 to 10 percent annual probability) for future extreme heat events to impact the county.

C.2.3 Hailstorm

Location and Spatial Extent

Hailstorms frequently accompany thunderstorms, so their locations and spatial extents coincide. It is assumed that Rutherford County is uniformly exposed to severe thunderstorms; therefore, all areas of the county are equally exposed to hail which may be produced by such storms.

Historical Occurrences

According to the National Climatic Data Center, 93 recorded hailstorm events have affected Rutherford County since 1979.[1] **Table C.7** is a summary of the hail events in Rutherford County. **Table C.8** provides detailed information about each event that occurred in the county. In all, hail occurrences resulted in over $33,000 (2013 dollars) in property damages. Hail ranged in diameter from 0.75 inches to 2.0 inches. It should be noted that hail is notorious for causing substantial damage to cars, roofs, and other areas of the built environment that may not be reported to the National Climatic Data Center. Therefore, it is likely that damages are greater than the reported value.

TABLE C.7: SUMMARY OF HAIL OCCURRENCES IN RUTHERFORD COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Bostic	2	0/0	$0
Chimney Rock Village	2	0/0	$0

[1] These hail events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is likely that additional hail events have affected Rutherford County. In addition to NCDC, the North Carolina Department of Insurance office was contacted for information. As additional local data becomes available, this hazard profile will be amended.

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Ellenboro	4	0/0	$0
Forest City	14	0/0	$0
Lake Lure	6	0/0	$33,598
Ruth	0	0/0	$0
Rutherfordton	20	0/0	$0
Spindale	2	0/0	$0
Unincorporated Area	43	0/0	$0
RUTHERFORD COUNTY TOTAL	**93**	**0/0**	**$33,598**

Source: National Climatic Data Center

TABLE C.8: HISTORICAL HAIL OCCURRENCES IN RUTHERFORD COUNTY

	Date	Magnitude	Deaths / Injuries	Property Damage*
Bostic				
Bostic	13-MAY-93	0.88 in.	0/0	$0
BOSTIC	12-JUL-03	0.88 in.	0/0	$0
Chimney Rock Village				
CHIMNEY ROCK	13-MAY-00	1.00 in.	0/0	$0
CHIMNEY ROCK	09-JUN-09	1.50 in.	0/0	$0
Ellenboro				
ELLENBORO	03-MAY-03	1.75 in.	0/0	$0
ELLENBORO	09-MAY-04	0.75 in.	0/0	$0
ELLENBORO	26-JUL-10	0.75 in.	0/0	$0
ELLENBORO	09-APR-11	2.00 in.	0/0	$0
Forest City				
FOREST CITY	02-JUN-97	0.75 in.	0/0	$0
FOREST CITY	02-JUN-97	2.00 in.	0/0	$0
FOREST CITY	07-MAY-02	0.75 in.	0/0	$0
FOREST CITY	03-JUL-02	0.75 in.	0/0	$0
FOREST CITY	19-JUN-05	0.75 in.	0/0	$0
FOREST CITY	13-MAY-06	0.75 in.	0/0	$0
FOREST CITY	12-JUN-06	1.00 in.	0/0	$0
FOREST CITY	19-APR-07	0.75 in.	0/0	$0
FOREST CITY	16-JUN-07	0.75 in.	0/0	$0
FOREST CITY	16-JUN-07	0.75 in.	0/0	$0
FOREST CITY	24-JUN-07	0.75 in.	0/0	$0
FOREST CITY	22-JUL-08	0.75 in.	0/0	$0
FOREST CITY	09-APR-11	1.25 in.	0/0	$0
FOREST CITY	02-JUN-11	1.00 in.	0/0	$0
Lake Lure				
LAKE LURE	13-MAY-00	1.50 in.	0/0	$0
LAKE LURE	02-MAY-03	0.75 in.	0/0	$0
LAKE LURE	15-MAY-03	0.75 in.	0/0	$33,598
LAKE LURE	08-MAY-04	0.75 in.	0/0	$0
LAKE LURE	26-JUN-08	0.75 in.	0/0	$0

	Date	Magnitude	Deaths / Injuries	Property Damage*
LAKE LURE	26-APR-12	1.00 in.	0/0	$0
Ruth				
None Reported	--	--	--	--
Rutherfordton				
Rutherfordton	31-MAR-93	0.75 in.	0/0	$0
Rutherfordton	13-MAY-93	0.88 in.	0/0	$0
RUTHERFORDTON	29-MAY-96	0.88 in.	0/0	$0
RUTHERFORDTON	02-JUN-97	2.00 in.	0/0	$0
RUTHERFORDTON	25-JUN-01	1.00 in.	0/0	$0
RUTHERFORDTON	04-JUL-02	0.75 in.	0/0	$0
RUTHERFORDTON	29-APR-03	1.50 in.	0/0	$0
RUTHERFORDTON	03-MAY-03	1.75 in.	0/0	$0
RUTHERFORDTON	03-MAY-03	1.75 in.	0/0	$0
RUTHERFORDTON	12-JUN-04	1.00 in.	0/0	$0
RUTHERFORDTON	05-JUL-05	0.75 in.	0/0	$0
RUTHERFORDTON	03-APR-06	0.75 in.	0/0	$0
RUTHERFORDTON	20-MAY-06	0.75 in.	0/0	$0
RUTHERFORDTON	20-MAY-06	0.75 in.	0/0	$0
RUTHERFORDTON	21-JUL-06	0.75 in.	0/0	$0
RUTHERFORDTON	20-MAY-08	0.88 in.	0/0	$0
RUTHERFORDTON	18-JUN-09	1.75 in.	0/0	$0
RUTHERFORDTON	23-JUL-09	0.75 in.	0/0	$0
RUTHERFORDTON	01-MAY-12	1.00 in.	0/0	$0
RUTHERFORDTON	24-JUN-12	1.00 in.	0/0	$0
Spindale				
SPINDALE	29-APR-03	1.00 in.	0/0	$0
SPINDALE	26-JUN-11	0.88 in.	0/0	$0
Unincorporated Area				
RUTHERFORD COUNTY	25-JUN-79	1.75	0/0	$0
RUTHERFORD COUNTY	04-JUN-85	0.75	0/0	$0
RUTHERFORD COUNTY	05-JUN-85	1.75	0/0	$0
RUTHERFORD COUNTY	05-JUN-85	1.75	0/0	$0
RUTHERFORD COUNTY	10-JUL-85	1.00	0/0	$0
RUTHERFORD COUNTY	17-MAY-88	0.75	0/0	$0
RUTHERFORD COUNTY	26-JUL-89	0.75	0/0	$0
RUTHERFORD COUNTY	01-MAY-90	1.75	0/0	$0
RUTHERFORD COUNTY	01-MAY-90	1.00	0/0	$0
SUNSHINE	02-JUN-97	0.75	0/0	$0
THERMAL CITY	26-MAY-98	0.88	0/0	$0
GILKEY	26-MAY-98	1.75	0/0	$0
UNION MILLS	26-MAY-98	1.75	0/0	$0
THERMAL CITY	26-MAY-98	0.88	0/0	$0
HENRIETTA	16-MAR-02	0.75	0/0	$0
SUNSHINE	04-JUL-02	0.75	0/0	$0
THERMAL CITY	12-JUL-03	1.00	0/0	$0
THERMAL CITY	12-JUL-03	0.88	0/0	$0

	Date	Magnitude	Deaths / Injuries	Property Damage*
SUNSHINE	12-JUL-03	0.75	0/0	$0
HENRIETTA	03-APR-06	0.75	0/0	$0
SUNSHINE	26-MAY-06	0.75	0/0	$0
SUNSHINE	12-JUN-07	0.75	0/0	$0
SUNSHINE	14-JUN-07	0.88	0/0	$0
ALEXANDER MILLS	27-JUN-07	0.75	0/0	$0
SUNSHINE	23-AUG-07	1.75	0/0	$0
CLIFFSIDE	21-JUL-08	0.75	0/0	$0
HARRIS	30-SEP-08	1.00	0/0	$0
UREE	30-SEP-08	0.75	0/0	$0
CAROLEEN	30-SEP-08	0.75	0/0	$0
ALEXANDER MILLS	30-SEP-08	0.75	0/0	$0
CLIFFSIDE JCT	30-SEP-08	0.75	0/0	$0
ALEXANDER MILLS	09-SEP-09	1.75	0/0	$0
GILKEY	28-JUN-10	1.00	0/0	$0
ROCK SPGS	05-AUG-10	1.00	0/0	$0
GILKEY	09-APR-11	1.75	0/0	$0
GILKEY	09-APR-11	1.75	0/0	$0
WHITEHOUSE	02-JUN-11	1.00	0/0	$0
ROCK SPGS	05-JUN-11	1.00	0/0	$0
WHITEHOUSE	12-JUN-11	0.75	0/0	$0
WHITEHOUSE	27-JUN-11	0.75	0/0	$0
CLIFFSIDE JCT	02-SEP-11	1.00	0/0	$0
ROCK SPGS	01-MAY-12	1.00	0/0	$0
GILKEY	28-SEP-12	0.75	0/0	$0

*Property damage is reported in 2013 dollars; All damage may not have been reported.
Source: National Climatic Data Center

Probability of Future Occurrences

Based on historical occurrence information, it is assumed that the probability of future hail occurrences is highly likely (100 percent annual probability). Since hail is an atmospheric hazard (coinciding with thunderstorms), it is assumed that Rutherford County has equal exposure to this hazard. It can be expected that future hail events will continue to cause minor damage to property and vehicles throughout the county.

C.2.4 Hurricane and Tropical Storm

Location and Spatial Extent

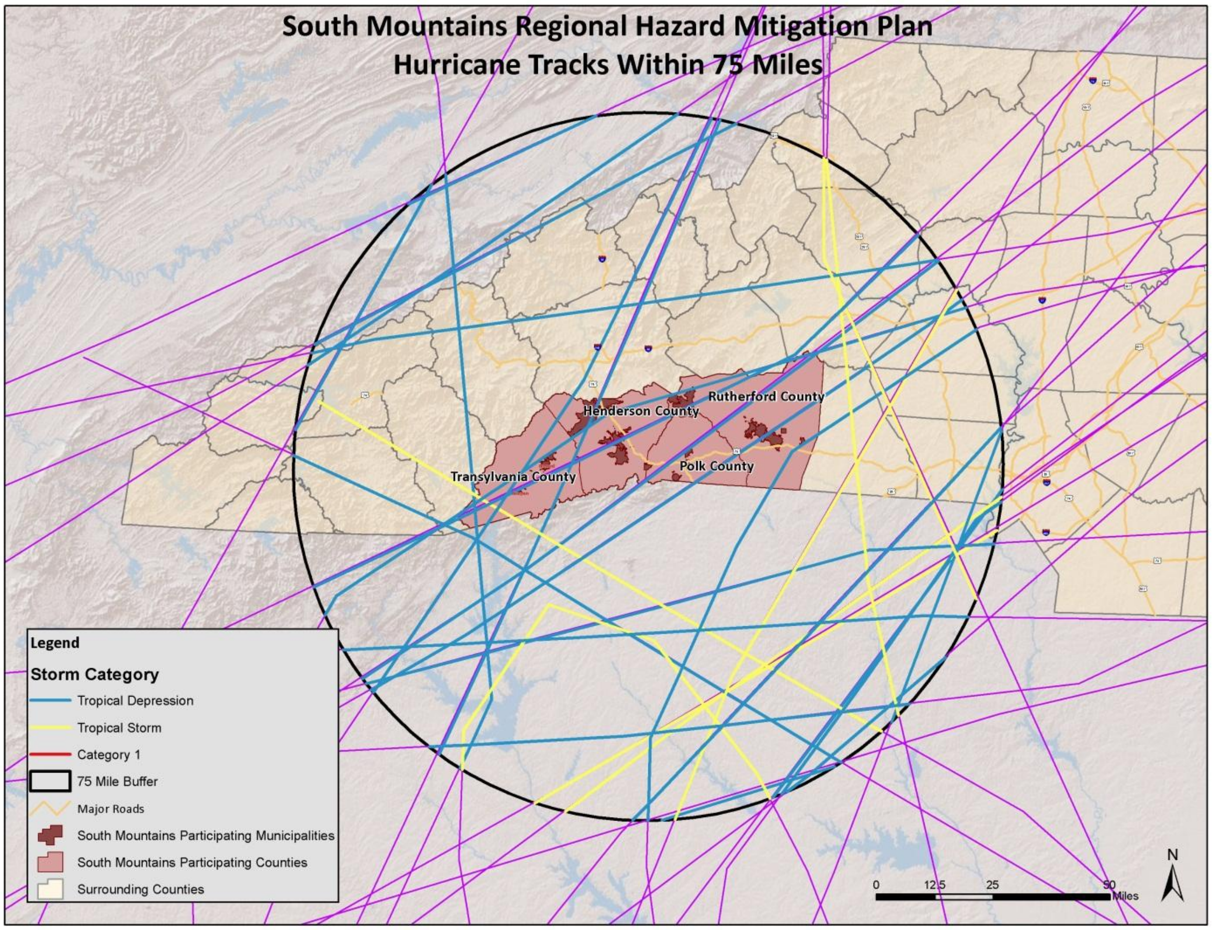
Hurricanes and tropical storms threaten the entire Atlantic and Gulf seaboard of the United States. While coastal areas are most directly exposed to the brunt of landfalling storms, their impact is often felt hundreds of miles inland and they can affect Rutherford County. The entire county is equally susceptible to hurricane and tropical storms.

Historical Occurrences

According to the National Hurricane Center's historical storm track records, 30 hurricane or tropical storm tracks have passed within 75 miles of Rutherford County since 1850.[2] This includes 7 tropical storms and 23 tropical depressions.

Of the recorded storm event, four tropical depressions have traversed directly through Rutherford County as shown in **Figure C.1**. **Table C.9** provides for each event the date of occurrence, name (if applicable), maximum wind speed (as recorded within 75 miles of the South Mountains Region) and Category of the storm based on the Saffir-Simpson Scale.

FIGURE C.1: HISTORICAL HURRICANE STORM TRACKS WITHIN 75 MILES OF RUTHERFORD COUNTY



Source: National Oceanic and Atmospheric Administration; National Hurricane Center

[2] These storm track statistics do not include extra-tropical storms. Though these related hazard events are less severe in intensity, they may cause significant local impact in terms of rainfall and high winds.

TABLE C.9: HISTORICAL STORM TRACKS WITHIN 75 MILES OF RUTHERFORD COUNTY (1850–2010)

Date of Occurrence	Storm Name	Maximum Wind Speed (miles per hour)	Maximum Storm Category
9/17/1859	NOT NAMED	--	Tropical Depression (TD)
9/24/1886	NOT NAMED	35	Tropical Storm (TS)
8/1/1891	NOT NAMED	35	Tropical Storm (TS)
7/8/1896	NOT NAMED	26	Tropical Depression (TD)
9/28/1901	NOT NAMED	22	Tropical Depression (TD)
10/11/1902	NOT NAMED	31	Tropical Depression (TD)
10/10/1905	NOT NAMED	--	Tropical Depression (TD)
9/18/1906	NOT NAMED	31	Tropical Depression (TD)
9/23/1907	NOT NAMED	40	Tropical Storm (TS)
8/30/1911	NOT NAMED	26	Tropical Depression (TD)
6/17/1912	NOT NAMED	--	Tropical Depression (TD)
9/4/1913	NOT NAMED	26	Tropical Depression (TD)
8/31/1915	NOT NAMED	26	Tropical Depression (TD)
7/15/1916	NOT NAMED	31	Tropical Depression (TD)
8/11/1928	NOT NAMED	35	Tropical Storm (TS)
5/30/1934	NOT NAMED	26	Tropical Depression (TD)
8/28/1949	NOT NAMED	35	Tropical Storm (TS)
9/30/1959	GRACIE	22	Tropical Depression (TD)
8/30/1964	CLEO	22	Tropical Depression (TD)
6/8/1968	CELESTE	53	Tropical Storm (TS)
9/8/1977	BABE	22	Tropical Depression (TD)
8/18/1985	ONE-C	48	Tropical Storm (TS)
9/22/1989	HUGO	22	Tropical Depression (TD)
8/17/1994	BERYL	--	Tropical Depression (TD)
7/24/1997	DANNY	18	Tropical Depression (TD)
7/10/2003	DOLORES	--	Tropical Depression (TD)
9/8/2004	FRANCES	18	Tropical Depression (TD)
9/17/2004	IVAN	13	Tropical Depression (TD)
9/28/2004	JEANNE	18	Tropical Depression (TD)
7/7/2005	CINDY	18	Tropical Depression (TD)

Source: National Hurricane Center

The National Climatic Data Center did not report any events associated with a hurricane or tropical storm in Rutherford County between 1950 and 2013. However, federal records indicate that three disaster declarations were made in 1996 (Hurricane Fran) and 2004 (Tropical Storm Frances and Hurricane Ivan) for the county.[3]

[3] All of the participating counties were declared disaster areas for these storms particular storms. A complete listing of historical disaster declarations, including the affected counties, can be found in Section 4: *Hazard Identification*.

Flooding is generally the greatest hazard of concern with hurricane and tropical storm events in Rutherford County. Most events do not carry winds that are above that of the winter storms and straight line winds received by the county. Some anecdotal information is available for the major storms that have impacted that area as found below:

Hurricane Fran – September 5, 1996
Just prior to landfall of Hurricane Fran, a small portion of the region, in the Bat Cave (Henderson County), Chimney Rock (Rutherford County), Lake Lure (Rutherford County) areas, received up to 11 inches of rain in a 3 hour period. The rains were the result of nearly stationary, very heavy thunderstorms. Severe damage to property in the immediate area resulted, with about 70 homes and businesses destroyed or significantly damaged. As Hurricane Fran moved inland, it dropped an additional 5 to 10 inches of rain over the area resulting in significant flooding throughout the region.

Tropical Storm Frances – September 7-8, 2004
Tropical Storm Frances was a slow-moving, relatively large storm that dumped heavy rains over the eastern United States. The remnants of Frances produced a swath of 5 to 15 inches of rain across the North Carolina Mountains with reports of 12 to 15 inches of rain along the higher terrain and isolated reports in excess of 18 inches. Wind gusts reached between 40 and 60 mph along the Appalachian Mountains and thousands of trees were downed. Trees fell on structures, vehicles, and power lines. Additionally, the downed trees led to the death of an elderly man in Hendersonville when a tree fell through the resident's structure. Flooding also led to numerous landslides in the area which added to the damage of infrastructure and residential and commercial structures. Frances caused significant crop damages totaling $55 million statewide. North Carolina residents received almost $20.6 million in federal disaster assistance following the storm.

Hurricane Ivan – September 16-17, 2004
Just a week and a half following Tropical Storm Frances, the remnants of Hurricane Ivan hit western North Carolina when many streams and rivers were already well above flood stage. The widespread flooding forced many roads to be closed and landslides were common across the mountain region. Wind gusts reached between 40 and 60 mph across the higher elevations of the Appalachian Mountains resulting in numerous downed trees. More than $13.8 million of federal aid was dispersed across North Carolina following Ivan.

The Hurricane Frances/Ivan combination of events resulted in widespread road closures (including Highways 64, 280, 25, and 276) as well as infrastructure damages (many bridges and roads were completely washed out), residential structure damages, and commercial structure damages due to massive flooding. Trees were blown down and fell on structures, vehicles, and powerlines, adding to the already widespread debris buildup and power outages.

Probability of Future Occurrences
Given the inland location of the county, it is more likely to be affected by remnants of hurricane and tropical storm systems (as opposed to a major hurricane) which may result in flooding or high winds. The probability of being impacted is less than coastal areas, but still remains a real threat to Rutherford County due to induced events like flooding and landsliding. Based on historical evidence, the probability level of future occurrence is possible (between 1 and 10 percent annual probability). Given the regional nature of the hazard, all areas in the county are equally exposed to this hazard. However, when the county is impacted, the damage could be catastrophic, threatening lives and property throughout the planning area.

C.2.5 Lightning

Location and Spatial Extent

Lightning occurs randomly, therefore it is impossible to predict where and with what frequency it will strike. It is assumed that all of Rutherford County is uniformly exposed to lightning.

Historical Occurrences

According to the National Climatic Data Center, there have been 15 recorded lightning events in Rutherford County since 1995, as listed in summary **Table C.10**.[4] These events resulted in over $660,000 (2013 dollars) in damages and caused 7 injuries. A complete listing of those events can be found in **Table C.11.** Many of the reported events are those that caused damage, and it should be expected that damages are likely much higher for this hazard than what is reported.

TABLE C.10: SUMMARY OF LIGHTNING OCCURRENCES IN RUTHERFORD COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Bostic	2	0/0	$1,426
Chimney Rock Village	1	0/1	$0
Ellenboro	1	0/0	$0
Forest City	3	0/1	$367,669
Lake Lure	2	0/0	$70,516
Ruth	0	0/0	$0
Rutherfordton	2	0/0	$67,196
Spindale	0	0/0	$0
Unincorporated Area	4	0/5	$153,549
RUTHERFORD COUNTY TOTAL	**15**	**0/7**	**$660,356**

Source: National Climatic Data Center

TABLE C.11: HISTORIC LIGHTNING OCCURRENCES IN RUTHERFORD COUNTY

	Date	Deaths / Injuries	Property Damage*	Details
Bostic				
BOSTIC	15-JUN-01	0/0	$1,426	Lightning earlier in the afternoon struck a tree and later caused it to fall across a barn.
BOSTIC	31-JUL-03	0/0	$0	
Chimney Rock Village				
CHIMNEY ROCK	18-JUL-03	0/1	$0	A person was injured when he was struck by lightning.

[4] These lightning events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is certain that additional lightning events have occurred in Rutherford County. The State Fire Marshall's office was also contacted for additional information but none could be provided. As additional local data becomes available, this hazard profile will be amended.

	Date	Deaths / Injuries	Property Damage*	Details
Ellenboro				
ELLENBORO	16-JUL-97	0/0	$0	A home was severely damaged by lightning in Ellenboro. Damage estimates are unknown.
Forest City				
Forest City	10-MAY-95	0/0	$291,662	Lightning started a fire that destroyed a home on Pinnacle Mountain.
FOREST CITY	31-JUL-00	0/0	$8,811	Strong, nearly stationary thunderstorms dumped excessive rain and produced damaging lightning strikes and gusty winds over and near Forest City during the early morning hours. An estimated 5 inches of rain fell in the area causing urban flooding to begin around midnight. Soon after though, numerous creeks flooded, washing away parts of several streets and roads. One lightning strike caused a fire which burned an outbuilding. Some trees were downed from a combination of the heavy rain, wind and lightning.
FOREST CITY	31-JUL-03	0/1	$67,196	A man was injured when he was struck by lightning. Lightning also ignited several structure fires in the area, one of which caused significant damage.
Lake Lure				
LAKE LURE	04-JUL-02	0/0	$69,212	Lightning caused fires at 6 buildings.
LAKE LURE	08-MAY-04	0/0	$1,305	Lightning ignited several fires and downed some power lines.
Ruth				
None Reported	--	--	--	--
Rutherfordton				
RUTHERFORDTON	21-JUL-03	0/0	$67,196	A lightning strike ignited a fire at a barn, destroying the barn and its contents.
RUTHERFORDTON	27-JUN-05	0/0	$0	Tree trees snapped off by lightning.
Spindale				
None Reported	--	--	--	--
Unincorporated Area				
UNION MILLS	16-JUL-97	0/0	$0	A mobile home was destroyed

	Date	Deaths / Injuries	Property Damage*	Details
				by lightning in Union Mills. Damage estimates are unknown.
ALEXANDER MILLS	20-AUG-99	0/0	$15,126	A barn was destroyed along with the hay inside, by a lightning-ignited fire in Alexander Mills.
GILKEY	17-APR-02	0/0	$138,423	Lightning struck a tree and entered a nearby house, causing a fire. The fire burned a large part of the house.
CLIFFSIDE	09-JUL-09	0/5	$0	Lightning struck and injured 5 workers at a power plant near Cliffside. Although most of the injuries were minor, two people were transported to the hospital.

*Property Damage is reported in 2013 dollars.
Source: National Climatic Data Center

Probability of Future Occurrences

Although there was not a high number of historical lightning events reported in Rutherford County via NCDC data, it is considered a regular occurrence, especially accompanied by thunderstorms. In fact, lightning events will assuredly happen on an annual basis, though not all events will cause damage. According to Vaisala's U.S. National Lightning Detection Network (NLDN®), Rutherford County is located in an area of the country that experienced an average of 3 to 4 lightning flashes per square kilometer per year between 1997 and 2010. Therefore, the probability of future events is highly likely (100 percent annual probability). It can be expected that future lightning events will continue to threaten life and cause minor property damages throughout the county.

C.2.6 Thunderstorm Wind / High Wind

Location and Spatial Extent

A wind event is an atmospheric hazard, and thus has no geographic boundaries. It is typically a widespread event that can occur in all regions of the United States. However, thunderstorms are most common in the central and southern states because atmospheric conditions in those regions are favorable for generating these powerful storms. Also, Rutherford County typically experiences several straight-line wind events each year. These wind events can and have caused significant damage. It is assumed that Rutherford County has uniform exposure to an event and the spatial extent of an impact could be large.

Historical Occurrences

Severe storms have resulted in one disaster declaration in Rutherford County.[5] According to NCDC, there have been 187 reported thunderstorm wind and high wind events since 1964 in Rutherford

[5] A complete listing of historical disaster declarations can be found in Section 4: *Hazard Profiles*.

County.[6] These events caused over $3.5 million (2013 dollars) in damages. There were reports of 14 injuries and 3 fatalities. **Table C.12** summarizes this information. **Table C.13** presents detailed thunderstorm wind and high wind event reports including date, magnitude, and associated damages for each event.[7]

TABLE C.12: SUMMARY OF THUNDERSTORM / HIGH WIND OCCURRENCES IN RUTHERFORD COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Bostic	6	0/0	$0
Chimney Rock Village	5	0/0	$0
Ellenboro	5	0/0	$1,344
Forest City	21	0/0	$544,184
Lake Lure	14	0/0	$2,728
Ruth	0	0/0	$0
Rutherfordton	42	1/0	$428,127
Spindale	5	0/0	$0
Unincorporated Area	89	0/2	$2,542,895
RUTHERFORD COUNTY TOTAL	**187**	**1/2**	**$3,519,278**

Source: National Climatic Data Center

TABLE C.13: HISTORICAL THUNDERSTORM / HIGH WIND OCCURRENCES IN RUTHERFORD COUNTY

	Date	Type	Magnitude	Deaths / Injuries	Property Damage*
Bostic					
BOSTIC	07-MAY-02	TSTM WIND	50 kts.	0/0	$0
BOSTIC	12-JUL-03	TSTM WIND	50 kts.	0/0	$0
BOSTIC	31-JUL-03	TSTM WIND	50 kts.	0/0	$0
BOSTIC	09-MAY-04	TSTM WIND	50 kts.	0/0	$0
BOSTIC	15-JUN-09	THUNDERSTORM WIND	50 kts.	0/0	$0
BOSTIC	18-JUL-10	THUNDERSTORM WIND	55 kts.	0/0	$0
Chimney Rock Village					
CHIMNEY ROCK	16-JUL-97	TSTM WIND	50 kts.	0/0	$0
CHIMNEY ROCK	02-MAY-02	TSTM WIND	50 kts.	0/0	$0
CHIMNEY ROCK	12-JUN-04	TSTM WIND	50 kts.	0/0	$0
CHIMNEY ROCK	09-JUN-09	THUNDERSTORM WIND	55 kts.	0/0	$0
CHIMNEY ROCK	15-MAY-12	THUNDERSTORM WIND	50 kts.	0/0	$0
Ellenboro					
ELLENBORO	22-JUN-98	TSTM WIND	50 kts.	0/0	$0
ELLENBORO	21-MAY-01	TSTM WIND	50 kts.	0/0	$0
ELLENBORO	03-MAY-03	TSTM WIND	60 kts.	0/0	$1,344

[6] These thunderstorm events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is certain that additional thunderstorm events have occurred in Rutherford County. As additional local data becomes available, this hazard profile will be amended.

[7] The dollar amount of damages provided by NCDC is divided by the number of affected counties to reflect a damage estimate for the county.

	Date	Type	Magnitude	Deaths / Injuries	Property Damage*
ELLENBORO	07-JUL-05	TSTM WIND	50 kts.	0/0	$0
ELLENBORO	24-AUG-07	THUNDERSTORM WIND	50 kts.	0/0	$0
Forest City					
FOREST CITY	28-JUL-97	TSTM WIND	50 kts.	0/0	$0
FOREST CITY	05-AUG-97	TSTM WIND	60 kts.	0/0	$471,905
FOREST CITY	22-JUN-98	TSTM WIND	65 kts.	0/0	$0
FOREST CITY	21-MAY-01	TSTM WIND	50 kts.	0/0	$0
FOREST CITY	14-JUN-01	TSTM WIND	60 kts.	0/0	$0
FOREST CITY	02-MAY-02	TSTM WIND	50 kts.	0/0	$4,153
FOREST CITY	01-JUL-02	TSTM WIND	50 kts.	0/0	$0
FOREST CITY	03-JUL-02	TSTM WIND	50 kts.	0/0	$34,606
FOREST CITY	11-NOV-02	TSTM WIND	55 kts.	0/0	$4,153
FOREST CITY	04-AUG-03	TSTM WIND	50 kts.	0/0	$4,032
FOREST CITY	19-JUN-05	TSTM WIND	55 kts.	0/0	$12,668
FOREST CITY	27-JUN-05	TSTM WIND	50 kts.	0/0	$0
FOREST CITY	14-AUG-05	TSTM WIND	55 kts.	0/0	$12,668
FOREST CITY	22-JUN-06	TSTM WIND	50 kts.	0/0	$0
FOREST CITY	11-OCT-06	THUNDERSTORM WIND	50 kts.	0/0	$0
FOREST CITY	16-JUN-07	THUNDERSTORM WIND	50 kts.	0/0	$0
FOREST CITY	25-AUG-07	THUNDERSTORM WIND	50 kts.	0/0	$0
FOREST CITY	23-JUL-09	THUNDERSTORM WIND	50 kts.	0/0	$0
FOREST CITY	25-OCT-10	THUNDERSTORM WIND	50 kts.	0/0	$0
FOREST CITY	16-NOV-10	THUNDERSTORM WIND	50 kts.	0/0	$0
FOREST CITY	26-JUN-11	THUNDERSTORM WIND	50 kts.	0/0	$0
Lake Lure					
LAKE LURE	23-AUG-99	TSTM WIND	50 kts.	0/0	$0
LAKE LURE	04-JUL-01	TSTM WIND	50 kts.	0/0	$0
LAKE LURE	08-JUL-01	TSTM WIND	50 kts.	0/0	$0
LAKE LURE	17-APR-02	TSTM WIND	50 kts.	0/0	$1,384
LAKE LURE	02-MAY-02	TSTM WIND	55 kts.	0/0	$0
LAKE LURE	02-MAY-03	TSTM WIND	50 kts.	0/0	$1,344
LAKE LURE	15-MAY-03	TSTM WIND	60 kts.	0/0	$0
LAKE LURE	22-AUG-03	TSTM WIND	55 kts.	0/0	$0
LAKE LURE	10-JUL-04	TSTM WIND	50 kts.	0/0	$0
LAKE LURE	22-JUN-06	TSTM WIND	50 kts.	0/0	$0
LAKE LURE	27-JUN-08	THUNDERSTORM WIND	55 kts.	0/0	$0
LAKE LURE	22-JUN-10	THUNDERSTORM WIND	50 kts.	0/0	$0
LAKE LURE	05-JUL-12	THUNDERSTORM WIND	50 kts.	0/0	$0
LAKE LURE	05-JUL-12	THUNDERSTORM WIND	50 kts.	0/0	$0
Ruth					
None Reported	--	--	--	--	--
Rutherfordton					
Rutherfordton	16-AUG-94	THUNDERSTORM WINDS	0 kts.	0/0	$0
Rutherfordton	10-MAY-95	THUNDERSTORM WINDS	0 kts.	0/0	$24,858
Rutherfordton	09-JUN-95	THUNDERSTORM WINDS	0 kts.	0/0	$0

	Date	Type	Magnitude	Deaths / Injuries	Property Damage*
RUTHERFORDTON	25-MAY-96	TSTM WIND	50 kts.	0/0	$0
RUTHERFORDTON	13-JUN-96	TSTM WIND	50 kts.	0/0	$80,456
RUTHERFORDTON	04-JUL-97	TSTM WIND	50 kts.	0/0	$0
RUTHERFORDTON	04-JUL-97	TSTM WIND	50 kts.	0/0	$0
RUTHERFORDTON	28-JUL-97	TSTM WIND	50 kts.	0/0	$4,719
RUTHERFORDTON	05-AUG-97	TSTM WIND	60 kts.	0/0	$0
RUTHERFORDTON	04-JUL-98	TSTM WIND	50 kts.	0/0	$0
RUTHERFORDTON	07-JUL-99	TSTM WIND	52 kts.	0/0	$0
RUTHERFORDTON	23-AUG-99	TSTM WIND	50 kts.	0/0	$0
RUTHERFORDTON	10-AUG-00	TSTM WIND	50 kts.	0/0	$0
RUTHERFORDTON	18-AUG-00	TSTM WIND	65 kts.	0/0	$0
RUTHERFORDTON	25-JUN-01	TSTM WIND	55 kts.	0/0	$0
RUTHERFORDTON	04-JUL-01	TSTM WIND	60 kts.	0/0	$0
RUTHERFORDTON	08-JUL-01	TSTM WIND	50 kts.	0/0	$0
RUTHERFORDTON	17-APR-02	TSTM WIND	50 kts.	0/0	$1,384
RUTHERFORDTON	13-MAY-02	TSTM WIND	55 kts.	0/0	$34,606
RUTHERFORDTON	06-JUN-02	TSTM WIND	55 kts.	0/0	$0
RUTHERFORDTON	04-JUL-02	TSTM WIND	55 kts.	0/0	$138,423
RUTHERFORDTON	03-MAY-03	TSTM WIND	60 kts.	0/0	$4,032
RUTHERFORDTON	03-MAY-03	TSTM WIND	60 kts.	0/0	$134,392
RUTHERFORDTON	15-JUN-03	TSTM WIND	50 kts.	0/0	$1,344
RUTHERFORDTON	16-JUL-03	TSTM WIND	52 kts.	0/0	$0
RUTHERFORDTON	30-MAY-04	TSTM WIND	55 kts.	0/0	$3,914
RUTHERFORDTON	12-JUN-04	TSTM WIND	50 kts.	0/0	$0
RUTHERFORDTON	05-JUL-05	TSTM WIND	50 kts.	0/0	$0
RUTHERFORDTON	11-JUN-06	TSTM WIND	50 kts.	0/0	$0
RUTHERFORDTON	03-AUG-06	TSTM WIND	50 kts.	0/0	$0
RUTHERFORDTON	11-OCT-06	THUNDERSTORM WIND	50 kts.	0/0	$0
RUTHERFORDTON	08-JUN-07	THUNDERSTORM WIND	50 kts.	0/0	$0
RUTHERFORDTON	21-AUG-07	THUNDERSTORM WIND	55 kts.	0/0	$0
RUTHERFORDTON	04-MAR-08	THUNDERSTORM WIND	55 kts.	0/0	$0
RUTHERFORDTON	20-MAY-08	THUNDERSTORM WIND	50 kts.	0/0	$0
RUTHERFORDTON	02-AUG-08	THUNDERSTORM WIND	55 kts.	0/0	$0
RUTHERFORDTON	18-JUN-09	THUNDERSTORM WIND	55 kts.	0/0	$0
RUTHERFORDTON	05-AUG-10	THUNDERSTORM WIND	50 kts.	0/0	$0
RUTHERFORDTON	04-APR-11	THUNDERSTORM WIND	55 kts.	1/0	$0
RUTHERFORDTON	26-JUN-11	THUNDERSTORM WIND	50 kts.	0/0	$0
RUTHERFORDTON	23-JUL-12	THUNDERSTORM WIND	50 kts.	0/0	$0
RUTHERFORDTON	23-JUL-12	THUNDERSTORM WIND	50 kts.	0/0	$0
Spindale					
SPINDALE	04-AUG-00	TSTM WIND	55 kts.	0/0	$0
SPINDALE	21-JUL-06	TSTM WIND	50 kts.	0/0	$0
SPINDALE	31-JUL-08	THUNDERSTORM WIND	50 kts.	0/0	$0
SPINDALE	31-JUL-11	THUNDERSTORM WIND	60 kts.	0/0	$0
SPINDALE	31-JUL-11	THUNDERSTORM WIND	60 kts.	0/0	$0

	Date	Type	Magnitude	Deaths / Injuries	Property Damage*
Unincorporated Area					
RUTHERFORD COUNTY	24-JUN-64	TSTM WIND	0 kts.	0/0	$0
RUTHERFORD COUNTY	04-JUL-70	TSTM WIND	0 kts.	0/0	$0
RUTHERFORD COUNTY	22-FEB-74	TSTM WIND	0 kts.	0/0	$0
RUTHERFORD COUNTY	20-MAR-84	TSTM WIND	0 kts.	0/0	$0
RUTHERFORD COUNTY	03-JUN-85	TSTM WIND	61 kts.	0/0	$0
RUTHERFORD COUNTY	05-JUN-85	TSTM WIND	52 kts.	0/0	$0
RUTHERFORD COUNTY	06-FEB-86	TSTM WIND	0 kts.	0/0	$0
RUTHERFORD COUNTY	30-JUL-87	TSTM WIND	0 kts.	0/0	$0
RUTHERFORD COUNTY	28-AUG-87	TSTM WIND	0 kts.	0/0	$0
RUTHERFORD COUNTY	16-JUL-88	TSTM WIND	0 kts.	0/0	$0
RUTHERFORD COUNTY	26-MAY-89	TSTM WIND	0 kts.	0/0	$0
RUTHERFORD COUNTY	05-JUN-89	TSTM WIND	0 kts.	0/0	$0
RUTHERFORD COUNTY	12-JUN-89	TSTM WIND	0 kts.	0/0	$0
RUTHERFORD COUNTY	15-JUN-89	TSTM WIND	0 kts.	0/0	$0
RUTHERFORD COUNTY	28-JUN-89	TSTM WIND	0 kts.	0/0	$0
RUTHERFORD COUNTY	10-FEB-90	TSTM WIND	0 kts.	0/0	$0
RUTHERFORD COUNTY	24-JUL-91	TSTM WIND	0 kts.	0/0	$0
RUTHERFORD COUNTY	08-JUN-92	TSTM WIND	0 kts.	0/0	$0
Northeastern Rutherfo	10-JUN-95	THUNDERSTORM WINDS	0 kts.	0/0	$0
RUTHERFORD COUNTY	05-OCT-95	HIGH WINDS	0 kts.	0/0	$1,657,168
Mountains and Foothil	11-NOV-95	HIGH WINDS	0 kts.	0/0	$34,524
RUTHERFORD COUNTY	18-JAN-96	HIGH WIND	0 kts.	0/0	$5,028
HARRIS	08-JUN-96	TSTM WIND	50 kts.	0/0	$0
UNION MILLS	28-AUG-96	TSTM WIND	50 kts.	0/0	$0
UNION MILLS	02-JUN-97	TSTM WIND	50 kts.	0/0	$0
CAROLEEN	05-AUG-97	TSTM WIND	60 kts.	0/0	$275,278
RUTHERFORD COUNTY	03-FEB-98	HIGH WIND	0 kts.	0/0	$25,823
RUTHERFORD COUNTY	23-FEB-98	HIGH WIND	50 kts.	0/0	$0
RUTHERFORD COUNTY	24-FEB-98	HIGH WIND	50 kts.	0/0	$1,936
GILKEY	26-MAY-98	TSTM WIND	50 kts.	0/0	$0
UNION MILLS	26-MAY-98	TSTM WIND	50 kts.	0/0	$0
CLIFFSIDE	23-JUL-98	TSTM WIND	50 kts.	0/0	$0
RUTHERFORD COUNTY	01-MAR-99	HIGH WIND	77 kts.	0/0	$75,629
RUTHERFORD COUNTY	15-SEP-99	HIGH WIND	45 kts.	0/0	$0
RUTHERFORD COUNTY	28-MAR-00	HIGH WIND	50 kts.	0/0	$0
RUTHERFORD COUNTY	08-APR-00	HIGH WIND	50 kts.	0/0	$0
RUTHERFORD COUNTY	20-MAR-01	HIGH WIND	55 kts.	0/0	$67,893
RUTHERFORD COUNTY	04-FEB-02	HIGH WIND	50 kts.	0/0	$0
CAROLEEN	02-JUL-02	TSTM WIND	55 kts.	0/2	$0
HARRIS	24-AUG-02	TSTM WIND	55 kts.	0/0	$0
RUTHERFORD COUNTY	06-NOV-02	HIGH WIND	50 kts.	0/0	$0
RUTHERFORD COUNTY	25-DEC-02	HIGH WIND	50 kts.	0/0	$0
UNION MILLS	02-MAY-03	TSTM WIND	65 kts.	0/0	$268,783
RUTHERFORD COUNTY	31-MAY-03	HIGH WIND	50 kts.	0/0	$0
UNION MILLS	08-JUN-03	TSTM WIND	50 kts.	0/0	$0

	Date	Type	Magnitude	Deaths / Injuries	Property Damage*
THERMAL CITY	12-JUL-03	TSTM WIND	50 kts.	0/0	$0
SUNSHINE	12-JUL-03	TSTM WIND	50 kts.	0/0	$1,344
UNION MILLS	12-JUL-03	TSTM WIND	50 kts.	0/0	$0
RUTHERFORD COUNTY	14-OCT-03	HIGH WIND	50 kts.	0/0	$1,512
RUTHERFORD COUNTY	13-NOV-03	HIGH WIND	50 kts.	0/0	$2,993
RUTHERFORD COUNTY	07-MAR-04	HIGH WIND	60 kts.	0/0	$30,445
HARRIS	12-JUN-04	TSTM WIND	50 kts.	0/0	$3,914
HARRIS	12-JUN-04	TSTM WIND	50 kts.	0/0	$1,305
RUTHERFORD COUNTY	05-JUL-04	HIGH WIND	55 kts.	0/0	$1,305
RUTHERFORD COUNTY	16-SEP-04	HIGH WIND	50 kts.	0/0	$5,219
RUTHERFORD COUNTY	17-SEP-04	HIGH WIND	50 kts.	0/0	$6,116
RUTHERFORD COUNTY	22-JAN-05	HIGH WIND	50 kts.	0/0	$0
RUTHERFORD COUNTY	02-APR-05	HIGH WIND	60 kts.	0/0	$73,895
HARRIS	28-JUL-05	TSTM WIND	50 kts.	0/0	$0
RUTHERFORD COUNTY	14-JAN-06	HIGH WIND	60 kts.	0/0	$1,230
RUTHERFORD COUNTY	03-APR-06	HIGH WIND	50 kts.	0/0	$4,919
RUTHERFORD COUNTY	01-DEC-06	HIGH WIND	55 kts.	0/0	$0
RUTHERFORD COUNTY	16-APR-07	HIGH WIND	60 kts.	0/0	$28,430
CLIFFSIDE	24-JUN-07	THUNDERSTORM WIND	50 kts.	0/0	$0
SUNSHINE	23-AUG-07	THUNDERSTORM WIND	60 kts.	0/0	$0
RUTHERFORD COUNTY	10-FEB-08	HIGH WIND	55 kts.	0/0	$0
RUTHERFORD COUNTY	11-MAY-08	HIGH WIND	60 kts.	0/0	$0
RUTHERFORD COUNTY	12-MAY-08	HIGH WIND	50 kts.	0/0	$0
CLIFFSIDE	21-JUL-08	THUNDERSTORM WIND	50 kts.	0/0	$0
RUTHERFORD COUNTY	07-JAN-09	HIGH WIND	50 kts.	0/0	$0
HARRIS	10-APR-09	THUNDERSTORM WIND	50 kts.	0/0	$0
GILKEY	09-MAY-09	THUNDERSTORM WIND	50 kts.	0/0	$0
HOLLIS	05-AUG-10	THUNDERSTORM WIND	50 kts.	0/0	$0
HARRIS	04-APR-11	THUNDERSTORM WIND	65 kts.	0/0	$0
ROCK SPGS	05-JUN-11	THUNDERSTORM WIND	50 kts.	0/0	$0
UNION MILLS	09-JUN-11	THUNDERSTORM WIND	50 kts.	0/0	$0
GILKEY	09-JUN-11	THUNDERSTORM WIND	50 kts.	0/0	$0
SUNSHINE	12-JUN-11	THUNDERSTORM WIND	50 kts.	0/0	$0
ALEXANDER MILLS	22-JUN-11	THUNDERSTORM WIND	50 kts.	0/0	$0
GILKEY	13-JUL-11	THUNDERSTORM WIND	50 kts.	0/0	$0
GILKEY	13-JUL-11	THUNDERSTORM WIND	50 kts.	0/0	$0
SUNSHINE	02-SEP-11	THUNDERSTORM WIND	55 kts.	0/0	$0
CLIFFSIDE	12-JUN-12	THUNDERSTORM WIND	50 kts.	0/0	$0
UREE	03-JUL-12	THUNDERSTORM WIND	55 kts.	0/0	$0
UREE	04-JUL-12	THUNDERSTORM WIND	50 kts.	0/0	$0
ROCK SPGS	04-JUL-12	THUNDERSTORM WIND	50 kts.	0/0	$0
UNION MILLS	19-JUL-12	THUNDERSTORM WIND	50 kts.	0/0	$0
AVONDALE	09-AUG-12	THUNDERSTORM WIND	55 kts.	0/0	$0
GILKEY	08-SEP-12	THUNDERSTORM WIND	50 kts.	0/0	$0

*Property damage is reported in 2013 dollars; All damage may not have been reported.
Source: National Climatic Data Center

Probability of Future Occurrences

Given the high number of previous events, it is certain that wind events, including straight-line wind and thunderstorm wind, will occur in the future. This results in a probability level of highly likely (100 percent annual probability) for future wind events for the entire county.

C.2.7 Tornado

Location and Spatial Extent

Tornadoes occur throughout the state of North Carolina, and thus in Rutherford County. Tornadoes typically impact a relatively small area, but damage may be extensive. Event locations are completely random and it is not possible to predict specific areas that are more susceptible to tornado strikes over time. Therefore, it is assumed that Rutherford County is uniformly exposed to this hazard.

Historical Occurrences

Tornadoes are a fairly rare occurrence in mountainous areas. However, they have and do occur in Rutherford County. Tornadoes have resulted in one disaster declaration in Rutherford County in 1989.[8] According to the National Climatic Data Center, there have been a total of eight recorded tornado events in Rutherford County since 1973 (**Table C.14**), resulting in more than $712,000 (2013 dollars) in property damages.[9] In addition, 10 injuries were reported (**Table C.15**). The magnitude of these tornadoes ranges from F0 to F4 in intensity, although an F5 event is possible. It is important to note that only tornadoes that have been reported are factored into this risk assessment. It is likely that a high number of occurrences have gone unreported over the past 63 years.

TABLE C.14: SUMMARY OF TORNADO OCCURRENCES IN RUTHERFORD COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Bostic	0	0/0	$0
Chimney Rock Village	0	0/0	$0
Ellenboro	1	0/10	$0
Forest City	2	0/0	$74,266
Lake Lure	0	0/0	$0
Ruth	0	0/0	$0
Rutherfordton	1	0/0	$0
Spindale	0	0/0	$0
Unincorporated Area	4	0/0	$638,222
RUTHERFORD COUNTY TOTAL	**8**	**0/10**	**$712,488**

Source: National Climatic Data Center

[8] A complete listing of historical disaster declarations can be found in Section 4: *Hazard Profiles*.

[9] These tornado events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is likely that additional tornadoes have occurred in Rutherford County. As additional local data becomes available, this hazard profile will be amended.

TABLE C.15: HISTORICAL TORNADO IMPACTS IN RUTHERFORD COUNTY

	Date	Magnitude	Deaths/ Injuries	Property Damage*	Details
Bostic					
None Reported	--	--	--	--	--
Chimney Rock Village					
None Reported	--	--	--	--	--
Ellenboro					
ELLENBORO	11-JAN-12	F2	0/10	$0	A tornado damage path began near the Ellenboro community, just northeast of the intersection of Pinehurst Rd and Bridge Rd. The track was relatively weak and intermittent for the first mile or so, as it crossed into a wooded area before emerging on Tiney Rd near the Corinth community. The aluminum siding and some roofing was peeled off a shed at this location. The intermittent path continued to the northeast, before becoming more concentrated in the area near Piney Mountain Rd and Piney Mountain Church Rd. The tornado reached its peak intensity as it moved roughly parallel to Piney Mountain Rd, crossing W E Padgett Rd toward Walls Church Rd. Several homes received minor to major damage in this area, while two mobile homes were completely destroyed. Ten people were injured, one seriously. Several outbuildings were also destroyed, while numerous trees and power lines were felled. The tornado began to weaken as it continued northeast, crossing Walls Church Rd and Dycus Rd before lifting just north of Salem Church Rd. The tornado was the first winter tornado in Rutherford County recorded history, and the first significant tornado (F2/EF2 and stronger) to affect the county since 1989.
Forest City					
FOREST CITY	07-JUL-05	F1	0/0	$63,339	This tornado moved into far southern Rutherford County from Spartanburg County in the Jonas Rd area. The metal roof was torn off a barn just across the state line. Otherwise, damage was mainly confined to snapped off an uprooted trees, some of which fell on homes. Near the end of the track, a mobile home was lifted and dropped 50-100 feet from its original position, resulting in

	Date	Magnitude	Deaths/ Injuries	Property Damage*	Details
					severe damage.
FOREST CITY	26-OCT-10	F0	0/0	$10,927	This tornado began just southwest of Crowe Dairy Rd, where the tops of several trees were blown out. The tornado intensified as it moved northeast, blowing the porch off a home and scattering debris as far as 50 yards. In addition, part of the roof was lifted off an attached garage and doors were blown in on a shed at this location.
Lake Lure					
None Reported	--	--	--	--	--
Ruth					
None Reported	--	--	--	--	--
Rutherfordton					
RUTHERFORDTON	24-MAY-00	F0	0/0	$0	A few thunderstorms crossed the mountains, then exploded and quickly became large supercells as they moved into the foothills late in the afternoon. The most damaging of the supercells developed in northern McDowell county and became severe along the Burke/McDowell county line near Lake James, dropping baseball size hail. This severe storm tracked southeast along the county border, producing golf ball to softball size hail all the way to the Rutherford county line. In addition to the very large hail, this supercell was able to generate a few weak (F0) tornadoes. The first tornado briefly touched down near Bridgewater and blew windows out of a house. It may also have been responsible for wind damage at a nearby mobile home park where 15 to 25 mobile homes sustained damage from both wind and hail. The second tornado developed in extreme eastern McDowell county and blew down trees across Interstate 40 before crossing into Burke county. Several motorists on Interstate 40 sighted the tornado and had their vehicles damaged by softball size hail. A resident in extreme southwest Burke county, near the Rutherford county line measured a 94 mph gust of wind as the parent supercell moved overhead. A damage survey team did not find any tornadic damage in the

	Date	Magnitude	Deaths/ Injuries	Property Damage*	Details
					vicinity but suspected this may have been the actual mesocyclone on the ground. There was extensive hail damage to homes, vehicles and plants from softball size hail that was seen "bounding" down the hillside. The third tornado developed near South Mountain State Park in northeast Rutherford county and blew down numerous trees in the vicinity of the park. This storm went on to produce nickel to baseball size hail in Cleveland county. Other supercell thunderstorms developed downstream in the western piedmont, producing damaging wind which blew down power lines in Newton and dime size hail north of Huntersville. One more supercell thunderstorm developed in the wake of the previous tornadic thunderstorm and followed a similar track. However, no tornadoes were sighted. This storm did produce wind damage in Shelby where a few trees were downed, briefly blocking roads. A slow-moving thunderstorm in Mitchell county produced excessive rainfall which resulted in 3 roads being washed out and 3 trees being washed down a hillside.
Spindale					
None Reported	--	--	--	--	--
Unincorporated Area					
RUTHERFORD COUNTY	27-MAY-73	F0	0/0	$0	
RUTHERFORD COUNTY	18-MAY-75	F2	0/0	$11,728	
RUTHERFORD COUNTY	18-MAY-75	F1	0/0	$117,282	
RUTHERFORD COUNTY	05-MAY-89	F4	0/0	$509,212	

*Property damage is reported in 2013 dollars; All damage may not have been reported.
Source: National Climatic Data Center

Probability of Future Occurrences

According to historical information, tornado events are not an annual occurrence for the county. Furthermore, the mountainous terrain of the county makes tornadoes a rare occurrence. While the majority of the reported tornado events are small in terms of size, intensity, and duration, they do pose a significant threat should Rutherford County experience a direct tornado strike. The probability of future tornado occurrences affecting Rutherford County is possible (1 to 10 percent annual probability).

C.2.8 Winter Storm and Freeze

Location and Spatial Extent

Nearly the entire continental United States is susceptible to winter storm and freeze events. Some ice and winter storms may be large enough to affect several states, while others might affect limited, localized areas. The degree of exposure typically depends on the normal expected severity of local winter weather. Rutherford County is accustomed to severe winter weather conditions and frequently receives severe winter weather during the winter months. Given the atmospheric nature of the hazard, the entire county has uniform exposure to a winter storm.

Historical Occurrences

Winter weather has resulted in three disaster declarations in Rutherford County. This includes the Blizzard of 1996, one subsequent 1996 winter storm, and a severe ice storm in 2002.[10] According to the National Climatic Data Center, there have been a total of 61 recorded winter storm events in Rutherford County since 1993 (**Table C.16**).[11] These events resulted in nearly $16 million (2013 dollars) in damages.[12] Detailed information on the recorded winter storm events can be found in **Table C.17**.

TABLE C.16: SUMMARY OF WINTER STORM EVENTS IN RUTHERFORD COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Rutherford County	61	0/0	$15,988,915

Source: National Climatic Data Center

TABLE C.17: HISTORICAL WINTER STORM IMPACTS IN RUTHERFORD COUNTY

	Date	Type of Storm	Deaths / Injuries	Property Damage*
Bostic				
None Reported	--	--	--	--
Chimney Rock Village				
None Reported	--	--	--	--
Ellenboro				
None Reported	--	--	--	--
Forest City				
None Reported	--	--	--	--
Lake Lure				
None Reported	--	--	--	--
Ruth				
None Reported	--	--	--	--

[10] Not all of the participating counties were declared disaster areas for these events. A complete listing of historical disaster declarations, including the affected counties, can be found in Section 4: *Hazard Profiles*.
[11] These ice and winter storm events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is certain that additional winter storm conditions have affected Rutherford County.
[12] The dollar amount of damages provided by NCDC is divided by the number of affected counties to reflect a damage estimate for the county.

	Date	Type of Storm	Deaths / Injuries	Property Damage*
Rutherfordton				
None Reported	--	--	--	--
Spindale				
None Reported	--	--	--	--
Unincorporated Area				
Statewide	12-MAR-93	WINTER STORM	2/10†	$874,516
Northern Interior and	10-FEB-94	ICE STORM	0/0	$0
RUTHERFORD COUNTY	11-JAN-96	WINTER STORM	0/0	$0
RUTHERFORD COUNTY	02-FEB-96	ICE STORM	0/0	$2,011,388
RUTHERFORD COUNTY	03-FEB-96	SNOW	0/0	$0
RUTHERFORD COUNTY	16-FEB-96	SNOW	0/0	$0
RUTHERFORD COUNTY	18-DEC-96	HEAVY SNOW	0/0	$0
RUTHERFORD COUNTY	08-JAN-97	Snow and sleet	0/0	$0
RUTHERFORD COUNTY	09-JAN-97	ICE STORM	0/0	$149,811
RUTHERFORD COUNTY	13-FEB-97	WINTER STORM	0/0	$0
RUTHERFORD COUNTY	08-DEC-97	WINTRY MIX	0/0	$0
RUTHERFORD COUNTY	29-DEC-97	SNOW	0/0	$0
RUTHERFORD COUNTY	27-JAN-98	HEAVY SNOW	0/0	$0
RUTHERFORD COUNTY	23-DEC-98	FREEZING RAIN/SLEET	0/0	$0
RUTHERFORD COUNTY	24-DEC-98	SNOW	0/0	$0
RUTHERFORD COUNTY	02-JAN-99	ICE STORM	0/0	$0
RUTHERFORD COUNTY	31-JAN-99	SNOW AND SLEET	0/0	$0
RUTHERFORD COUNTY	01-FEB-99	FREEZING RAIN	0/0	$0
RUTHERFORD COUNTY	19-FEB-99	SNOW	0/0	$0
RUTHERFORD COUNTY	09-MAR-99	SNOW AND SLEET	0/0	$0
RUTHERFORD COUNTY	26-MAR-99	SNOW	0/0	$0
RUTHERFORD COUNTY	24-DEC-99	SNOW	0/0	$0
RUTHERFORD COUNTY	22-JAN-00	HEAVY SNOW	0/0	$0
RUTHERFORD COUNTY	29-JAN-00	FREEZING RAIN	0/0	$0
RUTHERFORD COUNTY	19-NOV-00	SNOW	0/0	$0
RUTHERFORD COUNTY	03-DEC-00	SNOW	0/0	$0
RUTHERFORD COUNTY	13-DEC-00	FREEZING RAIN	0/0	$0
RUTHERFORD COUNTY	19-DEC-00	SNOW	0/0	$0
RUTHERFORD COUNTY	22-FEB-01	SNOW/SLEET	0/0	$0
RUTHERFORD COUNTY	20-MAR-01	HEAVY SNOW	0/0	$0
RUTHERFORD COUNTY	17-APR-01	SNOW SHOWERS	0/0	$0
RUTHERFORD COUNTY	03-JAN-02	HEAVY SNOW	0/0	$0
RUTHERFORD COUNTY	04-DEC-02	ICE STORM	0/0	$12,583,944
RUTHERFORD COUNTY	16-JAN-03	WINTER WEATHER/MIX	0/0	$0
RUTHERFORD COUNTY	23-JAN-03	HEAVY SNOW	0/0	$0
RUTHERFORD COUNTY	06-FEB-03	WINTER WEATHER/MIX	0/0	$0
RUTHERFORD COUNTY	16-FEB-03	SLEET STORM	0/0	$0
RUTHERFORD COUNTY	27-FEB-03	WINTER WEATHER/MIX	0/0	$0
RUTHERFORD COUNTY	30-MAR-03	WINTER WEATHER/MIX	0/0	$0
RUTHERFORD COUNTY	10-APR-03	WINTER WEATHER/MIX	0/0	$0
RUTHERFORD COUNTY	04-DEC-03	WINTER WEATHER/MIX	0/0	$0

	Date	Type of Storm	Deaths / Injuries	Property Damage*
RUTHERFORD COUNTY	25-JAN-04	HEAVY SNOW	0/0	$0
RUTHERFORD COUNTY	25-JAN-04	SLEET STORM	0/0	$0
RUTHERFORD COUNTY	27-JAN-04	WINTER WEATHER/MIX	0/0	$0
RUTHERFORD COUNTY	02-FEB-04	WINTER WEATHER/MIX	0/0	$0
RUTHERFORD COUNTY	26-FEB-04	HEAVY SNOW	0/0	$255,246
RUTHERFORD COUNTY	27-MAR-04	FROST/FREEZE	0/0	$0
RUTHERFORD COUNTY	22-JAN-05	WINTER WEATHER/MIX	0/0	$0
RUTHERFORD COUNTY	29-JAN-05	WINTER STORM	0/0	$0
RUTHERFORD COUNTY	27-FEB-05	WINTER WEATHER/MIX	0/0	$0
RUTHERFORD COUNTY	17-MAR-05	WINTER WEATHER/MIX	0/0	$0
RUTHERFORD COUNTY	08-DEC-05	WINTER WEATHER	0/0	$0
RUTHERFORD COUNTY	15-DEC-05	WINTER WEATHER	0/0	$0
RUTHERFORD COUNTY	15-DEC-05	ICE STORM	0/0	$114,009
RUTHERFORD COUNTY	16-DEC-05	FREEZING FOG	0/0	$0
RUTHERFORD COUNTY	20-MAR-06	WINTER WEATHER	0/0	$0
RUTHERFORD COUNTY	21-JAN-07	WINTER WEATHER	0/0	$0
RUTHERFORD COUNTY	01-FEB-07	WINTER STORM	0/0	$0
RUTHERFORD COUNTY	31-JAN-08	WINTER WEATHER	0/0	$0
RUTHERFORD COUNTY	01-FEB-08	ICE STORM	0/0	$0
RUTHERFORD COUNTY	10-JAN-11	HEAVY SNOW	0/0	$0

*Property damage is reported in 2013 dollars; All damage may not have been reported.
†Deaths/injuries were not reported at the county level; potentially outside of the county.
Source: National Climatic Data Center

There have been several severe winter weather events in Rutherford County. The text below describes one of the major events and associated impacts on the county. Similar impacts can be expected with severe winter weather.

1996 Winter Storm
This storm left two feet of snow and several thousand citizens without power for up to nine days. Although shelters were opened, some roads were impassible for up to four days. This event caused considerable disruption to business, industry, schools, and government services.

Winter storms throughout the planning area have several negative externalities including hypothermia, cost of snow and debris cleanup, business and government service interruption, traffic accidents, and power outages. Furthermore, citizens may resort to using inappropriate heating devices that could to fire or an accumulation of toxic fumes.

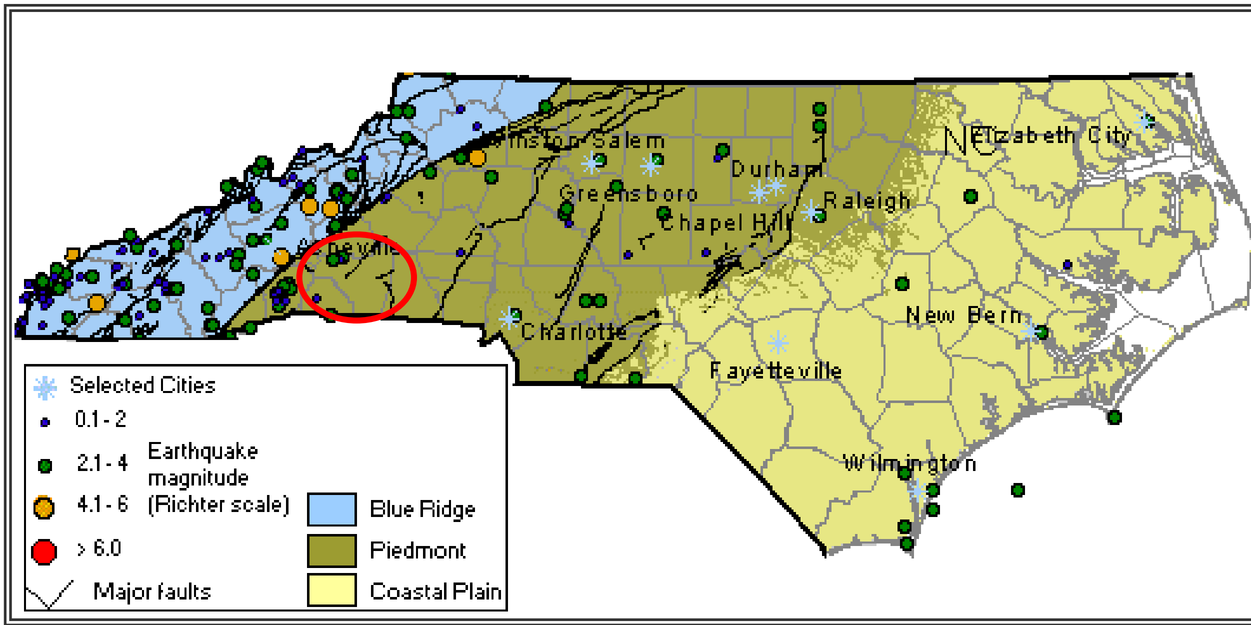
Probability of Future Occurrences
Winter storm events will remain a regular occurrence in Rutherford County due to its location in the western part of the state. According to historical information, Rutherford County generally experiences several winter storm events each year. Therefore, the annual probability is highly likely (100 percent).

C.2.9 Earthquake

Location and Spatial Extent

Approximately two-thirds of North Carolina is subject to earthquakes, with the western and southeast region most vulnerable to a very damaging earthquake. The state is affected by both the Charleston Fault in South Carolina and New Madrid Fault in Tennessee. Both of these faults have generated earthquakes measuring greater than 8 on the Richter Scale during the last 200 years. In addition, there are several smaller fault lines throughout North Carolina. **Figure C.2** is a map showing geological and seismic information for North Carolina.

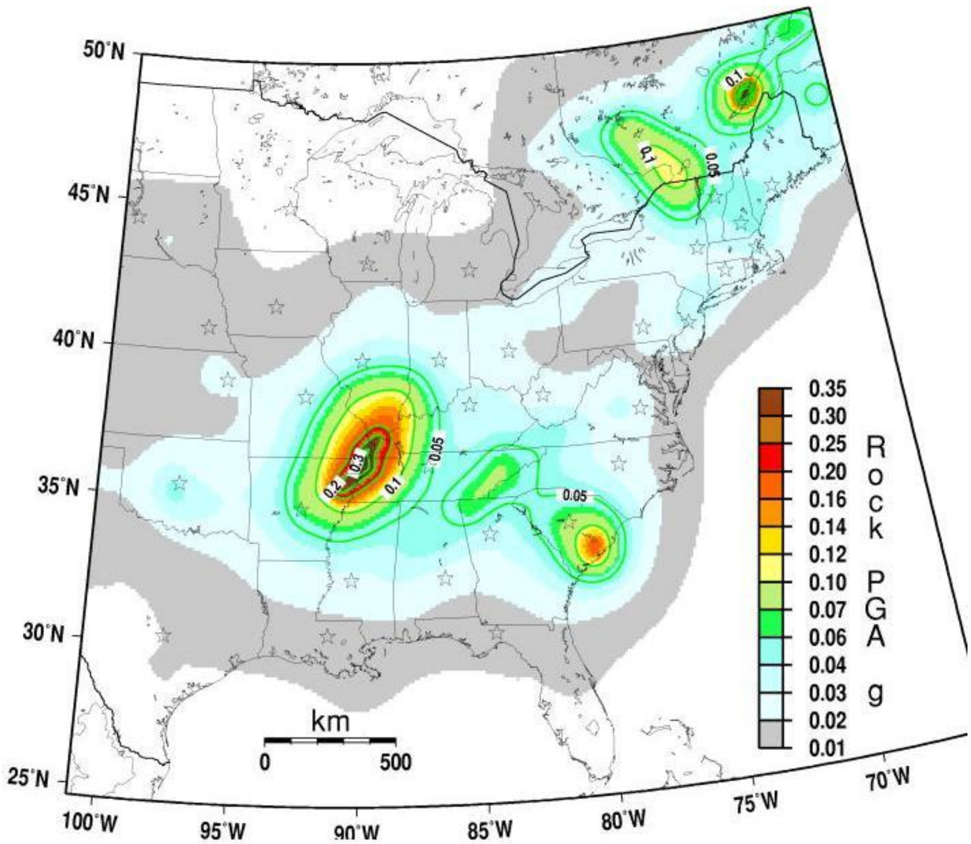
FIGURE C.2: GEOLOGICAL AND SEISMIC INFORMATION FOR NORTH CAROLINA



Source: North Carolina Geological Survey

Figure C.3 shows the intensity level associated with Rutherford County, based on the national USGS map of peak acceleration with 10 percent probability of exceedance in 50 years. It is the probability that ground motion will reach a certain level during an earthquake. The data show peak horizontal ground acceleration (the fastest measured change in speed, for a particle at ground level that is moving horizontally due to an earthquake) with a 10 percent probability of exceedance in 50 years. The map was compiled by the U.S. Geological Survey (USGS) Geologic Hazards Team, which conducts global investigations of earthquake, geomagnetic, and landslide hazards. According to this map, Rutherford County lies within an approximate zone of level “4” to “5” ground acceleration. This indicates that the county exists within an area of low to moderate seismic risk.

FIGURE C.3: PEAK ACCELERATION WITH 10 PERCENT PROBABILITY OF EXCEEDANCE IN 50 YEARS



Source: USGS, 2008

Historical Occurrences

At least 22 earthquakes are known to have affected Rutherford County since 1886. The strongest of these measured a V on the Modified Mercalli Intensity (MMI) scale. **Table C.18** provides a summary of earthquake events reported by the National Geophysical Data Center between 1638 and 1985. **Table C.19** presents a detailed occurrence of each event including the date, distance for the epicenter, magnitude, and Modified Mercalli Intensity (if known). [13]

TABLE C.18: SUMMARY OF SEISMIC ACTIVITY IN RUTHERFORD COUNTY

Location	Number of Occurrences	Greatest MMI Reported	Richter Scale Equivalent
Bostic	0	--	--
Chimney Rock Village	3	V	< 4.8
Ellenboro	1	IV	< 4.8
Forest City	2	IV	< 4.8
Lake Lure	2	IV	< 4.8
Ruth	0	--	--
Rutherfordton	4	V	< 4.8

[13] Due to reporting mechanisms, not all earthquakes events were recorded during this time. Furthermore, some are missing data, such as the epicenter location, due to a lack of widely used technology. In these instances, a value of "unknown" is reported.

Location	Number of Occurrences	Greatest MMI Reported	Richter Scale Equivalent
Spindale	3	IV	< 4.8
Unincorporated Area	7	V	< 4.8
RUTHERFORD COUNTY TOTAL	**22**	**V**	

Source: National Geophysical Data Center

TABLE C.19: SIGNIFICANT SEISMIC EVENTS IN RUTHERFORD COUNTY (1638 -1985)

Location	Date	Epicentral Distance	Magnitude	MMI
Bostic				
None Reported	--	--	--	--
Chimney Rock Village				
CHIMNEY ROCK	2/21/1916	23.0 km		V
CHIMNEY ROCK	11/30/1973	159.0 km	4.7	IV
CHIMNEY ROCK	3/25/1983	21.0 km	3.3	III
Ellenboro				
ELLENBORO	11/30/1973	205.0 km	4.7	IV
Forest City				
FOREST CITY	5/13/1957	48.0 km		4
FOREST CITY	4/9/1981	25.0 km	3.2	4
Lake Lure				
LAKE LURE	5/13/1957	40.0 km		4
LAKE LURE	11/30/1973	164.0 km	4.7	4
Ruth				
None Reported	--	--	--	--
Rutherfordton				
RUTHERFORDTON	9/1/1886	328.0 km		5
RUTHERFORDTON	11/3/1928	90.0 km		3
RUTHERFORDTON	11/20/1969	241.0 km	4.3	5
RUTHERFORDTON	11/30/1973	187.0 km	4.7	4
Spindale				
SPINDALE	5/13/1957			3
SPINDALE	2/3/1972	249.0 km	4.5	3
SPINDALE	4/9/1981	18.0 km	3.2	4
Unincorporated Area				
CAROLEEN	2/21/1916	68.0 km		4
RUTHERFORDTON (10 MI W OF)	11/20/1969	245.0 km	4.3	5
HIGH SHOALS	2/3/1972	223.0 km	4.5	4
UNION MILLS	11/30/1973	183.0 km	4.7	3
CLIFFSIDE	11/30/1973	207.0 km	4.7	
UNION MILLS	8/2/1974	186.0 km	4.9	3
UNION MILLS	4/9/1981	10.0 km	3.2	4

Source: National Geophysical Data Center

Probability of Future Occurrences

The probability of significant, damaging earthquake events affecting Rutherford County is unlikely. However, it is likely that future earthquakes resulting in light to moderate perceived shaking and damages ranging from none to very light will affect the county. The annual probability level for the county is estimated between 1 and 10 percent (possible).

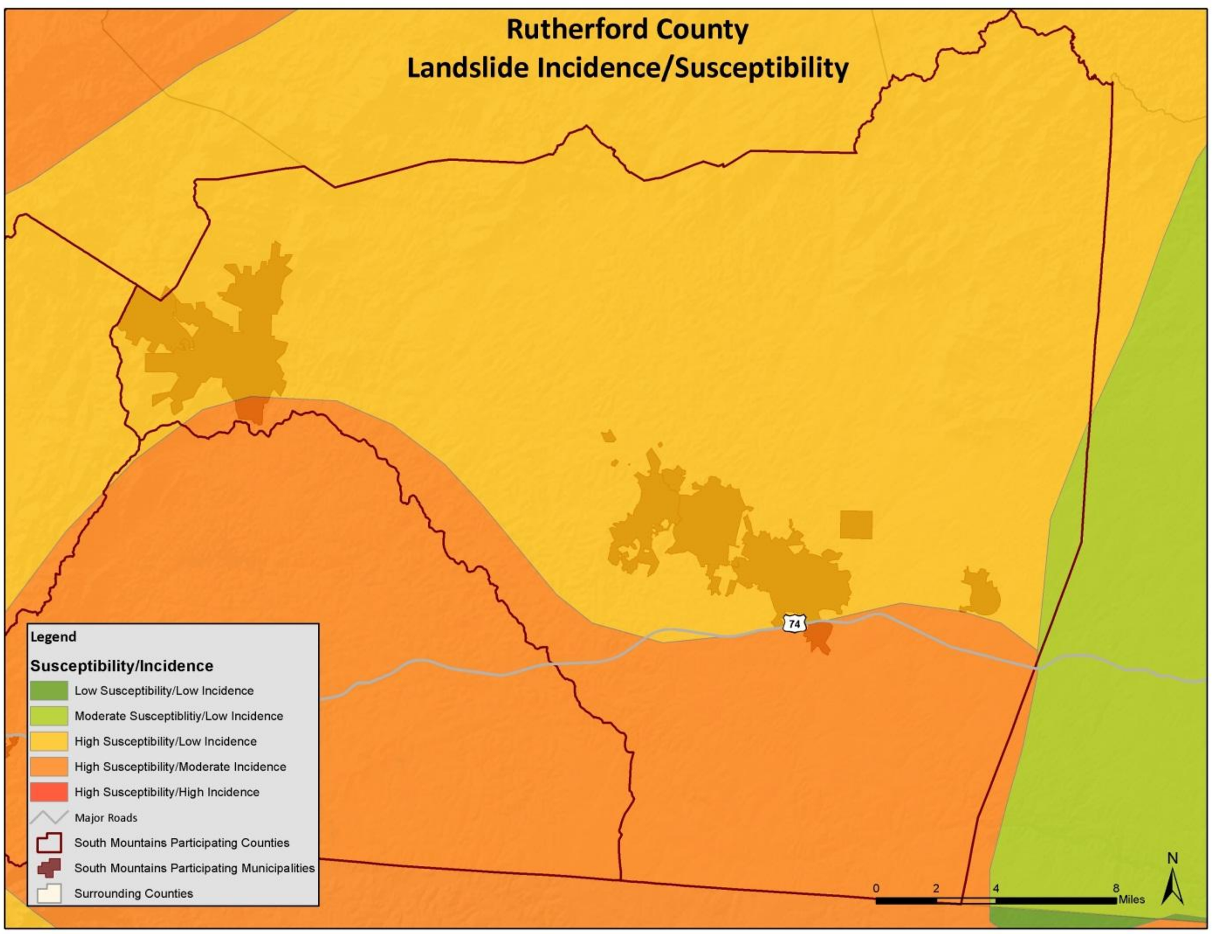
C.2.10 Landslide

Location and Spatial Extent

Landslides occur along steep slopes when the pull of gravity can no longer be resisted (often due to heavy rain). Human development can also exacerbate risk by building on previously undevelopable steep slopes and constructing roads by cutting through mountains. Landslides are possible throughout Rutherford County.

According to **Figure C.4** below, the majority of the county has low landslide activity. The remaining portion of the county, along the southern border, has a moderate incidence occurrence rate. There is high susceptibility throughout the county.

FIGURE C.4: LANDSLIDE SUSCEPTIBILITY AND INCIDENCE MAP OF RUTHERFORD COUNTY



Source: USGS

Historical Occurrences

Steep topography throughout Rutherford County makes the planning area susceptible to landslides. Most landslides are caused by heavy rainfall in the area. Building on steep slopes that was not previously possible also contributes to risk. **Table C.20** presents a summary of the landslide occurrence events as provided by the North Carolina Geological Survey[14]. The georeferenced locations of the landslide events presented in the aforementioned tables are presented in **Figure C.5**. Some incidence mapping has also been completed throughout the western portion of North Carolina though it is not complete. Therefore, it should be noted that many more incidents than what is reported are likely to have occurred in Rutherford County.

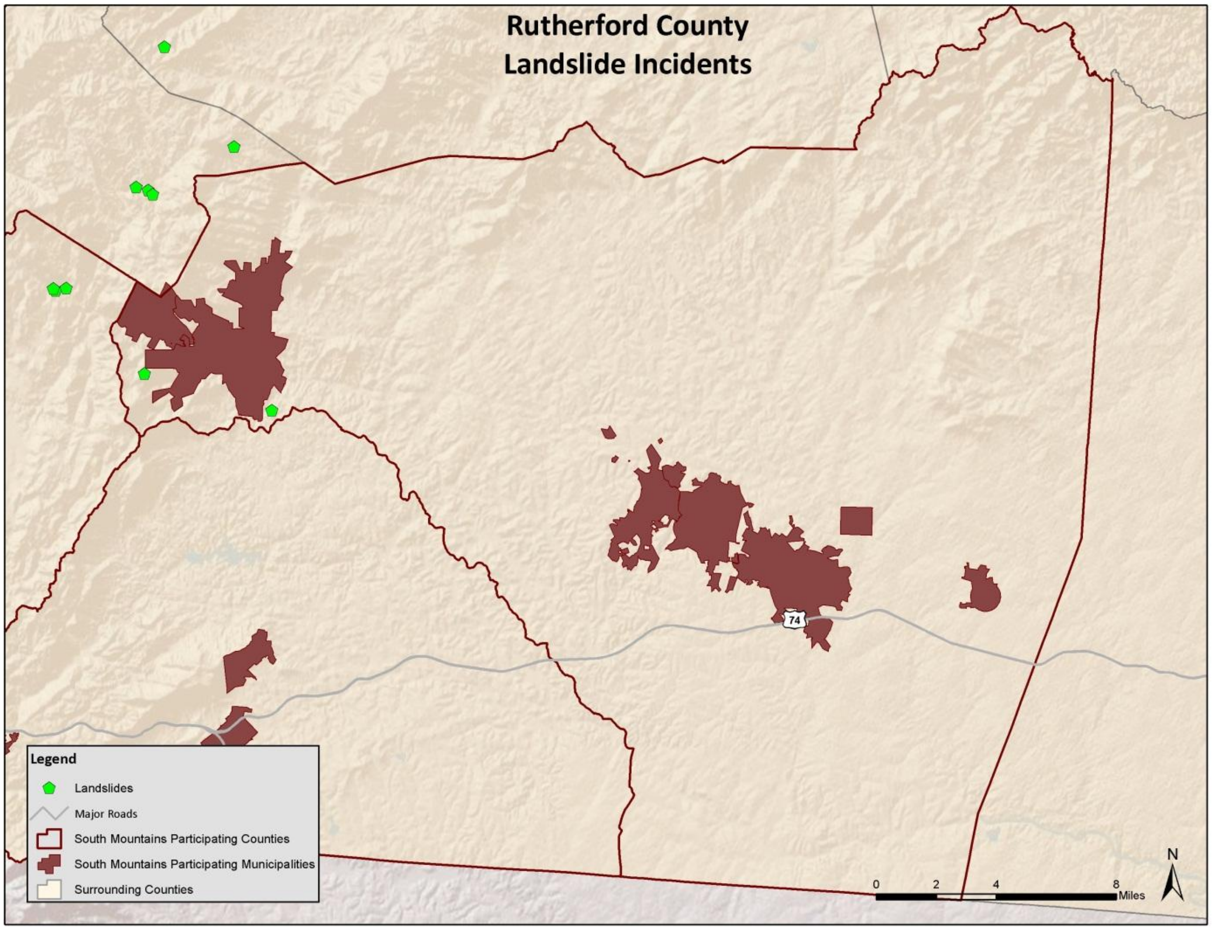
TABLE C.20: SUMMARY OF LANDSLIDE ACTIVITY IN RUTHERFORD COUNTY

Location	Number of Occurrences
Bostic	0
Chimney Rock Village	0
Ellenboro	0
Forest City	0
Lake Lure	0
Ruth	0
Rutherfordton	0
Spindale	0
Unincorporated Area	2
RUTHERFORD COUNTY TOTAL	**2**

Source: North Carolina Geological Survey

[14] It should be noted that the North Carolina Geological Survey (NCGS) emphasized the dataset provided was incomplete. Therefore, there may be additional historical landslide occurrences. Furthermore, dates were not included for every event. The earliest date reported was 1940. No damage information was provided by NCGS.

FIGURE C.5: LOCATION OF PREVIOUS LANDSLIDE OCCURRENCES IN RUTHERFORD COUNTY



Source: North Carolina Geological Survey

The information below identifies additional historical information reported in the previous county hazard mitigation plan.

Rutherford County

In Rutherford County there have been very few incidents of landslides. Most have occurred along road cuts and have been caused during periods of severe storms.

Probability of Future Occurrences

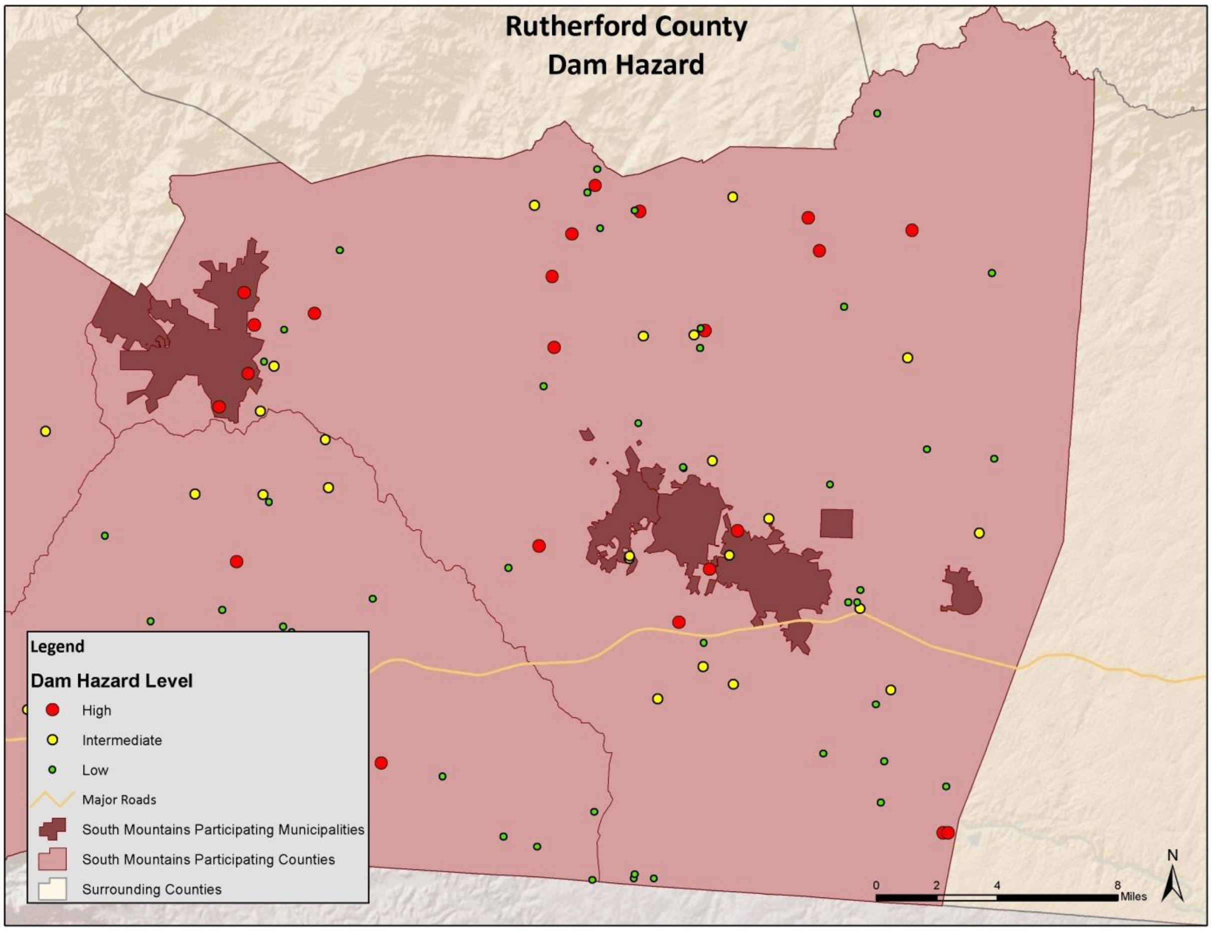
Based on historical information and the USGS susceptibility index, the probability of future landslide events is possible (1 to 10 percent probability). Local conditions may become more favorable for landslides due to heavy rain, for example. This would increase the likelihood of occurrence. It should also be noted that some areas in Rutherford County have greater risk than others given factors such as steepness on slope and modification of slopes.

C.2.11 Dam and Levee Failure

Location and Spatial Extent

According to the North Carolina Division of Land Management there are 71 dams in Rutherford County.[15] **Figure C.6** shows the dam location and the corresponding hazard ranking for each. Of these dams, 20 are classified as high hazard potential. These high hazard dams are listed in **Table C.21**.

FIGURE C.6: RUTHERFORD COUNTY DAM LOCATION AND HAZARD RANKING



Source: North Carolina Division of Land Resources, 2012

TABLE C.21: RUTHERFORD COUNTY HIGH HAZARD DAMS

Dam Name	Hazard Potential	Surface Area (acres)	Max Capacity (Ac-ft)	Owner Type
Rutherford County				
2nd Broad River Watershed Dam #22	High	10.0	710	Local Gov
Second Broad River Watershed #16	High	6.0	854	Local Gov

15 The February 8, 2012 list of high hazard dams obtained from the North Carolina Division of Energy, Mineral, and Land Resources (http://portal.ncdenr.org/web/lr/dams) was reviewed and amended by local officials to the best of their knowledge.

Dam Name	Hazard Potential	Surface Area (acres)	Max Capacity (Ac-ft)	Owner Type
Second Broad Watershed #14	High	13.0	480	Local Gov
Sunnyside Lake Dam	High	8.0	97	Private
Camp Occoneechee Dam	High	12.0	138	Private
Murray Hilton Lake Dam	High	10.0	274	Private
Brooks Lake Dam	High	16.0	200	Private
Bald Mountain Lake Dam	High	49.8	288	Private
John W. Bennett Dam	High	2.0	25	Private
Second Broad River W.S. Structure #23	High	12.0	770	Private
Second Broad W.S. Structure #13	High	21.5	1,269	Private
Shumont Estates Dam	High	11.5	200	Private
Boy Scouts Dairy Barn Dam	High	2.0	32	Private
Second Broad W.S.Structure #2	High	41.0	3,360	Private
Laurel Lake Dam	High	6.9	145	Private
Willow Lake Estates	High	6.2	72	Private
Isothermal College Dam	High	15.0	104	State
Lake Lure Dam	High	740.0	44,914	Utility
Cliffside Inactive Ash Basin #5 Main Dam	High	45.7	0	
Cliffside Inactive Ash Basin #5 Saddle Dam	High	45.7	0	

Source: North Carolina Division of Land Resources, 2012

It should also be noted that the North Carolina dam classification regulations were recently updated. As a result of the change, more dams are generally classified as high hazard.

Historical Occurrences

There is no record of significant dam failure in the county. However, it should be noted that several breach scenarios in the county could be catastrophic.

The information below identifies additional historical information reported in the previous county hazard mitigation plan.

Rutherford County

Most of the dams in Rutherford County are earthen type and do not hold enough water to cause major problems if the dam were to be breached or collapse. However, the dam at Lake Lure is a major issue, and the effects of its failure could be sizeable. Conditions affecting Lake Lure Dam could result in a hazard to life and/or property downstream of the dam due to a sudden release of large volumes of water.

Probability of Future Occurrences

Given the current dam inventory and historic data, a dam breach is unlikely (less than 1 percent annual probability) in the future. However, as has been demonstrated in the past, regular monitoring is necessary to prevent these events.

C.2.12 Erosion

Location and Spatial Extent

Erosion in Rutherford County is typically caused by flash flooding events. Unlike coastal areas, where the soil is mainly composed of fine grained particles such as sand, Rutherford County soils have much greater organic matter content. Furthermore, vegetation also helps to prevent erosion in the area. Erosion occurs in the county, particularly along the banks of rivers and streams, but it is not an extreme threat. No areas of concern were reported by the planning committee.

Historical Occurrences

Several sources were vetted to identify areas of erosion in Rutherford County. This includes searching local newspapers, interviewing local officials, and reviewing the previous hazard mitigation plan. Erosion was addressed in the previous Rutherford County hazard mitigation plan; however, it was found to be a relatively low-risk hazard. The information below identifies historical information presented in the plan.

Rutherford County

Erosion was deemed an insignificant hazard.

Probability of Future Occurrences

Erosion remains a natural, dynamic, and continuous process for Rutherford County, and it will continue to occur. The annual probability level assigned for erosion is likely (between 10 and 100 percent).

C.2.13 Flood

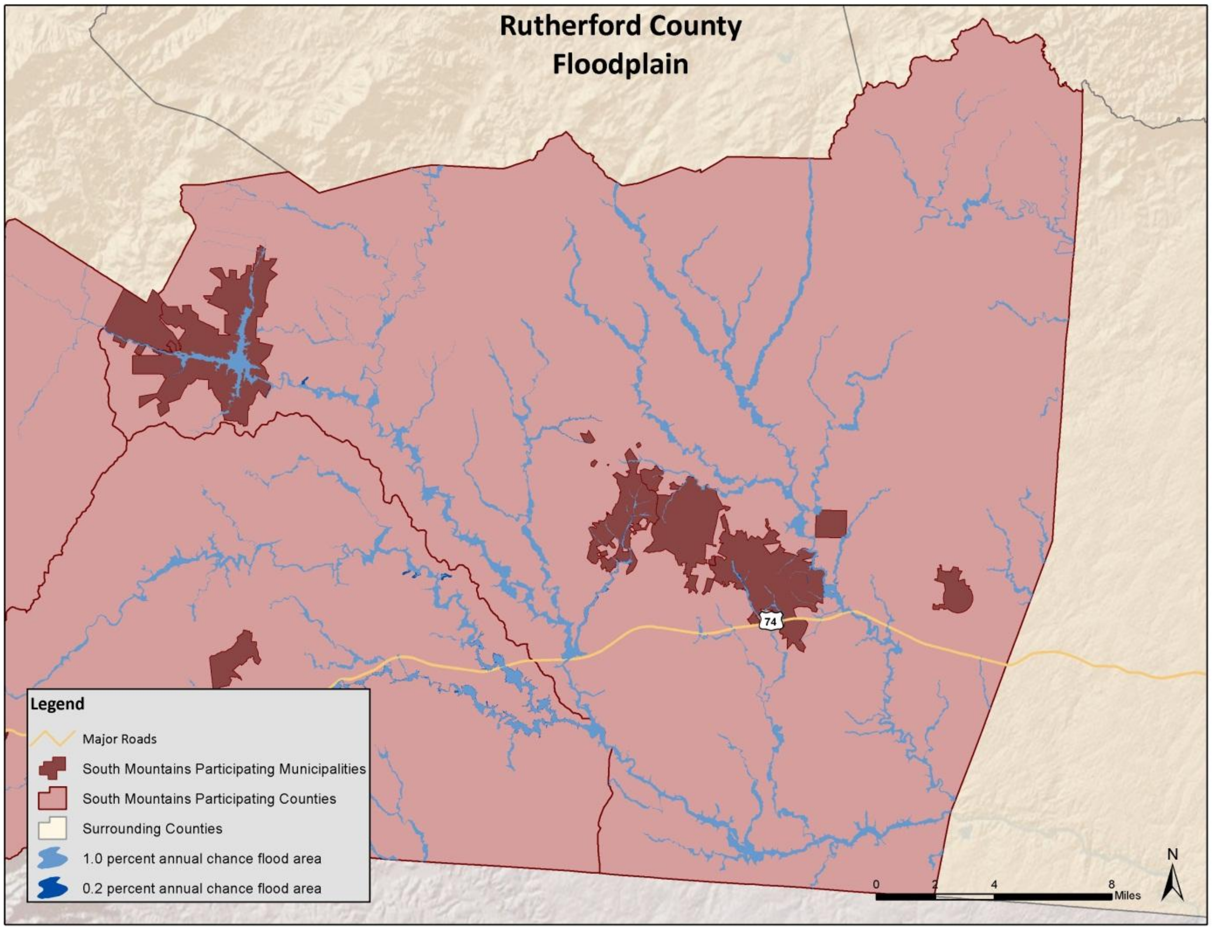
Location and Spatial Extent

There are areas in Rutherford County that are susceptible to flood events. Special flood hazard areas in the county were mapped using Geographic Information System (GIS) and FEMA Digital Flood Insurance Rate Maps (DFIRM).[16] This includes Zone A (1-percent annual chance floodplain), Zone AE (1-percent annual chance floodplain with elevation), Zone X500 (0.2-percent annual chance floodplain). According to GIS analysis, of the 564 square miles that make up Rutherford County, there are 28.84 square miles of land in zones A and AE (1-percent annual chance floodplain/100-year floodplain) and 0.25 square miles of land in zone X500 (0.2-percent annual chance floodplain/500-year floodplain).

These flood zone values account for 5.2 percent of the total land area in Rutherford County. It is important to note that while FEMA digital flood data is recognized as best available data for planning purposes, it does not always reflect the most accurate and up-to-date flood risk. Flooding and flood-related losses often do occur outside of delineated special flood hazard areas. **Figure C.7**, **Figure C.8**, **Figure C.9**, **Figure C.10**, **Figure C.11**, **Figure C.12**, **Figure C.13**, **Figure C.14**, and **Figure C.15** illustrate the location and extent of currently mapped special flood hazard areas for Rutherford County and its municipalities based on best available FEMA Digital Flood Insurance Rate Map (DFIRM) data.

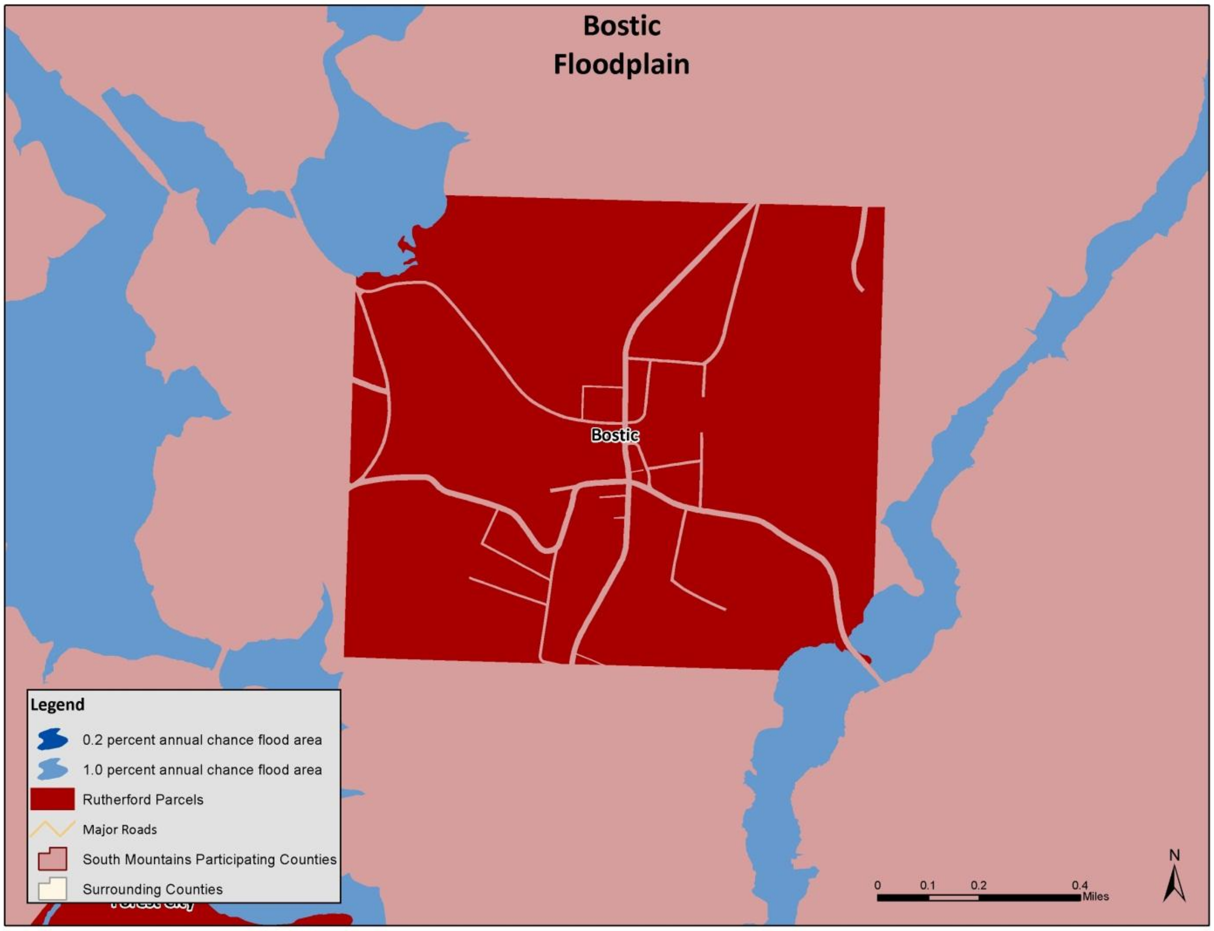
[16] The county-level DFIRM data used for Rutherford County were updated in 2010.

FIGURE C.7: SPECIAL FLOOD HAZARD AREAS IN RUTHERFORD COUNTY



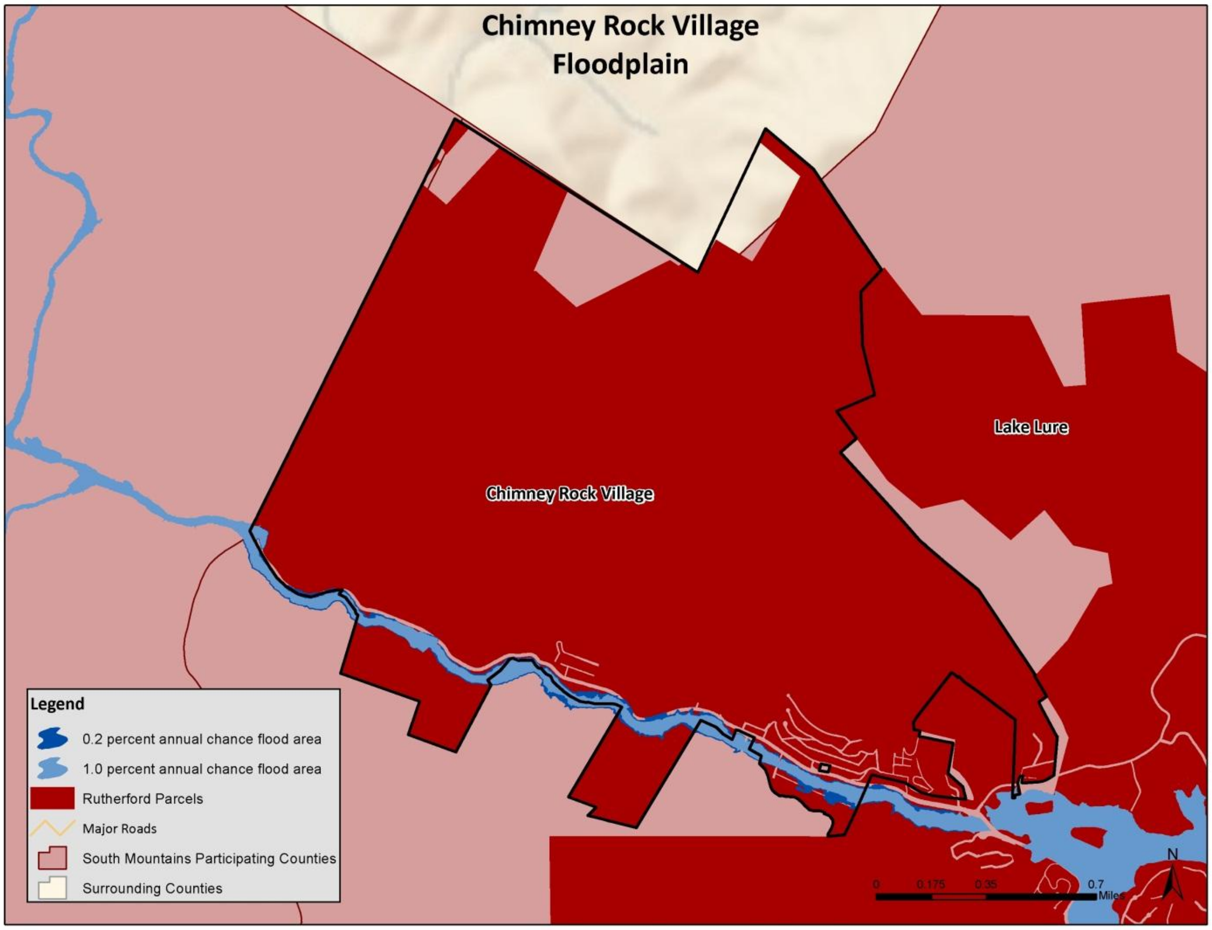
Source: Federal Emergency Management Agency

FIGURE C.8: SPECIAL FLOOD HAZARD AREAS IN BOSTIC



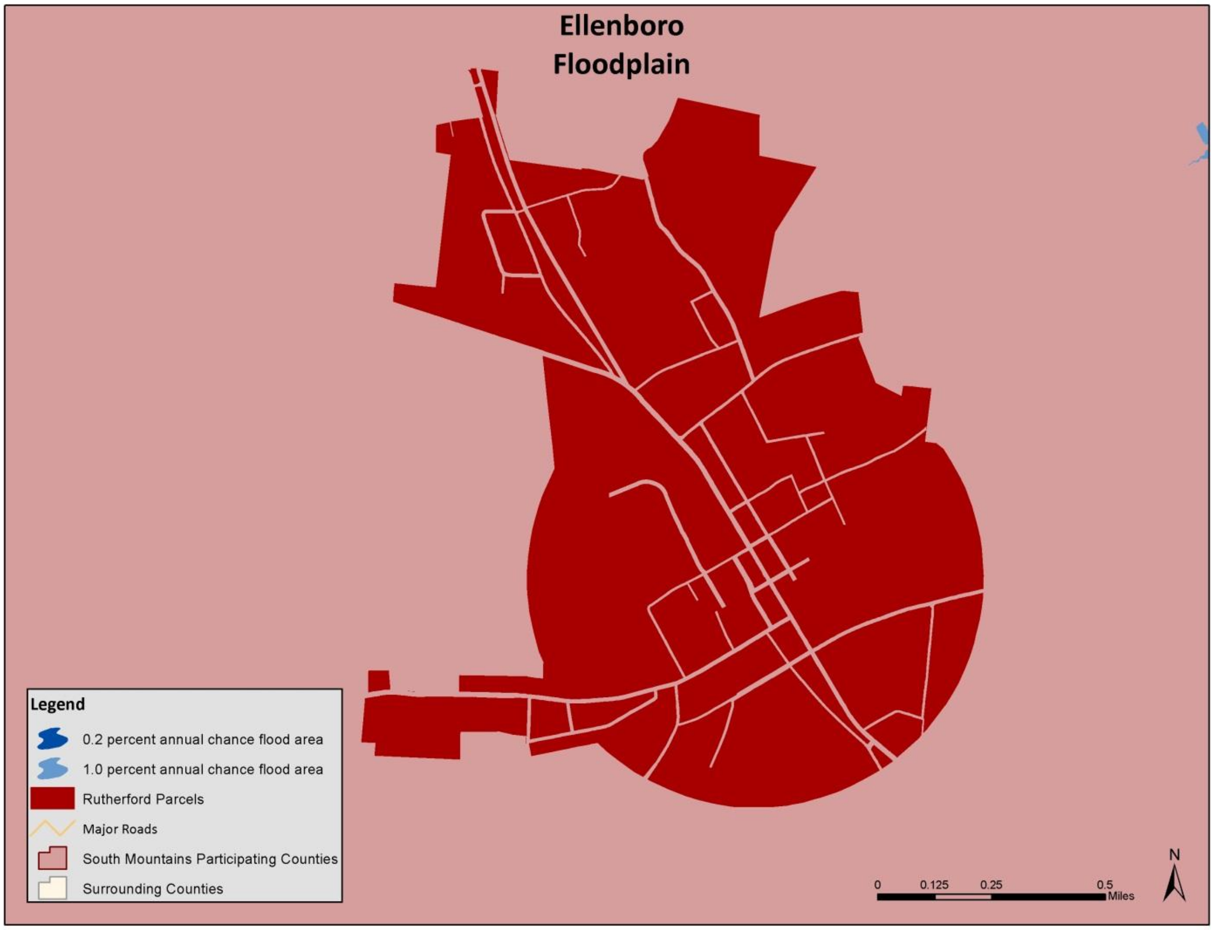
Source: Federal Emergency Management Agency

FIGURE C.9: SPECIAL FLOOD HAZARD AREAS IN CHIMNEY ROCK VILLAGE



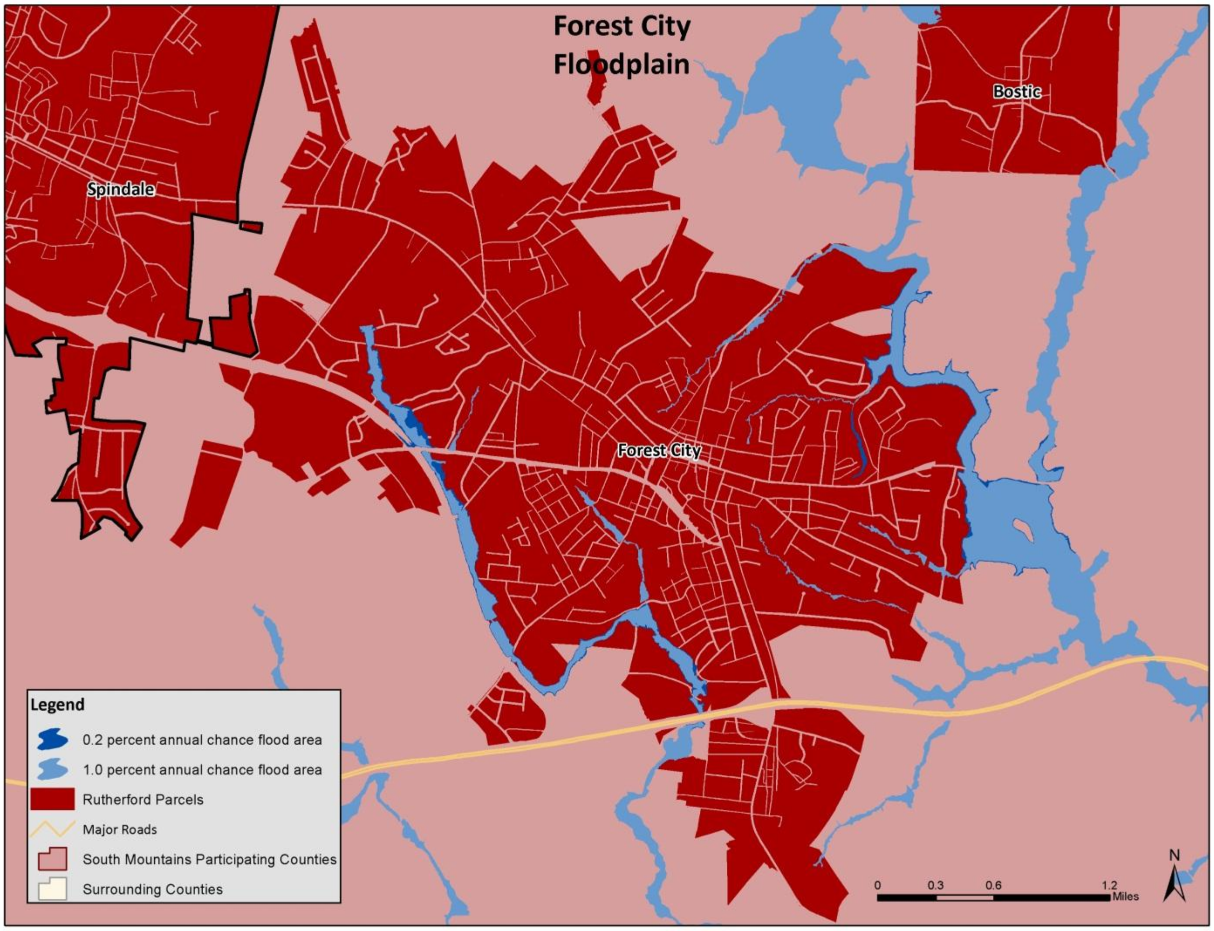
Source: Federal Emergency Management Agency

FIGURE C.10: SPECIAL FLOOD HAZARD AREAS IN ELLENBORO



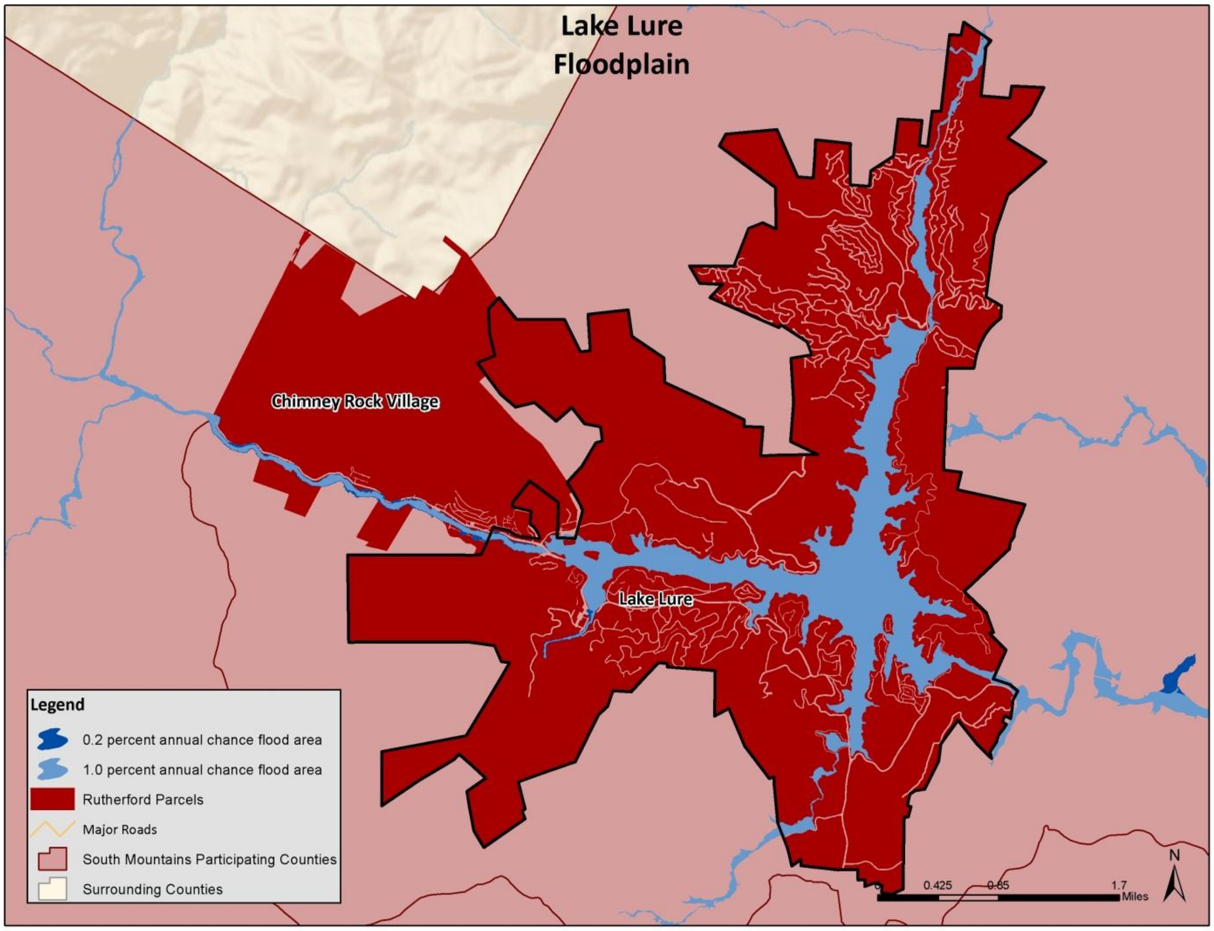
Source: Federal Emergency Management Agency

FIGURE C.11: SPECIAL FLOOD HAZARD AREAS IN FOREST CITY



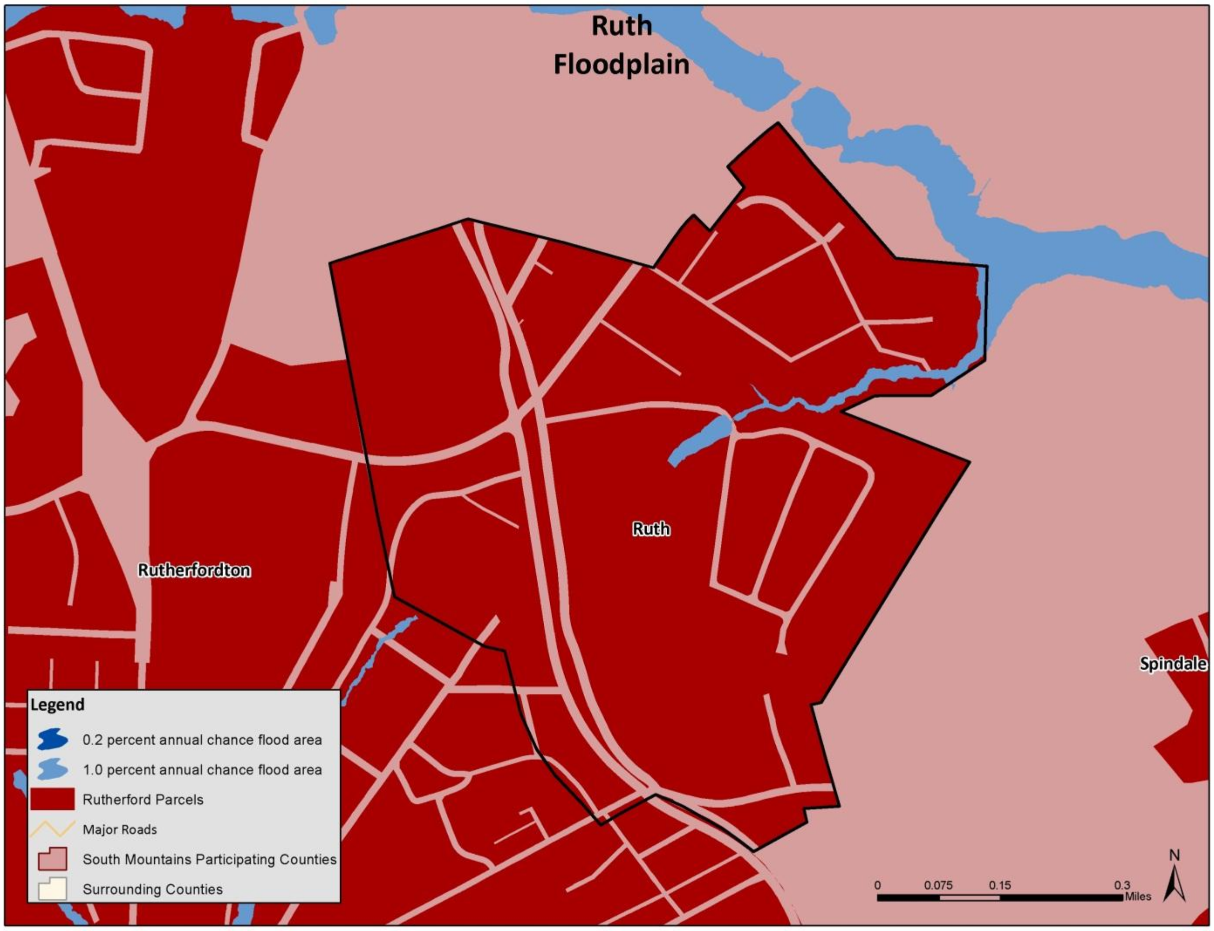
Source: Federal Emergency Management Agency

FIGURE C.12: SPECIAL FLOOD HAZARD AREAS IN LAKE LURE



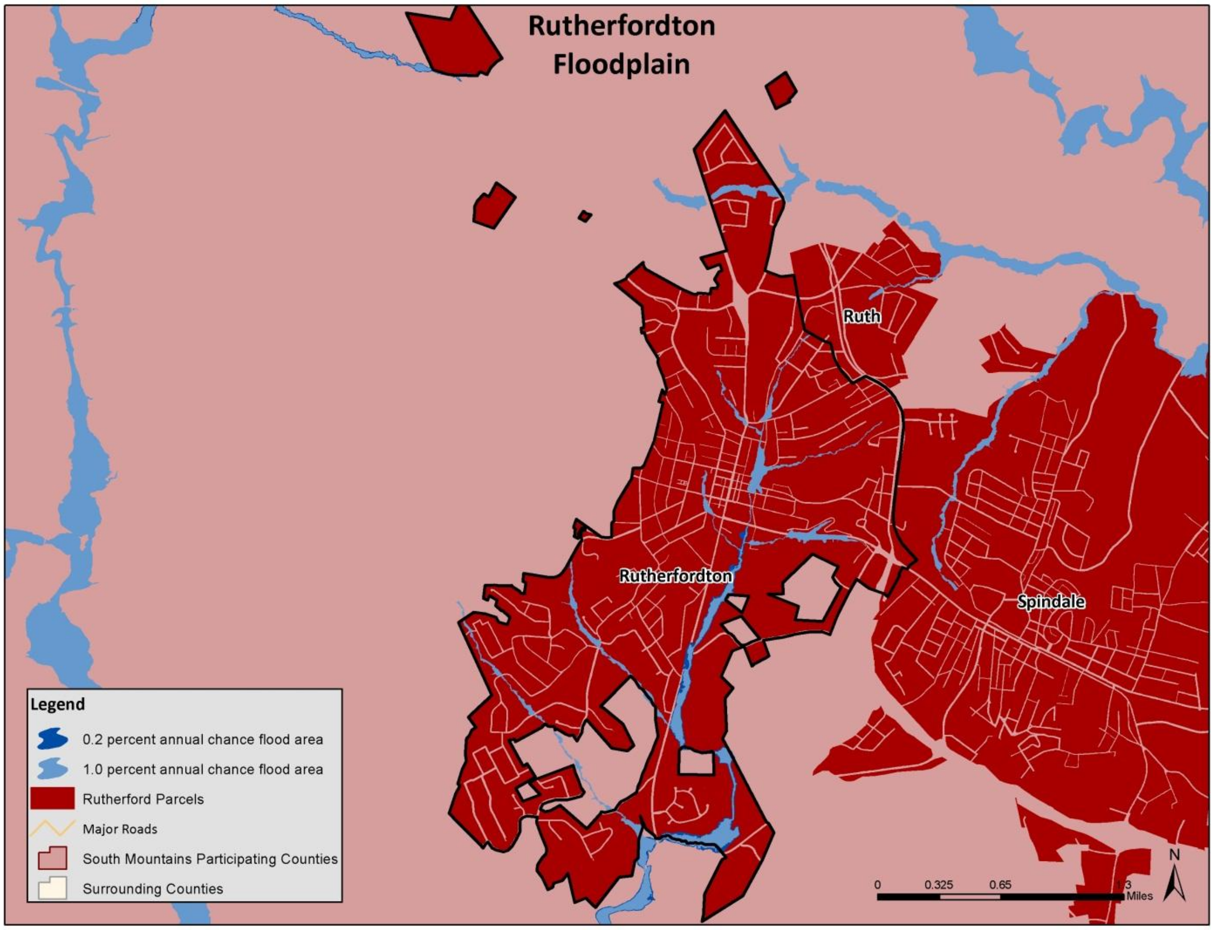
Source: Federal Emergency Management Agency

FIGURE C.13: SPECIAL FLOOD HAZARD AREAS IN RUTH



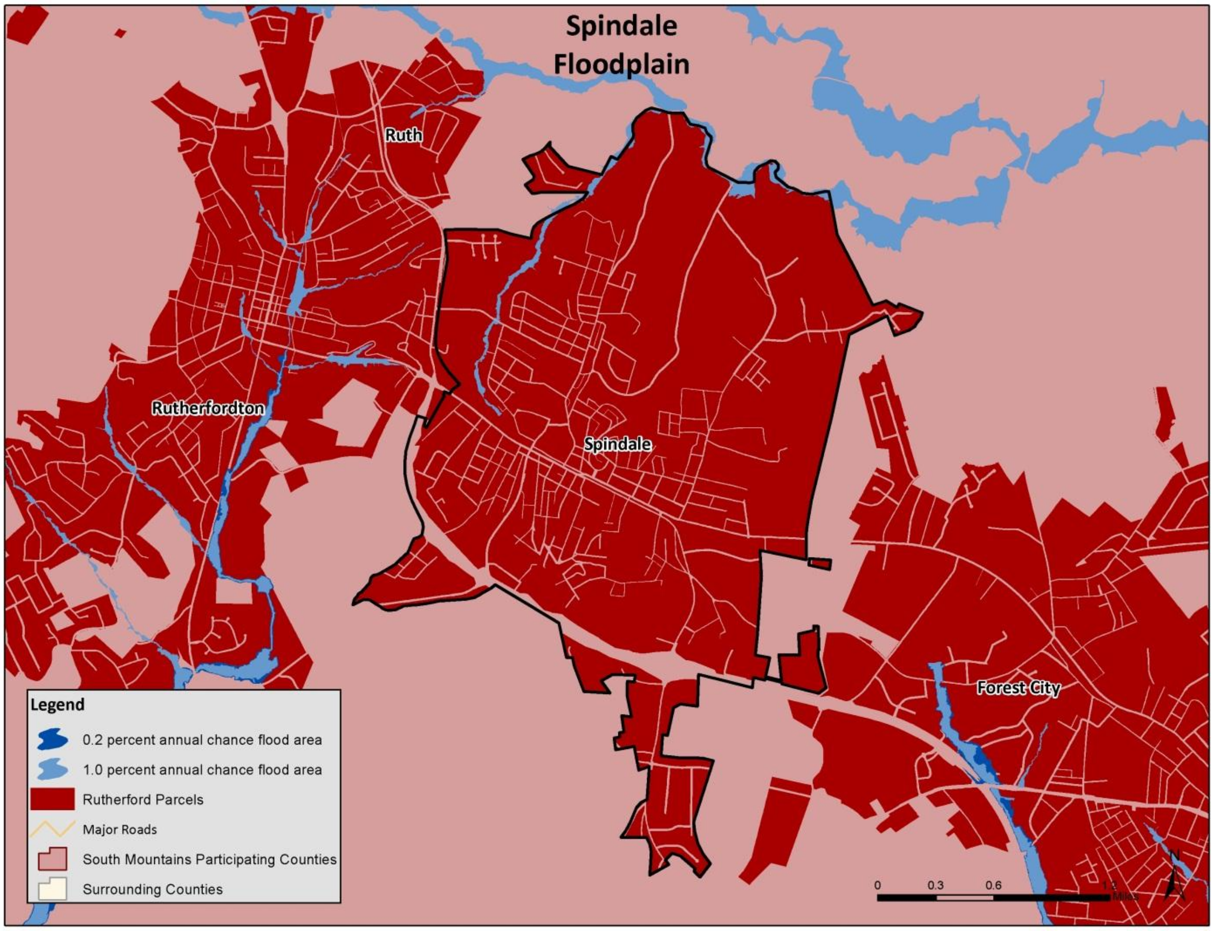
Source: Federal Emergency Management Agency

FIGURE C.14: SPECIAL FLOOD HAZARD AREAS IN RUTHERFORDTON



Source: Federal Emergency Management Agency

FIGURE C.15: SPECIAL FLOOD HAZARD AREAS IN SPINDALE



Source: Federal Emergency Management Agency

Historical Occurrences

Flooding has resulted in one disaster declaration in Rutherford County in 1977.[17] Information from the National Climatic Data Center was used to ascertain additional historical flood events. The National Climatic Data Center reported a total of 25 events in Rutherford County since 1993.[18] A summary of these events is presented in **Table C.22**. These events accounted for over $10.5 million (2013 dollars) in property damage in the county.[19] In addition two injuries were reported. Specific information on flood events, including date, type of flooding, and deaths and injuries, can be found in **Table C.23**.

TABLE C.22: SUMMARY OF FLOOD OCCURRENCES IN RUTHERFORD COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Bostic	0	0/0	$0

[17] A complete listing of historical disaster declarations can be found in Section 4: *Hazard Profiles*.
[18] These events are only inclusive of those reported by NCDC. It is likely that additional occurrences have occurred and have gone unreported.
[19] The total damage amount was averaged over the number of affected counties when multiple counties were involved in the flood event.

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Chimney Rock Village	1	0/0	$4,827,330
Ellenboro	0	0/0	$0
Forest City	5	0/2	$142,576
Lake Lure	3	0/0	$3,710,170
Ruth	0	0/0	$0
Rutherfordton	2	0/0	$0
Spindale	0	0/0	$0
Unincorporated Area	14	0/0	$1,847,577
RUTHERFORD COUNTY TOTAL	**25**	**0/2**	**$10,527,653**

Source: National Climatic Data Center

TABLE C.23: HISTORICAL FLOOD EVENTS IN RUTHERFORD COUNTY

	Date	Type	Deaths / Injuries	Property Damage*
Bostic				
None Reported	--	--	--	--
Chimney Rock Village				
CHIMNEY ROCK	04-SEP-96	FLASH FLOOD	0/0	$4,827,330
Ellenboro				
None Reported	--	--	--	--
Forest City				
FOREST CITY	31-JUL-00	FLASH FLOOD	0/0	$0
FOREST CITY	03-JUL-01	FLASH FLOOD	0/2	$142,576
FOREST CITY	24-DEC-02	FLASH FLOOD	0/0	$0
FOREST CITY	04-AUG-03	FLASH FLOOD	0/0	$0
FOREST CITY	11-AUG-03	FLASH FLOOD	0/0	$0
Lake Lure				
LAKE LURE	04-SEP-96	FLASH FLOOD	0/0	$3,218,220
LAKE LURE	27-SEP-04	FLASH FLOOD	0/0	$0
LAKE LURE	26-JUN-06	FLASH FLOOD	0/0	$491,950
Ruth				
None Reported	--	--	--	--
Rutherfordton				
RUTHERFORDTON	04-JUL-01	URBAN/SML STREAM FLD	0/0	$0
RUTHERFORDTON	24-JUL-01	FLASH FLOOD	0/0	$0
Spindale				
None Reported	--	--	--	--
Unincorporated Area				
RUTHERFORD COUNTY	23-MAR-93	FLASH FLOODS	0/0	$0
RUTHERFORD COUNTY	27-JUL-94	FLASH FLOOD	0/0	$0
RUTHERFORD COUNTY	26-JAN-96	FLOOD	0/0	$3,218
WEST PORTION	07-JAN-98	FLOOD	0/0	$30,978
COUNTYWIDE	20-MAR-03	FLASH FLOOD	0/0	$0

	Date	Type	Deaths / Injuries	Property Damage*
RUTHERFORD COUNTY	18-APR-03	FLOOD	0/0	$0
NORTH PORTION	12-JUL-03	FLASH FLOOD	0/0	$0
RUTHERFORD COUNTY	13-JUL-03	FLOOD	0/0	$0
RUTHERFORD COUNTY	07-SEP-04	FLOOD	0/0	$1,239,535
RUTHERFORD COUNTY	17-SEP-04	FLOOD	0/0	$130,477
SOUTH CENTRAL PORTION	07-JUL-05	FLASH FLOOD	0/0	$190,016
RUTHERFORD COUNTY	07-JUL-05	FLOOD	0/0	$0
RUTHERFORD COUNTY	07-OCT-05	FLOOD	0/0	$253,354
HOLLIS	17-AUG-09	FLASH FLOOD	0/0	$0

*Property damage is reported in 2013 dollars; All damage may not have been reported.
Source: National Climatic Data Center

Historical Summary of Insured Flood Losses

According to FEMA flood insurance policy records as of June 2013, there have been 30 flood losses reported in Rutherford County through the National Flood Insurance Program (NFIP) since 1978, totaling over $626,000 in claims payments. A summary of these figures for the county is provided in **Table C.24**. It should be emphasized that these numbers include only those losses to structures that were insured through the NFIP policies, and for losses in which claims were sought and received. It is likely that many additional instances of flood loss in Rutherford County were either uninsured, denied claims payment, or not reported.

TABLE C.24: SUMMARY OF INSURED FLOOD LOSSES IN RUTHERFORD COUNTY

Location	Flood Losses	Claims Payments
Bostic	0	$0
Chimney Rock Village	0	$0
Ellenboro*	--	--
Forest City	0	$0
Lake Lure	0	$0
Ruth*	--	--
Rutherfordton	0	$0
Spindale	0	$0
Unincorporated Area	30	$626,560
RUTHERFORD COUNTY TOTAL	**30**	**$626,560**

*This community does not participate in the National Flood Insurance Program. Therefore, no values are reported.
Source: FEMA, NFIP

Repetitive Loss Properties

FEMA defines a repetitive loss property as any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling 10-year period, since 1978. A repetitive loss property may or may not be currently insured by the NFIP. Currently there are over 140,000 repetitive loss properties nationwide.

As of October 2013, there are 6 non-mitigated repetitive loss properties located in Rutherford County, which accounted for 15 losses and more than $300,000 in claims payments under the NFIP. The average claim amount for these properties is $20,000. The properties are a mix of single family residential, multi-family residential, and commercial. Without mitigation this property will likely continue to experience flood losses. **Table C.25** presents detailed information on repetitive loss properties and NFIP claims and policies for Rutherford County.

TABLE C.25: REPETITIVE LOSS PROPERTIES IN RUTHERFORD COUNTY

Location	Number of Properties	Types of Properties	Number of Losses	Building Payments	Content Payments	Total Payments	Average Payment
Bostic	0	--	0	$0	$0	$0	$0
Chimney Rock Village	0	--	0	$0	$0	$0	$0
Ellenboro*	--	--	--	--	--	--	--
Forest City	0	--	0	$0	$0	$0	$0
Lake Lure	0	--	0	$0	$0	$0	$0
Ruth*	--	--	-	--	--	--	--
Rutherfordton	0	--	0	$0	$0	$0	$0
Spindale	0	--	0	$0	$0	$0	$0
Unincorporated Area	6	4 single family, 1 multi family, 1 commercial	15	$277,172.95	$22,835.72	$300,007.67	$20,000.51
RUTHERFORD COUNTY TOTAL	**6**	**--**	**15**	**$277,172.95**	**$22,835.72**	**$300,007.67**	**$20,000.51**

* These communities do not participate in the National Flood Insurance Program. Therefore, no values are reported.
Source: National Flood Insurance Program

Probability of Future Occurrences

Flood events will remain a threat in areas prone to flooding in Rutherford County, and the probability of future occurrences will remain likely (between 10 and 100 percent annual probability). The participating jurisdictions and unincorporated areas of the county have risk to flooding, though not all areas will experience floods. The probability of future flood events based on magnitude and according to best available data is illustrated in the figures above**,** which indicates those areas susceptible to the 1-percent annual chance flood (100-year floodplain) and the 0.2-percent annual chance flood (500-year floodplain).

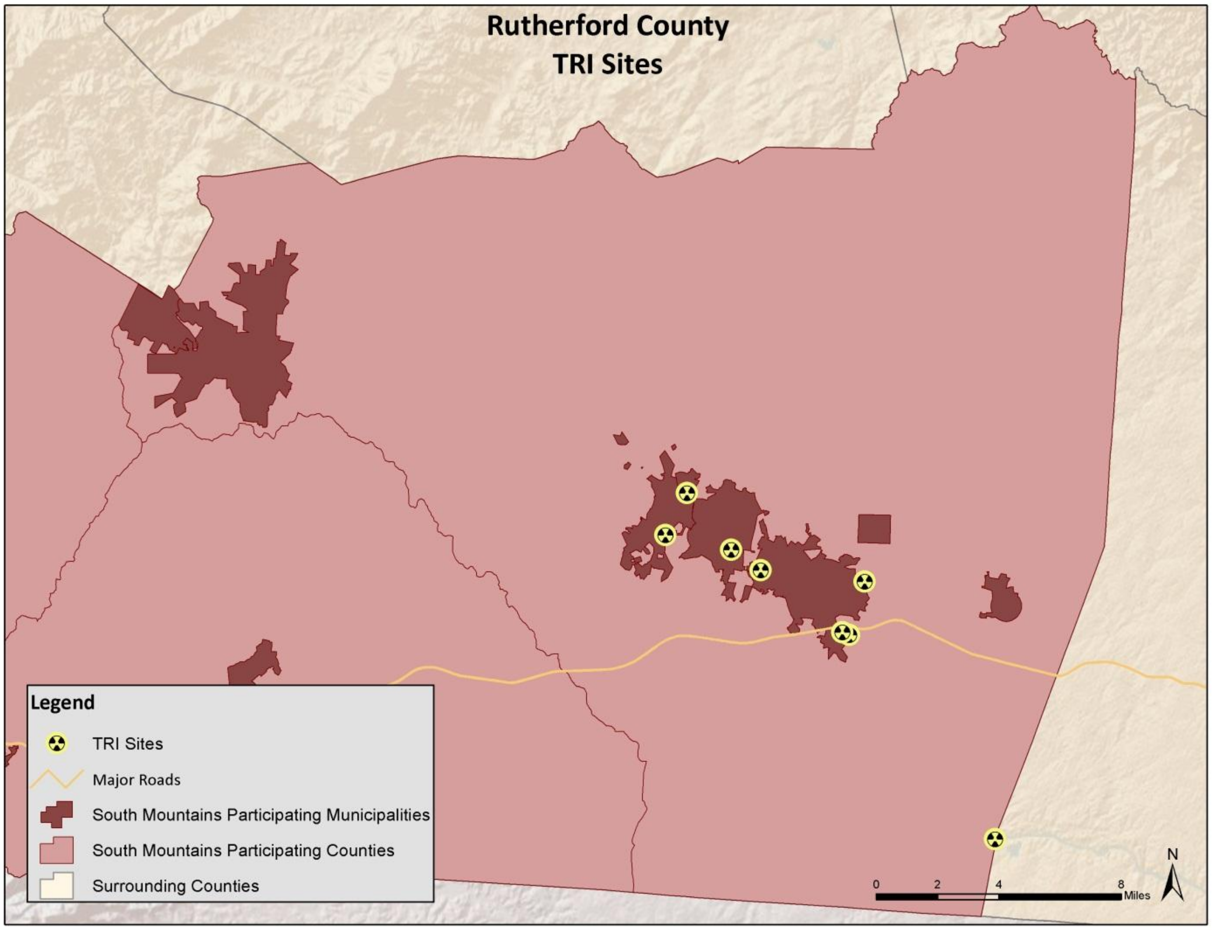
It can be inferred from the floodplain location maps, previous occurrences, and repetitive loss properties that risk varies throughout the county and participating jurisdictions. For example, Lake Lure and Rutherfordton have more floodplain and thus a higher risk of flood than other municipalities. Flood is not the greatest hazard of concern but will continue to occur and cause damage. Therefore, mitigation actions may be warranted, particularly for repetitive loss properties.

C.2.14 Hazardous Materials Incidents

Location and Spatial Extent

Rutherford County has seven TRI sites. These sites are shown in **Figure C.16.**

FIGURE C.16: TOXIC RELEASE INVENTORY (TRI) SITES IN RUTHERFORD COUNTY



Source: EPA

In addition to "fixed" hazardous materials locations, hazardous materials may also impact the county via roadways and rail. Many roads in the county are narrow and winding, making hazardous material transport in the area especially treacherous. All roads that permit hazardous material transport are considered potentially at risk to an incident.

Historical Occurrences

There has been a total of one recorded HAZMAT incident in Rutherford County since 1976 (**Table C.26**). **Table C.27** presents detailed information on historic HAZMAT incidents in Rutherford County as reported by the U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA).

TABLE C.26: SUMMARY OF HAZMAT INCIDENTS IN RUTHERFORD COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Bostic	0	--	--
Chimney Rock Village	0	--	--
Ellenboro	0	--	--

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Forest City	1	0/0	$0
Lake Lure	0	--	--
Ruth	0	--	--
Rutherfordton	0	--	--
Spindale	0	--	--
Unincorporated Area	0	--	--
RUTHERFORD COUNTY TOTAL	**1**	**0/0**	**$0**

Source: USDOT PHMSA

TABLE C.27: HAZMAT INCIDENTS IN RUTHERFORD COUNTY

Report Number	Date	City	Mode	Serious Incident?	Fatalities / Injuries	Damages ($)*	Quantity Released
Bostic							
None Reported	--	--	--	--	--	--	--
Chimney Rock Village							
None Reported	--	--	--	--	--	--	--
Ellenboro							
None Reported	--	--	--	--	--	--	--
Forest City							
I-1976060381	6/2/1976	FOREST CITY	Highway	No	0/0	$0	0
Lake Lure							
None Reported	--	--	--	--	--	--	--
Ruth							
None Reported	--	--	--	--	--	--	--
Rutherfordton							
None Reported	--	--	--	--	--	--	--
Spindale							
None Reported	--	--	--	--	--	--	--
Unincorporated Area							
None Reported	--	--	--	--	--	--	--

*Property damage is reported in 2013 dollars.
Source: USDOT PHMSA

Probability of Future Occurrences

Given the location of seven toxic release inventory sites in Rutherford County and the prior roadway incident, it is possible that a hazardous material incident may occur in the county (between 1 and 10 percent annual probability). County and town officials are mindful of this possibility and take precautions to prevent such an event from occurring. Furthermore, there are detailed plans in place to respond to an occurrence. The county may also be impacted by neighboring counties which also face risk due to TRI sites.

C.2.15 Wildfire

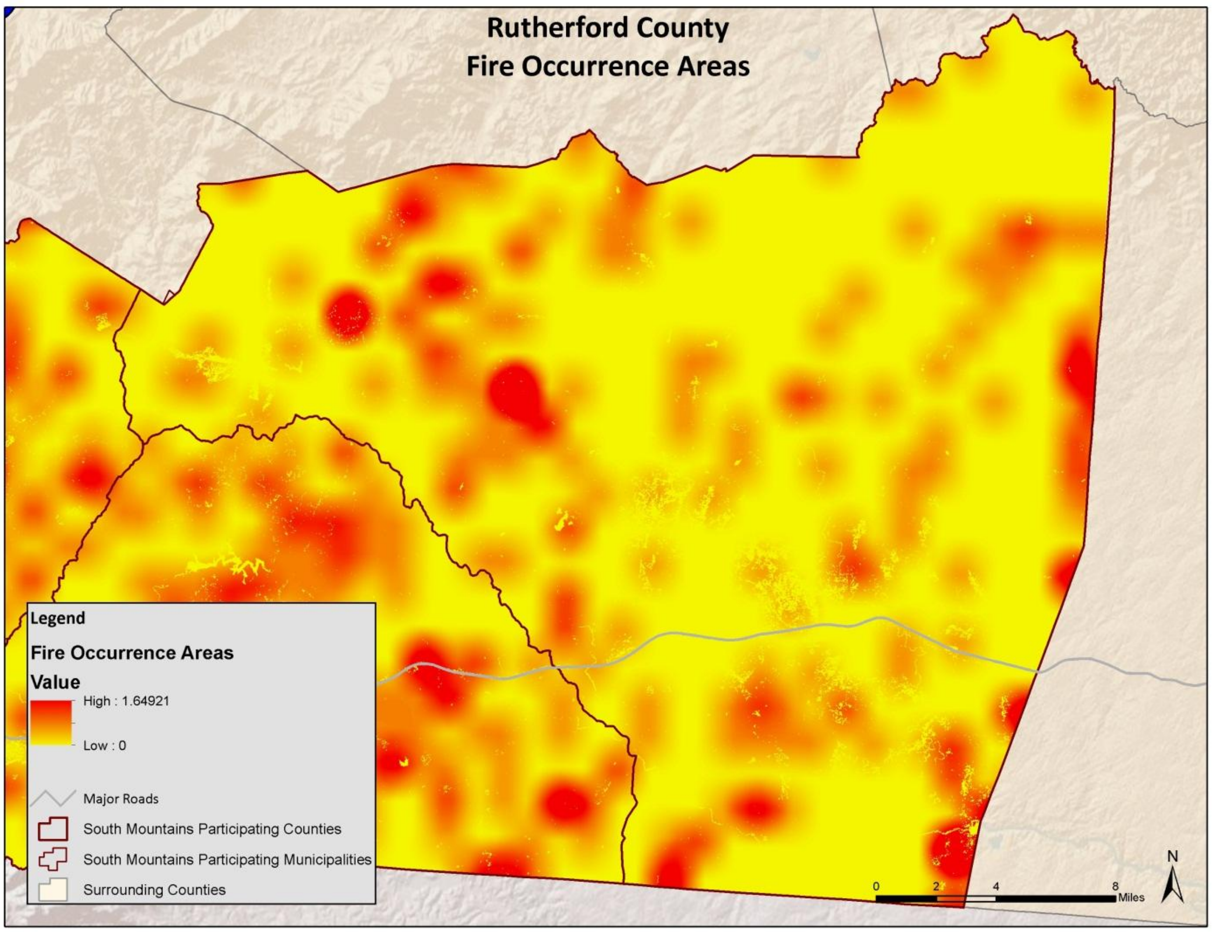
Location and Spatial Extent

The entire county is at risk to a wildfire occurrence. However, several factors such as drought conditions or high levels of fuel on the forest floor, may make a wildfire more likely. Furthermore, areas in the urban-wildland interface are particularly susceptible to fire hazard as populations abut formerly undeveloped areas. The Fire Occurrence Areas in the figure below give an indication of historic location.

Historical Occurrences

Figure C.17 shows the Fire Occurrence Areas (FOA) in Rutherford County based on data from the Southern Wildfire Risk Assessment. This data is based on historical fire ignitions and is reported as the number of fires that occur per 1,000 acres each year.

FIGURE C.17: HISTORIC WILDFIRE EVENTS IN RUTHERFORD COUNTY



Source: Southern Wildfire Risk Assessment

Based on data from the North Carolina Division of Forest Resources from 2003 to 2012, Rutherford County experienced an average of 48 wildfires annually which burn an average of 292 acres per year. The data indicates that most of these fires are small, averaging 6 acres per fire. **Table C.28** lists the number of reported wildfire occurrences in the county between the years 2003 and 2012.

TABLE C.28: HISTORICAL WILDFIRE OCCURRENCES IN RUTHERFORD COUNTY

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Rutherford County										
Number of Fires	3	15	19	46	79	70	32	66	95	56
Number of Acres	14.0	58.2	53.2	178.7	855.9	1,114.2	32.6	80.3	335.4	192.7

Source: North Carolina Division of Forest Resources

The National Climatic Data Center also reported one wildfire event in the Rutherford Mountains on February 12, 2011. A wildfire that began in the Chimney Rock State Park area quickly spread during a period of windy and very dry conditions. The fire burned almost 1,500 acres near the Polk and Rutherford County line south of Chimney Rock before being contained.

Probability of Future Occurrences

Wildfire events will be an ongoing occurrence in Rutherford County. The likelihood of wildfires increases during drought cycles and abnormally dry conditions. Fires are likely to stay small in size but could increase due local climate and ground conditions. Dry, windy conditions with an accumulation of forest floor fuel (potentially due to ice storms or lack of fire) could create conditions for a large fire that spreads quickly. It should also be noted that some areas do vary somewhat in risk. For example, highly developed areas are less susceptible unless they are located near the urban-wildland boundary. The risk will also vary due to assets. Areas in the urban-wildland interface will have much more property at risk, resulting in increased vulnerability and need to mitigate compared to rural, mainly forested areas. In this case, the participating jurisdictions appear to have a similar risk to the surrounding areas. The probability assigned to Rutherford County for future wildfire events is likely (10 to 100 percent annual probability).

C.2.16 Conclusions on Hazard Risk

The hazard profiles presented above were developed using best available data and result in what may be considered principally a qualitative assessment as recommended by FEMA in its “How-to” guidance document titled *Understanding Your Risks: Identifying Hazards and Estimating Losses* (FEMA Publication 386-2). It relies heavily on historical and anecdotal data, stakeholder input, and professional and experienced judgment regarding observed and/or anticipated hazard impacts. It also carefully considers the findings in other relevant plans, studies, and technical reports.

Hazard Extent

Table C.29 describes the extent of each natural hazard identified for Rutherford County. The extent of a hazard is defined as its severity or magnitude, as it relates to the planning area.

TABLE C.29: EXTENT OF RUTHERFORD COUNTY HAZARDS

Atmospheric Hazards	
Drought	Drought extent is defined by the North Carolina Drought Monitor Classifications which include Abnormally Dry, Moderate Drought, Severe Drought, Extreme Drought, and Exceptional Drought (page 5:6). According to the North Carolina Drought Monitor Classifications, the most severe drought condition is Exceptional. Rutherford County has received this ranking three times over the fourteen-year reporting period.
Extreme Heat	The extent of extreme heat can be defined by the maximum temperature reached. The highest temperature recorded in Rutherford County is 107 degrees Fahrenheit on August 1, 1999.
Hailstorm	Hail extent can be defined by the size of the hail stone. The largest hail stone reported in Rutherford County was 2.0 inches (last reported on April 9, 2011). It should be noted that future events may exceed this.
Hurricane and Tropical Storm	Hurricane extent is defined by the Saffir-Simpson Scale which classifies hurricanes into Category 1 through Category 5 (Table 5.9). The greatest classification of hurricane to traverse directly through Rutherford County was an Unnamed 1902 Storm which reached a maximum wind speed of 31 knots in the county. Although the county is much more likely to be impacted by the remnants of a hurricane or tropical storm, these events demonstrate that Category 3 or 4 storms can and have impacted the county directly.
Lightning	According to the Vaisala flash density map (Figure 5.5), Rutherford County is located in an area that experiences 3 to 4 lightning flashes per square kilometer per year. It should be noted that future lightning occurrences may exceed these figures.
Thunderstorm Wind / High Wind	Thunderstorm extent is defined by the number of thunder events and wind speeds reported. According to a 63-year history from the National Climatic Data Center, the strongest recorded wind event in Rutherford County was reported on March 1, 1999 at 77 knots (approximately 89 mph). It should be noted that future events may exceed these historical occurrences.
Tornado	Tornado hazard extent is measured by tornado occurrences in the US provided by FEMA (Figure 5.6) as well as the Fujita/Enhanced Fujita Scale (Tables 5.14 and 5.15). The greatest magnitude reported in the county was an F4 (reported on May 5, 1989).
Winter Storm and Freeze	The extent of winter storms can be measured by the amount of snowfall received (in inches). The greatest 24-hour snowfall reported in Rutherford County was 16 inches on December 17, 1930. Due to extreme variations in elevation throughout the county, extent totals will vary for each participating jurisdiction and reliable data on snowfall totals is not available.
Geologic Hazards	
Earthquake	Earthquake extent can be measured by the Richter Scale (Table 5.18) and the Modified Mercalli Intensity (MMI) scale (Table 5.19) and the distance of the epicenter from Rutherford County. According to data provided by the National Geophysical Data Center, the greatest MMI to impact the county was V (slightly strong) with a correlating Richter Scale measurement of approximately 4.8 (last reported on November 20, 1969). The epicenter of this earthquake was located 241.0 km away.

Landslide	As noted above in the landslide profile, the landslide data provided by the North Carolina Geological survey is incomplete. This provides a challenge when trying to determine an accurate extent for the landslide hazard. However, when using the USGS landslide susceptibility index, extent can be measured with incidence, which is low to moderate in Rutherford County. There is also high susceptibility throughout the county.
Hydrologic Hazards	
Dam Failure	Dam failure extent is defined using the North Carolina Division of Land Resources criteria (Table 5.23). Of the 71 dams in Rutherford County, 20 are classified as high-hazard.
Erosion	The extent of erosion can be defined by the measurable rate of erosion that occurs. There are no erosion rate records located in Rutherford County.
Flood	Flood extent can be measured by the amount of land and property in the floodplain as well as flood height and velocity. The amount of land in the floodplain accounts for 5.2 percent of the total land area in Rutherford County. Flood depth and velocity are recorded via United States Geological Survey stream gages throughout the region. While a gage does not exist for each participating jurisdiction, there is one at or near many areas. The greatest peak discharge recorded for the county was at Cove Creek near Lake Lure on June 5, 1957. Water reached a discharge of 7,050 cubic feet per second and the stream gage height was recorded at 18.53 feet.
Other Hazards	
Hazardous Materials Incident	According to USDOT PHMSA, the largest hazardous materials incident reported in the county was 0 LGA released on the highway on June 2, 1976. It should be noted that larger events are possible.
Wildfire	Wildfire data was provided by the North Carolina Division of Forest Resources and is reported annually by county from 2003-2012. The greatest number of fires to occur in Rutherford County in any year was 95 in 2011. The greatest number of acres to burn in the county in a single year occurred in 2008 when 1,114 acres were burned. Although this data lists the extent that has occurred, larger and more frequent wildfires are possible throughout the county.

Priority Risk Index Results

In order to draw some meaningful planning conclusions on hazard risk for Rutherford County, the results of the hazard profiling process were used to generate countywide hazard classifications according to a "Priority Risk Index" (PRI). More information on the PRI and how it was calculated can be found in Section 5.18.2.

Table C.30 summarizes the degree of risk assigned to each category for all initially identified hazards based on the application of the PRI. Assigned risk levels were based on the detailed hazard profiles developed for this section, as well as input from the Regional Hazard Mitigation Planning Committee. The results were then used in calculating PRI values and making final determinations for the risk assessment.

TABLE C.30: SUMMARY OF PRI RESULTS FOR RUTHERFORD COUNTY

Hazard	Category/Degree of Risk					
	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Atmospheric Hazards						
Drought	Likely	Minor	Large	More than 24 hours	More than 1 week	**2.5**
Extreme Heat	Possible	Minor	Large	More than 24 hours	Less than 1 week	**2.1**
Hailstorm	Highly Likely	Limited	Moderate	Less than 6 hours	Less than 6 hours	**2.9**
Hurricane and Tropical Storm	Possible	Limited	Large	More than 24 hours	Less than 24 hours	**2.3**
Lightning	Highly Likely	Minor	Negligible	Less than 6 hours	Less than 6 hours	**2.2**
Thunderstorm / High Wind	Highly Likely	Critical	Moderate	6 to 12 hours	Less than 6 hours	**3.1**
Tornado	Possible	Critical	Small	Less than 6 hours	Less than 6 hours	**2.4**
Winter Storm and Freeze	Highly Likely	Critical	Large	More than 24 hours	Less than 1 week	**3.3**
Geologic Hazards						
Earthquake	Possible	Minor	Moderate	Less than 6 hours	Less than 6 hours	**2.0**
Landslide	Possible	Critical	Small	Less than 6 hours	Less than 6 hours	**2.2**
Hydrologic Hazards						
Dam and Levee Failure	Unlikely	Critical	Moderate	Less than 6 hours	Less than 6 hours	**2.3**
Erosion	Likely	Minor	Small	More than 24 hours	More than 1 week	**2.1**
Flood	Likely	Critical	Moderate	6 to 12 hours	Less than 1 week	**3.0**
Other Hazards						
Hazardous Materials Incident	Possible	Limited	Small	Less than 6 hours	Less than 24 hours	**2.2**
Wildfire	Likely	Limited	Small	Less than 6 hours	Less than 1 week	**2.6**

C.2.17 Final Determinations on Hazard Risk

The conclusions drawn from the hazard profiling process for Rutherford County, including the PRI results and input from the Regional Hazard Mitigation Planning Committee, resulted in the classification of risk for each identified hazard according to three categories: High Risk, Moderate Risk, and Low Risk (**Table C.31**). For purposes of these classifications, risk is expressed in relative terms according to the estimated impact that a hazard will have on human life and property throughout all of Rutherford County. A more quantitative analysis to estimate potential dollar losses for each hazard has been performed separately, and is described in Section 6: *Vulnerability Assessment* and below in Section C.3. It should be noted that although some hazards are classified below as posing low risk, their occurrence of varying or unprecedented magnitudes is still possible in some cases and their assigned classification will continue to be evaluated during future plan updates.

TABLE C.31: CONCLUSIONS ON HAZARD RISK FOR RUTHERFORD COUNTY

HIGH RISK	Winter Storm and Freeze Thunderstorm Wind / High Wind Flood Hailstorm
MODERATE RISK	Wildfire Drought Tornado Hurricane and Tropical Storm Dam and Levee Failure
LOW RISK	Landslide Lightning Hazardous Material Incident Extreme Heat Erosion Earthquake

C.3 RUTHERFORD COUNTY VULNERABILITY ASSESSMENT

This subsection identifies and quantifies the vulnerability of Rutherford County to the significant hazards previously identified. This includes identifying and characterizing an inventory of assets in the county and assessing the potential impact and expected amount of damages caused to these assets by each identified hazard event. More information on the methodology and data sources used to conduct this assessment can be found in Section 6: *Vulnerability Assessment*.

C.3.1 Asset Inventory

Table C.32 lists the number of parcels, total value of parcels, total number of parcels with improvements, and the total assessed value of improvements for Rutherford County and its participating jurisdictions (study area of vulnerability assessment).[20]

TABLE C.32: IMPROVED PROPERTY IN RUTHERFORD COUNTY

Location	Number of Parcels	Total Assessed Value of Parcels	Estimated Number of Buildings	Total Assessed Value of Improvements
Bostic	258	$24,957,450	179	$21,554,050
Chimney Rock Village	438	$47,710,950	188	$18,841,350

[20] Total assessed values for improvements is based on tax assessor records as joined to digital parcel data. This data does not include dollar figures for tax-exempt improvements such as publicly-owned buildings and facilities. It should also be noted that, due to record keeping, some duplication is possible thus potentially resulting in an inflated value exposure for an area.

Location	Number of Parcels	Total Assessed Value of Parcels	Estimated Number of Buildings	Total Assessed Value of Improvements
Ellenboro	542	$24,788,350	399	$17,807,450
Forest City	4,603	$456,893,840	3,276	$321,462,000
Lake Lure	4,434	$752,508,400	1,729	$302,754,000
Ruth	232	$18,082,500	158	$13,931,200
Rutherfordton	2,389	$303,983,850	1,678	$252,924,100
Spindale	2,785	$172,674,050	1,888	$133,768,150
Unincorporated Area	42,729	$3,613,618,630	23,306	$2,392,864,750
RUTHERFORD COUNTY TOTAL	**58,410**	**$5,415,218,020**	**32,801**	**$3,475,907,050**

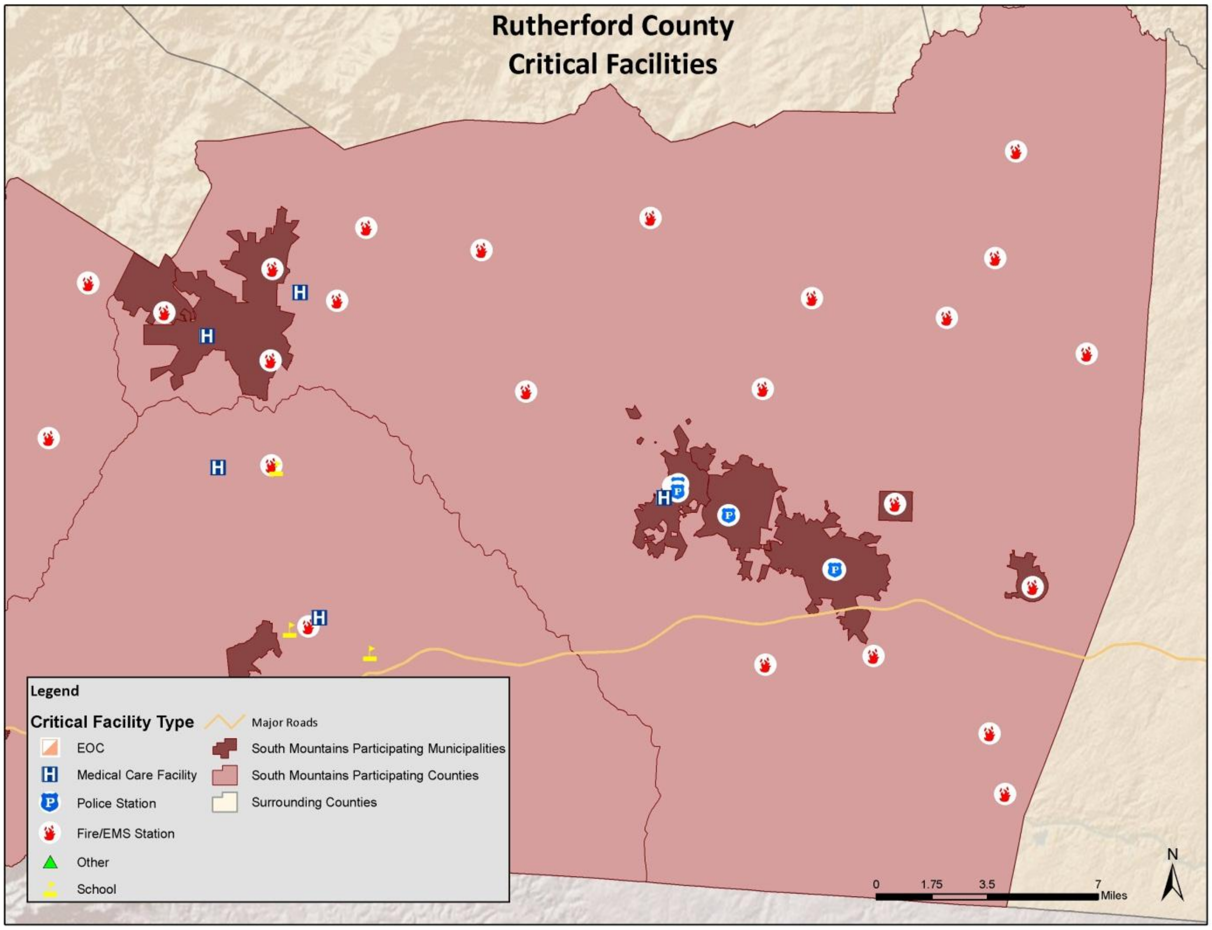
Table C.33 lists the fire stations, police stations, emergency operations centers (EOCs), medical care facilities, schools and other critical facilities located in Rutherford County. Local governments at the county level provided a majority of the data for this analysis; however gaps in the data were filled using Hazus 2.1 to obtain the location of some critical facilities for which spatial data was not available. In addition, **Figure C.18** shows the locations of essential facilities in Rutherford County. **Table C.45**, near the end of this section, shows a complete list of the critical facilities by name, as well as the hazards that affect each facility. As noted previously, this list is not all-inclusive and only includes information provided by the county.

TABLE C.33: CRITICAL FACILITY INVENTORY IN RUTHERFORD COUNTY

Location	Fire Stations	Police Stations	Medical Care Facilities	EOC	Schools	Other
Bostic	1	0	0	0	0	0
Chimney Rock Village	1	0	0	0	0	0
Ellenboro	1	0	0	0	0	0
Forest City	1	1	0	0	0	0
Lake Lure	2	0	1	0	0	0
Ruth	0	0	0	0	0	0
Rutherfordton	1	2	1	0	0	0
Spindale	1	1	0	0	0	0
Unincorporated Area	15	0	1	0	0	0
RUTHERFORD COUNTY TOTAL	**23**	**4**	**3**	**0**	**0**	**0**

Source: Hazus-MH

FIGURE C.18: CRITICAL FACILITY LOCATIONS IN RUTHERFORD COUNTY



Source: Hazus-MH 2.1

C.3.2 Social Vulnerability

In addition to identifying those assets potentially at risk to identified hazards, it is important to identify and assess those particular segments of the resident population in Rutherford County that are potentially at risk to these hazards.

Table C.34 lists the population by jurisdiction according to U.S. Census 2010 population estimates. Unfortunately, estimates were not available at the census block level, limited the results to county-wide estimates. The total population in Rutherford County according to Census data is 67,810 persons. Additional population estimates are presented above in Section C.1.

TABLE C.34: TOTAL POPULATION IN RUTHERFORD COUNTY

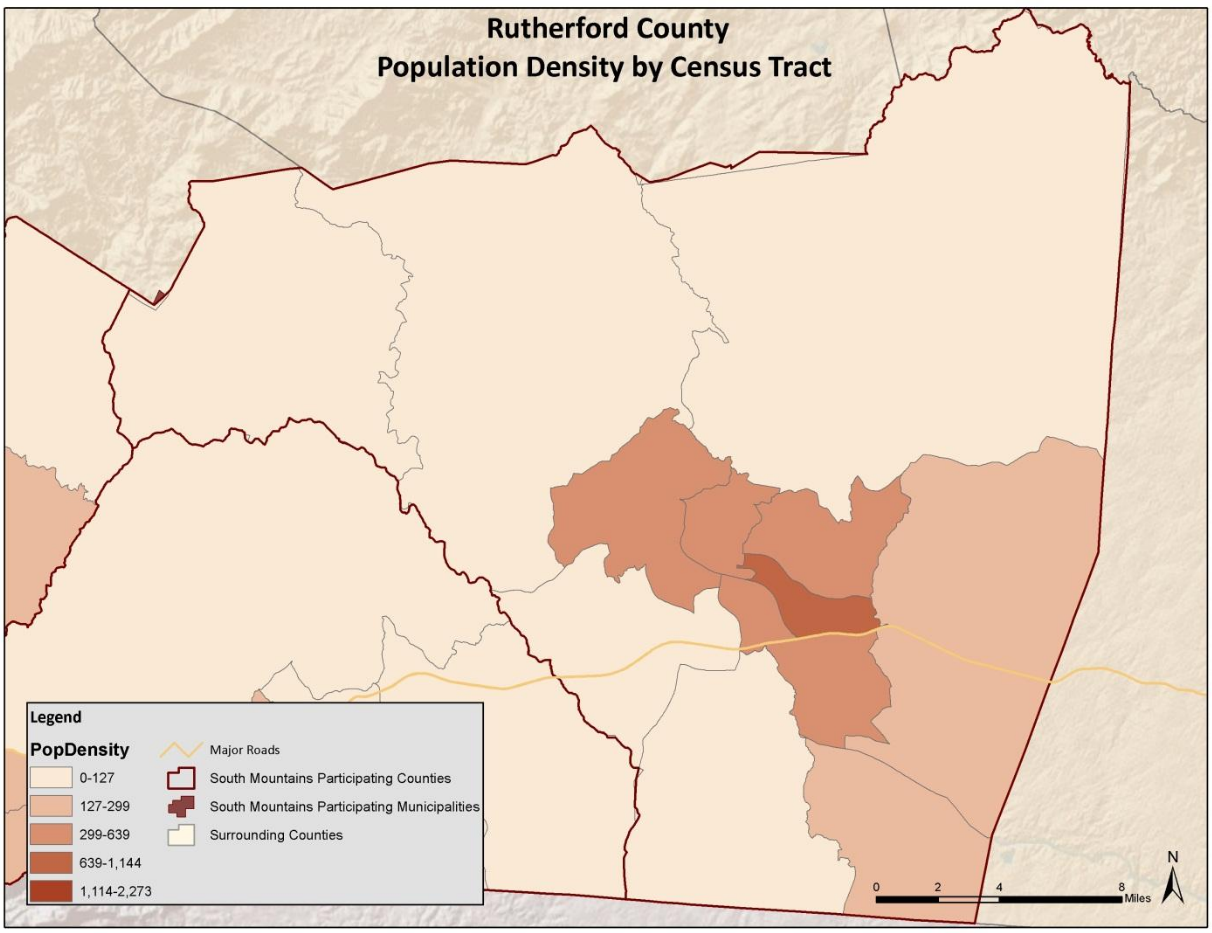
Jurisdiction	2010 Census Population
Rutherford County	**67,810**

Jurisdiction	2010 Census Population
Town of Bostic	386
Village of Chimney Rock	113
Town of Ellenboro	873
Town of Forest City	7,476
Town of Lake Lure	1,192
Town of Ruth	440
Town of Rutherfordton	4,213
Town of Spindale	4,321

Source: U.S. Census 2010

In addition, **Figure C.19** illustrates the population density by census tract as it was reported by the U.S. Census Bureau in 2010.[21]

FIGURE C.19: POPULATION DENSITY IN RUTHERFORD COUNTY



Source: U.S. Census Bureau, 2010

[21] Population by census block was not available at the time this plan was completed.

C.3.3 Vulnerability Assessment Results

As noted in Section 6: *Vulnerability Assessment*, only hazards with a specific geographic boundary, modeling tool, or sufficient historical data allow for further analysis. Those results, specific to Rutherford County, are presented here. All other hazards are assumed to impact the entire planning region (drought, hailstorm, lightning, thunderstorm wind, tornado, and winter storm and freeze) or, due to lack of data, analysis would not lead to credible results (erosion, dam and levee failure). The total county exposure, and thus risk, was presented in **Table C.32**.

The annualized loss estimate for all hazards is presented at the end of this section in **Table C.45.**

The hazards presented in this section include: hurricane and tropical storm winds, earthquake, landslide, flood, hazardous materials incident, and wildfire.

<u>Hurricane and Tropical Storm</u>

Historical evidence indicates that Rutherford County has a significant risk to the hurricane and tropical storm hazard. Several tracks have come near or traversed through the county, as shown and discussed in Section C.3.3.

Hurricanes and tropical storms can cause damage through numerous additional hazards such as flooding, erosion, tornadoes, and high winds and precipitation, thus it is difficult to estimate total potential losses from these cumulative effects. The current Hazus-MH hurricane model only analyzes hurricane winds and is not capable of modeling and estimating cumulative losses from all hazards associated with hurricanes; therefore only hurricane winds are analyzed in this section. It can be assumed that all existing and future buildings and populations are at risk to the hurricane and tropical storm hazard. Hazus-MH 2.1 was used to determine annualized losses for the county as shown below in **Table C.35.** Only losses to buildings are reported, in order to best match annualized losses reported for other hazards. Hazus-MH reports losses at the U.S. Census tract level, so determining participating jurisdiction losses was not possible.

TABLE C.35: ANNUALIZED LOSS ESTIMATIONS FOR HURRICANE WIND HAZARD

Location	Total Annualized Loss
Rutherford County	$167,000

Source: Hazus-MH 2.1

In addition, probable peak wind speeds were calculated in Hazus. These are shown below in **Table C.36.**

TABLE C.36: PROBABLE PEAK HURRICANE / TROPICAL STORM WIND SPEEDS (MPH)

Location	50-year event	100-year event	500-year event	1,000-year event
Bostic	56	66	85	91
Chimney Rock Village	53	63	82	89
Ellenboro	57	66	86	92
Forest City	56	66	86	92
Lake Lure	53	63	82	89
Ruth	56	66	85	91
Rutherfordton	56	66	85	91

Location	50-year event	100-year event	500-year event	1,000-year event
Spindale	56	66	86	92
MAXIMUM WIND SPEED REPORTED	**57**	**66**	**86**	**92**

Source: Hazus-MH 2.1

Social Vulnerability

Given equal susceptibility across the county, it is assumed that the total population is at risk to the hurricane and tropical storm hazard.

Critical Facilities

Given equal vulnerability across Rutherford County, all critical facilities are considered to be at risk. Some buildings may perform better than others in the face of such an event due to construction and age, among other factors. Determining individual building response is beyond the scope of this plan. However, this plan will consider mitigation actions for vulnerable structures, including critical facilities, to reduce the impacts of the hurricane wind hazard. A list of specific critical facilities and their associated risk can be found in **Table C.45** at the end of this section.

In conclusion, a hurricane event has the potential to impact many existing and future buildings, critical facilities, and populations in Rutherford County. Hurricane events can cause substantial damage in their wake including fatalities, extensive debris clean-up, and extended power outages.

Earthquake

For the earthquake hazard vulnerability assessment, a probabilistic scenario was created to estimate the annualized loss for Rutherford County. The results of the analysis reported at the U.S. Census tract level do not make it feasible to estimate losses at the jurisdiction level. Since the scenario is annualized, no building counts are provided. Losses reported included losses due to building damage and do not include losses to contents, inventory, or business interruption. **Table C.37** summarizes the findings.

TABLE C.37: ANNUALIZED LOSS ESTIMATIONS FOR EARTHQUAKE HAZARD

Location	Total Annualized Loss
Rutherford County	$30,000

Source: Hazus-MH 2.1

Social Vulnerability

It can be assumed that all existing future populations are at risk to the earthquake hazard.

Critical Facilities

The Hazus probabilistic analysis indicated that no critical facilities would sustain measurable damage in an earthquake event. However, all critical facilities should be considered at-risk to minor damage, should an event occur. A list of individual critical facilities and their risk can be found in **Table C.45**.

In conclusion, an earthquake has the potential to impact all existing and future buildings, facilities, and populations in Rutherford County. Minor earthquakes may rattle dishes and cause minimal damage while stronger earthquakes will result in structural damage as indicated in the Hazus scenario above. Impacts of earthquakes include debris clean-up, service disruption and, in severe cases, fatalities due to building collapse. Specific vulnerabilities for assets will be greatly dependent on their individual design and the mitigation measures in place, where appropriate. Such site-specific vulnerability determinations are outside the scope of this assessment but will be considered during future plan updates if data becomes available. Furthermore, mitigation actions to address earthquake vulnerability will be considered.

Landslide

In order to complete the vulnerability assessment for landslides in Rutherford County, GIS analysis was used. The potential dollar value of exposed land and property total can be determined using the USGS Landslide Susceptibility Index (detailed in Section C.3.9), county level tax parcel data, and GIS analysis. **Table C.38** presents the potential at-risk property where available. All areas of Rutherford County are identified as moderate or high incidence areas by the USGS landslide data. All areas are also of high landslide susceptibility. The incidence levels (high and moderate) were used to identify different areas of concern for the analysis below.

TABLE C.38: TOTAL POTENTIAL AT-RISK PARCELS FOR THE LANDSLIDE HAZARD

Location	Number of Parcels At Risk		Number of Improvements At Risk		Total Value of Improvements At Risk ($)	
Incidence Level	Moderate	High	Moderate	High	Moderate	High
Bostic	0	0	0	0	$0	$0
Chimney Rock Village	0	0	0	0	$0	$0
Ellenboro	0	0	0	0	$0	$0
Forest City	350	0	270	0	$11,281,600	$0
Lake Lure	36	0	17	0	$6,465,300	$0
Ruth	0	0	0	0	$0	$0
Rutherfordton	0	0	0	0	$0	$0
Spindale	0	0	0	0	$0	$0
Unincorporated Area	13,804	0	8,709	0	$816,323,320	$0
RUTHERFORD COUNTY TOTAL	**14,190**	**0**	**8,996**	**0**	**$834,070,220**	**$0**

Source: USGS

Social Vulnerability

Given high susceptibility across the entire county, it is assumed that the total population is at risk.

Critical Facilities

All critical facilities are located in a high susceptibility area. Four facilities in Rutherford County are located in the moderate incidence area (high susceptibility). There are no critical facilities are located in the high landslide incidence/susceptibility area. A list of specific critical facilities and their associated risk can be found in **Table C.45** at the end of this section.

In conclusion, a landslide has the potential to impact all existing and future buildings, facilities, and populations in Rutherford County, though some areas are at a higher risk than others due to a variety of factors. For example, steep slopes and modified slopes bear a greater risk than flat areas. Specific vulnerabilities for county assets will be greatly dependent on their individual design and the mitigation measures in place, where appropriate. Such site-specific vulnerability determinations are outside the scope of this assessment but will be considered during future plan updates if data becomes available.

Flood

Historical evidence indicates that Rutherford County is susceptible to flood events. A total of 25 flood events have been reported by the National Climatic Data Center resulting in over $10.5 million dollars in damages. On an annualized level, these damages amounted to $605,552 for Rutherford County.

In order to assess flood risk, a GIS-based analysis was used to estimate exposure to flood events using Digital Flood Insurance Rate Map (DFIRM) data in combination with local tax assessor records for the county. The determination of assessed value at-risk (exposure) was calculated using GIS analysis by summing the total assessed building values for only those improved properties that were confirmed to be located within an identified floodplain. **Table C.39** presents the potential at-risk property. Both the number of parcels and the approximate value are presented.

TABLE C.39: ESTIMATED EXPOSURE OF PARCELS TO THE FLOOD HAZARD

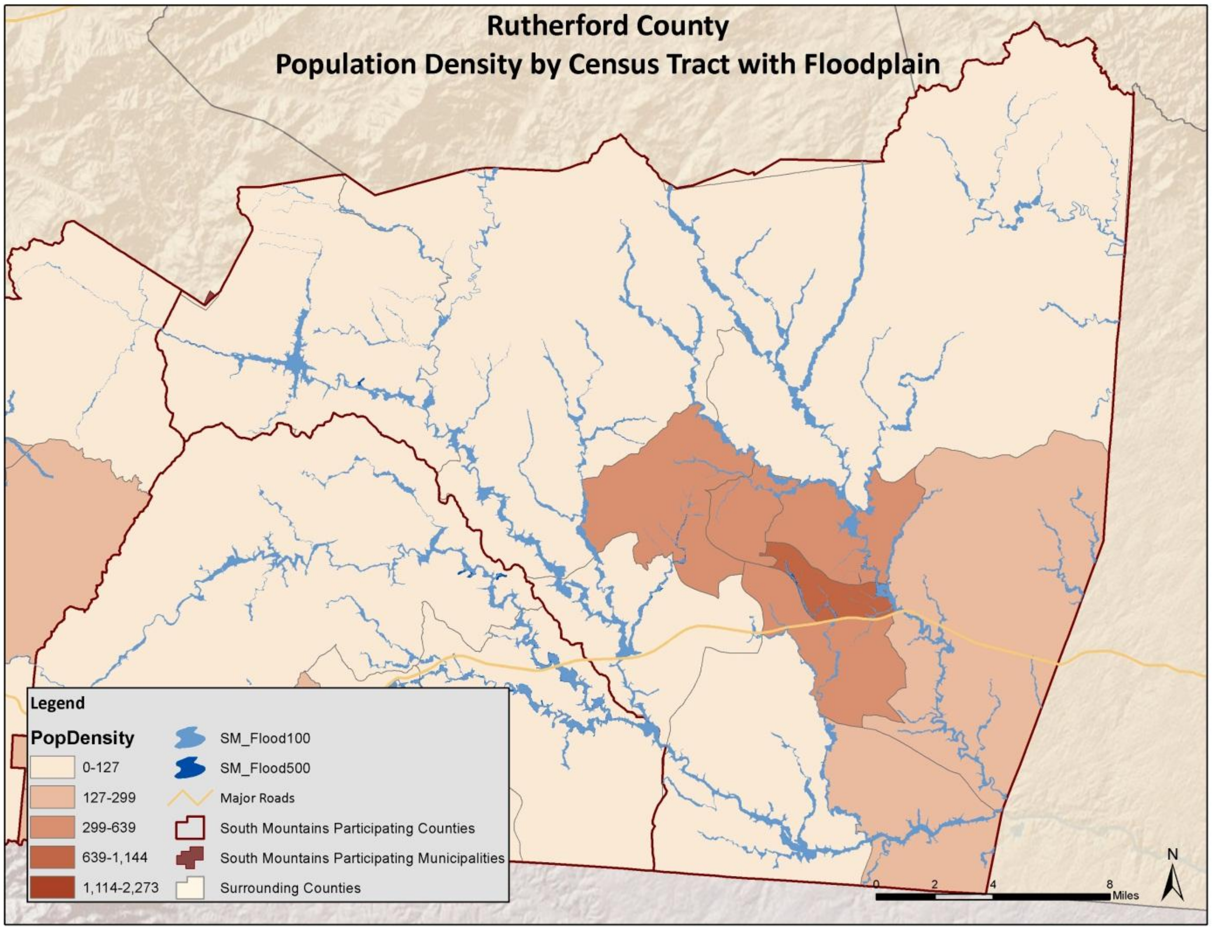
	1.0-percent ACF			0.2-percent ACF		
Location	Approx. Number of Parcels	Approx. Number Improved Buildings	Approx. Improved Value of Buildings	Approx. Number of Parcels	Approx. Number Improved Buildings	Approx. Improved Value of Buildings
Bostic	1	1	$5,300	0	0	$0
Chimney Rock Village	81	36	$4,244,200	13	10	$626,400
Ellenboro	0	0	$0	0	0	$0
Forest City	182	76	$15,837,400	23	10	$1,446,900
Lake Lure	915	677	$122,617,650	2	2	$1,299,900
Ruth	15	8	$390,800	0	0	$0
Rutherfordton	233	142	$14,545,300	5	5	$361,800
Spindale	31	18	$2,414,300	0	0	$0
Unincorporated Area	3,814	1,822	$332,018,160	30	6	$383,100
RUTHERFORD COUNTY TOTAL	**5,272**	**2,780**	**$492,073,110**	**73**	**33**	**$4,118,100**

Source: FEMA DFIRM

Social Vulnerability

Since 2010 population was only available at the tract level, it was difficult to determine a reliable figure on population at-risk to flood due to tract level population data. **Figure C.20** is presented to gain a better understanding of at risk population.

FIGURE C.20 : POPULATION DENSITY NEAR FLOODPLAINS



Source: FEMA DFIRM, U.S. Census 2010

Critical Facilities

The critical facility analysis revealed that there are a no critical facilities located in the Rutherford County 1.0-percent annual chance floodplain and 0.2-percent annual chance floodplain based on FEMA DFIRM boundaries and GIS analysis. A list of specific critical facilities and their associated risk can be found in **Table C.45** at the end of this section.

In conclusion, a flood has the potential to impact many existing and future buildings and populations in Rutherford County, though some areas are at a higher risk than others. All types of structures in a floodplain are at-risk, though elevated structures will have a reduced risk. As noted, the floodplains used in this analysis include the 100-year and 500-year FEMA regulated floodplain boundaries. It is certainly possible that more severe events could occur beyond these boundaries or urban (flash) flooding could impact additional structures. Such site-specific vulnerability determinations are outside the scope of this assessment but will be considered during future plan updates. Furthermore, areas subject to repetitive flooding should be analyzed for potential mitigation actions.

Hazardous Materials Incident

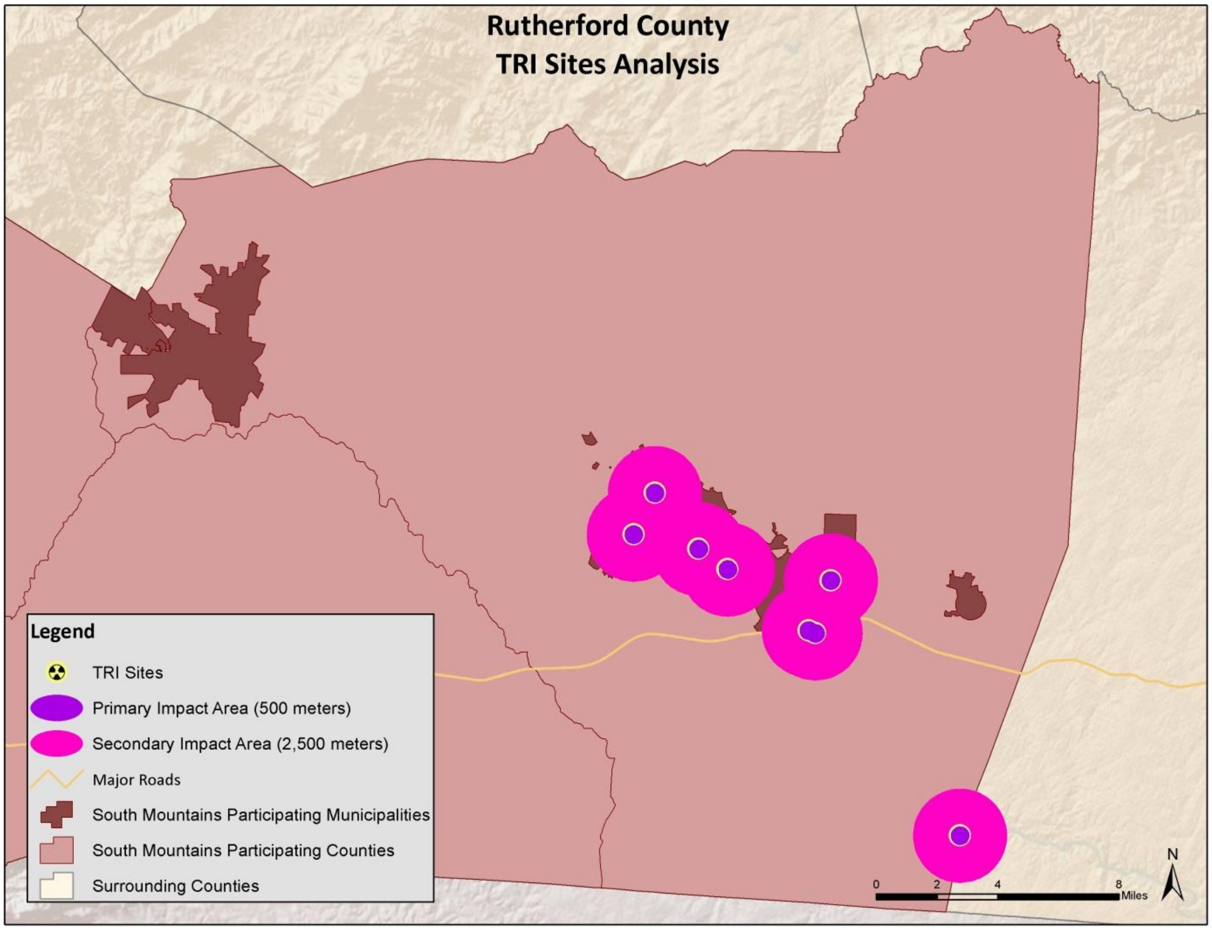
Although historical evidence and existing Toxic Release Inventory sites indicate that Rutherford County is susceptible to hazardous materials events, there are few reports of damage. Therefore, it is difficult to calculate a reliable annualized loss figure. It is assumed that while one major event could result in significant losses, annualizing structural losses over a long period of time would most likely yield a negligible annualized loss estimate for Rutherford County.

Most hazardous materials incidents that occur are contained and suppressed before destroying any property or threatening lives. However, they can have a significant negative impact. Such events can cause multiple deaths, completely shut down facilities for 30 days or more, and cause more than 50 percent of affected properties to be destroyed or suffer major damage. In a hazardous materials incident, solid, liquid, and/or gaseous contaminants may be released from fixed or mobile containers. Weather conditions will directly affect how the hazard develops. Certain chemicals may travel through the air or water, affecting a much larger area than the point of the incidence itself. Non-compliance with fire and building codes, as well as failure to maintain existing fire and containment features, can substantially increase the damage from a hazardous materials release. The duration of a hazardous materials incident can range from hours to days. Warning time is minimal to none.

In order to conduct the vulnerability assessment for this hazard, GIS intersection analysis was used for fixed and mobile areas and parcels.[22] In both scenarios, two sizes of buffers—500 and 2,500 meters—were used. These areas are assumed to respect the different levels of effect: immediate (primary) and secondary. Primary and secondary impact sites were selected based on guidance from FEMA 426, Reference Manual to Mitigate Potential Terrorist Attacks against Buildings and engineering judgment. For the fixed site analysis, geo-referenced TRI listed toxic sites in Rutherford County, along with buffers, were used for analysis as shown in **Figure C.21.** For the mobile analysis, the major roads (Interstate highway, U.S. highway, and State highway) and railroads, where hazardous materials are primarily transported that could adversely impact people and buildings, were used for the GIS buffer analysis. **Figure C.22** shows the areas used for mobile toxic release buffer analysis. The results indicate the approximate number of parcels, improved value, as shown in **Table C.40** (fixed sites), **Table C.41** (mobile road sites) and **Table C.42** (mobile railroad sites).[23]

[22] This type of analysis will likely yield inflated results (generally higher than what is actually reported after an event).
[23] Note that parcels included in the 2,500 meter analysis are also included in the 500 meter analysis.

FIGURE C.21 : TRI SITES WITH BUFFERS IN RUTHERFORD COUNTY



Source: EPA

TABLE C.40: EXPOSURE OF IMPROVED PROPERTY TO HAZARDOUS MATERIALS (FIXED SITES)

	500-meter buffer			2,500-meter buffer		
Location	**Approx. Number of Parcels**	**Approx. Number Improved**	**Approx. Improved Value**	**Approx. Number of Parcels**	**Approx. Number Improved**	**Approx. Improved Value**
Bostic	0	0	$0	75	57	$3,431,000
Chimney Rock Village	0	0	$0	0	0	$0
Ellenboro	0	0	$0	0	0	$0
Forest City	231	161	$33,345,200	3,839	2,766	$283,969,200
Lake Lure	0	0	$0	0	0	$0
Ruth	55	39	$4,985,100	232	158	$13,931,200
Rutherfordton	192	146	$10,386,700	2,325	1,642	$244,318,200
Spindale	221	166	$9,708,200	2,771	1,878	$132,875,750
Unincorporated Area	191	129	$27,821,550	4,473	2,929	$455,531,650
RUTHERFORD COUNTY TOTAL	**890**	**641**	**$86,246,750**	**13,715**	**9,430**	**$1,134,057,000**

FIGURE C.22 : MOBILE HAZMAT BUFFERS IN RUTHERFORD COUNTY

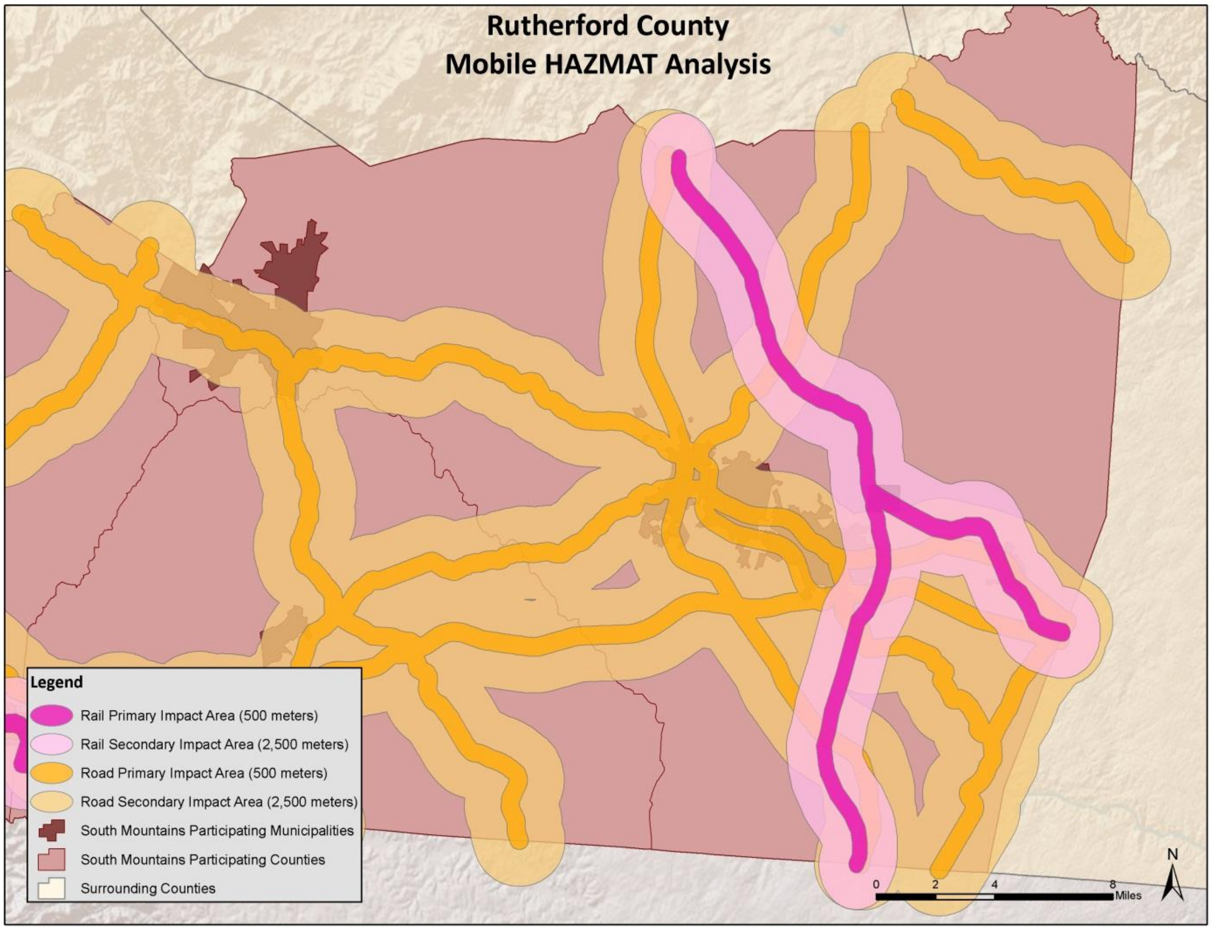


TABLE C.41: EXPOSURE OF IMPROVED PROPERTY TO HAZARDOUS MATERIALS SPILL (MOBILE ANALYSIS - ROAD)

	500-meter buffer			2,500-meter buffer		
Location	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value
Bostic	0	0	$0	3	2	$192,400
Chimney Rock Village	391	175	$14,201,250	438	188	$18,841,350
Ellenboro	427	323	$15,006,450	542	399	$17,807,450
Forest City	3,030	2,223	$237,191,600	4,603	3,276	$321,462,000
Lake Lure	1,662	691	$86,849,750	2,963	1,185	$175,312,350
Ruth	215	147	$12,070,000	232	158	$13,931,200
Rutherfordton	1,890	1,344	$197,686,000	2,389	1,678	$252,924,100
Spindale	1,586	1,114	$88,724,950	2,785	1,888	$133,768,150
Unincorporated Area	11,246	6,874	$856,288,220	29,019	17,035	$1,802,803,730
RUTHERFORD COUNTY TOTAL	**20,447**	**12,891**	**$1,508,018,220**	**42,974**	**25,809**	**$2,737,042,730**

TABLE C.42: EXPOSURE OF IMPROVED PROPERTY TO HAZARDOUS MATERIALS SPILL (MOBILE ANALYSIS - RAILROAD)

	500-meter buffer			2,500-meter buffer		
Location	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value
Bostic	220	151	$20,451,750	258	179	$21,554,050
Chimney Rock Village	0	0	$0	0	0	$0
Ellenboro	342	257	$12,001,750	542	399	$17,807,450
Forest City	4	1	$22,600	1,402	1,011	$75,758,700
Lake Lure	0	0	$0	0	0	$0
Ruth	0	0	$0	0	0	$0
Rutherfordton	0	0	$0	0	0	$0
Spindale	0	0	$0	0	0	$0
Unincorporated Area	1,893	1,275	$124,839,070	8,166	5,367	$586,949,070
RUTHERFORD COUNTY TOTAL	**2,459**	**1,684**	**$157,315,170**	**10,368**	**6,956**	**$702,069,270**

Social Vulnerability

Given high susceptibility across the entire county, it is assumed that the total population is at risk to a hazardous materials incident. It should be noted that areas of population concentration may be at an elevated risk due to a greater burden to evacuate population quickly.

Critical Facilities

Fixed Site Analysis:

The critical facility analysis for fixed TRI sites revealed that there are eight Rutherford County facilities located in a HAZMAT risk zone. The primary impact zone does not include any facilities so all at risk facilities are in the secondary, 2,500 meter zone. A list of specific critical facilities and their associated risk can be found in **Table C.45** at the end of this section.

Mobile Analysis:

The critical facility analysis for road and railroad transportation corridors in Rutherford County revealed that there are 21 critical facilities located in the primary and secondary mobile HAZMAT buffer areas for roads and 4 critical facilities located in the railroad HAZMAT buffer areas. It should be noted that many of the facilities located in the buffer areas for road are also located in the buffer areas for railroad and/or the fixed site analysis. A list of specific critical facilities and their associated risk can be found in **Table C.45** at the end of this section.

In conclusion, a hazardous material incident has the potential to impact many existing and future buildings, critical facilities, and populations in Rutherford County. Those areas in a primary buffer are at the highest risk, though all areas carry some vulnerability due to variations in conditions that could alter the impact area such direction and speed of wind, volume of release, etc. Further, incidents from neighboring counties could also impact the county and participating jurisdictions.

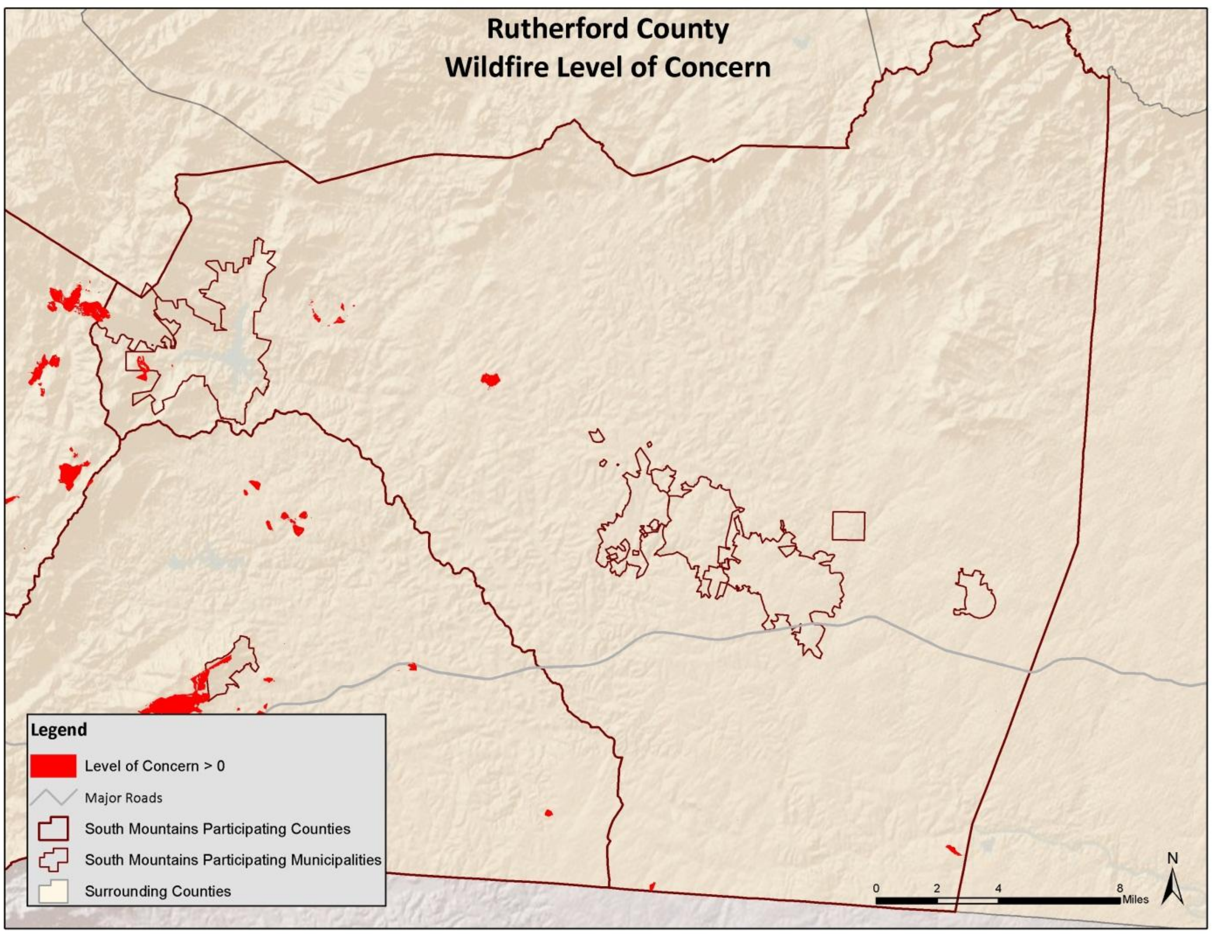
Wildfire

Although historical evidence indicates that Rutherford County is susceptible to wildfire events, there are few reports of damage. Therefore, it is difficult to calculate a reliable annualized loss figure. Annualized loss is considered negligible though it should be noted that a single event could result in significant damages throughout the county.

To estimate exposure to wildfire, the approximate number of parcels and their associated improved value was determined using GIS analysis. For the critical facility analysis, areas of concern were intersected with critical facility locations. **Figure C.23**, **Figure C.24**, **Figure C.25**, **Figure C.26**, **Figure C.27**, **Figure C.28**, **Figure C.29**, **Figure C.30**, and **Figure C.31** show the Level of Concern data. Initially provided as raster data, it was converted to a polygon to allow for analysis. The LOC data ranges from 1 – 100 with higher values being most severe (as noted previously, this is only a measure of relative risk). Eight was the highest level recorded in the Rutherford County planning area. Therefore, areas with a value above 1 were chosen to be displayed as areas of risk. The region contains some lands where the value falls into the at-risk category, though the region has somewhat less land labeled as at-risk compared to other regions of North Carolina. Since all of this land area is on the lower tenth of the overall LOC scale, there is likely considerably less risk in the region than in other areas of the country.

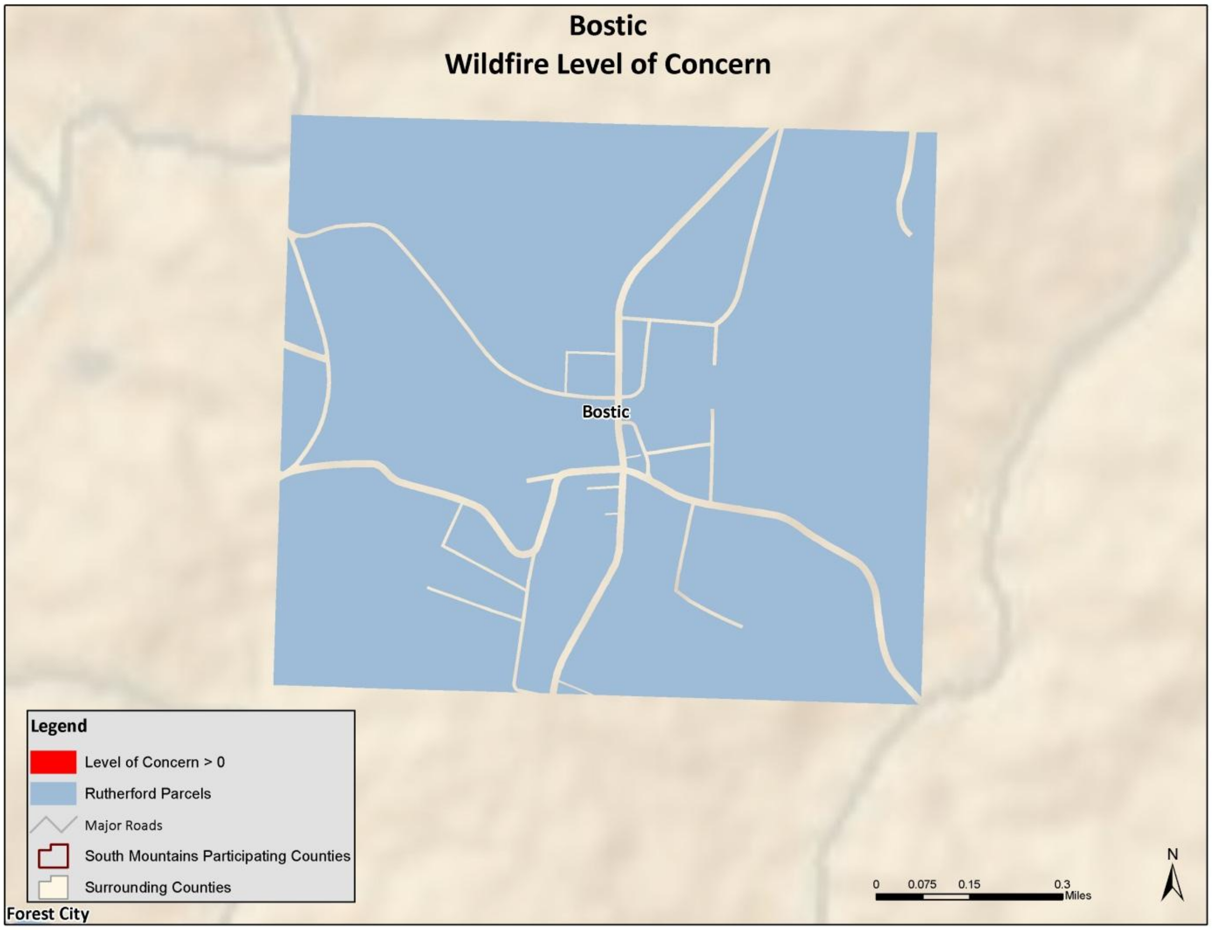
Table C.43 shows the results of the analysis.

FIGURE C.23: WILDFIRE RISK AREAS IN RUTHERFORD COUNTY



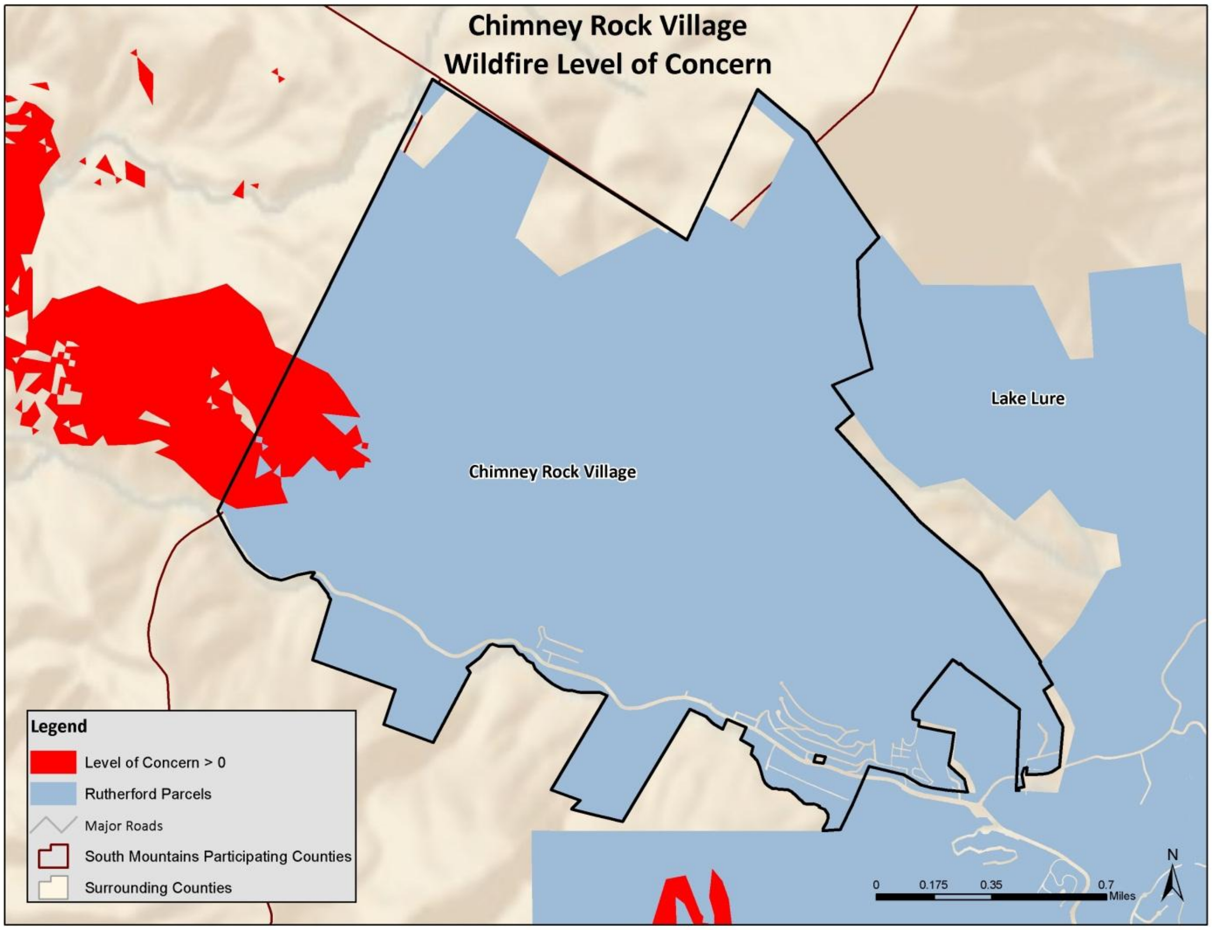
Source: Southern Wildfire Risk Assessment Data

FIGURE C.24: WILDFIRE RISK AREAS IN BOSTIC



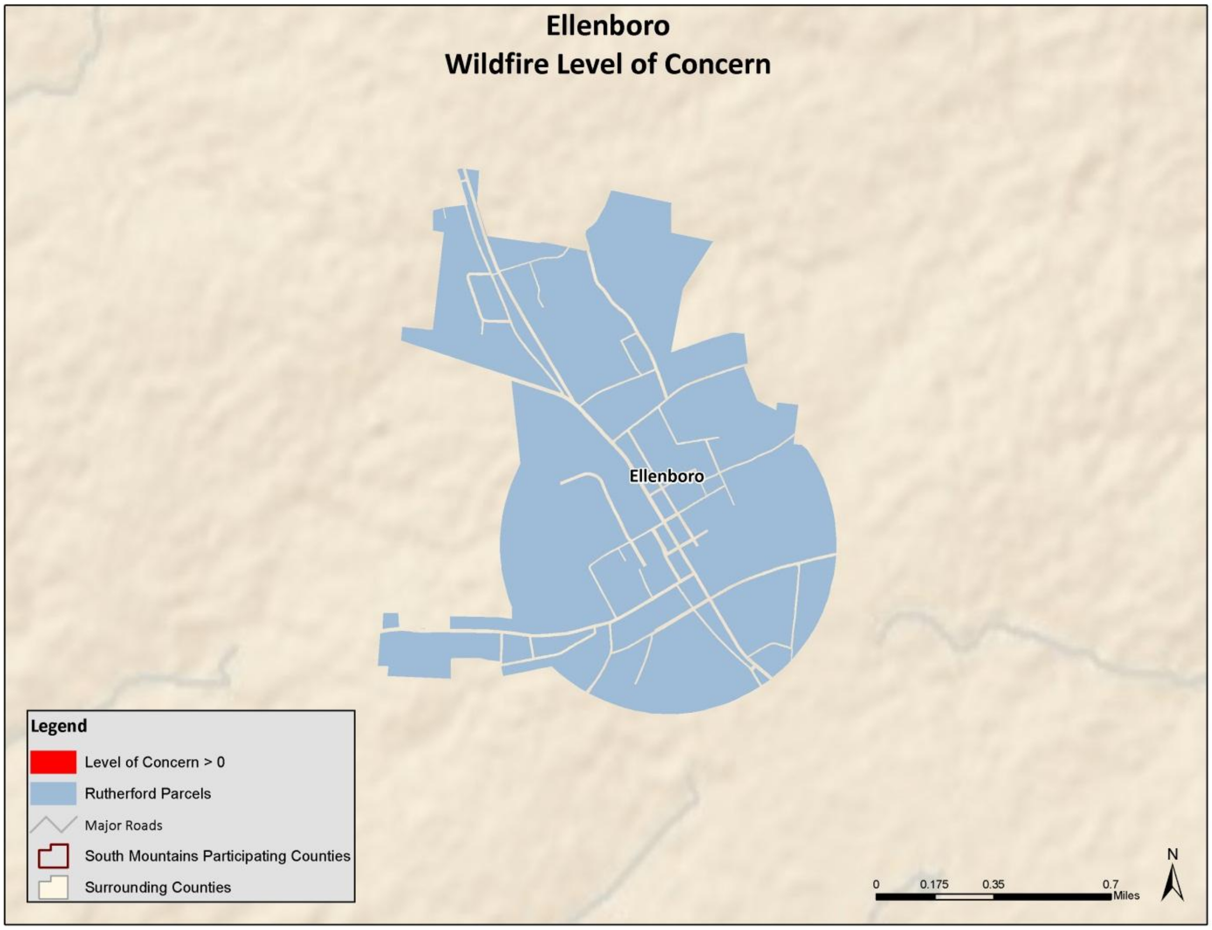
Source: Southern Wildfire Risk Assessment Data

FIGURE C.25: WILDFIRE RISK AREAS IN CHIMNEY ROCK VILLAGE



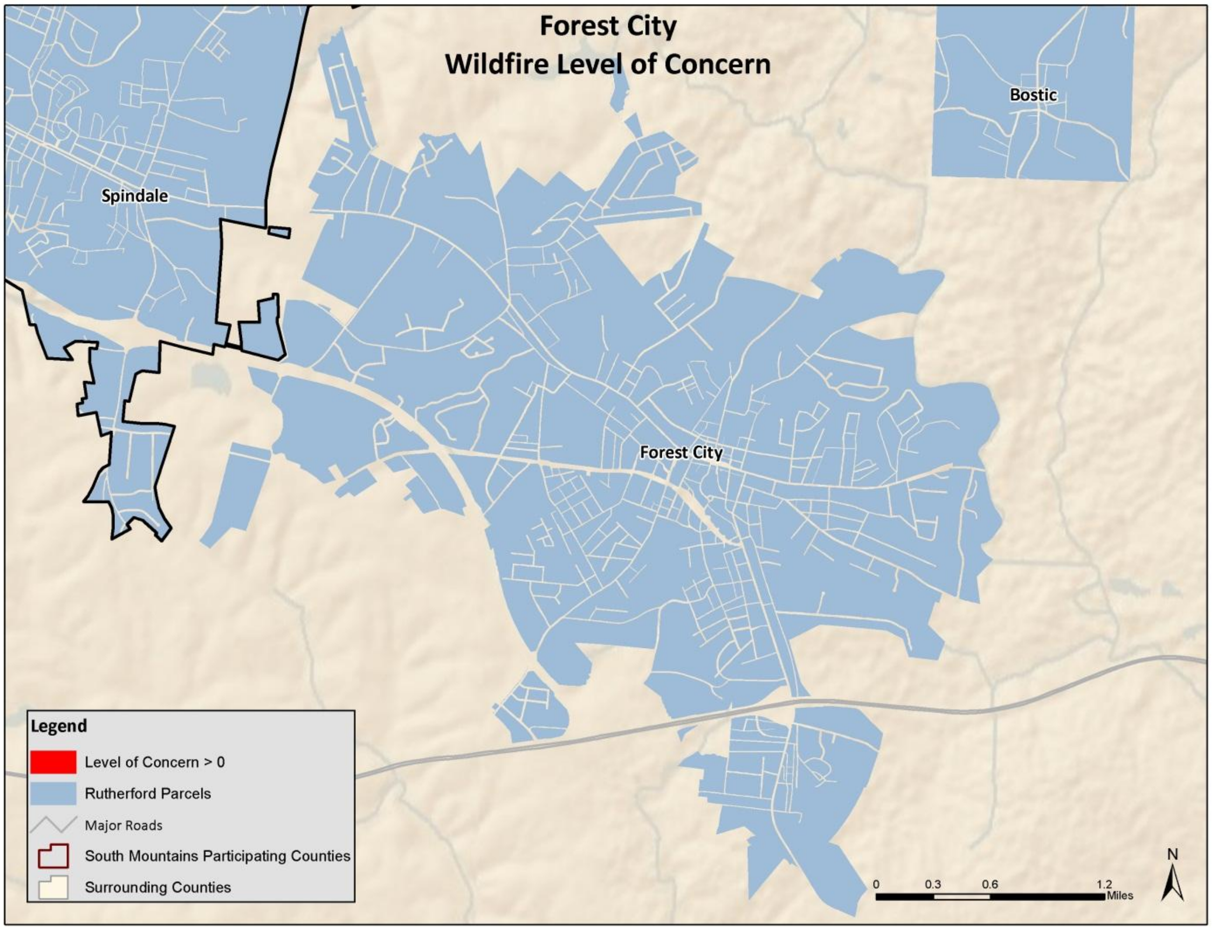
Source: Southern Wildfire Risk Assessment Data

FIGURE C.26: WILDFIRE RISK AREAS IN ELLENBORO



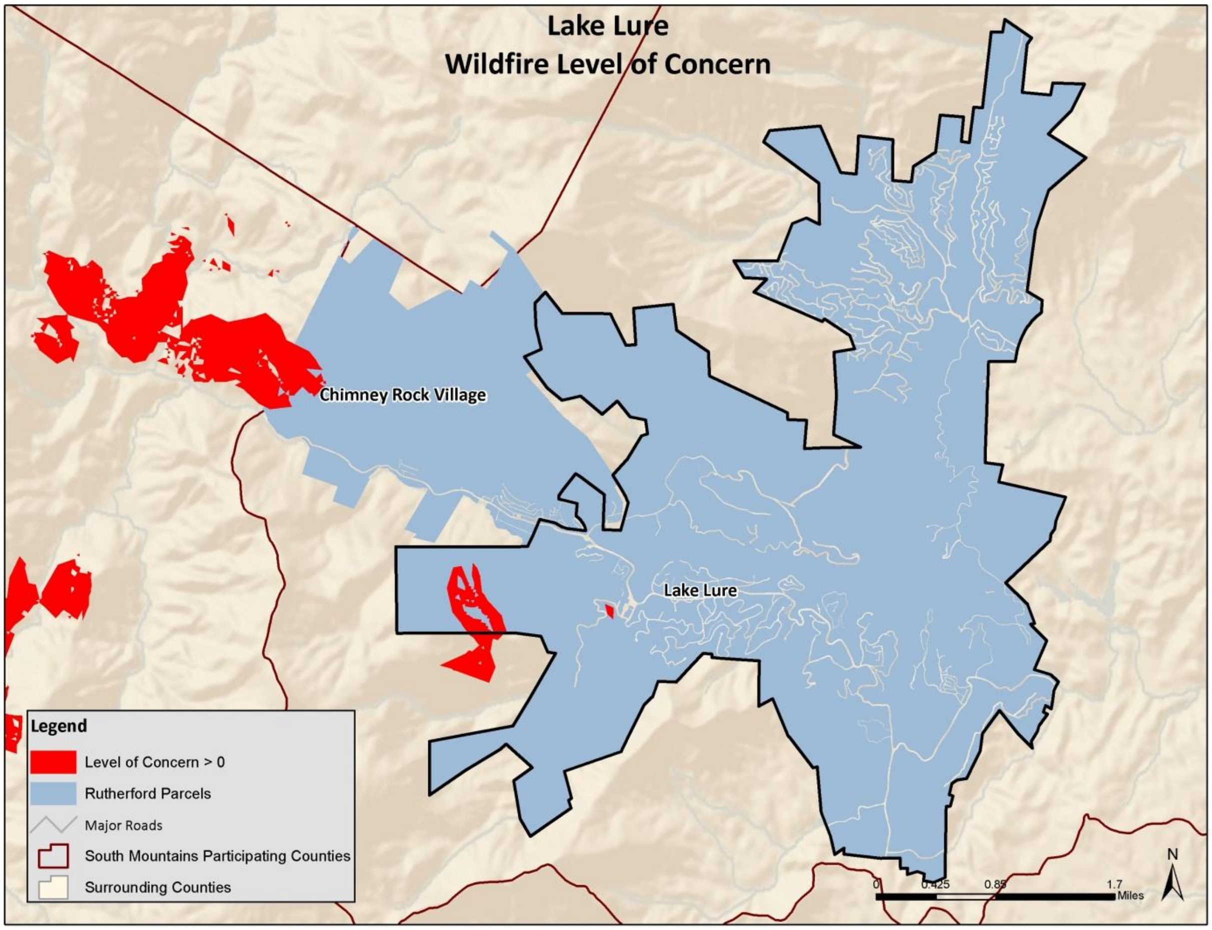
Source: Southern Wildfire Risk Assessment Data

FIGURE C.27: WILDFIRE RISK AREAS IN FOREST CITY



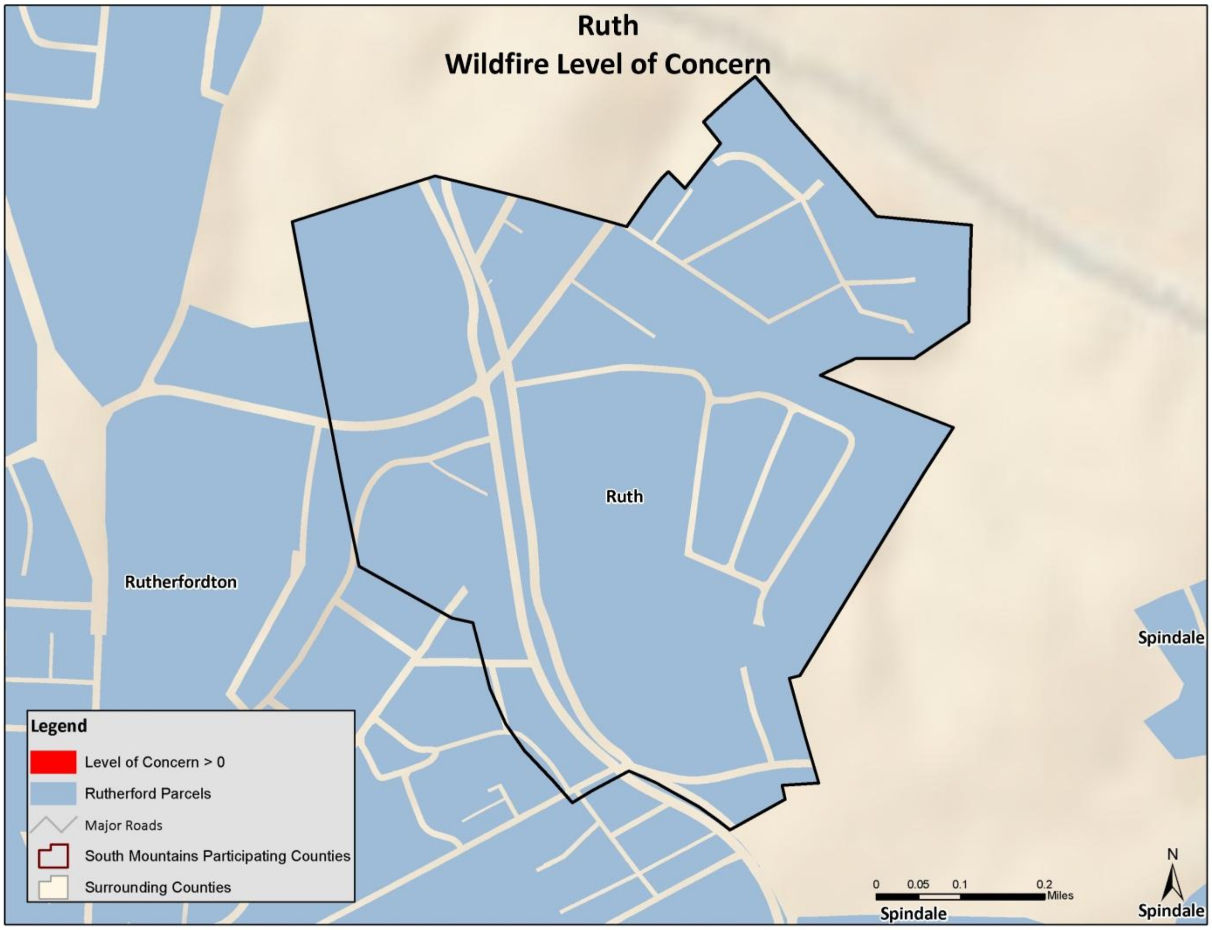
Source: Southern Wildfire Risk Assessment Data

FIGURE C.28: WILDFIRE RISK AREAS IN LAKE LURE



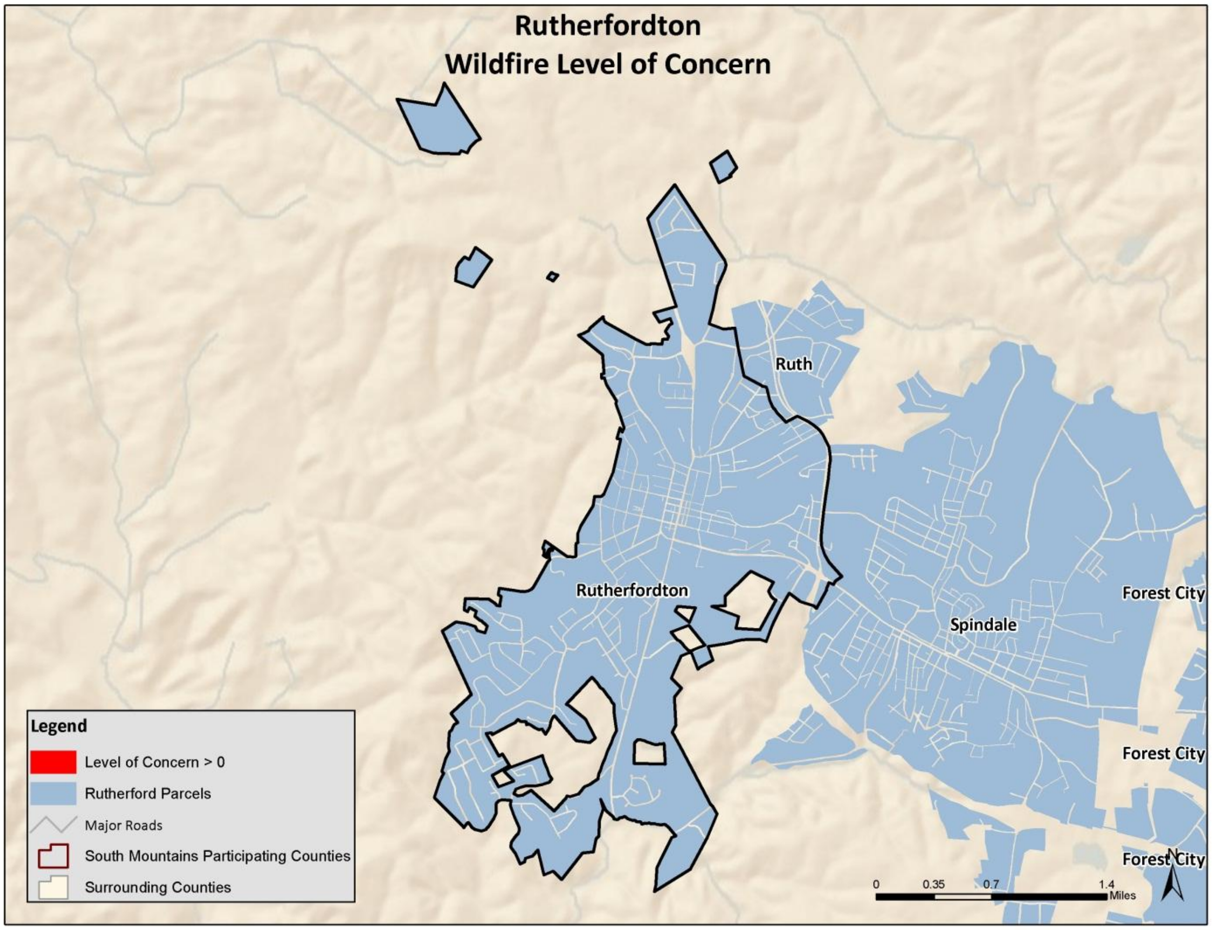
Source: Southern Wildfire Risk Assessment Data

FIGURE C.29: WILDFIRE RISK AREAS IN RUTH



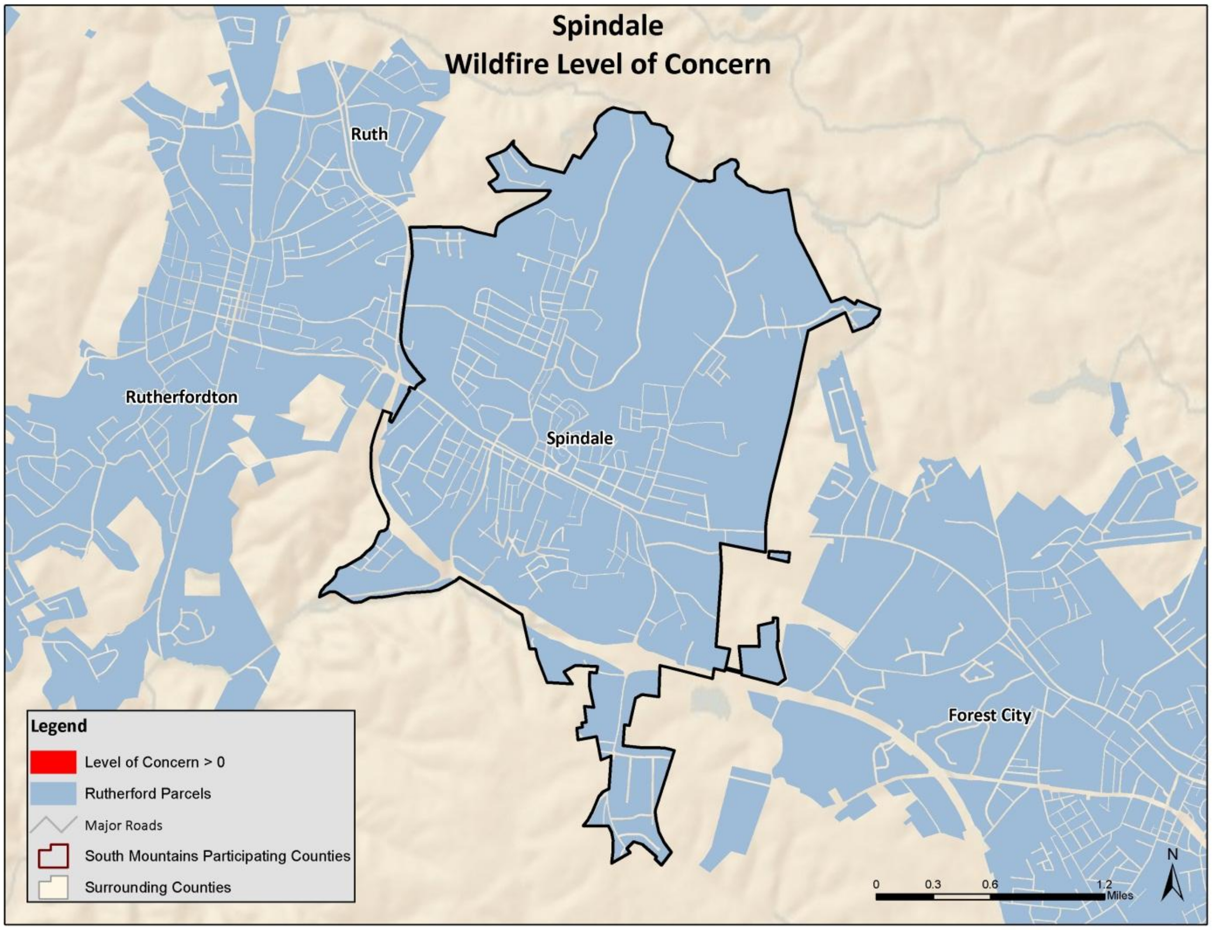
Source: Southern Wildfire Risk Assessment Data

FIGURE C.30: WILDFIRE RISK AREAS IN RUTHERFORDTON



Source: Southern Wildfire Risk Assessment Data

FIGURE C.31: WILDFIRE RISK AREAS IN SPINDALE



Source: Southern Wildfire Risk Assessment Data

TABLE C.43: EXPOSURE OF IMPROVED PROPERTY TO WILDFIRE AREAS OF CONCERN

	HIGH WILDFIRE RISK AREA		
Location	**Approx. Number of Parcels**	**Approx. Number of Buildings**	**Approx. Improved Value**
Bostic	0	0	$0
Chimney Rock Village	6	0	$0
Ellenboro	0	0	$0
Forest City	0	0	$0
Lake Lure	3	0	$0
Ruth	0	0	$0
Rutherfordton	0	0	$0
Spindale	0	0	$0
Unincorporated Area	126	62	$7,506,250
RUTHERFORD COUNTY TOTAL	**135**	**62**	**$7,506,250**

Looking at jurisdictional level, unincorporated areas of the county face the highest level of concern areas. However, some areas of the county (notably Chimney Rock Village and Lake Lure) have some small areas where the level of concern is above 1.

Social Vulnerability
Although not all areas have equal vulnerability, there is some susceptibility across the entire county. It is assumed that the total population is at risk to the wildfire hazard. Determining the exact number of people in certain wildfire zones is difficult with existing data and could be misleading.

Critical Facilities
The critical facility analysis revealed that there are no critical facilities located in wildfire areas of concern. It should also be noted that several factors could impact the spread of a wildfire putting all facilities at risk. A list of specific critical facilities and their associated risk can be found in **Table C.45** at the end of this section.

In conclusion, a wildfire event has the potential to impact many existing and future buildings, critical facilities, and populations in Rutherford County.

Conclusions on Hazard Vulnerability

Table C.44 presents a summary of annualized loss for each hazard in Rutherford County. Due to the reporting of hazard damages primarily at the county level, it was difficult to determine an accurate annualized loss estimate for each municipality. Therefore, an annualized loss was determined through the damage reported through historical occurrences at the county level. These values should be used as an additional planning tool or measure risk for determining hazard mitigation strategies throughout the region.

TABLE C.44: ANNUALIZED LOSS FOR RUTHERFORD COUNTY

Event	Rutherford County
Dam Failure	Negligible
Drought	Negligible
Extreme Heat	Negligible
Erosion	Negligible
Hail	$2,584
Hurricane & Tropical Storm	$167,000
Landslide	Negligible
Lightning	$43,272
Thunderstorm Wind/High Wind	$108,725
Tornado	$25,239
Winter Storm & Freeze	$799,446
Flood	$605,552
Earthquake	$30,000
HAZMAT Incident	Negligible
Wildfire	Negligible

As noted previously, all existing and future buildings and populations (including critical facilities) are vulnerable to atmospheric hazards including drought, hailstorm, hurricane and tropical storm, lightning, thunderstorm wind, tornado, and winter storm and freeze. Some buildings may be more vulnerable to these hazards based on locations, construction, and building type. **Table C.45** shows the critical facilities vulnerable to additional hazards analyzed in this section. The table lists those assets that are determined to be exposed to each of the identified hazards (marked with an "**X**").

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TABLE C.45: AT-RISK CRITICAL FACILITIES IN RUTHERFORD COUNTY

		ATMOSPHERIC							GEOLOGIC			HYDROLOGIC		OTHER						
FACILITY NAME	FACILITY TYPE	Drought	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 500m	Fixed HAZMAT 2,500 meter	Mobile HZMT 500 METER (road)	Mobile HZMT 2,500 meter (road)	Mobile HZMT 500 METER (rail)	Mobile HZMT 2,500 METER (rail)	Wildfire
RUTHERFORD COUNTY																				
RUTHERFORDTON FIRE DEPT	Fire Station	X	X	X	X	X	X	X	X						X	X	X			
RUTHERFORD COUNTY SHERIFF	Police Station	X	X	X	X	X	X	X	X						X	X	X			
RUTHERFORDTON POLICE DEPT	Police Station	X	X	X	X	X	X	X	X						X	X	X			
RUTHERFORD COUNTY HO	Hospital	X	X	X	X	X	X	X	X						X	X	X			
FAIRFIELD MOUNTAINS FIRE DEPT	Fire Station	X	X	X	X	X	X	X	X											
LAKE LURE FIRE DEPT	Fire Station	X	X	X	X	X	X	X	X							X	X			
MEDICAL CLINIC	Hospital	X	X	X	X	X	X	X	X							X	X			
BOSTIC FIRE DEPT	Fire Station	X	X	X	X	X	X	X	X									X	X	
FOREST CITY FIRE DEPARTMENT	Fire Station	X	X	X	X	X	X	X	X							X	X			
FOREST CITY POLICE DEPT.	Police Station	X	X	X	X	X	X	X	X							X	X			
SPINDALE FIRE DEPT	Fire Station	X	X	X	X	X	X	X	X						X	X	X			
SPINDALE POLICE DEPT.	Police Station	X	X	X	X	X	X	X	X						X	X	X			
ELLENBORO FIRE DEPT	Fire Station	X	X	X	X	X	X	X	X							X	X	X	X	
CHIMNEY ROCK FIRE DEPT	Fire Station	X	X	X	X	X	X	X	X							X	X			

		ATMOSPHERIC							GEOLOGIC			HYDROLOGIC		OTHER						
FACILITY NAME	FACILITY TYPE	Drought	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 500m	Fixed HAZMAT 2,500 meter	Mobile HZMT 500 METER (road)	Mobile HZMT 2,500 meter (road)	Mobile HZMT 500 METER (rail)	Mobile HZMT 2,500 METER (rail)	Wildfire
CLIFFSIDE STATION 2	Fire Station	X	X	X	X	X	X	X	X		X					X	X			
BILLS CREEK STATION 1	Fire Station	X	X	X	X	X	X	X	X											
HUDLOW STATION 2	Fire Station	X	X	X	X	X	X	X	X							X	X			
HOLLIS (POLKVILLE) FIRE DEPT	Fire Station	X	X	X	X	X	X	X	X											
CHERRY MOUNTAIN STATION 1	Fire Station	X	X	X	X	X	X	X	X											
CHERRY MOUNTAIN STATION 2	Fire Station	X	X	X	X	X	X	X	X											
CHERRY MOUNTAIN STATION 3	Fire Station	X	X	X	X	X	X	X	X							X	X			
GREEN HILL FIRE DEPARTMENT	Fire Station	X	X	X	X	X	X	X	X							X	X			
CLIFFSIDE STATION 1	Fire Station	X	X	X	X	X	X	X	X		X				X	X	X			
SDO FIRE DEPT	Fire Station	X	X	X	X	X	X	X	X		X					X	X			
UNION MILLS FIRE DEPT	Fire Station	X	X	X	X	X	X	X	X							X	X			
HUDLOW STATION 1	Fire Station	X	X	X	X	X	X	X	X							X	X		X	
SHINGLE HOLLOW FIRE DEPT	Fire Station	X	X	X	X	X	X	X	X											
SANDY MUSH FIRE DEPT	Fire Station	X	X	X	X	X	X	X	X		X				X	X	X		X	
BILLS CREEK STATION 2	Fire	X	X	X	X	X	X	X	X											

		ATMOSPHERIC							GEOLOGIC			HYDROLOGIC		OTHER						
FACILITY NAME	FACILITY TYPE	Drought	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 500m	Fixed HAZMAT 2,500 meter	Mobile HZMT 500 METER (road)	Mobile HZMT 2,500 meter (road)	Mobile HZMT 500 METER (rail)	Mobile HZMT 2,500 METER (rail)	Wildfire
	Station																			
MEDICAL CLINIC	Hospital	X	X	X	X	X	X	X	X											

C.4 RUTHERFORD COUNTY CAPABILITY ASSESSMENT

This subsection discusses the capability of Rutherford County to implement hazard mitigation activities. More information on the purpose and methodology used to conduct the assessment can be found in Section 7: *Capability Assessment*.

C.4.1 Planning and Regulatory Capability

Table C.46 provides a summary of the relevant local plans, ordinances, and programs already in place or under development for Rutherford County. A checkmark (✓) indicates that the given item is currently in place and being implemented. An asterisk (*) indicates that the given item is currently being developed for future implementation. Each of these local plans, ordinances, and programs should be considered available mechanisms for incorporating the requirements of the South Mountains Regional Hazard Mitigation Plan.

TABLE C.46: RELEVANT PLANS, ORDINANCES, AND PROGRAMS

Planning Tool/Regulatory Tool	Hazard Mitigation Plan	Comprehensive Land Use Plan	Floodplain Management Plan	Open Space Management Plan (Parks & Rec/Greenway Plan	Stormwater Management Plan/Ordinance	Natural Resource Protection Plan	Flood Response Plan	Emergency Operations Plan	Continuity of Operations Plan	Evacuation Plan	Disaster Recovery Plan	Capital Improvements Plan	Economic Development Plan	Historic Preservation Plan	Flood Damage Prevention Ordinance	Zoning Ordinance	Subdivision Ordinance	Unified Development Ordinance	Post-Disaster Redevelopment Ordinance	Building Code	Fire Code	National Flood Insurance Program (NFIP)	NFIP Community Rating System
RUTHERFORD COUNTY	✓	✓						✓				✓	✓		✓		✓			✓	✓	✓	
Bostic	✓	✓						✓					✓		✓					✓	✓	✓	
Chimney Rock Village	✓	✓						✓					✓		✓	✓	✓	✓		✓	✓	✓	
Ellenboro	✓	✓						✓					✓							✓	✓		
Forest City	✓	✓			✓			✓				✓	✓		✓	✓	✓	✓		✓	✓	✓	
Lake Lure	✓	✓		✓				✓				✓	✓		✓	✓	✓			✓	✓	✓	
Ruth	✓	✓						✓					✓							✓	✓		
Rutherfordton	✓	✓						✓				✓	✓		✓	✓				✓	✓	✓	
Spindale	✓	✓						✓					✓		✓	✓				✓	✓	✓	

A more detailed discussion on the county's planning and regulatory capabilities follows.

Emergency Management

Hazard Mitigation Plan
Rutherford County has previously adopted a hazard mitigation plan. The Village of Chimney Rock and the Towns of Bostic, Ellenboro, Forest City, Lake Lure, Ruth, Rutherfordton, and Spindale were also included in this plan.

Emergency Operations Plan
Rutherford County maintains a countywide emergency operations plan that covers all of its municipalities through its Emergency Management Department. However, the Town of Lake Lure has adopted its own town emergency operations plan administered by the town's Emergency Management Department.

General Planning

Comprehensive Land Use Plan
Rutherford County has adopted a land use plan that encompasses the county as well as the Town of Bostic, the Village of Chimney Rock, the Town of Ellenboro, the Town of Forest City, the Town of Lake Lure, the Town of Ruth, the Town of Rutherfordton, and the Town of Spindale. Chimney Rock Village, Forest City, Lake Lure, Rutherfordton, and Spindale have also adopted municipal-level comprehensive plans.

Capital Improvements Plan
Rutherford County, the Town of Forest City, the Town of Lake Lure, and the Town of Rutherfordton also have capital improvement plans.

Zoning Ordinance
Rutherford County does not have a zoning ordinance. However, the municipalities of Chimney Rock Village, Forest City, Lake Lure, Rutherfordton, and Spindale have adopted zoning ordinances that are overseen by municipal zoning administrators.

Subdivision Ordinance
Rutherford County, the Village of Chimney Rock, the Town of Forest City, and the Town of Lake Lure have each adopted subdivision regulations.

Building Codes, Permitting, and Inspections
North Carolina has a state compulsory building code which applies throughout the state. Rutherford County provides building code enforcement not only for the county but also for the Village of Chimney Rock and the Towns of Lake Lure, Rutherfordton, Ruth, Spindale, Ellenboro, and Bostic.

Floodplain Management

Table C.47 provides NFIP policy and claim information for each participating jurisdiction in Rutherford County.

TABLE C.47: NFIP POLICY AND CLAIM INFORMATION

Jurisdiction	Date Joined NFIP	Current Effective Map Date	NFIP Policies in Force	Insurance in Force	Closed Claims	Total Payments to Date
RUTHERFORD COUNTY†	06/01/87	01/06/10	63	$14,961,300	30	$626,560
Bostic	09/25/09	01/06/10	1	$350,000	0	$0
Chimney Rock Village	02/14/97	01/06/10	15	$3,659,000	0	$0
Ellenboro*	--	--	--	--	--	--
Forest City	06/17/86	01/06/10	4	$1,015,000	0	$0
Lake Lure	03/04/97	01/06/10	24	$8,866,000	0	$0
Ruth*	--	--	--	--	--	--
Rutherfordton	06/17/86	01/06/10	6	$1,378,000	0	$0
Spindale	06/04/79	01/06/10	2	$400,000	0	$0

†Includes unincorporated areas of county only
*Community does not participate in the NFIP
Source: NFIP Community Status information as of 9/5/13; NFIP claims and policy information as of 6/30/13

All jurisdictions listed above that are participants in the NFIP will continue to comply with all required provisions of the program and will work to adequately comply in the future utilizing a number of strategies. For example, the jurisdictions will coordinate with NCEM and FEMA to develop maps and regulations related to special flood hazard areas within their jurisdictional boundaries and, through a consistent monitoring process, will design and improve their floodplain management program in a way that reduces the risk of flooding to people and property.

The Town of Ellenboro does not participate in the NFIP because none of its land area is currently located within the floodplain. The Town of Ruth also does not participate in the NFIP due to lack of available funding and political support.

Flood Damage Prevention Ordinance
All communities participating in the NFIP are required to adopt a local flood damage prevention ordinance. Rutherford County and all of its municipalities participating in this hazard mitigation plan, with the exception of the Towns of Ellenboro and Ruth, also participate in the NFIP and have adopted flood damage prevention regulations.

Open Space Management Plan
Rutherford County does not have an open space management plan. However, the Town of Lake Lure has adopted a parks, recreation, trails, and open space plan.

Stormwater Management Plan
Rutherford County has not adopted a stormwater management plan. However, the Town of Forest City has adopted stormwater management regulations through the town Unified Development Ordinance.

C.4.2 Administrative and Technical Capability

Table C.48 provides a summary of the capability assessment results for Rutherford County with regard to relevant staff and personnel resources. A checkmark (✓) indicates the presence of a staff member(s) in that jurisdiction with the specified knowledge or skill.

TABLE C.48: RELEVANT STAFF / PERSONNEL RESOURCES

Staff / Personnel Resource	Planners with knowledge of land development/land management practices	Engineers or professionals trained in construction practices related to buildings and/or infrastructure	Planners or engineers with an understanding of natural and/or human-caused hazards	Emergency Manager	Floodplain Manager	Land Surveyors	Scientists familiar with the hazards of the community	Staff with education or expertise to assess the community's vulnerability to hazards	Personnel skilled in GIS and/or Hazus	Resource development staff or grant writers
RUTHERFORD COUNTY	✓	✓	✓	✓	✓		✓	✓	✓	
Bostic	✓	✓	✓	✓	✓		✓	✓		
Chimney Rock Village	✓	✓	✓	✓	✓		✓	✓		
Ellenboro	✓	✓	✓	✓			✓	✓		
Forest City	✓	✓		✓	✓		✓	✓		
Lake Lure	✓	✓		✓	✓		✓	✓	✓	
Ruth	✓	✓	✓	✓			✓	✓		
Rutherfordton	✓	✓		✓	✓		✓	✓		
Spindale	✓	✓	✓	✓	✓		✓	✓		

Credit for having a floodplain manager was given to those jurisdictions that have a flood damage prevention ordinance, and therefore an appointed floodplain administrator, regardless of whether the appointee was dedicated solely to floodplain management. Credit was given for having a scientist familiar with the hazards of the community if a jurisdiction has a Cooperative Extension Service or Soil and Water Conservation Department. Credit was also given for having staff with education or expertise to assess the community's vulnerability to hazards if a staff member from the jurisdiction was a participant on the existing hazard mitigation plan's planning committee.

C.4.3 Fiscal Capability

Table C.49 provides a summary of the results for Rutherford County with regard to relevant fiscal resources. A checkmark (✓) indicates that the given fiscal resource is locally available for hazard mitigation purposes (including match funds for state and federal mitigation grant funds) according to the previous county hazard mitigation plan.

TABLE C.49: RELEVANT FISCAL RESOURCES

Fiscal Tool / Resource	Capital Improvement Programming	Community Development Block Grants (CDBG)	Special Purpose Taxes (or taxing districts)	Gas/Electric Utility Fees	Water/Sewer Fees	Stormwater Utility Fees	Development Impact Fees	General Obligation, Revenue, and/or Special Tax Bonds	Partnering Arrangements or Intergovernmental Agreements	Other: HMGP, FMA, PDM, PA, SBA, other federal grants, etc.
RUTHERFORD COUNTY	✓	✓	✓						✓	✓
Bostic	✓	✓	✓						✓	✓
Chimney Rock Village	✓	✓	✓						✓	✓
Ellenboro	✓	✓	✓						✓	✓
Forest City	✓	✓	✓						✓	✓
Lake Lure	✓	✓	✓						✓	✓
Ruth	✓	✓	✓						✓	✓
Rutherfordton	✓	✓	✓						✓	✓
Spindale	✓	✓	✓						✓	✓

C.4.4 Political Capability

Rutherford County has experienced the devastating effects of natural hazards (i.e., recent hurricanes and ice storms). The previous hazard mitigation plan indicates that the citizens, property owners, business owners, and elected officials of the county are committed to implementing a hazard mitigation plan in order to reduce community vulnerability. The Rutherford County Board of Commissioners, the professional staff, and the citizens of the county are continually striving to make Rutherford County a safer community in which to live, work, and play. The county recognizes that implementation of a hazard mitigation plan is an essential component in helping to achieve these goals.

C.4.5 Conclusions on Local Capability

Table C.50 shows the results of the capability assessment using the designed scoring methodology described in Section 7: *Capability Assessment*. The capability score is based solely on the information found in existing hazard mitigation plans and readily available on the jurisdictions' government websites. According to the assessment, the average local capability score for the county and its municipalities is 27.2, which falls into the moderate capability ranking.

TABLE C.50: CAPABILITY ASSESSMENT RESULTS

Jurisdiction	Overall Capability Score	Overall Capability Rating
RUTHERFORD COUNTY	36	Moderate
Bostic	24	Moderate
Chimney Rock Village	29	Moderate
Ellenboro	17	Limited
Forest City	33	Moderate
Lake Lure	34	Moderate
Ruth	17	Limited
Rutherfordton	28	Moderate
Spindale	27	Moderate

C.5 RUTHERFORD COUNTY MITIGATION STRATEGY

This subsection provides the blueprint for Rutherford County to follow in order to become less vulnerable to its identified hazards. It is based on general consensus of the Regional Hazard Mitigation Planning Committee and the findings and conclusions of the capability assessment and risk assessment. Additional Information can be found in Section 8: *Mitigation Strategy* and Section 9: *Mitigation Action Plan*.

C.5.1 Mitigation Goals

Rutherford County developed five mitigation goals in coordination with the other participating South Mountains Region jurisdictions. The regional mitigation goals are presented in **Table C.51**.

TABLE C.51: SOUTH MOUNTAINS REGIONAL MITIGATION GOALS

	Goal
Goal #1	Improve public education/awareness
Goal #2	Protect human life, safety and welfare by minimizing the potential for damage to personal property, infrastructure, and loss of life due to natural and human caused hazards.
Goal #3	Protect and maintain emergency services infrastructure and equipment to support emergency responders and improve disaster response time/operations.
Goal #4	Improve technical, legal, and institutional capability to respond to and recover from disasters.
Goal #5	Reduce or eliminate the risk of natural disasters.

C.5.2 Mitigation Action Plan

The mitigation actions proposed by Rutherford County, the Town of Bostic, the Village of Chimney Rock, the Town of Ellenboro, the Town of Forest City, the Town of Lake Lure, the Town of Ruth, the Town of Rutherfordton, and the Town of Spindale are listed in the following individual Mitigation Action Plans.

Rutherford County Mitigation Action Plan

Rutherford County Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Encourage power companies or public utilities to continue to be aggressive in the general maintenance and clearing of utility rights-of-way and easements.	All	Moderate	N/A	N/A	EMD	Completed	Completed 2012 spraying continues annually
P-2	Document the location and prioritization of critical facilities.	All	Moderate	N/A	N/A	EMD	Completed	Completed 2013 mapped by GIS
P-3	Document the location and preparedness of the emergency shelters.	All	High	N/A	N/A	EMD	Completed	Completed 2013 and identified in EOP
P-4	Use future growth projections to present alternative utility layout.	All	Low	N/A	N/A	EMD	Deleted	Deleted, this action was deemed to be not technically feasible
P-5	Plan for debris collection and disposal.	All	Moderate			EMD	Completed	Completed 2013
P-6	Review all aspects of emergency response to ensure that emergency services are more than adequate to protect public health and safety.	All	Moderate	N/A	N/A	EMD	Completed	Completed 2012

Rutherford County Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
P-7	Encourage small communities, towns, fire departments, or neighborhoods to participate in the Fire Wise Program and become certified Fire Wise Communities.	WF	Moderate	Grant Funds		Fire Marshall	2016	Deferred due to funding and a lack of community interest
P-8	Update and enforce subdivision regulations, particularly regarding subjects such as accessibility, density and streets and roads.	All	Moderate			Planning Department	Completed	Completed at this time
P-9	Develop parcel specific land use maps.	All	Moderate			GIS Department	2019	Deferred, the county has not been able to develop parcel specific land use maps due to lack of staff time. It will work to complete this action going forward.
P-10	Utilize drought tolerant farming practices.	DR	Moderate			County Extension Service	Deleted	Deleted, this action was deemed to be outside the scope of the CES.
Property Protection								
PP-1	Encourage power companies or public utilities to continue to place utilities underground in new developments, and to relocate existing overhead utilities underground where feasible.	All	Moderate			EMD	Completed	Completed 2012

Rutherford County Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Natural Resource Protection								
NRP-1	Research and evaluate the possibility of stream buffers along the floodplains.	FL	Moderate			Planning Department	2018	Deferred, the county has not had sufficient staff time and funding to research/evaluate stream buffers, so it will work to complete this action in the next cycle.
NRP-2	Identify open space, greenways, and conservation areas along the floodplains and as soon as feasible should plan for acquisition or easements.	FL	Moderate	Grant Funds		Planning Department	2017	Deferred due to funding constraints. The county will work to complete this action in the next cycle.
NRP-3	Develop buffers along streams and rivers prone to repetitive flooding.	FL	Moderate			Planning Department	2018	Deferred due to funding constraints. The county will work to complete this action in the next cycle.
Emergency Services								
ES-1	Seek training in order to provide capable and quick damage assessment and identify mitigation opportunities presented by disaster events.	All	High	Local Funds		EMD	Completed	Completed 2012

Rutherford County Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
ES-2	All critical facilities that do not have backup power generation capabilities should seek funding in order to obtain these capabilities.	All	Moderate	FEMA/Local Funds/NCEM		EMD	2019	Deferred due to funding constraints. The county would like to equip all critical facilities with backup power generation capabilities in the future, so it will seek funding to do so.
Structural Projects								
SP-1	Encourage the Broad River Water Authority, the Town of Forest City, and the Cleveland County Water District to continue to expand into the rural areas of the county.	DR/WF	Moderate	Local Funds		County Fire Marshall	2018	Completed, but additional extensions are planned for other areas, so this action will be carried over to the next cycle.
SP-2	Build interconnects between the various water systems.	DR	Low			Water System Managers	Completed	Completed
SP-3	Public water suppliers should study the feasibility of water storage, either in the form of extra basins at the intake or treatment facility, or in the form of larger reservoirs.	DR	Low			Water System Managers	2019	Deferred due to lack of funding. The county will work to improve water storage capacity in the future.
Public Education and Awareness								
PEA-1	Create a brochure to be made available to the public, documenting what to do when extended power outages occur.	All	Moderate	Local Funds	$2,500 annually	County EM Staff	2017	Deferred, Not adequate personnel or staff time to create outreach materials. The county will work to complete this in the next several years.

Rutherford County Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
PEA-2	Create brochures or handouts that would be available to the public regarding a host of issues related to fire and burning.	WF	Moderate	Local Funds	$2,500 annually	County Fire Marshall	2017	Deferred, Not adequate on personnel or staff time to create outreach materials. The county will work to complete this in the next several years.
PEA-3	Provide information to citizens regarding drought, heat, and shortage of water. Information could be available as brochures, notification on water bills, public service announcements, newspaper articles, etc.	WF/DR	High			Water System Managers	2017	Deferred although some information has been provided to customers, additional information should be developed and sent out to the public.
FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees EMD = Rutherford County Emergency Management Department								

Town of Bostic Mitigation Action Plan

Town of Bostic Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Participate in and enforce the National Flood Insurance Program.	FL	Moderate			Floodplain Administrator	Completed	The town currently participates in the NFIP.
P-2	Encourage small communities, towns, fire departments, or neighborhoods to participate in the Fire Wise Program and become certified Fire Wise Communities.	WF	Moderate	Grant Funds		Fire Chief	2016	Deferred due to lack of community interest. The town will work to become more involved in the Firewise program going forward.
Property Protection								
PP-1								
Natural Resource Protection								
NRP-1								
Emergency Services								
ES-1	Provide additional capacity to the current communications system during emergency situations to improve response capability. Built a new communications center to provide the necessary operational capacity required by the City.	All	High	General Revenue and Grants		Police Department	2017	Although improvements have been made to the communication center's capacity, there are still further improvements that should be made in the future. This action will be worked on going forward.

Town of Bostic Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
ES-2	Provide a two – way communication system for emergency services. Continue to provide two-way communications for emergency services.	All	High	Grants		Police and Fire Departments	Completed	Two-way communication systems have been implemented and are in place.
ES-3	Purchase generators to use as an emergency power supply for water and sewer treatment plants if power is lost during a disaster.	All	High	General Revenue and Grants		Water and Sewer Department	Completed	Generators have been purchased for water and sewer treatment plants
ES-4	Purchase generators to use at the operations center that controls information technology, communications and protection for fiber optic cable.	All	High	General Revenue and Grants		Information Technology	Completed	Completed
ES-5	Develop an action plan to reroute and control traffic during emergency situations.	All	High	General Revenue and Grants		Police Department	Completed	Remote control capability has been implemented throughout the City.
ES-6	Seek training in order to provide capable and quick damage assessment and identify mitigation opportunities presented by disaster events.	All	High	Local Funds		EM Staff	2018	Some training on damage assessments have been completed, but more are necessary to improve the overall process and efficiency.
Structural Projects								
SP-1								
Public Education and Awareness Activities								
PEA-1								

FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake
LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees EMD = Rutherford County Emergency Management Department Town = Town of Bostic

Chimney Rock Village Mitigation Action Plan

Chimney Rock Village Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Develop a Floodplain Management Plan.	FL	High	General Revenue and Grants		Town Council	Completed	The Floodplain Management Plan is included in Land Development Code adopted March 2006.
P-2	Develop a Stormwater Management Ordinance. Encourage Town participation in the Community Rating System.	FL	High	General Revenue and Grants		Town Council	2018	The Storm water Management plan is included in Land Development Code adopted March 2006. Completed Plan but no funding to implement. The village will need to work on developing an implementation plan.
P-3	Develop a stand-by acquisition grant application that lists properties located in the floodplain.	FL	Moderate	Grants		Town Council	2019	Deferred due to lack of funding and staff time to create the application and develop a list of eligible properties
P-4	Identify properties adjacent to the railroad tracks and post in a GIS system for potential buyout of highly vulnerable structures.	HM	Moderate	General Revenue and Grants		Town Council	Deleted	This action was determined to not be applicable so it has been deleted.

Chimney Rock Village Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
P-5	Initiate a storm water study to determine if storm water is exacerbating flooding along waterways, and provide solutions or alternatives to manage this problem.	FL	Moderate	General Revenue		Public Works	2018	Deferred due to lack of funding to complete stormwater study. A comprehensive stormwater study should be completed in the future.
P-6	Encourage small communities, towns, fire departments, or neighborhoods to participate in the Fire Wise Program and become certified Fire Wise Communities.	WF	Moderate	Grant Funds		Fire Chief	2016	Deferred due to lack of funding. The town will work to become more involved in the Firewise program going forward.
Property Protection								
PP-1								
Natural Resource Protection								
NRP-1								
Emergency Services								
ES-1	Seek training in order to provide capable and quick damage assessment and identify mitigation opportunities presented by disaster events.	All	High	Local Funds		EM Staff	Completed	Completed 2012
ES-2	All critical facilities that do not have backup power generation capabilities should seek funding in order to obtain these capabilities.	All	Moderate	FEMA/Local Funds/NCEM		EMD	2019	Deferred due to funding constraints. The county would like to equip all critical facilities with backup power generation capabilities in the future, so it will seek funding to do so.

Chimney Rock Village Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Structural Projects								
SP-1								
Public Education and Awareness Activities								
PEA-1	Create a brochure to be made available to the public, documenting what to do when extended power outages occur.	All	Moderate	Local Funds	$2,500 annually	County EM Staff	2017	Deferred, Not adequate personnel or staff time to create outreach materials. The county will work to complete this in the next several years.
FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees EMD = Rutherford County Emergency Management Department Village = Chimney Rock Village								

Town of Ellenboro Mitigation Action Plan

Town of Ellenboro Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Participate in and enforce the National Flood Insurance Program.	FL	Moderate			Floodplain Administrator	Deleted	No Floodplain in jurisdiction
P-2	Encourage small communities, towns, fire departments, or neighborhoods to participate in the Fire Wise Program and become certified Fire Wise Communities.	WF	Moderate	Grant Funds		Fire Chief	2016	Deferred due to lack of community interest. The town will work to become more involved in the Firewise program going forward.
Property Protection								
PP-1								
Natural Resource Protection								
NRP-1								
Emergency Services								
ES-1	Seek training in order to provide capable and quick damage assessment and identify mitigation opportunities presented by disaster events.	All	High	Local Funds		EM Staff	Completed	Completed 2012

Town of Ellenboro Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
ES-2	All critical facilities that do not have backup power generation capabilities should seek funding in order to obtain these capabilities.	All	Moderate	FEMA/Local Funds/NC EM		EMD	2019	Deferred due to funding constraints. The county would like to equip all critical facilities with backup power generation capabilities in the future, so it will seek funding to do so.
Structural Projects								
SP-1								
Public Education and Awareness Activities								
PEA-1	Create a brochure to be made available to the public, documenting what to do when extended power outages occur.	All	Moderate	Local Funds	$2,500 annually	County EM Staff	2017	Deferred, Not adequate personnel or staff time to create outreach materials. The county will work to complete this in the next several years.

FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake
LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees EMD = Rutherford County Emergency Management Department Town = Town of Ellenboro

Town of Forest City Mitigation Action Plan

Town of Forest City Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Enforce general and nuisance Ordinances to clear brush and debris.	WF	Moderate			Code Enforcemen t	Completed	Completed. These ordinances have been put in place and are being enforced.
P-2	Initiate a storm water study to determine if storm water is exacerbating flooding along waterways, and provide solutions or alternatives to manage this problem.	FL	Moderate	General Revenue		Public Works	2018	Deferred due to lack of funding to complete stormwater study. A comprehensive stormwater study should be completed in the future.
P-3	Encourage small communities, towns, fire departments, or neighborhoods to participate in the Fire Wise Program and become certified Fire Wise Communities.	WF	Moderate	Grant Funds		Fire Chief	2016	New Action
Property Protection								
PP-1								
Natural Resource Protection								
NRP-1								

Town of Forest City Existing Mitigation Actions								
Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
Emergency Services								
ES-1	Seek training in order to provide capable and quick damage assessment and identify mitigation opportunities presented by disaster events.	All	High	Local Funds		EM Staff	Completed	Completed 2012
ES-2	All critical facilities that do not have backup power generation capabilities should seek funding in order to obtain these capabilities.	All	Moderate	FEMA/Local Funds/NCEM		EMD	2019	Deferred due to funding constraints. The county would like to equip all critical facilities with backup power generation capabilities in the future, so it will seek funding to do so.
Structural Projects								
SP-1								
Public Education and Awareness Activities								
PEA-1	Create a brochure to be made available to the public, documenting what to do when extended power outages occur.	All	Moderate	Local Funds	$2,500 annually	County EM Staff	2017	Deferred, Not adequate personnel or staff time to create outreach materials. The county will work to complete this in the next several years.
FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees EMD = Rutherford County Emergency Management Department Town = Town of Forest City								

Town of Lake Lure Mitigation Action Plan

Town of Lake Lure Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Enforce general and nuisance Ordinances to clear brush and debris.	WF	Moderate			Code Enforcemen t	Completed	Completed. These ordinances have been put in place and are being enforced.
P-2	Initiate a storm water study to determine if storm water is exacerbating flooding along waterways, and provide solutions or alternatives to manage this problem.	FL	Moderate	General Revenue		Public Works	2018	Deferred due to lack of funding to complete stormwater study. A comprehensive stormwater study should be completed in the future.
P-3	Encourage small communities, towns, fire departments, or neighborhoods to participate in the Fire Wise Program and become certified Fire Wise Communities.	WF	Moderate	Grant Funds		Fire Chief	2016	New Action
Property Protection								
PP-1								
Natural Resource Protection								
NRP-1								

Town of Lake Lure Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Emergency Services								
ES-1	Seek training in order to provide capable and quick damage assessment and identify mitigation opportunities presented by disaster events.	All	High	Local Funds		EM Staff	Completed	Completed 2012
ES-2	All critical facilities that do not have backup power generation capabilities should seek funding in order to obtain these capabilities.	All	Moderate	FEMA/Local Funds/NCEM		EMD	2019	Deferred due to funding constraints. The county would like to equip all critical facilities with backup power generation capabilities in the future, so it will seek funding to do so.
Structural Projects								
SP-1								
Public Education and Awareness Activities								
PEA-1	Create a brochure to be made available to the public, documenting what to do when extended power outages occur.	All	Moderate	Local Funds	$2,500 annually	County EM Staff	2017	Deferred, Not adequate personnel or staff time to create outreach materials. The county will work to complete this in the next several years.

FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake
LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees EMD = Rutherford County Emergency Management Department Town = Town of Lake Lure

Town of Ruth Mitigation Action Plan

Town of Ruth Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Encourage Town participation in the National Flood Insurance Program and subsequent participation in the Community Rating System Program.	FL	High			Town Council	2019	Town Council will consider participation
P-2	Encourage small communities, towns, fire departments, or neighborhoods to participate in the Fire Wise Program and become certified Fire Wise Communities.	WF	Moderate	Grant Funds		Fire Chief	2016	Deferred due to lack of community interest. The town will work to become more involved in the Firewise program going forward.
Property Protection								
PP-1								
Natural Resource Protection								
NRP-1								
Emergency Services								
ES-1	Seek training in order to provide capable and quick damage assessment and identify mitigation opportunities presented by disaster events.	All	High	Local Funds		EM Staff	Completed	Completed 2012

Town of Ruth Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
ES-2	All critical facilities that do not have backup power generation capabilities should seek funding in order to obtain these capabilities.	All	Moderate	FEMA/Local Funds/NCEM		EMD	2019	Deferred due to funding constraints. The county would like to equip all critical facilities with backup power generation capabilities in the future, so it will seek funding to do so.
Structural Projects								
SP-1	Encourage the Broad River Water Authority, the Town of Forest City, and the Cleveland County Water District to continue to expand into the rural areas of the county.	DR/WF	Moderate	Local Funds		County Fire Marshall	2018	Completed, but additional extensions are planned for other areas, so this action will be carried over to the next cycle.
Public Education and Awareness Activities								
PEA-1	Create a brochure to be made available to the public, documenting what to do when extended power outages occur.	All	Moderate	Local Funds	$2,500 annually	County EM Staff	2017	Deferred, Not adequate personnel or staff time to create outreach materials. The county will work to complete this in the next several years.
FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees EMD = Rutherford County Emergency Management Department Town = Town of Ruth								

Town of Rutherfordton Mitigation Action Plan

Town of Rutherfordton Existing Mitigation Actions								
Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
Prevention								
P-1	Enforce general and nuisance Ordinances to clear brush and debris.	WF	Moderate			Code Enforcement	Completed	Completed
P-2	Encourage small communities, towns, fire departments, or neighborhoods to participate in the Fire Wise Program and become certified Fire Wise Communities.	WF	Moderate	Grant Funds		Fire Chief	2016	Deferred due to funding and a lack of community interest
Property Protection								
PP-1								
Natural Resource Protection								
NRP-1								
Emergency Services								
ES-1	Seek training in order to provide capable and quick damage assessment and identify mitigation opportunities presented by disaster events.	All	High	Local Funds		EM Staff	Completed	Completed 2012

Town of Rutherfordton Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
ES-2	All critical facilities that do not have backup power generation capabilities should seek funding in order to obtain these capabilities.	All	Moderate	FEMA/Local Funds/NCEM		EMD	2019	Deferred due to funding constraints. The county would like to equip all critical facilities with backup power generation capabilities in the future, so it will seek funding to do so.
Structural Projects								
SP-1								
Public Education and Awareness Activities								
PEA-1	Create a brochure to be made available to the public, documenting what to do when extended power outages occur.	All	Moderate	Local Funds	$2,500 annually	County EM Staff	2017	Deferred, Not adequate personnel or staff time to create outreach materials. The county will work to complete this in the next several years.
FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees EMD = Rutherford County Emergency Management Department Town = Town of Rutherfordton								

Town of Spindale Mitigation Action Plan

Town of Spindale Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Enforce general and nuisance Ordinances to clear brush and debris.	WF	Moderate			Code Enforcement	Completed	Completed. These ordinances have been put in place and are being enforced.
P-2	Initiate a storm water study to determine if storm water is exacerbating flooding along waterways, and provide solutions or alternatives to manage this problem.	FL	Moderate	General Revenue		Public Works	2018	Deferred due to lack of funding to complete stormwater study. A comprehensive stormwater study should be completed in the future.
P-3	Encourage small communities, towns, fire departments, or neighborhoods to participate in the Fire Wise Program and become certified Fire Wise Communities.	WF	Moderate	Grant Funds		Fire Chief	2016	Deferred due to lack of community interest. The town will work to become more involved in the Firewise program going forward.
Property Protection								
PP-1								
Natural Resource Protection								
NRP-1								

Town of Spindale Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
Emergency Services								
ES-1	Seek training in order to provide capable and quick damage assessment and identify mitigation opportunities presented by disaster events.	All	High	Local Funds		EM Staff	Completed	Completed 2012
ES-2	All critical facilities that do not have backup power generation capabilities should seek funding in order to obtain these capabilities.	All	Moderate	FEMA/Local Funds/NCEM		EMD	2019	Deferred due to funding constraints. The county would like to equip all critical facilities with backup power generation capabilities in the future, so it will seek funding to do so.
Structural Projects								
SP-1								
Public Education and Awareness Activities								
PEA-1	Create a brochure to be made available to the public, documenting what to do when extended power outages occur.	All	Moderate	Local Funds	$2,500 annually	County EM Staff	2017	Deferred, Not adequate personnel or staff time to create outreach materials. The county will work to complete this in the next several years.

FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake
LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees EMD = Rutherford County Emergency Management Department Town = Town of Spindale

Annex D
Transylvania County

This annex includes jurisdiction-specific information for Transylvania County and its participating municipalities. It consists of the following five subsections:

- D.1 Transylvania County Community Profile
- D.2 Transylvania County Risk Assessment
- D.3 Transylvania County Vulnerability Assessment
- D.4 Transylvania County Capability Assessment
- D.5 Transylvania County Mitigation Strategy

D.1 TRANSYLVANIA COUNTY COMMUNITY PROFILE

D.1.1 Geography and the Environment

Transylvania County is situated along the North Carolina and South Carolina state border. The county is located along the Blue Ridge Mountain Range. It comprises one town, the Town of Rosman, and one city, the City of Brevard.

The county is a typical mountain county consisting of mountain ranges, isolated peaks, rolling plateaus, and valleys. Elevations within the county range from 1,265 to 6,043 feet. One of the county's highest elevations is at Chestnut Knob reaching 6,025 feet. The total area of the county is 378 square miles, 2 square miles of which is water area. Transylvania contains 250 waterfalls, including one of the highest falls in the Eastern US.

Summer temperatures in the county range from highs of about 81˚F to lows in the high 40s. Winter temperatures range from highs of 70˚F to lows of 23˚F. Irregular elevation strongly influences temperature experienced by the county. Year round, average temperatures in the county are typically 56˚F. The county averages over five inches of rainfall each month. Transylvania is located in the wettest area of North Carolina.

D.1.2 Population and Demographics

According to the 2010 Census, Transylvania County has a population of 33,090 people. The county has seen over 11% growth between 2000 and 2010, and the population density is 87 people per square mile. Population counts from the US Census Bureau for 1990, 2000, and 2010 for the county and participating municipalities are presented in **Table D.1**.

TABLE D.1: POPULATION COUNTS FOR TRANSYLVANIA COUNTY

Jurisdiction	1990 Census Population	2000 Census Population	2010 Census Population	% Change 2000-2010
Transylvania County	**25,520**	**29,334**	**33,090**	**12.8%**
City of Brevard	5,388	6,789	7,609	12.1%
Town of Rosman	385	490	576	17.6%

Source: US Census Bureau

Based on the 2010 Census, the median age of residents of Transylvania County is 48.8 years. The racial characteristics of the county are presented in **Table D.2**. Whites make up the majority of the population in the county, accounting for 92 percent of the population.

TABLE D.2: DEMOGRAPHICS OF TRANSYLVANIA COUNTY

Jurisdiction	White, Percent (2010)	Black or African American, Percent (2010)	American Indian or Alaska Native, Percent (2010)	Asian, Percent (2010)	Native Hawaiian or Other Pacific Islander, Percent (2010)	Other Race, Percent (2010)	Two or More Races, percent (2010)	Persons of Hispanic Origin, Percent (2010)*
Transylvania County	**92.4%**	**3.9%**	**0.3%**	**0.4%**	**0.0%**	**1.3%**	**1.7%**	**2.9%**
City of Brevard	83.3%	11.0%	0.3%	1.0%	0.0%	1.7%	2.7%	3.7%
Town of Rosman	93.2%	0.2%	1.9%	0.2%	0.0%	2.6%	1.9%	10.4%

*Hispanics may be of any race, so also are included in applicable race categories
Source: US Census Bureau

D.1.3 Housing

According to the 2010 US Census, there are 19,163 housing units in Transylvania County, the majority of which are single family homes or mobile homes. Housing information for the county and municipalities is presented in **Table D.3**. As shown in the table, the Transylvania County has a significantly higher percentage of seasonal housing units compared to its municipalities.

TABLE D.3: HOUSING CHARACTERISTICS OF TRANSYLVANIA COUNTY

Jurisdiction	Housing Units (2000)	Housing Units (2010)	Seasonal Units, Percent (2010)	Median Home Value (2007-2011)
Transylvania County	**15,553**	**19,163**	**16.5%**	**$166,300**
City of Brevard	3,058	3, 867	3.7%	$189,200
Town of Rosman	236	272	2.2%	$104,600

Source: US Census Bureau

D.1.4 Infrastructure

Transportation

There are several US and state highways that serve Transylvania County and link it with other regions of North Carolina as well as the neighboring states of Georgia, South Carolina, and Tennessee. US 64 is the longest numbered route in North Carolina and is a major east-west route though the eastern portion of the state. US 178 is a two-lane road, also known as Pickens Highway, that begins at an intersection with US 64, west of the Town of Rosman. US 276 operates through the City of Brevard and the Pisgah National Forest. This route is heavily traveled due to its scenic view. NC 215, NC 280, and NC 281 are additional major arterials within the county.

Within Transylvania County, the Transylvania County Transportation System is free to residents over the age of 60, disabled individuals, and children. The county offers shuttles for medical transportation and dialysis.

Utilities

Electrical power in Transylvania County is provided by one public company, Duke Energy Progress. In addition to the public utility provider, Haywood Electric Membership Corporation is an electricity cooperative that provides service to the county.

Water and sewer service is provided by many of the towns in the South Mountains Region, but generally municipal water systems are extremely limited in the mountains and private or shared wells and septic systems are considered the norm. Water for municipal and industrial use is obtained largely from surface streams; however, residential water is obtained from wells and springs.

Community Facilities

There are a number of buildings and community facilities located throughout Transylvania County. According to the data collected for the vulnerability assessment (Section 6.4.1), there are 8 fire/EMS stations, 5 police stations, and 12 public schools located within the county.

There is one hospital located in Transylvania County. The Transylvania Regional Hospital in the City of Brevard has 92 beds. Three outpatient medical centers are associated with the hospital.

There are eight public recreation parks within Transylvania County spanning over 60 acres. Within the county there are nine national, state, and local parks. Pisgah National Forest, DuPont State Park, and Gorges State Park are available recreational facilitates in Transylvania County. The City of Brevard maintains five local parks and recreation areas. The Cascade Lake Recreation Area is another park within the county.

D.1.5 Land Use

The most populous areas in Transylvania County are concentrated along transportation routes and more urbanized areas. Land reserved for recreational use exists throughout the county and has been preserved by both the State of North Carolina and Federal Government. The county seeks to conserve its naturally valuable land, water, and resources and preserve its distinctive rural character, mountain heritage, natural environment, and ambiance.

Transylvania County Comprehensive Plan addresses land use regulations throughout the county and for the Town of Rosman. The City of Brevard adopted and maintains an independent Land Use Plan. The county has not adopted countywide zoning; however, it does maintain one Zoning Ordinance related to land governed by the Pisgah National Forest. The City of Brevard does have zoning and maintains a City Planning and Zoning Department.

D.1.6 Employment and Industry

The North Carolina Employment Security Commission reported an annual average employment of 11,791 workers and an average unemployment rate of 8.2 percent in Transylvania County for 2011. In 2011, the top employment industry was Education and Health Services, making up 24.1 percent of total employment. Other major industries were Construction (14.3%); Retail Trade (9.3%); and Arts, Entertainment, Recreation, and Accommodation and Food Services (9.3%). The county's average annual median household income was $41,103 from 2007 to 2011.

D.2 TRANSYLVANIA COUNTY RISK ASSESSMENT

This subsection includes hazard profiles for each of the significant hazards identified in Section 4: *Hazard Identification* as they pertain to Transylvania County. Each hazard profile includes a description of the hazard's location and extent, notable historical occurrences, and the probability of future occurrences. Additional information can be found in Section 5: *Hazard Profiles*.

D.2.1 Drought

Location and Spatial Extent

Drought typically covers a large area and cannot be confined to any geographic or political boundaries. Local areas may experience much more severe and/or frequent drought events than what is represented on the Palmer Drought Severity Index map. Furthermore, it is assumed that the county would be uniformly exposed to drought, making the spatial extent potentially widespread. It is also notable that drought conditions typically do not cause significant damage to the built environment.

Historical Occurrences

According to the North Carolina Drought Monitor, Transylvania County has had drought occurrences in 13 of the last 14 years (2000-2013). **Table D.4** shows the most severe drought classification for each year, according to North Carolina Drought Monitor classifications. It should be noted that the North Carolina Drought Monitor also estimates what percentage of the county is in each classification of drought severity. For example, the most severe classification reported may be exceptional but a majority of the county may actually be in a less severe condition.

TABLE D. 4: HISTORICAL DROUGHT OCCURRENCES IN TRANSYLVANIA COUNTY

Abnormally Dry | Moderate Drought | Severe Drought | Extreme Drought | Exceptional Drought

	Transylvania County
2000	EXTREME
2001	EXTREME
2002	EXCEPTIONAL
2003	NORMAL
2004	MODERATE
2005	ABNORMAL
2006	SEVERE
2007	EXCEPTIONAL
2008	EXCEPTIONAL
2009	EXTREME
2010	MODERATE
2011	MODERATE
2012	MODERATE
2013	ABNORMAL

Source: North Carolina Drought Monitor (through Sept. 2013)

Probability of Future Occurrences

Based on historical occurrence information, it is assumed that Transylvania County has a probability level of likely (10 to 100 percent annual probability) for future drought events. This hazard may vary slightly by location but each area has an equal probability of experiencing a drought. However, historical information also indicates that there is a much lower probability for extreme, long-lasting drought conditions.

D.2.2 Extreme Heat

Location and Spatial Extent

Excessive heat typically impacts a large area and cannot be confined to any geographic or political boundaries. All of Transylvania County is susceptible to extreme heat conditions.

Historical Occurrences

Data from the National Climatic Data Center was used to determine historical extreme heat and heat wave events in Transylvania County. There were no events reported.

In addition, information from the State Climate Office of North Carolina was reviewed to obtain historical temperature records in the county. Temperature information has been reported since 1902. The recorded maximum for Transylvania County can be found below in **Table D.5**.

TABLE 5.5: HIGHEST RECORDED TEMPERATURE IN TRANSYLVANIA COUNTY

Location	Date	Temperature (F)
Buck Forest	6/6/1977	100
TRANSYLVANIA COUNTY MAXIMUM	--	

Source: State Climate Office of North Carolina

The State Climate Office also reports average maximum temperatures in various locations in the county. The most centralized location is Brevard. **Table D.6** shows the average maximum temperatures from 1971 to 2000 at the Brevard observation station which can be used as a general comparison for the county.

TABLE D.6: AVERAGE MAXIMUM TEMPERATURE IN BREVARD, TRANSYLVANIA COUNTY

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Avg. Max (°F)	47.2	51.5	59.4	67.2	74.0	79.2	81.8	80.1	75.3	67.5	58.4	49.9

Source: State Climate Office of North Carolina

Probability of Future Occurrences

Based on historical occurrence information, it is assumed that all of Transylvania County has a probability level of possible (1 to 10 percent annual probability) for future extreme heat events to impact the county.

D.2.3 Hailstorm

Location and Spatial Extent

Hailstorms frequently accompany thunderstorms, so their locations and spatial extents coincide. It is assumed that Transylvania County is uniformly exposed to severe thunderstorms; therefore, all areas of the county are equally exposed to hail which may be produced by such storms.

Historical Occurrences

According to the National Climatic Data Center, 93 recorded hailstorm events have affected Transylvania County since 1970.[1] **Table D.7** is a summary of the hail events in Transylvania County. **Table D.8** provides detailed information about each event that occurred in the county. In all, hail occurrences resulted in over $100,000 (2013 dollars) in property damages. Hail ranged in diameter from 0.5 inches to 2.75 inches. It should be noted that hail is notorious for causing substantial damage to cars, roofs, and other areas of the built environment that may not be reported to the National Climatic Data Center. Therefore, it is likely that damages are greater than the reported value.

TABLE D.7: SUMMARY OF HAIL OCCURRENCES IN TRANSYLVANIA COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Brevard	15	0/0	$80,456
Rosman	7	0/0	$27,685
Unincorporated Area	54	0/0	$0
TRANSYLVANIA COUNTY TOTAL	**93**	**0/0**	**$108,141**

Source: National Climatic Data Center

[1] These hail events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is likely that additional hail events have affected Transylvania County. In addition to NCDC, the North Carolina Department of Insurance office was contacted for information. As additional local data becomes available, this hazard profile will be amended.

TABLE D.8: HISTORICAL HAIL OCCURRENCES IN TRANSYLVANIA COUNTY

	Date	Magnitude	Deaths / Injuries	Property Damage*
Brevard				
BREVARD	20-APR-96	0.75 in.	0/0	$80,456
BREVARD	27-MAY-98	1.00 in.	0/0	$0
BREVARD	08-AUG-03	0.75 in.	0/0	$0
BREVARD	20-JUN-05	0.75 in.	0/0	$0
BREVARD	20-JUN-05	0.88 in.	0/0	$0
BREVARD	20-JUN-05	0.50 in.	0/0	$0
BREVARD	04-AUG-05	0.75 in.	0/0	$0
BREVARD	19-APR-06	0.75 in.	0/0	$0
BREVARD	19-APR-06	0.88 in.	0/0	$0
BREVARD	01-JUL-06	0.75 in.	0/0	$0
BREVARD	11-MAY-07	0.75 in.	0/0	$0
BREVARD	12-JUN-07	1.00 in.	0/0	$0
BREVARD	09-MAY-08	1.75 in.	0/0	$0
BREVARD	09-MAY-08	0.75 in.	0/0	$0
BREVARD	10-JUN-08	0.75 in.	0/0	$0
Rosman				
ROSMAN	19-MAY-01	0.75 in.	0/0	$0
ROSMAN	01-JUL-02	1.25 in.	0/0	$27,685
ROSMAN	20-MAY-06	0.88 in.	0/0	$0
ROSMAN	25-MAY-06	0.75 in.	0/0	$0
ROSMAN	10-AUG-06	0.75 in.	0/0	$0
ROSMAN	23-JUN-07	1.00 in.	0/0	$0
ROSMAN	09-JUL-12	0.88 in.	0/0	$0
Unincorporated Area				
TRANSYLVANIA COUNTY	15-MAY-70	1.00 in.	0/0	$0
TRANSYLVANIA COUNTY	03-APR-74	0.75 in.	0/0	$0
TRANSYLVANIA COUNTY	07-JUN-85	0.75 in.	0/0	$0
TRANSYLVANIA COUNTY	09-JUL-85	1.00 in.	0/0	$0
TRANSYLVANIA COUNTY	09-JUL-85	1.00 in.	0/0	$0
TRANSYLVANIA COUNTY	24-JUN-86	2.75 in.	0/0	$0
TRANSYLVANIA COUNTY	01-MAY-87	0.75 in.	0/0	$0
TRANSYLVANIA COUNTY	14-MAY-88	0.75 in.	0/0	$0
TRANSYLVANIA COUNTY	24-JUN-88	0.75 in.	0/0	$0
TRANSYLVANIA COUNTY	25-JUN-88	0.75 in.	0/0	$0
TRANSYLVANIA COUNTY	02-MAY-90	1.00 in.	0/0	$0
TRANSYLVANIA COUNTY	02-MAY-90	1.00 in.	0/0	$0
TRANSYLVANIA COUNTY	02-JUL-91	1.00 in.	0/0	$0
Lake Toxaway	31-MAR-93	1.75 in.	0/0	$0
Pisgah Forest	31-MAR-93	0.75 in.	0/0	$0
Pisgah Forest	09-JUN-95	0.75 in.	0/0	$0
LAKE TOXAWAY	15-MAR-96	0.75 in.	0/0	$0
LAKE TOXAWAY	24-MAY-96	0.75 in.	0/0	$0
COUNTYWIDE	04-JUL-97	1.25 in.	0/0	$0
LAKE TOXAWAY	08-JAN-98	1.00 in.	0/0	$0

	Date	Magnitude	Deaths / Injuries	Property Damage*
CONNESTEE	17-APR-02	0.75 in.	0/0	$0
LAKE TOXAWAY	11-JUN-03	0.75 in.	0/0	$0
BALSAM GROVE	10-MAY-05	0.75 in.	0/0	$0
PENROSE	03-APR-06	0.75 in.	0/0	$0
BALSAM GROVE	28-MAY-06	0.75 in.	0/0	$0
CEDAR MTN	11-JUN-06	0.75 in.	0/0	$0
LAKE TOXAWAY	02-JUL-06	0.75 in.	0/0	$0
BALSAM GROVE	04-JUL-06	0.88 in.	0/0	$0
PENROSE	12-JUN-07	0.75 in.	0/0	$0
PISGAH FOREST	12-JUN-07	0.75 in.	0/0	$0
BALSAM GROVE	21-JUL-08	0.88 in.	0/0	$0
GRANGE	09-JUN-09	0.88 in.	0/0	$0
GRANGE	16-JUN-09	0.88 in.	0/0	$0
OAKLAND	27-JUL-09	0.75 in.	0/0	$0
CEDAR MTN	09-SEP-09	1.00 in.	0/0	$0
POWELLTOWN	15-JUN-10	0.75 in.	0/0	$0
REID	15-JUN-10	0.75 in.	0/0	$0
PENROSE	25-JUL-10	0.75 in.	0/0	$0
POWELLTOWN	28-APR-11	0.88 in.	0/0	$0
SEGA LAKE	02-JUN-11	0.75 in.	0/0	$0
ECUSTA	02-JUN-11	0.75 in.	0/0	$0
NORTH BREVARD	09-JUN-11	1.00 in.	0/0	$0
JOHN ROCK	21-JUN-11	0.75 in.	0/0	$0
BALSAM GROVE	21-JUN-11	0.75 in.	0/0	$0
NORTH BREVARD	15-MAR-12	1.00 in.	0/0	$0
NORTH BREVARD	15-MAR-12	1.00 in.	0/0	$0
NORTH BREVARD	15-MAR-12	1.00 in.	0/0	$0
POWELLTOWN	24-MAR-12	1.00 in.	0/0	$0
POWELLTOWN	24-MAR-12	1.00 in.	0/0	$0
POWELLTOWN	24-MAR-12	1.00 in.	0/0	$0
SAPPHIRE	26-APR-12	0.88 in.	0/0	$0
OAKLAND	01-MAY-12	0.88 in.	0/0	$0
JOHN ROCK	02-MAY-12	0.88 in.	0/0	$0
OAKLAND	08-AUG-12	0.75 in.	0/0	$0

*Property damage is reported in 2013 dollars; All damage may not have been reported.
Source: National Climatic Data Center

Probability of Future Occurrences

Based on historical occurrence information, it is assumed that the probability of future hail occurrences is highly likely (100 percent annual probability). Since hail is an atmospheric hazard (coinciding with thunderstorms), it is assumed that Transylvania County has equal exposure to this hazard. It can be expected that future hail events will continue to cause minor damage to property and vehicles throughout the county.

D.2.4 Hurricane and Tropical Storm

Location and Spatial Extent

Hurricanes and tropical storms threaten the entire Atlantic and Gulf seaboard of the United States. While coastal areas are most directly exposed to the brunt of landfalling storms, their impact is often felt hundreds of miles inland and they can affect Transylvania County. The entire county is equally susceptible to hurricane and tropical storms.

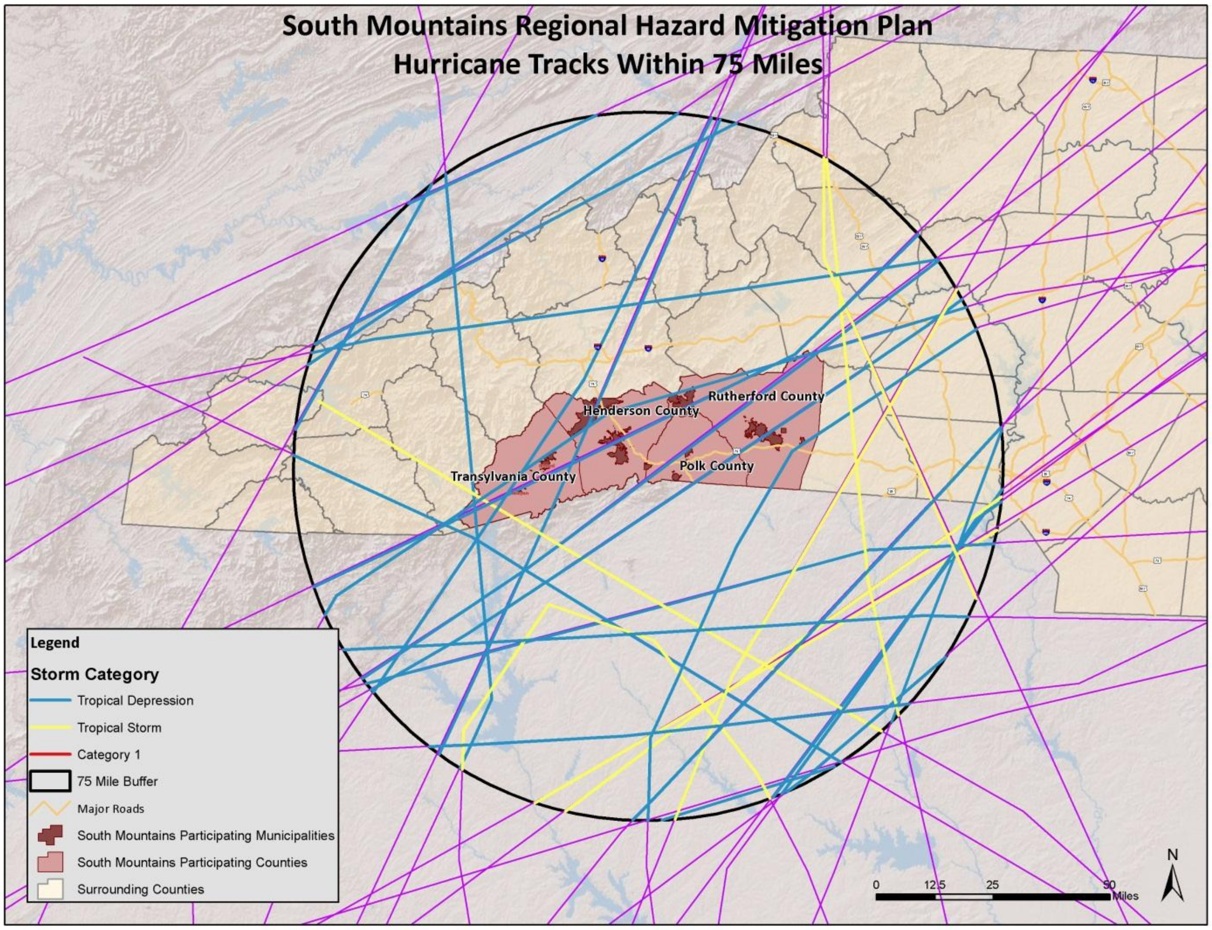
Historical Occurrences

According to the National Hurricane Center's historical storm track records, 30 hurricane or tropical storm tracks have passed within 75 miles of Transylvania County since 1850.[2] This includes 7 tropical storms, and 23 tropical depressions.

Of the recorded storm events, 1 tropical storm and 4 tropical depressions have traversed directly through Transylvania County as shown in **Figure D.1**. **Table D.9** provides for each event the date of occurrence, name (if applicable), maximum wind speed (as recorded within 75 miles of the South Mountains Region) and Category of the storm based on the Saffir-Simpson Scale.

[2] These storm track statistics do not include extra-tropical storms. Though these related hazard events are less severe in intensity, they may cause significant local impact in terms of rainfall and high winds.

FIGURE D.1: HISTORICAL HURRICANE STORM TRACKS WITHIN 75 MILES OF THE TRANSYLVANIA COUNTY



Source: National Oceanic and Atmospheric Administration; National Hurricane Center

TABLE D.9: HISTORICAL STORM TRACKS WITHIN 75 MILES OF TRANSYLVANIA COUNTY (1850–2010)

Date of Occurrence	Storm Name	Maximum Wind Speed (knots)	Storm Category
9/17/1859	NOT NAMED	--	Tropical Depression (TD)
9/24/1886	NOT NAMED	35	Tropical Storm (TS)
8/1/1891	NOT NAMED	35	Tropical Storm (TS)
7/8/1896	NOT NAMED	26	Tropical Depression (TD)
9/28/1901	NOT NAMED	22	Tropical Depression (TD)
10/11/1902	NOT NAMED	31	Tropical Depression (TD)
10/10/1905	NOT NAMED	--	Tropical Depression (TD)
9/18/1906	NOT NAMED	31	Tropical Depression (TD)
9/23/1907	NOT NAMED	40	Tropical Storm (TS)
8/30/1911	NOT NAMED	26	Tropical Depression (TD)
6/17/1912	NOT NAMED	--	Tropical Depression (TD)

Date of Occurrence	Storm Name	Maximum Wind Speed (knots)	Storm Category
9/4/1913	NOT NAMED	26	Tropical Depression (TD)
8/31/1915	NOT NAMED	26	Tropical Depression (TD)
7/15/1916	NOT NAMED	31	Tropical Depression (TD)
8/11/1928	NOT NAMED	35	Tropical Storm (TS)
5/30/1934	NOT NAMED	26	Tropical Depression (TD)
8/28/1949	NOT NAMED	35	Tropical Storm (TS)
9/30/1959	GRACIE	22	Tropical Depression (TD)
8/30/1964	CLEO	22	Tropical Depression (TD)
6/8/1968	CELESTE	53	Tropical Storm (TS)
9/8/1977	BABE	22	Tropical Depression (TD)
8/18/1985	ONE-C	48	Tropical Storm (TS)
9/22/1989	HUGO	22	Tropical Depression (TD)
8/17/1994	BERYL	--	Tropical Depression (TD)
7/24/1997	DANNY	18	Tropical Depression (TD)
7/10/2003	DOLORES	--	Tropical Depression (TD)
9/8/2004	FRANCES	18	Tropical Depression (TD)
9/17/2004	IVAN	13	Tropical Depression (TD)
9/28/2004	JEANNE	18	Tropical Depression (TD)
7/7/2005	CINDY	18	Tropical Depression (TD)

Source: National Hurricane Center

The National Climatic Data Center did not report any events associated with a hurricane or tropical storm in Transylvania County between 1950 and 2013. However, federal records indicate that two disaster declarations were made in 2004 (Tropical Storm Frances and Hurricane Ivan) for the region.[3]

Flooding is generally the greatest hazard of concern with hurricane and tropical storm events in Transylvania County. Most events do not carry winds that are above that of the winter storms and straight line winds received by the county. Some anecdotal information is available for the major storms that have impacted that area as found below:

Tropical Storm Frances – September 7-8, 2004

Tropical Storm Frances was a slow-moving, relatively large storm that dumped heavy rains over the eastern United States. The remnants of Frances produced a swath of 5 to 15 inches of rain across the North Carolina Mountains with reports of 12 to 15 inches of rain along the higher terrain and isolated reports in excess of 18 inches. Wind gusts reached between 40 and 60 mph along the Appalachian Mountains and thousands of trees were downed. Trees fell on structures, vehicles, and power lines. Additionally, the downed trees led to the death of an elderly man in Hendersonville when a tree fell through the resident's structure. Flooding also led to numerous landslides in the area which added to the damage of infrastructure and residential and commercial structures. Frances caused significant crop damages totaling $55 million statewide. North Carolina residents received almost $20.6 million in federal disaster assistance following the storm.

[3] All of the participating counties were declared disaster areas for these storms particular storms. A complete listing of historical disaster declarations, including the affected counties, can be found in Section 4: *Hazard Identification*.

Hurricane Ivan – September 16-17, 2004
Just a week and a half following Tropical Storm Frances, the remnants of Hurricane Ivan hit western North Carolina when many streams and rivers were already well above flood stage. The widespread flooding forced many roads to be closed and landslides were common across the mountain region. Wind gusts reached between 40 and 60 mph across the higher elevations of the Appalachian Mountains resulting in numerous downed trees. More than $13.8 million of federal aid was dispersed across North Carolina following Ivan.

The Hurricane Frances/Ivan combination of events resulted in widespread road closures (including Highways 64, 280, 25, and 276) as well as infrastructure damages (many bridges and roads were completely washed out), residential structure damages, and commercial structure damages due to massive flooding. Trees were blown down and fell on structures, vehicles, and powerlines, adding to the already widespread debris buildup and power outages.

Probability of Future Occurrences
Given the inland location of the county, it is more likely to be affected by remnants of hurricane and tropical storm systems (as opposed to a major hurricane) which may result in flooding or high winds. The probability of being impacted is less than coastal areas, but still remains a real threat to Transylvania County due to induced events like flooding and landsliding. Based on historical evidence, the probability level of future occurrence is possible (between 1 and 10 percent annual probability). Given the regional nature of the hazard, all areas in the county are equally exposed to this hazard. However, when the county is impacted, the damage could be catastrophic, threatening lives and property throughout the planning area.

D.2.5 Lightning

Location and Spatial Extent
Lightning occurs randomly, therefore it is impossible to predict where and with what frequency it will strike. It is assumed that all of Transylvania County is uniformly exposed to lightning.

Historical Occurrences
According to the National Climatic Data Center, there have been 10 recorded lightning events in Transylvania County since 1999, as listed in summary **Table D.10**.[4] These events resulted in almost $800,000 and caused 6 injuries. A complete listing of those events can be found in **Table D.11.** Many of the reported events are those that caused damage, and it should be expected that damages are likely much higher for this hazard than what is reported.

TABLE D.10: SUMMARY OF LIGHTNING OCCURRENCES IN TRANSYLVANIA COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Brevard	4	0/5	$302,518
Rosman	0	0/0	$0
Unincorporated Area	6	0/1	$488,704

[4] These lightning events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is certain that additional lightning events have occurred in Transylvania County. The State Fire Marshall's office was also contacted for additional information but none could be provided. As additional local data becomes available, this hazard profile will be amended.

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
TRANSYLVANIA COUNTY TOTAL	**10**	**0/6**	**$791,223**

Source: National Climatic Data Center

TABLE D.11: HISTORIC LIGHTNING OCCURRENCES IN TRANSYLVANIA COUNTY

	Date	Deaths / Injuries	Property Damage*	Details
Brevard				
BREVARD	04-JUN-99	0/0	$302,518	Lightning was suspected to have started a fire in a home about 12 hours after the actual strike. The home and its contents were destroyed.
BREVARD	27-JUL-99	0/3	$0	A severe thunderstorm downed several trees and power lines. In addition, a great amount of cloud to ground lightning was produced, which resulted in 3 injuries. One person was injured while in the basement, touching a water heater. Another injury occurred
BREVARD	06-JUN-02	0/0	$0	Lightning ignited a few fires.
BREVARD	20-APR-11	0/2	$0	Lightning struck a tree at Brevard College, causing minor injuries to two people standing nearby.
Rosman				
None Reported	--	--	--	--
Unincorporated Area				
SAPPHIRE	10-AUG-03	0/1	$0	A man was injured in Gorges State Park when the stream he was swimming in was struck by lightning.
CONNESTEE	11-JUL-04	0/0	$260,955	Lightning struck a house, igniting a fire which destroyed the house and its contents.
CEDAR MTN	06-JUL-08	0/0	$173,891	Lightning ignited a fire which destroyed most of a house on Fox Tower Rd.
DAVIDSON RIVER	20-AUG-09	0/0	$16,883	Lightning ignited a fire at a home on Wilson Rd, about two miles east northeast of Brevard, causing damage to the roof and attic.
BLANTYRE	28-FEB-11	0/0	$31,827	A lightning strike damaged a home on Sandrock Trail.
NORTH BREVARD	13-JUN-12	0/0	$5,150	Lighting started a fire in the basement of a home on Pine Mountain Trail, causing some minor damage before being

	Date	Deaths / Injuries	Property Damage*	Details
				extinguished by a burst water line.

*Property Damage is reported in 2013 dollars.
Source: National Climatic Data Center

Probability of Future Occurrences

Although there was not a high number of historical lightning events reported in Transylvania County via NCDC data, it is considered a regular occurrence, especially accompanied by thunderstorms. In fact, lightning events will assuredly happen on an annual basis, though not all events will cause damage. According to Vaisala's U.S. National Lightning Detection Network (NLDN®), Transylvania County is located in an area of the country that experienced an average of 2 to 4 lightning flashes per square kilometer per year between 1997 and 2010. Therefore, the probability of future events is highly likely (100 percent annual probability). It can be expected that future lightning events will continue to threaten life and cause minor property damages throughout the county.

D.2.6 Thunderstorm Wind / High Wind

Location and Spatial Extent

A wind event is an atmospheric hazard, and thus has no geographic boundaries. It is typically a widespread event that can occur in all regions of the United States. However, thunderstorms are most common in the central and southern states because atmospheric conditions in those regions are favorable for generating these powerful storms. Also, Transylvania County typically experiences several straight-line wind events each year. These wind events can and have caused significant damage. It is assumed that Transylvania County has uniform exposure to an event and the spatial extent of an impact could be large.

Historical Occurrences

Severe storms have resulted in two disaster declarations in Transylvania County in 1995 and 1998.[5] According to NCDC, there have been 88 reported thunderstorm wind and high wind events since 1970 in Transylvania County.[6] These events caused over $2.2 million (2013 dollars) in damages. **Table D.12** summarizes this information. **Table D.13** presents detailed thunderstorm wind and high wind event reports including date, magnitude, and associated damages for each event. [7]

TABLE D.12: SUMMARY OF THUNDERSTORM / HIGH WIND OCCURRENCES IN TRANSYLVANIA COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Brevard	20	0/0	$123,727
Rosman	4	0/0	$0

[5] A complete listing of historical disaster declarations can be found in Section 4: *Hazard Profiles*.
[6] These thunderstorm events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is certain that additional thunderstorm events have occurred in Transylvania County. As additional local data becomes available, this hazard profile will be amended.
[7] The dollar amount of damages provided by NCDC is divided by the number of affected counties to reflect a damage estimate for the county.

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Unincorporated Area	64	0/0	$2,115,808
TRANSYLVANIA COUNTY TOTAL	**88**	**0/0**	**$2,239,535**

Source: National Climatic Data Center

TABLE D.13: HISTORICAL THUNDERSTORM / HIGH WIND OCCURRENCES IN TRANSYLVANIA COUNTY

	Date	Type	Magnitude	Deaths / Injuries	Property Damage*
Brevard					
BREVARD	20-APR-96	TSTM WIND	0 kts.	0/0	$80,456
BREVARD	27-MAY-98	TSTM WIND	50 kts.	0/0	$0
BREVARD	19-JUN-98	TSTM WIND	50 kts.	0/0	$0
BREVARD	24-JUN-98	TSTM WIND	50 kts.	0/0	$0
BREVARD	24-JUN-98	TSTM WIND	50 kts.	0/0	$0
BREVARD	23-JAN-99	TSTM WIND	50 kts.	0/0	$37,815
BREVARD	27-JUL-99	TSTM WIND	50 kts.	0/0	$0
BREVARD	10-AUG-00	TSTM WIND	50 kts.	0/0	$0
BREVARD	19-MAY-01	TSTM WIND	50 kts.	0/0	$0
BREVARD	23-AUG-01	TSTM WIND	50 kts.	0/0	$0
BREVARD	06-JUN-02	TSTM WIND	50 kts.	0/0	$0
BREVARD	18-AUG-02	TSTM WIND	50 kts.	0/0	$1,384
BREVARD	11-NOV-02	TSTM WIND	50 kts.	0/0	$1,384
BREVARD	02-MAY-03	TSTM WIND	50 kts.	0/0	$0
BREVARD	16-JUL-03	TSTM WIND	52 kts.	0/0	$2,688
BREVARD	18-JUL-03	TSTM WIND	50 kts.	0/0	$0
BREVARD	08-AUG-03	TSTM WIND	50 kts.	0/0	$0
BREVARD	04-AUG-05	TSTM WIND	50 kts.	0/0	$0
BREVARD	22-JUN-06	TSTM WIND	50 kts.	0/0	$0
BREVARD	01-JUL-12	THUNDERSTORM WIND	50 kts.	0/0	$0
Rosman					
ROSMAN	06-JUN-05	TSTM WIND	50 kts.	0/0	$0
ROSMAN	22-APR-06	TSTM WIND	50 kts.	0/0	$0
ROSMAN	28-SEP-06	TSTM WIND	50 kts.	0/0	$0
ROSMAN	23-JUN-07	THUNDERSTORM WIND	50 kts.	0/0	$0
Unincorporated Area					
TRANSYLVANIA COUNTY	02-APR-70	TSTM WIND	0 kts.	0/0	$0
TRANSYLVANIA COUNTY	09-JUL-85	TSTM WIND	0 kts.	0/0	$0
TRANSYLVANIA COUNTY	09-JUL-85	TSTM WIND	0 kts.	0/0	$0
TRANSYLVANIA COUNTY	22-JUL-86	TSTM WIND	0 kts.	0/0	$0
TRANSYLVANIA COUNTY	12-JAN-88	TSTM WIND	0 kts.	0/0	$0
TRANSYLVANIA COUNTY	10-JUL-88	TSTM WIND	0 kts.	0/0	$0
TRANSYLVANIA COUNTY	15-JUL-88	TSTM WIND	0 kts.	0/0	$0
TRANSYLVANIA COUNTY	16-JUL-88	TSTM WIND	0 kts.	0/0	$0
TRANSYLVANIA COUNTY	17-SEP-91	TSTM WIND	0 kts.	0/0	$0

	Date	Type	Magnitude	Deaths / Injuries	Property Damage*
TRANSYLVANIA COUNTY	27-AUG-92	TSTM WIND	0 kts.	0/0	$0
TRANSYLVANIA COUNTY	05-OCT-95	HIGH WINDS	0 kts.	0/0	$1,657,168
PISGAH FOREST	21-FEB-97	TSTM WIND	50 kts.	0/0	$0
CONNESTEE	02-JUN-97	TSTM WIND	50 kts.	0/0	$0
COUNTYWIDE	04-JUL-97	TSTM WIND	50 kts.	0/0	$0
TRANSYLVANIA COUNTY	07-JAN-98	HIGH WIND	50 kts.	0/0	$7,744
TRANSYLVANIA COUNTY	15-SEP-99	HIGH WIND	45 kts.	0/0	$0
TRANSYLVANIA COUNTY	02-NOV-99	HIGH WIND	55 kts.	0/0	$0
TRANSYLVANIA COUNTY	16-FEB-01	HIGH WIND	55 kts.	0/0	$0
TRANSYLVANIA COUNTY	06-MAR-01	HIGH WIND	55 kts.	0/0	$0
TRANSYLVANIA COUNTY	20-MAR-01	HIGH WIND	55 kts.	0/0	$67,893
LITTLE RIVER	14-JUN-01	TSTM WIND	50 kts.	0/0	$0
TRANSYLVANIA COUNTY	29-NOV-01	HIGH WIND	50 kts.	0/0	$0
TRANSYLVANIA COUNTY	04-FEB-02	HIGH WIND	50 kts.	0/0	$0
TRANSYLVANIA COUNTY	27-SEP-02	HIGH WIND	50 kts.	0/0	$0
TRANSYLVANIA COUNTY	23-JAN-03	HIGH WIND	60 kts.	0/0	$3,072
LAKE TOXAWAY	02-MAY-03	TSTM WIND	50 kts.	0/0	$0
LAKE TOXAWAY	11-JUN-03	TSTM WIND	50 kts.	0/0	$0
TRANSYLVANIA COUNTY	14-OCT-03	HIGH WIND	50 kts.	0/0	$1,512
TRANSYLVANIA COUNTY	13-NOV-03	HIGH WIND	50 kts.	0/0	$2,993
TRANSYLVANIA COUNTY	07-MAR-04	HIGH WIND	50 kts.	0/0	$9,242
TRANSYLVANIA COUNTY	05-JUL-04	HIGH WIND	55 kts.	0/0	$1,864
TRANSYLVANIA COUNTY	07-SEP-04	HIGH WIND	50 kts.	0/0	$86,115
TRANSYLVANIA COUNTY	16-SEP-04	HIGH WIND	55 kts.	0/0	$168,533
TRANSYLVANIA COUNTY	17-SEP-04	HIGH WIND	50 kts.	0/0	$6,116
TRANSYLVANIA COUNTY	22-JAN-05	HIGH WIND	50 kts.	0/0	$0
TRANSYLVANIA COUNTY	02-APR-05	HIGH WIND	60 kts.	0/0	$73,895
TRANSYLVANIA COUNTY	14-JAN-06	HIGH WIND	60 kts.	0/0	$1,230
BALSAM GROVE	04-AUG-06	TSTM WIND	50 kts.	0/0	$0
TRANSYLVANIA COUNTY	15-NOV-06	HIGH WIND	50 kts.	0/0	$0
TRANSYLVANIA COUNTY	01-DEC-06	HIGH WIND	55 kts.	0/0	$0
TRANSYLVANIA COUNTY	15-APR-07	HIGH WIND	70 kts.	0/0	$0
TRANSYLVANIA COUNTY	16-APR-07	HIGH WIND	60 kts.	0/0	$28,430
TRANSYLVANIA COUNTY	10-FEB-08	HIGH WIND	55 kts.	0/0	$0
TRANSYLVANIA COUNTY	11-MAY-08	HIGH WIND	60 kts.	0/0	$0
GRANGE	20-MAY-08	THUNDERSTORM WIND	50 kts.	0/0	$0
LAKE TOXAWAY	20-MAY-08	THUNDERSTORM WIND	50 kts.	0/0	$0
BALSAM GROVE	21-JUL-08	THUNDERSTORM WIND	50 kts.	0/0	$0
BREVARD ARPT	29-JUL-08	THUNDERSTORM WIND	50 kts.	0/0	$0
SAPPHIRE	17-JUN-09	THUNDERSTORM WIND	50 kts.	0/0	$0
GRANGE	25-JUN-10	THUNDERSTORM WIND	55 kts.	0/0	$0
BALSAM GROVE	25-OCT-10	THUNDERSTORM WIND	50 kts.	0/0	$0
SELICA	28-FEB-11	THUNDERSTORM WIND	55 kts.	0/0	$0
LAKE TOXAWAY	04-APR-11	THUNDERSTORM WIND	55 kts.	0/0	$0
SAPPHIRE	28-APR-11	THUNDERSTORM WIND	50 kts.	0/0	$0
GRANGE	28-APR-11	THUNDERSTORM WIND	55 kts.	0/0	$0

	Date	Type	Magnitude	Deaths / Injuries	Property Damage*
BALSAM GROVE	15-JUN-11	THUNDERSTORM WIND	55 kts.	0/0	$0
JOHN ROCK	21-JUN-11	THUNDERSTORM WIND	50 kts.	0/0	$0
OAKLAND	04-JUL-11	THUNDERSTORM WIND	50 kts.	0/0	$0
OAKLAND	04-JUL-11	THUNDERSTORM WIND	50 kts.	0/0	$0
CONNESTEE	20-AUG-11	THUNDERSTORM WIND	50 kts.	0/0	$0
BALSAM GROVE	02-MAR-12	THUNDERSTORM WIND	50 kts.	0/0	$0
GRANGE	01-JUL-12	THUNDERSTORM WIND	50 kts.	0/0	$0
BALSAM GROVE	05-JUL-12	THUNDERSTORM WIND	50 kts.	0/0	$0
BREVARD ARPT	05-JUL-12	THUNDERSTORM WIND	50 kts.	0/0	$0

*Property damage is reported in 2013 dollars; All damage may not have been reported.
Source: National Climatic Data Center

Probability of Future Occurrences

Given the high number of previous events, it is certain that wind events, including straight-line wind and thunderstorm wind, will occur in the future. This results in a probability level of highly likely (100 percent annual probability) for future wind events for the entire county.

D.2.7 Tornado

Location and Spatial Extent

Tornadoes occur throughout the state of North Carolina, and thus in Transylvania County. Tornadoes typically impact a relatively small area, but damage may be extensive. Event locations are completely random and it is not possible to predict specific areas that are more susceptible to tornado strikes over time. Therefore, it is assumed that Transylvania County is uniformly exposed to this hazard.

Historical Occurrences

Tornadoes are a fairly rare occurrence in mountainous areas. However, they have and do occur in Transylvania County. According to the National Climatic Data Center, there have been a total of three recorded tornado events in Transylvania County since 1974 (**Table D.14**), resulting in just over $853,000 (2013 dollars) in property damages.[8] No injuries or fatalities were reported (**Table D.15**). The magnitude of these tornadoes ranges from F0 to F2 in intensity, although an F3 to F5 event is possible. It is important to note that only tornadoes that have been reported are factored into this risk assessment. It is likely that a high number of occurrences have gone unreported over the past 63 years.

TABLE D.14: SUMMARY OF TORNADO OCCURRENCES IN TRANSYLVANIA COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Brevard	0	0/0	$0
Rosman	0	0/0	$0
Unincorporated Area	3	0/0	$853,066
TRANSYLVANIA COUNTY TOTAL	**3**	**0/0**	**$853,066**

Source: National Climatic Data Center

[8] These tornado events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is likely that additional tornadoes have occurred in Transylvania County. As additional local data becomes available, this hazard profile will be amended.

TABLE D.15: HISTORICAL TORNADO IMPACTS IN TRANSYLVANIA COUNTY

	Date	Magnitude	Deaths/ Injuries	Property Damage*	Details
Brevard					
None Reported	--	--	--	--	--
Rosman					
None Reported	--	--	--	--	--
Unincorporated Area					
TRANSYLVANIA COUNTY	03-APR-74	F1	0/0	$128,114	
TRANSYLVANIA COUNTY	10-JAN-75	F2	0/0	$117,282	
TRANSYLVANIA COUNTY	20-JUN-84	F0	0/0	$607,670	

*Property damage is reported in 2013 dollars; All damage may not have been reported.
Source: National Climatic Data Center

Probability of Future Occurrences

According to historical information, tornado events are not an annual occurrence for the county. Furthermore, the mountainous terrain of the county makes tornadoes a rare occurrence. While the majority of the reported tornado events are small in terms of size, intensity, and duration, they do pose a significant threat should Transylvania County experience a direct tornado strike. The probability of future tornado occurrences affecting Transylvania County is possible (1 to 10 percent annual probability).

D.2.8 Winter Storm and Freeze

Location and Spatial Extent

Nearly the entire continental United States is susceptible to winter storm and freeze events. Some ice and winter storms may be large enough to affect several states, while others might affect limited, localized areas. The degree of exposure typically depends on the normal expected severity of local winter weather. Transylvania County is accustomed to severe winter weather conditions and frequently receives severe winter weather during the winter months. Given the atmospheric nature of the hazard, the entire county has uniform exposure to a winter storm.

Historical Occurrences

Winter weather has resulted in one disaster declaration in Transylvania County. This includes the Blizzard of 1996.[9] According to the National Climatic Data Center, there have been a total of 54 recorded winter storm events in Transylvania County since 1993 (**Table D.16**).[10] These events resulted in over $25 million (2013 dollars) in damages.[11] Detailed information on the recorded winter storm events can be found in **Table D.17**.

[9] Not all of the participating counties were declared disaster areas for these events. A complete listing of historical disaster declarations, including the affected counties, can be found in Section 4: *Hazard Profiles*.
[10] These ice and winter storm events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is certain that additional winter storm conditions have affected Transylvania County.
[11] The dollar amount of damages provided by NCDC is divided by the number of affected counties to reflect a damage estimate for the county.

TABLE D.16: SUMMARY OF WINTER STORM EVENTS IN TRANSYLVANIA COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Transylvania County	87	0/0	$20,680,523

Source: National Climatic Data Center

TABLE D.17: HISTORICAL WINTER STORM IMPACTS IN TRANSYLVANIA COUNTY

	Date	Type of Storm	Deaths / Injuries	Property Damage*
Brevard				
None Reported	--	--	--	--
Rosman				
None Reported	--	--	--	--
Unincorporated Area				
Statewide	12-MAR-93	WINTER STORM	2/10†	$874,516
Northern Interior and	10-FEB-94	ICE STORM	0/0	$0
TRANSYLVANIA COUNTY	01-FEB-96	FREEZING RAIN	0/0	$0
TRANSYLVANIA COUNTY	07-FEB-96	SNOW	0/0	$0
TRANSYLVANIA COUNTY	11-FEB-96	Other	0/0	$0
TRANSYLVANIA COUNTY	16-FEB-96	SNOW	0/0	$0
TRANSYLVANIA COUNTY	18-DEC-96	HEAVY SNOW	0/0	$0
TRANSYLVANIA COUNTY	08-JAN-97	Snow and sleet	0/0	$0
TRANSYLVANIA COUNTY	09-JAN-97	ICE STORM	0/0	$149,811
TRANSYLVANIA COUNTY	10-JAN-97	HEAVY SNOW	0/0	$0
TRANSYLVANIA COUNTY	13-FEB-97	WINTER STORM	0/0	$0
TRANSYLVANIA COUNTY	08-DEC-97	WINTRY MIX	0/0	$0
TRANSYLVANIA COUNTY	27-DEC-97	SNOW	0/0	$0
TRANSYLVANIA COUNTY	29-DEC-97	HEAVY SNOW	0/0	$0
TRANSYLVANIA COUNTY	30-DEC-97	HEAVY SNOW	0/0	$0
TRANSYLVANIA COUNTY	18-JAN-98	SNOW	0/0	$0
TRANSYLVANIA COUNTY	18-JAN-98	HEAVY SNOW	0/0	$0
TRANSYLVANIA COUNTY	27-JAN-98	HEAVY SNOW	0/0	$0
TRANSYLVANIA COUNTY	03-FEB-98	SNOW	0/0	$0
TRANSYLVANIA COUNTY	02-MAR-98	SNOW	0/0	$0
TRANSYLVANIA COUNTY	11-MAR-98	SNOW	0/0	$0
TRANSYLVANIA COUNTY	23-DEC-98	FREEZING RAIN/SLEET	0/0	$0
TRANSYLVANIA COUNTY	24-DEC-98	SNOW	0/0	$0
TRANSYLVANIA COUNTY	23-FEB-99	SNOW	0/0	$0
TRANSYLVANIA COUNTY	03-MAR-99	SNOW	0/0	$0
TRANSYLVANIA COUNTY	09-MAR-99	SNOW AND SLEET	0/0	$0
TRANSYLVANIA COUNTY	26-MAR-99	HEAVY SNOW	0/0	$0
TRANSYLVANIA COUNTY	24-DEC-99	SNOW	0/0	$0
TRANSYLVANIA COUNTY	16-JAN-00	FREEZING RAIN/SLEET	0/0	$0
TRANSYLVANIA COUNTY	20-JAN-00	SNOW	0/0	$0
TRANSYLVANIA COUNTY	22-JAN-00	HEAVY SNOW	0/0	$0

	Date	Type of Storm	Deaths / Injuries	Property Damage*
TRANSYLVANIA COUNTY	29-JAN-00	ICE STORM	0/0	$0
TRANSYLVANIA COUNTY	08-APR-00	SNOW	0/0	$0
TRANSYLVANIA COUNTY	19-NOV-00	SNOW	0/0	$0
TRANSYLVANIA COUNTY	13-DEC-00	FREEZING RAIN	0/0	$0
TRANSYLVANIA COUNTY	17-DEC-00	SNOW	0/0	$0
TRANSYLVANIA COUNTY	19-DEC-00	SNOW	0/0	$0
TRANSYLVANIA COUNTY	01-JAN-01	SNOW	0/0	$0
TRANSYLVANIA COUNTY	20-MAR-01	HEAVY SNOW	0/0	$0
TRANSYLVANIA COUNTY	03-JAN-02	HEAVY SNOW	0/0	$0
TRANSYLVANIA COUNTY	03-FEB-02	SNOW	0/0	$0
TRANSYLVANIA COUNTY	06-FEB-02	WINTER WEATHER	0/0	$0
TRANSYLVANIA COUNTY	04-DEC-02	ICE STORM	0/0	$19,577,022
TRANSYLVANIA COUNTY	16-JAN-03	HEAVY SNOW	0/0	$0
TRANSYLVANIA COUNTY	06-FEB-03	HEAVY SNOW	0/0	$0
TRANSYLVANIA COUNTY	09-FEB-03	WINTER WEATHER/MIX	0/0	$0
TRANSYLVANIA COUNTY	10-APR-03	HEAVY SNOW	0/0	$0
TRANSYLVANIA COUNTY	28-NOV-03	WINTER WEATHER/MIX	0/0	$0
TRANSYLVANIA COUNTY	03-DEC-03	WINTER WEATHER/MIX	0/0	$0
TRANSYLVANIA COUNTY	04-DEC-03	WINTER STORM	0/0	$0
TRANSYLVANIA COUNTY	25-JAN-04	HEAVY SNOW	0/0	$0
TRANSYLVANIA COUNTY	02-FEB-04	WINTER WEATHER/MIX	0/0	$0
TRANSYLVANIA COUNTY	05-FEB-04	WINTER WEATHER/MIX	0/0	$0
TRANSYLVANIA COUNTY	12-FEB-04	WINTER WEATHER/MIX	0/0	$0
TRANSYLVANIA COUNTY	15-FEB-04	WINTER WEATHER/MIX	0/0	$0
TRANSYLVANIA COUNTY	26-FEB-04	HEAVY SNOW	0/0	$0
TRANSYLVANIA COUNTY	30-MAR-04	WINTER WEATHER/MIX	0/0	$0
TRANSYLVANIA COUNTY	13-APR-04	WINTER WEATHER/MIX	0/0	$0
TRANSYLVANIA COUNTY	29-JAN-05	WINTER WEATHER/MIX	0/0	$0
TRANSYLVANIA COUNTY	29-JAN-05	WINTER STORM	0/0	$0
TRANSYLVANIA COUNTY	02-FEB-05	WINTER WEATHER/MIX	0/0	$0
TRANSYLVANIA COUNTY	03-FEB-05	ICE STORM	0/0	$0
TRANSYLVANIA COUNTY	27-FEB-05	WINTER WEATHER/MIX	0/0	$0
TRANSYLVANIA COUNTY	28-FEB-05	HEAVY SNOW	0/0	$0
TRANSYLVANIA COUNTY	17-MAR-05	WINTER WEATHER/MIX	0/0	$0
TRANSYLVANIA COUNTY	21-NOV-05	WINTER WEATHER/MIX	0/0	$0
TRANSYLVANIA COUNTY	03-DEC-05	WINTER WEATHER	0/0	$0
TRANSYLVANIA COUNTY	08-DEC-05	WINTER WEATHER	0/0	$0
TRANSYLVANIA COUNTY	15-DEC-05	WINTER WEATHER	0/0	$0
TRANSYLVANIA COUNTY	15-DEC-05	ICE STORM	0/0	$79,173
TRANSYLVANIA COUNTY	16-DEC-05	FREEZING FOG	0/0	$0
TRANSYLVANIA COUNTY	08-FEB-06	WINTER WEATHER	0/0	$0
TRANSYLVANIA COUNTY	11-FEB-06	WINTER WEATHER	0/0	$0
TRANSYLVANIA COUNTY	22-MAR-06	WINTER WEATHER	0/0	$0
TRANSYLVANIA COUNTY	09-JAN-07	WINTER WEATHER	0/0	$0
TRANSYLVANIA COUNTY	18-JAN-07	WINTER WEATHER	0/0	$0
TRANSYLVANIA COUNTY	21-JAN-07	WINTER WEATHER	0/0	$0

	Date	Type of Storm	Deaths / Injuries	Property Damage*
TRANSYLVANIA COUNTY	28-JAN-07	WINTER WEATHER	0/0	$0
TRANSYLVANIA COUNTY	01-FEB-07	HEAVY SNOW	0/0	$0
TRANSYLVANIA COUNTY	08-APR-07	FROST/FREEZE	0/0	$0
TRANSYLVANIA COUNTY	01-JAN-08	WINTER WEATHER	0/0	$0
TRANSYLVANIA COUNTY	16-JAN-08	HEAVY SNOW	0/0	$0
TRANSYLVANIA COUNTY	19-JAN-08	WINTER WEATHER	0/0	$0
TRANSYLVANIA COUNTY	31-JAN-08	WINTER WEATHER	0/0	$0
TRANSYLVANIA COUNTY	01-FEB-08	ICE STORM	0/0	$0
TRANSYLVANIA COUNTY	27-OCT-08	WINTER WEATHER	0/0	$0
TRANSYLVANIA COUNTY	01-DEC-08	WINTER WEATHER	0/0	$0

*Property damage is reported in 2013 dollars; All damage may not have been reported.
†Deaths/injuries were not reported at the county level; potentially outside of the county.
Source: National Climatic Data Center

There have been several severe winter weather events in Transylvania County. The text below describes one of the major events and associated impacts on the county. Similar impacts can be expected with severe winter weather.

1996 Winter Storm
This storm left two feet of snow and several thousand citizens without power for up to nine days. Although shelters were opened, some roads were impassible for up to four days. This event caused considerable disruption to business, industry, schools, and government services.

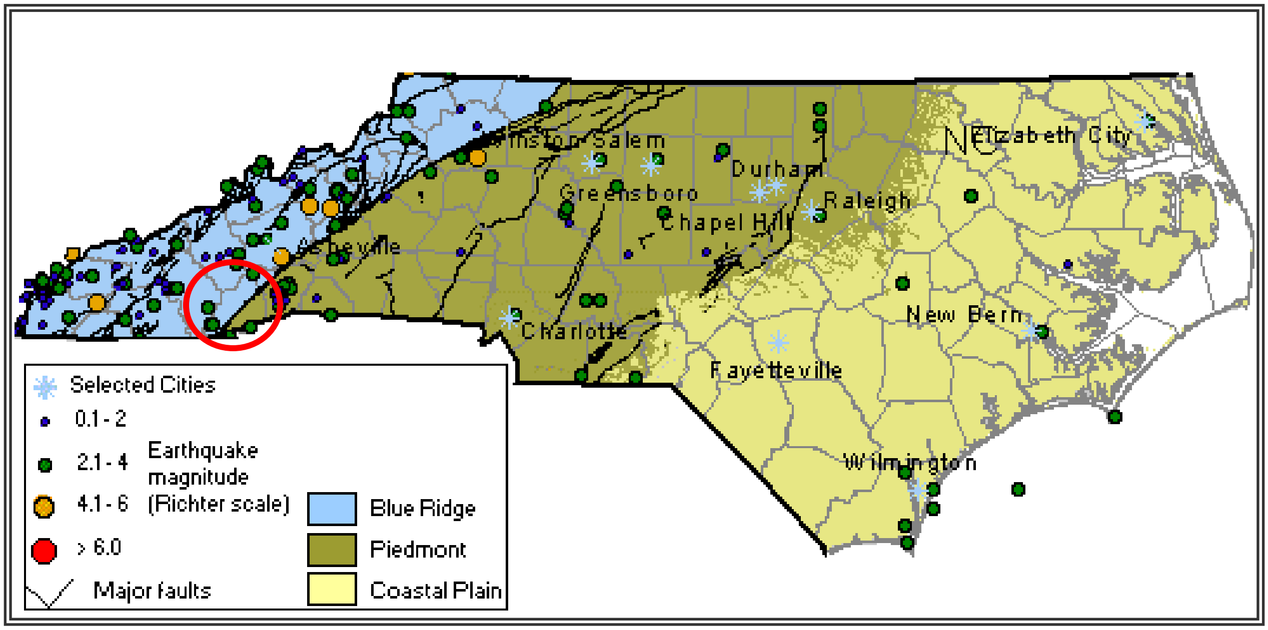
Winter storms throughout the planning area have several negative externalities including hypothermia, cost of snow and debris cleanup, business and government service interruption, traffic accidents, and power outages. Furthermore, citizens may resort to using inappropriate heating devices that could to fire or an accumulation of toxic fumes.

Probability of Future Occurrences
Winter storm events will remain a regular occurrence in Transylvania County due to its location in the western part of the state. According to historical information, Transylvania County generally experiences several winter storm events each year. Therefore, the annual probability is highly likely (10 to 100 percent).

D.2.9 Earthquake

Location and Spatial Extent
Approximately two-thirds of North Carolina is subject to earthquakes, with the western and southeast region most vulnerable to a very damaging earthquake. The state is affected by both the Charleston Fault in South Carolina and New Madrid Fault in Tennessee. Both of these faults have generated earthquakes measuring greater than 8 on the Richter Scale during the last 200 years. In addition, there are several smaller fault lines throughout North Carolina. **Figure D.2** is a map showing geological and seismic information for North Carolina.

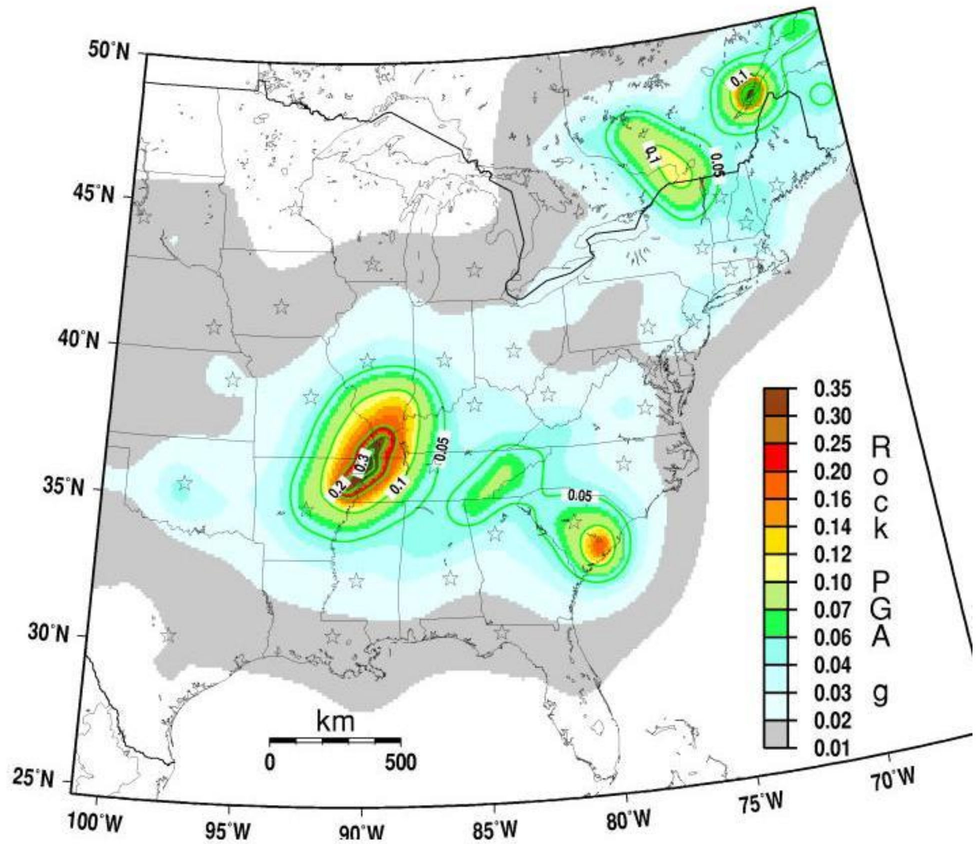
FIGURE D.2: GEOLOGICAL AND SEISMIC INFORMATION FOR NORTH CAROLINA



Source: North Carolina Geological Survey

Figure D.3 shows the intensity level associated with Transylvania County, based on the national USGS map of peak acceleration with 10 percent probability of exceedance in 50 years. It is the probability that ground motion will reach a certain level during an earthquake. The data show peak horizontal ground acceleration (the fastest measured change in speed, for a particle at ground level that is moving horizontally due to an earthquake) with a 10 percent probability of exceedance in 50 years. The map was compiled by the U.S. Geological Survey (USGS) Geologic Hazards Team, which conducts global investigations of earthquake, geomagnetic, and landslide hazards. According to this map, Transylvania County lies within an approximate zone of level "5" to "6" ground acceleration. This indicates that the county exists within an area of low to moderate seismic risk.

FIGURE D.3: PEAK ACCELERATION WITH 10 PERCENT PROBABILITY OF EXCEEDANCE IN 50 YEARS



Source: USGS, 2008

Historical Occurrences

At least 35 earthquakes are known to have affected Transylvania County since 1916. The strongest of these measured a V on the Modified Mercalli Intensity (MMI) scale. **Table D.18** provides a summary of earthquake events reported by the National Geophysical Data Center between 1638 and 1985. **Table D.19** presents a detailed occurrence of each event including the date, distance for the epicenter, magnitude and Modified Mercalli Intensity (if known). [12]

TABLE D.18: SUMMARY OF SEISMIC ACTIVITY IN TRANSYLVANIA COUNTY

Location	Number of Occurrences	Greatest MMI Reported	Richter Scale Equivalent
Brevard	11	V	< 4.8
Rosman	5	V	< 4.8
Unincorporated Area	19	V	< 4.8
TRANSYLVANIA COUNTY TOTAL	**35**	**V**	**<4.8**

Source: National Geophysical Data Center

[12] Due to reporting mechanisms, not all earthquakes events were recorded during this time. Furthermore, some are missing data, such as the epicenter location, due to a lack of widely used technology. In these instances, a value of "unknown" is reported.

TABLE D.19: SIGNIFICANT SEISMIC EVENTS IN TRANSYLVANIA COUNTY (1638 -1985)

Location	Date	Epicentral Distance	Magnitude	MMI
Brevard				
BREVARD	2/21/1916	36.0 km		5
BREVARD	10/20/1924	28.0 km		5
BREVARD	7/2/1957	36.0 km		3
BREVARD	7/13/1969	130.0 km	3.5	4
BREVARD	11/20/1969	286.0 km	4.3	4
BREVARD	12/13/1969	28.0 km		3
BREVARD	5/16/1974			2
BREVARD	11/25/1975	45.0 km		3
BREVARD	8/26/1979	39.0 km	3.7	4
BREVARD	5/5/1981	29.0 km	3.5	5
BREVARD	3/25/1983	32.0 km	3.3	4
Rosman				
ROSMAN	11/30/1973	126.0 km	4.7	4
ROSMAN	11/25/1975	32.0 km		3
ROSMAN	8/26/1979	26.0 km	3.7	5
ROSMAN	5/5/1981	41.0 km	3.5	4
ROSMAN	3/25/1983	46.0 km	3.3	4
Unincorporated Area				
LAKE TOXAWAY	2/21/1916	56.0 km		5
SAPPHIRE	11/24/1957	47.0 km		4
LAKE TOXAWAY	11/30/1973	119.0 km	4.7	4
PENROSE	11/30/1973	133.0 km	4.7	
PISGAH FOREST	11/30/1973	129.0 km	4.7	5
SAPPHIRE	11/30/1973	115.0 km	4.7	4
LAKE TOXAWAY	11/25/1975	28.0 km		4
CEDAR MOUNTAIN	8/26/1979	38.0 km	3.7	4
LAKE TOXAWAY	8/26/1979	22.0 km	3.7	4
PENROSE	8/26/1979	48.0 km	3.7	3
SAPPHIRE	8/26/1979	20.0 km	3.7	4
CEDAR MOUNTAIN	5/5/1981	28.0 km	3.5	3
LAKE TOXAWAY	5/5/1981	50.0 km	3.5	3
PENROSE	5/5/1981	20.0 km	3.5	4
PISGAH FOREST	5/5/1981	26.0 km	3.5	5
BALSAM GROVE	3/25/1983	44.0 km	3.3	3
CEDAR MOUNTAIN	3/25/1983	42.0 km	3.3	3
PENROSE	3/25/1983	19.0 km	3.3	4
PISGAH FOREST	3/25/1983	27.0 km	3.3	3

Source: National Geophysical Data Center

Probability of Future Occurrences

The probability of significant, damaging earthquake events affecting Transylvania County is unlikely. However, it is likely that future earthquakes resulting in light to moderate perceived shaking and damages ranging from none to very light will affect the county. The annual probability level for the county is estimated between 1 and 10 percent (possible).

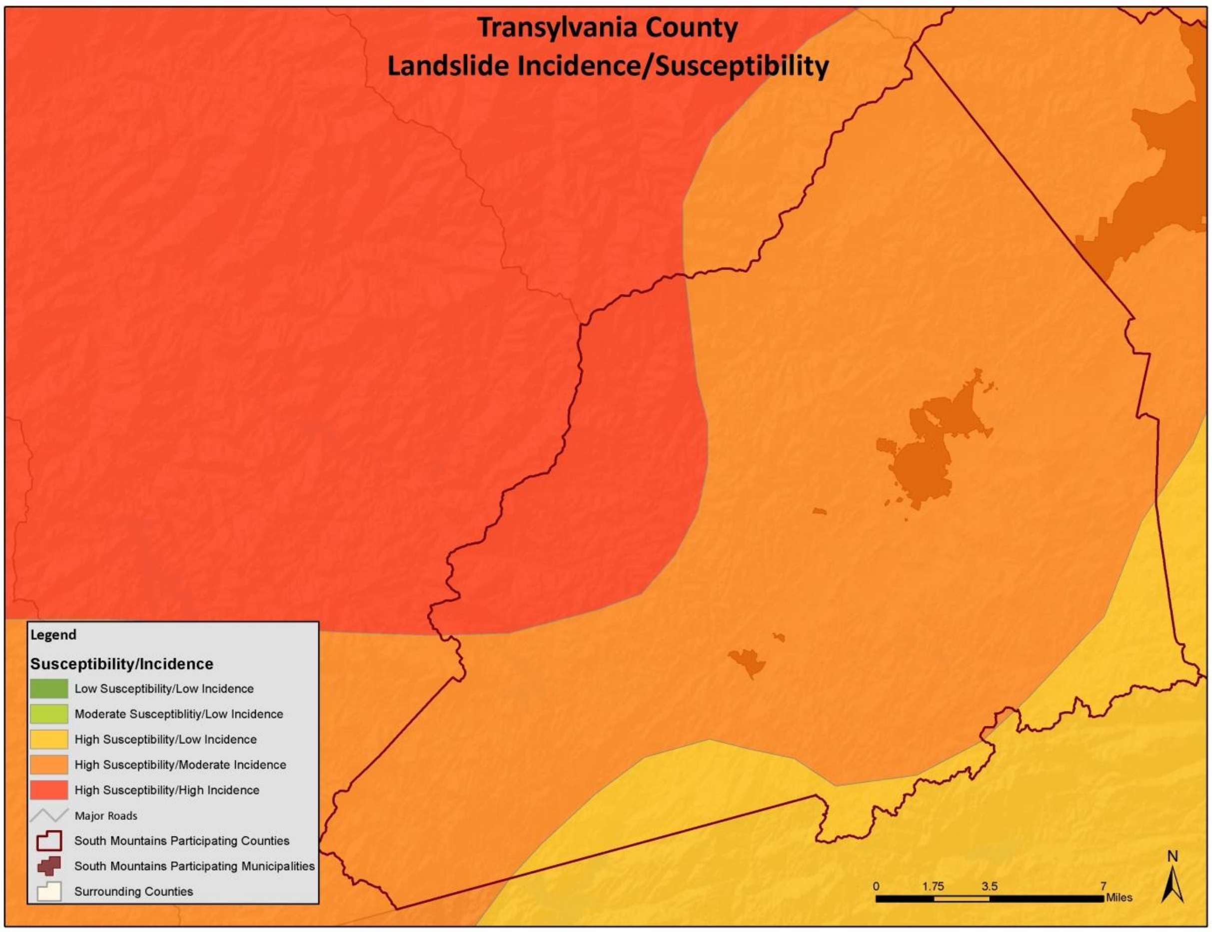
D.2.10 Landslide

Location and Spatial Extent

Landslides occur along steep slopes when the pull of gravity can no longer be resisted (often due to heavy rain). Human development can also exacerbate risk by building on previously undevelopable steep slopes and constructing roads by cutting through mountains. Landslides are possible throughout Transylvania County.

According to **Figure D.4** below, the majority of the county has moderate landslide activity. The remaining portion of the county along the west county boundary has a high incidence occurrence rate and the southern border has a low incidence. There is high susceptibility throughout the county.

FIGURE D.4: LANDSLIDE SUSCEPTIBILITY AND INCIDENCE MAP OF TRANSYLVANIA COUNTY



Source: USGS

Historical Occurrences

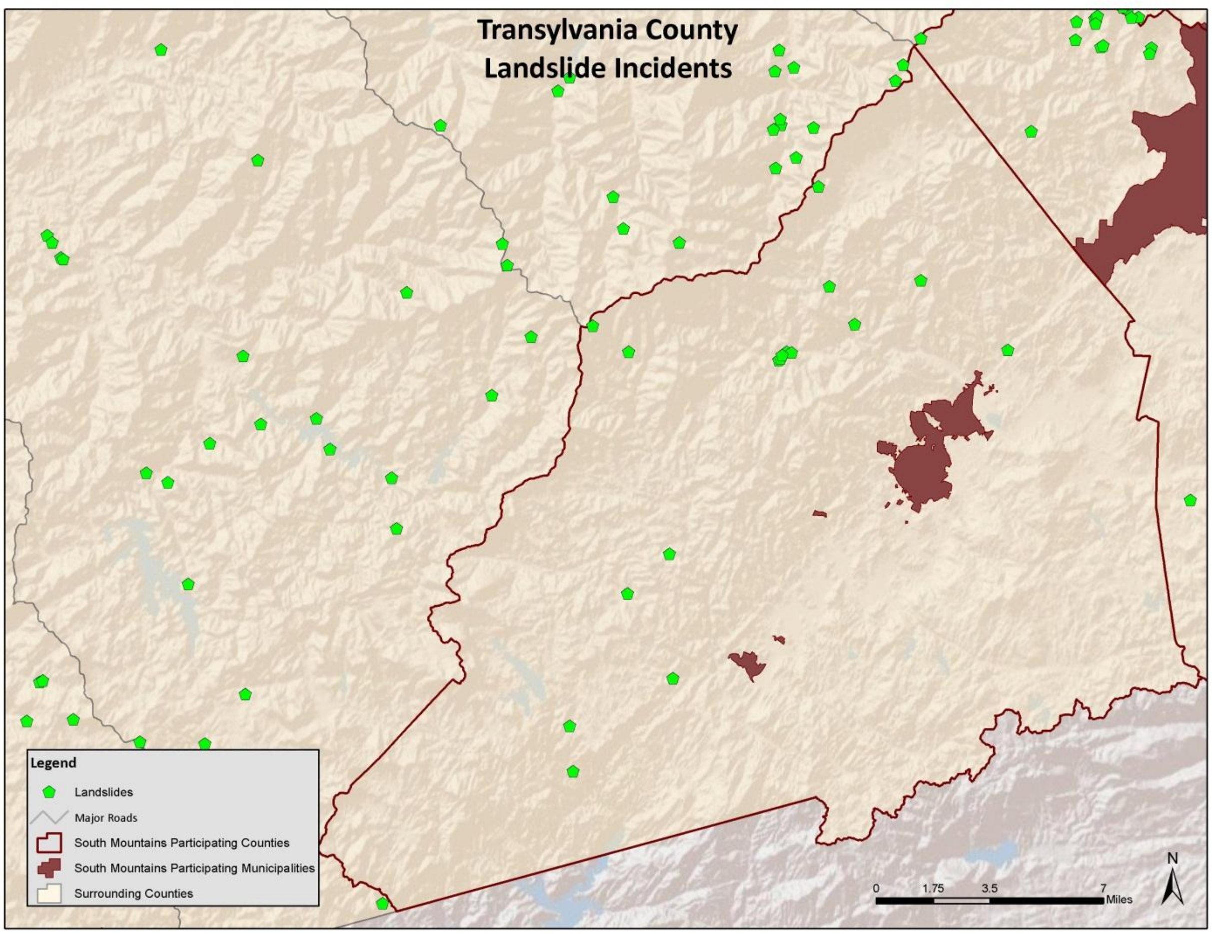
Steep topography throughout Transylvania County makes the planning area susceptible to landslides. Most landslides are caused by heavy rainfall in the area. Building on steep slopes that was not previously possible also contributes to risk. **Table D.20** presents a summary of the landslide occurrence events as provided by the North Carolina Geological Survey[13]. The georeferenced locations of the landslide events presented in the aforementioned tables are presented in **Figure D.5**. Some incidence mapping has also been completed throughout the western portion of North Carolina though it is not complete. Therefore, it should be noted that many more incidents than what is reported are likely to have occurred in Transylvania County.

TABLE D.20: SUMMARY OF LANDSLIDE ACTIVITY IN TRANSYLVANIA COUNTY

Location	Number of Occurrences
Brevard	0
Rosman	0
Unincorporated Area	17
TRANSYLVANIA COUNTY TOTAL	**17**

Source: North Carolina Geological Survey

FIGURE D.5: LOCATION OF PREVIOUS LANDSLIDE OCCURRENCES IN TRANSYLVANIA COUNTY



Source: North Carolina Geological Survey

[13] It should be noted that the North Carolina Geological Survey (NCGS) emphasized the dataset provided was incomplete. Therefore, there may be additional historical landslide occurrences. Furthermore, dates were not included for every event. The earliest date reported was 1940. No damage information was provided by NCGS.

The National Climatic Data Center also reported two landslide events in Transylvania County.

September 8, 2004
The remnants of Hurricane Frances brought very heavy rainfall to western North Carolina, resulting in widespread severe flooding across the mountains and foothills (Haywood, Transylvania, and Henderson Counties). Flooding developed along Shaws Creek in Henderson County. Flooding was widespread and severe across much of the area, with most creeks and streams in flood. Hundreds of homes and businesses were damaged or destroyed across the area, necessitating a number of evacuations and rescues. Numerous roads and bridges were washed out as well. Resulting landslides caused $1,522,235 (2013 dollars) of property damage in Henderson County and $1,522,235 (2013 dollars) of property damage in Transylvania County.

July 14, 2005
A mudslide off of highway 64 between Rosman and Lake Toxaway moved a mobile home from its foundation, rendering it uninhabitable. There was a total of $63,339 (2013 dollars) of property damage.

The information below identifies additional historical information reported in the previous hazard mitigation plans.

Transylvania County
In the past in the unincorporated areas of the county, there has been one residential structure destroyed and no damage to commercial or industrial property because of landslides. In addition there have been no reported deaths or injuries. However, the county has received significant damage to its infrastructure because of landslides, specifically in the 2004 hurricane season. There has been no landslide damage in any of the incorporated areas of Transylvania County.

The most significant issues the county faces with landslides are road closures, as was seen during Hurricane Frances and Tropical Storm Ivan. These storms spawned numerous slides in the unincorporated areas of Transylvania County; however, two slides were considered significant events. First, a slide covered portions of Sky Drive causing the road to give-way, resulting in $400,000 in damage. The second major event was on Cardinal Drive West where a slide caused $300,000 in damages to infrastructure. The slide not only resulted in road damages, but the debris from the slide flowed into Cardinal Lake causing debris blockage issues. The NCDOT has repaired and stabilized both roads that were damaged.

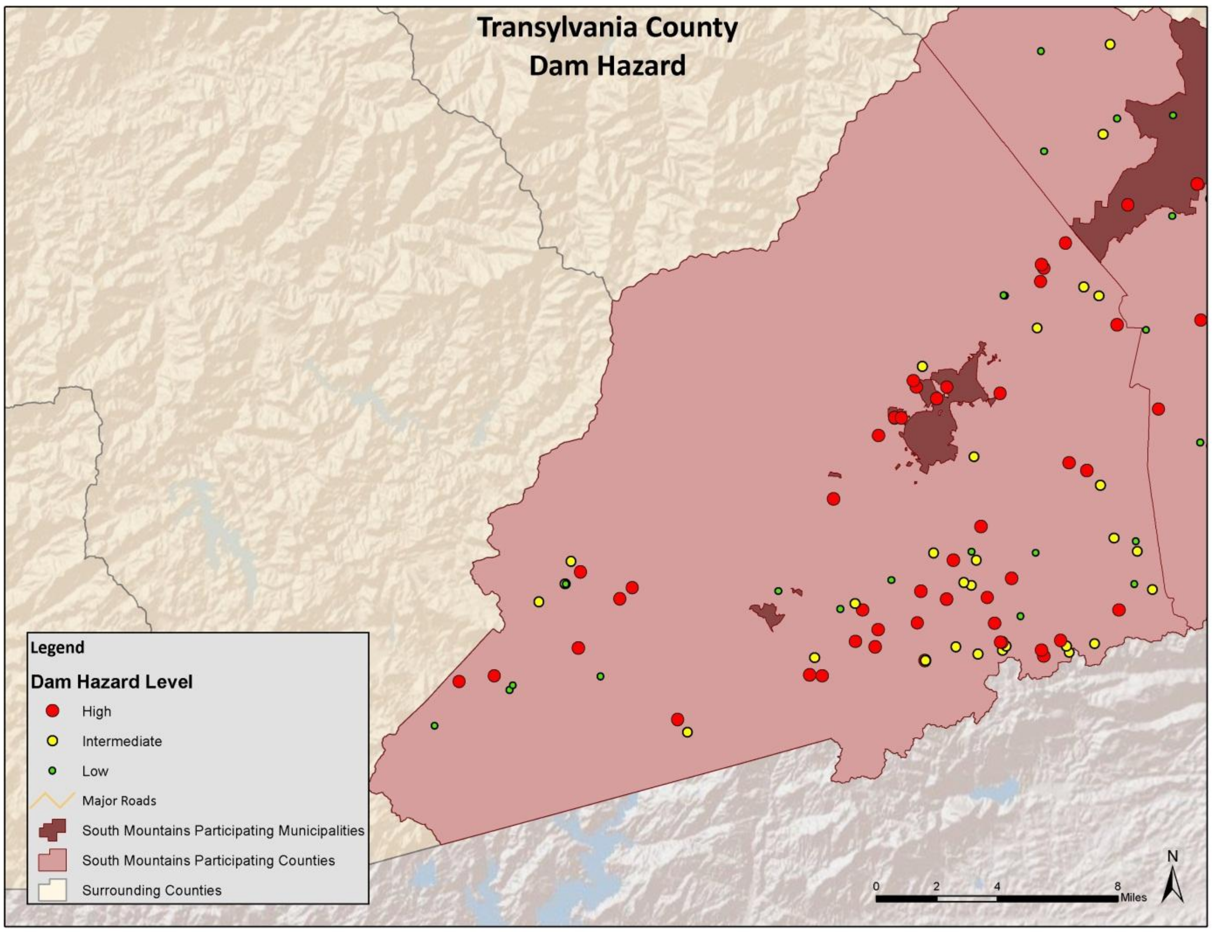
Probability of Future Occurrences
Based on historical information and the USGS susceptibility index, the probability of future landslide events is likely (10 to 100 percent probability). Local conditions may become more favorable for landslides due to heavy rain, for example. This would increase the likelihood of occurrence. It should also be noted that some areas in Transylvania County have greater risk than others given factors such as steepness on slope and modification of slopes.

D.2.11 Dam and Levee Failure

Location and Spatial Extent

According to the North Carolina Division of Land Management there are 87 dams in Transylvania County.[14] **Figure D.6** shows the dam location and the corresponding hazard ranking for each. Of these dams, 45 are classified as high hazard potential. These high hazard dams are listed in **Table D.21**.

FIGURE D.6: TRANSYLVANIA COUNTY DAM LOCATION AND HAZARD RANKING



Source: North Carolina Division of Land Resources, 2012

TABLE D.21: TRANSYLVANIA COUNTY HIGH HAZARD DAMS

Dam Name	Hazard Potential	Surface Area (acres)	Max Capacity (Ac-ft)	Owner Type
Transylvania County				
Arrowhead Lake	High	8.0	100	Private
Betty Kay Lake Dam	High	10.7	134	Private

[14] The February 8, 2012 list of high hazard dams obtained from the North Carolina Division of Energy, Mineral, and Land Resources (http://portal.ncdenr.org/web/lr/dams) was reviewed and amended by local officials to the best of their knowledge.

Dam Name	Hazard Potential	Surface Area (acres)	Max Capacity (Ac-ft)	Owner Type
Atagahi Lake Dam	High	65.0	2,780	Private
Deer Lake Dam	High	6.0	69	Private
Lake Tiaroga Dam	High	32.0	1,010	Private
Ticoa Lake Dam	High	75.0	2,435	Private
Lake Wanteska Dam	High	46.0	2,300	Private
High Rock Lake Dam	High	12.0	167	Private
Laurel Lake Dam	High	8.0	166	Private
Sagar Dam Lower Dam	High	38.0	0	Private
Line Runner Ridge Dam	High	9.0	127	Private
Young Dam	High	12.5	210	Private
Straus Lake Dam	High	5.3	58	Private
Thunder Lake	High	40.0	870	Private
Toxaway Dam Lower	High	553.0	21,500	Private
Hemlock Lake Dam	High	4.0	40	Private
Indian Lake Lower Dam	High	10.0	300	Private
Shearin Lake Dam	High		0	Private
Sequoyah Woods Lake Dam	High	12.0	182	Private
Blue Ridge Hills	High	14.0	117	Private
Aerated Stabilization Basin	High	60.0	1,200	Private
Brevard Music Camp Lower Dam	High	2.3	21	Private
Brevard Music Camp Lake Upper Dam	High	2.0	15	Private
Pine Shore Dam	High		40	Private
Eagle'S Nest	High		100	Private
Arrowhead Lake Dam	High	4.6	63	Private
Saltz Lake Dam	High	2.0	0	Private
Pisgah Forest Farm Dam	High		10	Private
Laurel Falls Lake Dam	High		0	Private
Frozen Lake Dam	High	7.0	0	Private
Intermont Dam	High	13.0	117	Private
Lake Megan Dam	High	3.0	24	Private
Siniard Lake Dam Lower	High	2.0	24	Private
Siniard Upper Pond Dam	High	1.2	10	Private
Emerald Lake Dam	High	3.0	36	Private
Rainbow Pond Dam	High	2.5	20	Private
Gaither Pond Dam	High	1.0	6	Private
Lewis Dam	High	1.0	10	Private
Bass Lake Dam	High	1.0	6	Private
Turkey Pen Farm Dam	High	1.5	12	Private
Sapphire Lakes G & T Dam #1	High	17.0	390	Private
Eagle Lake Dam	High	28.0	580	Private
Forest Lake Dam	High	2.3	22	Private
Graber Dam	High	2.5	30	Private
Cascade Lake Dam	High	64.0	2,304	Utility

So4urce: North Carolina Division of Land Resources, 2012

It should also be noted that the North Carolina dam classification regulations were recently updated. As a result of the change, more dams are generally classified as high hazard.

Historical Occurrences
There is no record of significant dam failure in the county, though little information was available. In addition, it should be noted that several breach scenarios in the county could be catastrophic.

The information below identifies additional historical information reported in the previous county hazard mitigation plan.

Transylvania County
There have been no significant incidents of dam failure in Transylvania County within the last 60 years.

Probability of Future Occurrences
Given the current dam inventory and historic data, a dam breach is unlikely (less than 1 percent annual probability) in the future. However, as has been demonstrated in the past, regular monitoring is necessary to prevent these events.

D.2.12 Erosion

Location and Spatial Extent
Erosion in Transylvania County is typically caused by flash flooding events. Unlike coastal areas, where the soil is mainly composed of fine grained particles such as sand, Transylvania County soils have much greater organic matter content. Furthermore, vegetation also helps to prevent erosion in the area. Erosion occurs in the county, particularly along the banks of rivers and streams, but it is not an extreme threat. No areas of concern were reported by the planning committee.

Historical Occurrences
Several sources were vetted to identify areas of erosion in Transylvania County. This includes searching local newspapers, interviewing local officials, and reviewing the previous hazard mitigation plan. Erosion was addressed in the previous Transylvania County hazard mitigation plan; however, it was found to be a relatively low-risk hazard. The information below identifies historical information presented in the plan.

Transylvania County
There is no recorded history of losses to structures from past erosion.

Probability of Future Occurrences
Erosion remains a natural, dynamic, and continuous process for Transylvania County, and it will continue to occur. The annual probability level assigned for erosion is likely (between 10 and 100 percent).

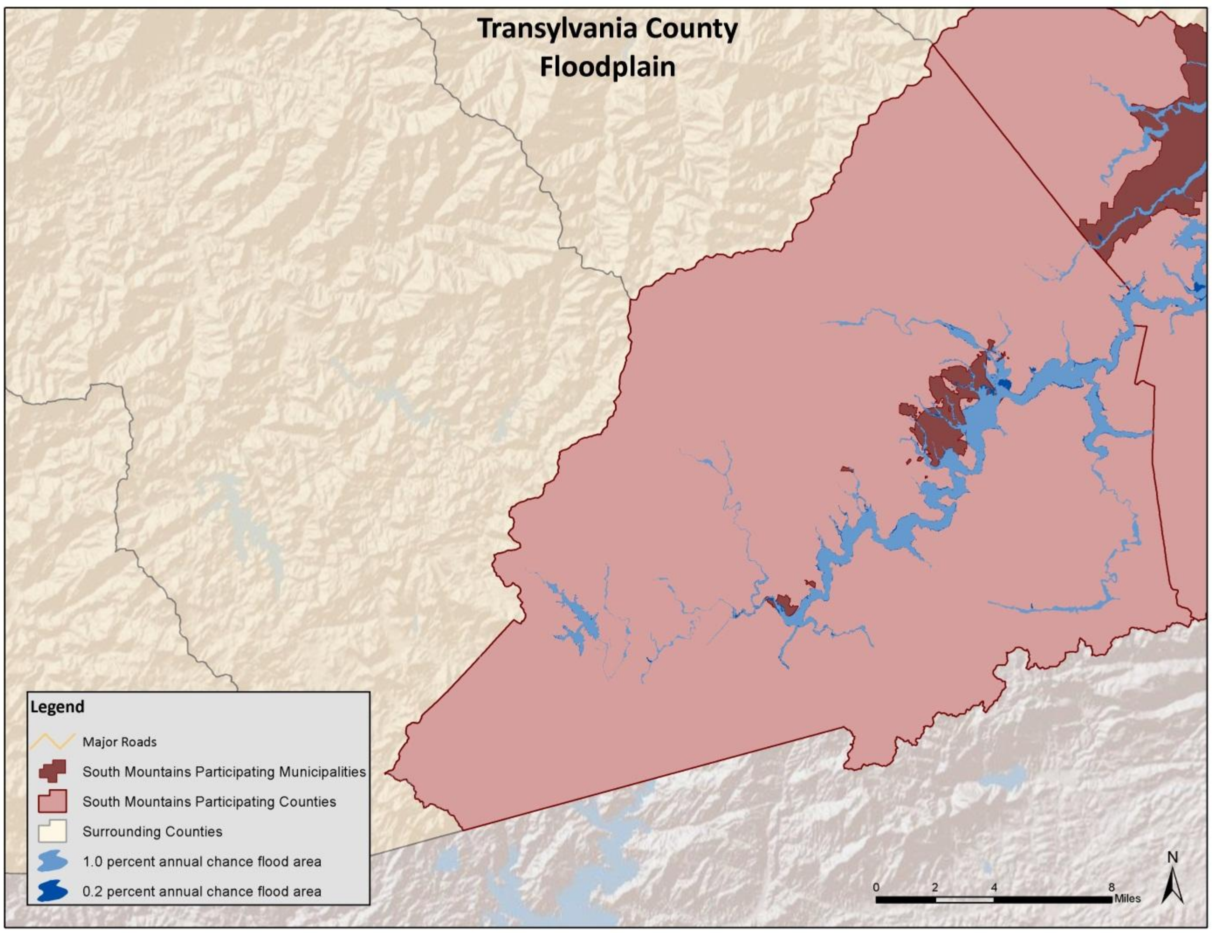
D.2.13 Flood

Location and Spatial Extent
There are areas in Transylvania County that are susceptible to flood events. Special flood hazard areas in the county were mapped using Geographic Information System (GIS) and FEMA Digital Flood

Insurance Rate Maps (DFIRM).[15] This includes Zone A (1-percent annual chance floodplain), Zone AE (1-percent annual chance floodplain with elevation), Zone X500 (0.2-percent annual chance floodplain). According to GIS analysis, of the 379 square miles that make up Transylvania County, there are 16.59 square miles of land in zones A and AE (1-percent annual chance floodplain/100-year floodplain) and 1.49 square miles of land in zone X500 (0.2-percent annual chance floodplain/500-year floodplain).

These flood zone values account for 4.8 percent of the total land area in Transylvania County. It is important to note that while FEMA digital flood data is recognized as best available data for planning purposes, it does not always reflect the most accurate and up-to-date flood risk. Flooding and flood-related losses often do occur outside of delineated special flood hazard areas. **Figure D.7**, **Figure D.8**, and **Figure D.9** illustrate the location and extent of currently mapped special flood hazard areas for Transylvania County and its municipalities based on best available FEMA Digital Flood Insurance Rate Map (DFIRM) data.

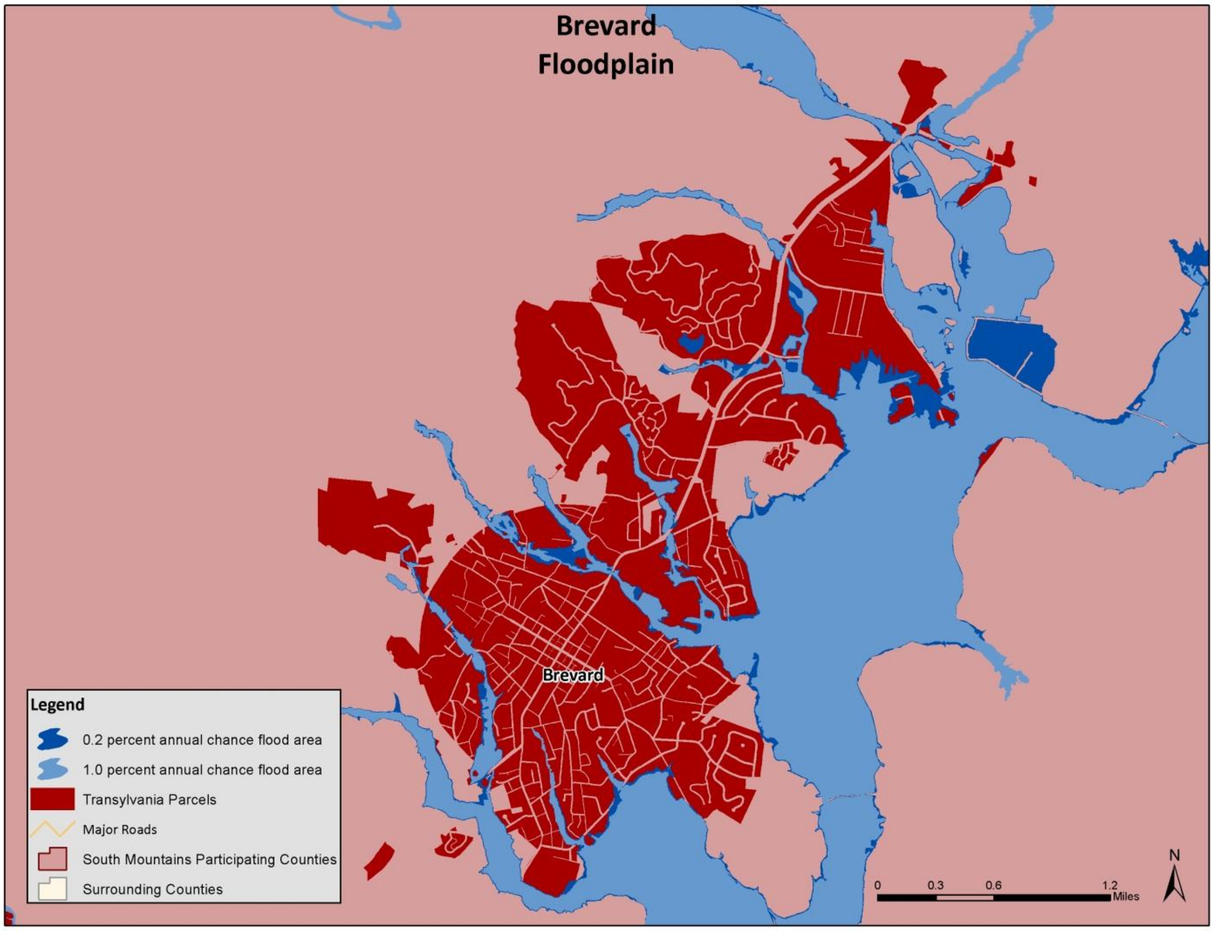
FIGURE D.7: SPECIAL FLOOD HAZARD AREAS IN TRANSYLVANIA COUNTY



Source: Federal Emergency Management Agency

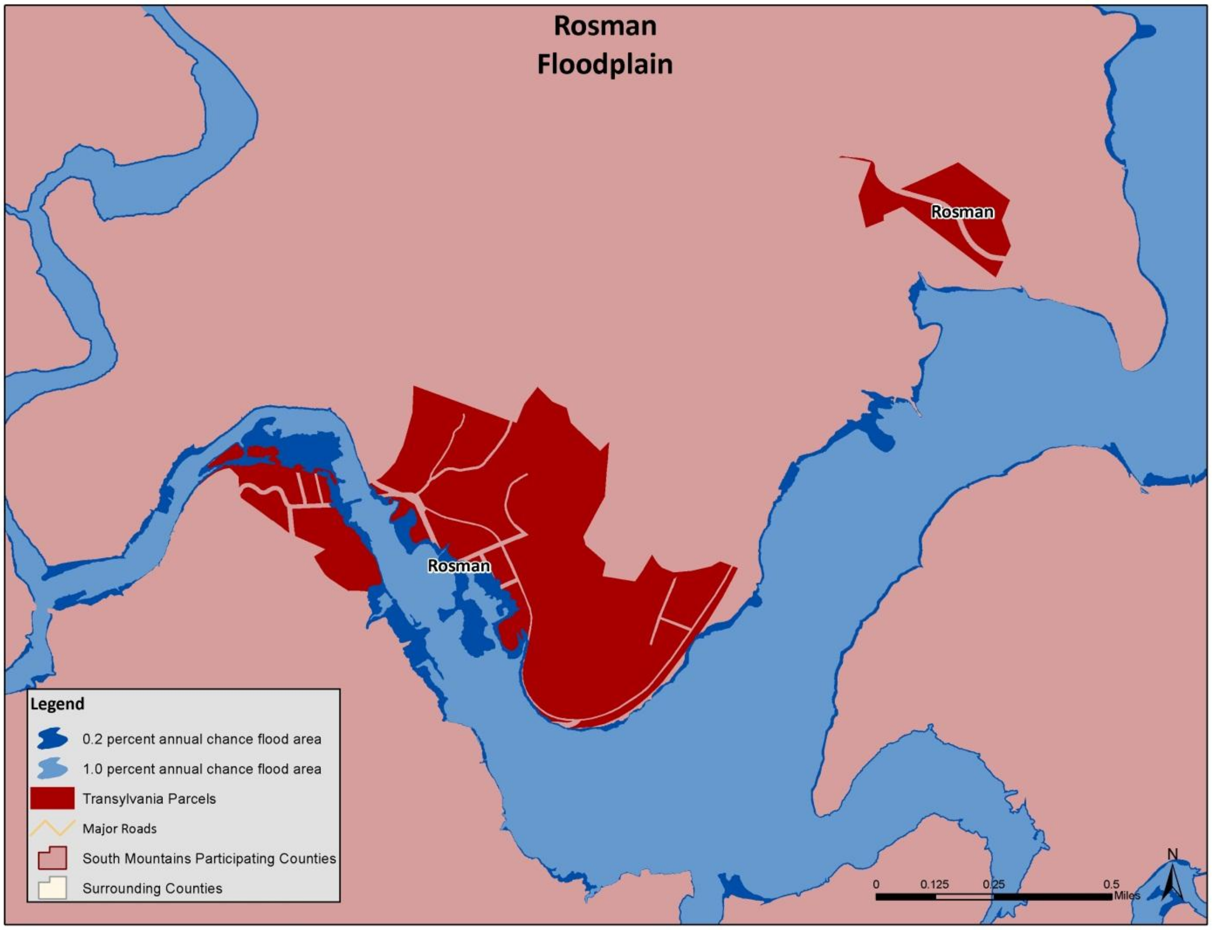
[15] The county-level DFIRM data used for Transylavnia County were updated in 2010.

FIGURE D.8: SPECIAL FLOOD HAZARD AREAS IN BREVARD



Source: Federal Emergency Management Agency

FIGURE D.9: SPECIAL FLOOD HAZARD AREAS IN ROSMAN



Source: Federal Emergency Management Agency

Historical Occurrences

Flooding has resulted in two disaster declarations in Transylvania County in 1995 and 1998.[16] Information from the National Climatic Data Center was used to ascertain additional historical flood events. The National Climatic Data Center reported a total of 52 events in Transylvania County since 1993.[17] A summary of these events is presented in **Table D.22**. These events accounted for almost $18.1 million (2013 dollars) in property damage in the county.[18] In addition, 10 injuries were reported. Specific information on flood events, including date, type of flooding, and deaths and injuries, can be found in **Table D.23**.

[16] A complete listing of historical disaster declarations can be found in Section 4: *Hazard Profiles*.
[17] These events are only inclusive of those reported by NCDC. It is likely that additional occurrences have occurred and have gone unreported.
[18] The total damage amount was averaged over the number of affected counties when multiple counties were involved in the flood event.

TABLE D.22: SUMMARY OF FLOOD OCCURRENCES IN TRANSYLVANIA COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Brevard	2	0/0	$0
Rosman	6	0/10	$2,374,009
Unincorporated Area	44	0/0	$15,724,727
TRANSYLVANIA COUNTY TOTAL	**52**	**0/10**	**$18,098,736**

Source: National Climatic Data Center

TABLE D.23: HISTORICAL FLOOD EVENTS IN TRANSYLVANIA COUNTY

	Date	Type	Deaths / Injuries	Property Damage*
Brevard				
BREVARD	27-SEP-04	FLASH FLOOD	0/0	$0
BREVARD	19-JUL-05	FLASH FLOOD	0/0	$0
Rosman				
ROSMAN	08-NOV-96	FLASH FLOOD	0/0	$0
ROSMAN	14-MAR-97	FLOOD	0/0	$0
ROSMAN	07-JAN-98	FLASH FLOOD	0/10	$2,323,338
ROSMAN	13-JUL-05	FLASH FLOOD	0/0	$50,671
ROSMAN	04-MAR-08	FLOOD	0/0	$0
ROSMAN	28-NOV-11	FLASH FLOOD	0/0	$0
Unincorporated Area				
TRANSYLVANIA COUNTY	23-MAR-93	FLASH FLOODS	0/0	$0
TRANSYLVANIA COUNTY	27-JUL-94	FLASH FLOOD	0/0	$0
TRANSYLVANIA COUNTY	27-AUG-95	FLASH FLOOD	0/0	$0
Various	04-OCT-95	FLASH FLOOD	0/0	$0
TRANSYLVANIA COUNTY	18-JAN-96	FLOOD	0/0	$0
TRANSYLVANIA COUNTY	26-JAN-96	FLOOD	0/0	$3,218
TRANSYLVANIA COUNTY	28-SEP-96	FLOOD	0/0	$0
COUNTYWIDE	01-DEC-96	FLASH FLOOD	0/0	$0
ROSMAN AREA	14-MAR-97	FLOOD	0/0	$0
COUNTYWIDE	07-JAN-98	FLOOD	0/0	$0
COUNTYWIDE	03-FEB-98	FLOOD	0/0	$0
COUNTYWIDE	26-NOV-99	FLOOD	0/0	$0
COUNTYWIDE	22-SEP-03	FLASH FLOOD	0/0	$26,878
TRANSYLVANIA COUNTY	19-NOV-03	FLOOD	0/0	$0
TRANSYLVANIA COUNTY	06-FEB-04	FLOOD	0/0	$0
CEDAR MTN	21-JUN-04	FLASH FLOOD	0/0	$3,914
SOUTH PORTION	07-SEP-04	FLASH FLOOD	0/0	$0
TRANSYLVANIA COUNTY	07-SEP-04	FLOOD	0/0	$13,700,118
TRANSYLVANIA COUNTY	16-SEP-04	FLOOD	0/0	$1,957,160
TRANSYLVANIA COUNTY	23-DEC-04	FLOOD	0/0	$0
TRANSYLVANIA COUNTY	12-JUN-05	FLOOD	0/0	$0
TRANSYLVANIA COUNTY	29-NOV-05	FLOOD	0/0	$0
LAKE TOXAWAY	04-MAR-08	FLASH FLOOD	0/0	$0

	Date	Type	Deaths / Injuries	Property Damage*
JOHN ROCK	20-SEP-09	FLOOD	0/0	$0
JOHN ROCK	20-SEP-09	FLASH FLOOD	0/0	$11,255
ECUSTA	21-SEP-09	FLOOD	0/0	$11,255
BLANTYRE	11-NOV-09	FLOOD	0/0	$0
ECUSTA	24-JAN-10	FLOOD	0/0	$0
ECUSTA	24-JAN-10	FLASH FLOOD	0/0	$0
GRANGE	30-NOV-10	FLASH FLOOD	0/0	$0
BLANTYRE	30-NOV-10	FLASH FLOOD	0/0	$10,927
ECUSTA	30-NOV-10	FLOOD	0/0	$0
ECUSTA	01-DEC-10	FLOOD	0/0	$0
SELICA	06-MAR-11	FLASH FLOOD	0/0	$0
GRANGE	06-MAR-11	FLASH FLOOD	0/0	$0
SELICA	06-MAR-11	FLOOD	0/0	$0
PENROSE	09-MAR-11	FLOOD	0/0	$0
GRANGE	09-MAR-11	FLASH FLOOD	0/0	$0
BLANTYRE	16-APR-11	FLOOD	0/0	$0
CALHOUN	16-APR-11	FLOOD	0/0	$0
CALHOUN	16-APR-11	FLASH FLOOD	0/0	$0
BLANTYRE	28-NOV-11	FLASH FLOOD	0/0	$0
BLANTYRE	28-NOV-11	FLOOD	0/0	$0
BLANTYRE	28-NOV-11	FLASH FLOOD	0/0	$0

*Property damage is reported in 2013 dollars; All damage may not have been reported.
Source: National Climatic Data Center

Historical Summary of Insured Flood Losses

According to FEMA flood insurance policy records as of June 2013, there have been 53 flood losses reported in Transylvania County through the National Flood Insurance Program (NFIP) since 1978, totaling over $550,000 in claims payments. A summary of these figures for the county is provided in **Table D.24**. It should be emphasized that these numbers include only those losses to structures that were insured through the NFIP policies, and for losses in which claims were sought and received. It is likely that many additional instances of flood loss in Transylvania County were either uninsured, denied claims payment, or not reported.

TABLE D.24: SUMMARY OF INSURED FLOOD LOSSES IN TRANSYLVANIA COUNTY

Location	Flood Losses	Claims Payments
Brevard	11	$150,815
Rosman	21	$93,223
Unincorporated Area	21	$305,983
TRANSYLVANIA COUNTY TOTAL	**53**	**$550,021**

Source: FEMA, NFIP

Repetitive Loss Properties

FEMA defines a repetitive loss property as any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling 10-year period, since 1978. A repetitive loss property may or may not be currently insured by the NFIP. Currently there are over 140,000 repetitive loss properties nationwide.

As of October 2013, there are 5 non-mitigated repetitive loss properties located in Transylvania County, which accounted for 13 losses and more than $125,000 in claims payments under the NFIP. The average claim amount for this property is $11,272. The properties are al single family residential. Without mitigation these properties will likely continue to experience flood losses. **Table D.25** presents detailed information on repetitive loss properties and NFIP claims and policies for Transylvania County.

TABLE D.25: REPETITIVE LOSS PROPERTIES IN TRANSYLVANIA COUNTY

Location	Number of Properties	Types of Properties	Number of Losses	Building Payments	Content Payments	Total Payments	Average Payment
Brevard	0	--	0	$0	$0	$0	$0
Rosman	3	3 single family	8	$62,461.84	$18,343.24	$80,805.08	$10,100.64
Unincorporated Area	2	2 single family	5	$63,165.43	$8,481.80	$71,647.23	$14,329.45
TRANSYLVANIA COUNTY TOTAL	**5**		**13**	**$125,627.27**	**$16,825.04**	**$152,452.31**	**$11,727.10**

Source: National Flood Insurance Program

Probability of Future Occurrences

Flood events will remain a threat in areas prone to flooding in Transylvania County, and the probability of future occurrences will remain likely (between 10 and 100 percent annual probability). The participating jurisdictions and unincorporated areas of the county have risk to flooding, though not all areas will experience floods. The probability of future flood events based on magnitude and according to best available data is illustrated in the figures above, which indicates those areas susceptible to the 1-percent annual chance flood (100-year floodplain) and the 0.2-percent annual chance flood (500-year floodplain).

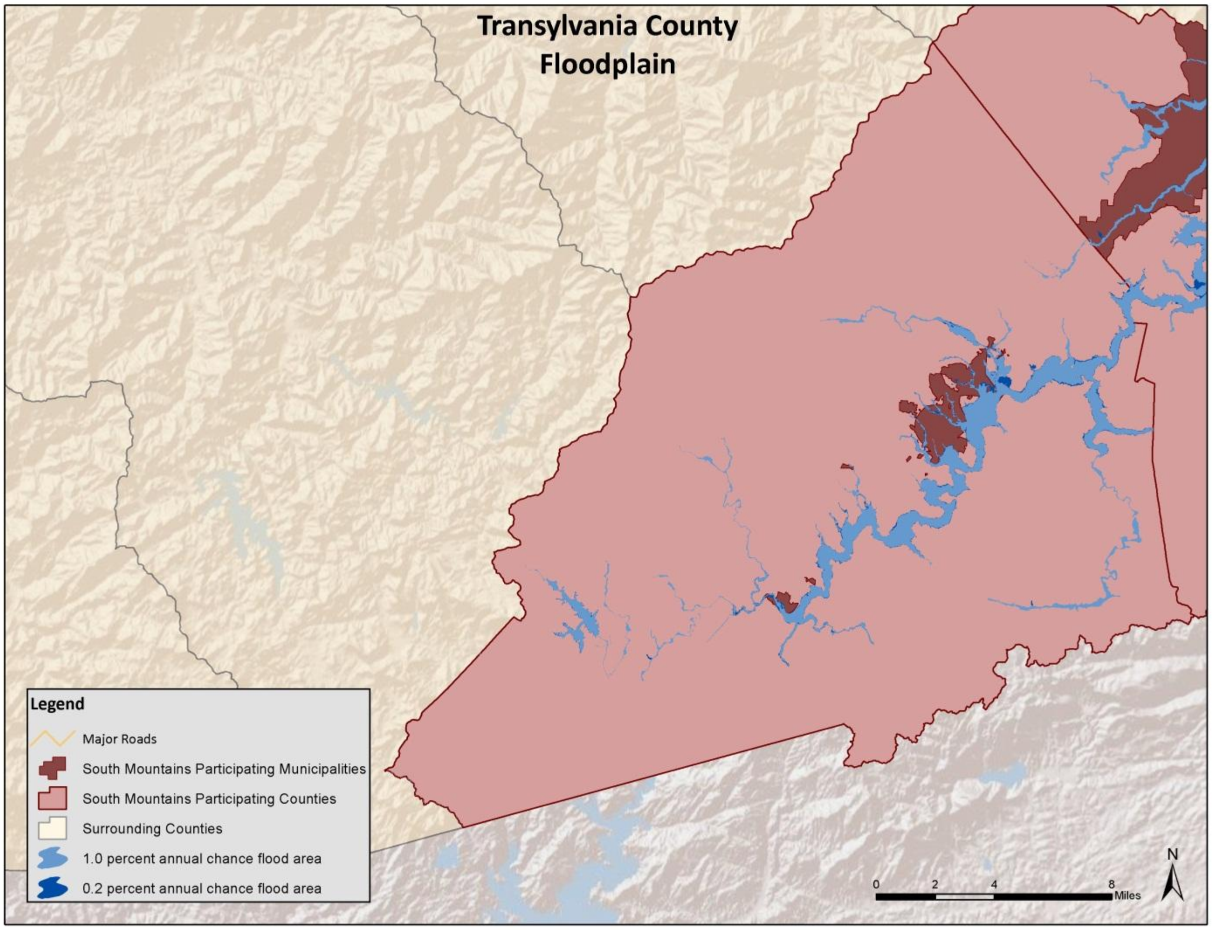
It can be inferred from the floodplain location maps, previous occurrences, and repetitive loss properties that risk varies throughout the county and participating jurisdictions. Both Brevard and Rosman have significant areas of floodplain and thus a somewhat high risk of flooding. Flood is not the greatest hazard of concern but will continue to occur and cause damage. Therefore, mitigation actions may be warranted, particularly for repetitive loss properties.

D.2.14 Hazardous Materials Incidents

Location and Spatial Extent

Transylvania County has no TRI sites shown in **Figure D.10.**

FIGURE D.10: TOXIC RELEASE INVENTORY (TRI) SITES IN TRANSYLVANIA COUNTY



Source: EPA

In addition to "fixed" hazardous materials locations, hazardous materials may also impact the county via roadways and rail. Many roads in the county are narrow and winding, making hazardous material transport in the area especially treacherous. All roads that permit hazardous material transport are considered potentially at risk to an incident.

Historical Occurrences

There has been a total of one recorded HAZMAT incident in Transylvania County since 2001 (**Table D.26**). **Table D.27** presents detailed information on historic HAZMAT incidents in Transylvania County as reported by the U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA).

TABLE D.26: SUMMARY OF HAZMAT INCIDENTS IN TRANSYLVANIA COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Brevard	1	0/0	$0
Rosman	0	--	--
Unincorporated Area	0	--	--

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
TRANSYLVANIA COUNTY TOTAL	**1**	**0/0**	**$0**

Source: USDOT PHMSA

TABLE D.27: HAZMAT INCIDENTS IN TRANSYLVANIA COUNTY

Report Number	Date	City	Mode	Serious Incident?	Fatalities / Injuries	Damages ($)*	Quantity Released
Brevard							
I-2002020100	12/17/2001	BREVARD	Highway	No	0/0	$0	50 LGA
Rosman							
None Reported	--	--	--	--	--	--	--
Unincorporated Area							
None Reported	--	--	--	--	--	--	--

*Property damage is reported in 2013 dollars.
Source: USDOT PHMSA

Probability of Future Occurrences

Given the prior roadway incidents, it is possible that a hazardous material incident may occur in the county (between 1 and 10 percent annual probability). County and town officials are mindful of this possibility and take precautions to prevent such an event from occurring. Furthermore, there are detailed plans in place to respond to an occurrence. The county may also be impacted by neighboring counties which also face risk due to TRI sites.

D.2.15 Wildfire

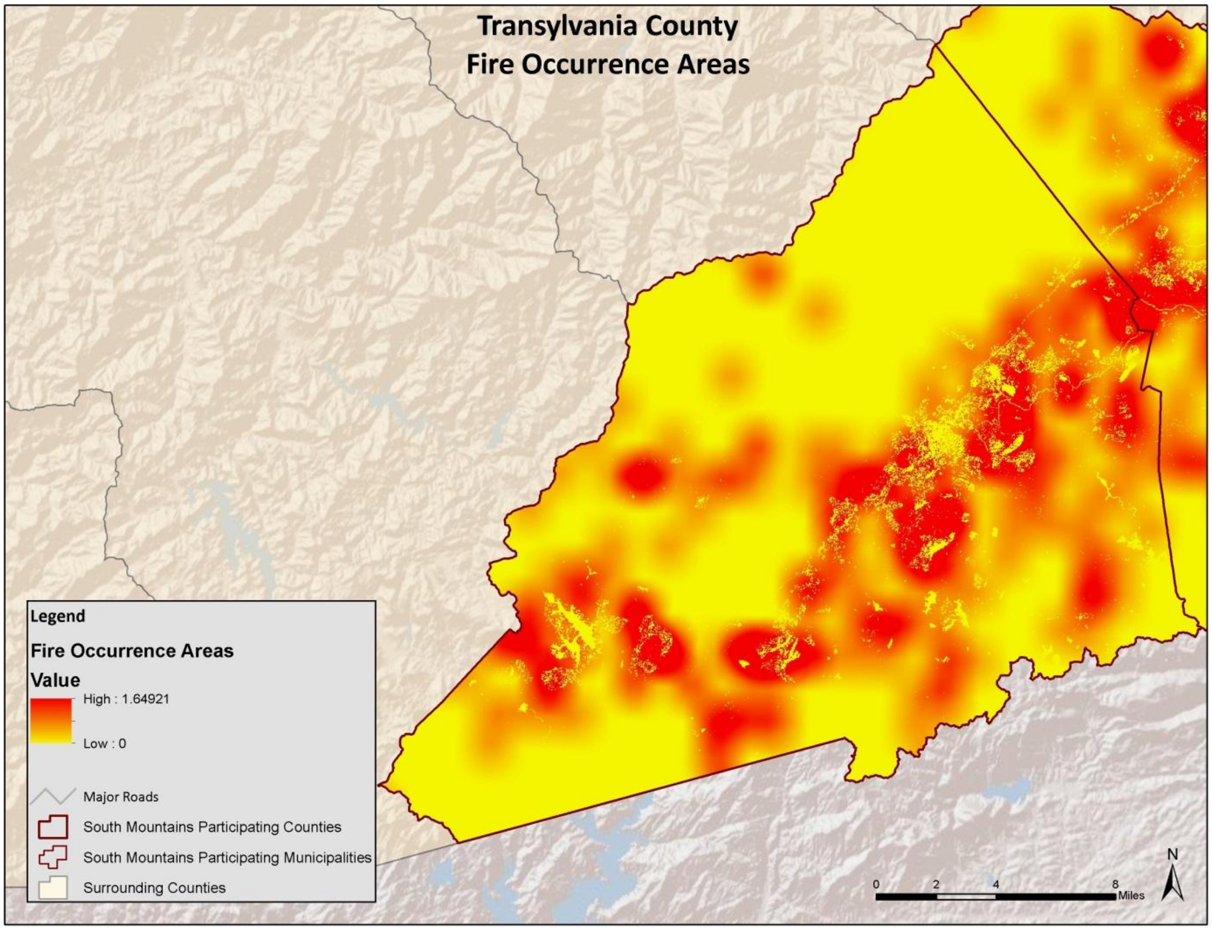
Location and Spatial Extent

The entire county is at risk to a wildfire occurrence. However, several factors such as drought conditions or high levels of fuel on the forest floor, may make a wildfire more likely. Furthermore, areas in the urban-wildland interface are particularly susceptible to fire hazard as populations abut formerly undeveloped areas. The Fire Occurrence Areas in the figure below give an indication of historic location.

Historical Occurrences

Figure D.11 shows the Fire Occurrence Areas (FOA) in Transylvania County based on data from the Southern Wildfire Risk Assessment. This data is based on historical fire ignitions and is reported as the number of fires that occur per 1,000 acres each year.

FIGURE D.11: HISTORIC WILDFIRE EVENTS IN TRANSYLVANIA COUNTY



Source: Southern Wildfire Risk Assessment

Based on data from the North Carolina Division of Forest Resources from 2003 to 2012, Transylvania County experienced an average of 24 wildfires annually which burn an average of 50 acres per year. The data indicates that most of these fires are small, averaging 2 acres per fire. **Table D.28** lists the number of reported wildfire occurrences in the county between the years 2003 and 2012.

TABLE D.28: HISTORICAL WILDFIRE OCCURRENCES IN TRANSYLVANIA COUNTY

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Transylvania County										
Number of Fires	23	21	20	35	29	29	23	13	23	26
Number of Acres	19.6	13.5	124.4	132.6	47.7	61.2	14.1	37.8	38.7	14.8

Source: North Carolina Division of Forest Resources

Probability of Future Occurrences

Wildfire events will be an ongoing occurrence in Transylvania County. The likelihood of wildfires increases during drought cycles and abnormally dry conditions. Fires are likely to stay small in size but could increase due local climate and ground conditions. Dry, windy conditions with an accumulation of forest floor fuel (potentially due to ice storms or lack of fire) could create conditions for a large fire that spreads quickly. It should also be noted that some areas do vary somewhat in risk. For example, highly developed areas are less susceptible unless they are located near the urban-wildland boundary. The risk will also vary due to assets. Areas in the urban-wildland interface will have much more property at risk, resulting in increased vulnerability and need to mitigate compared to rural, mainly forested areas. In this case, the participating jurisdictions appear to have a similar risk to the surrounding areas. The probability assigned to Transylvania County for future wildfire events is likely (10 to 100 percent annual probability).

D.2.16 Conclusions on Hazard Risk

The hazard profiles presented above were developed using best available data and result in what may be considered principally a qualitative assessment as recommended by FEMA in its "How-to" guidance document titled *Understanding Your Risks: Identifying Hazards and Estimating Losses* (FEMA Publication 386-2). It relies heavily on historical and anecdotal data, stakeholder input, and professional and experienced judgment regarding observed and/or anticipated hazard impacts. It also carefully considers the findings in other relevant plans, studies, and technical reports.

Hazard Extent

Table D.29 describes the extent of each natural hazard identified for Transylvania County. The extent of a hazard is defined as its severity or magnitude, as it relates to the planning area.

TABLE D.29: EXTENT OF TRANSYLVANIA COUNTY HAZARDS

Atmospheric Hazards	
Drought	Drought extent is defined by the North Carolina Drought Monitor Classifications which include Abnormally Dry, Moderate Drought, Severe Drought, Extreme Drought, and Exceptional Drought (page 5:6). According to the North Carolina Drought Monitor Classifications, the most severe drought condition is Exceptional. Transylvania County has received this ranking three times over the fourteen-year reporting period.
Extreme Heat	The extent of extreme heat can be defined by the maximum temperature reached. The highest temperature recorded in Transylvania County is 100 degrees Fahrenheit on June 6, 1977.
Hailstorm	Hail extent can be defined by the size of the hail stone. The largest hail stone reported in Transylvania County was 2.75 inches (reported on June 24, 1986). It should be noted that future events may exceed this.
Hurricane and Tropical Storm	Hurricane extent is defined by the Saffir-Simpson Scale which classifies hurricanes into Category 1 through Category 5 (Table 5.9). The greatest classification of hurricanes to traverse directly through Transylvania County was an Unnamed 1916 Storm which reached a maximum wind speed of 40 knots in the county. Although the county is much more likely to be impacted by the remnants of a hurricane or tropical storm, these events demonstrate that Category 3 or 4 storms can and have impacted the county directly.
Lightning	According to the Vaisala flash density map (Figure 5.5), Transylvania County is located in an area that experiences 2 to 4 lightning flashes per square kilometer per year. It should be noted that future lightning occurrences may exceed these figures.

Thunderstorm Wind / High Wind	Thunderstorm extent is defined by the number of thunder events and wind speeds reported. According to a 63-year history from the National Climatic Data Center, the strongest recorded wind event in Transylvania County was reported on April 15, 2007 at 70 knots (approximately 81 mph). It should be noted that future events may exceed these historical occurrences.
Tornado	Tornado hazard extent is measured by tornado occurrences in the US provided by FEMA (Figure 5.6) as well as the Fujita/Enhanced Fujita Scale (Tables 5.14 and 5.15). The greatest magnitude reported in the county was an F2 (reported on January 10, 1975).
Winter Storm and Freeze	The extent of winter storms can be measured by the amount of snowfall received (in inches). The greatest 24-hour snowfall reported in Transylvania County was 17 inches on December 3, 1971. Due to extreme variations in elevation throughout the county, extent totals will vary for each participating jurisdiction and reliable data on snowfall totals is not available.
Geologic Hazards	
Earthquake	Earthquake extent can be measured by the Richter Scale (Table 5.18) and the Modified Mercalli Intensity (MMI) scale (Table 5.19) and the distance of the epicenter from Transylvania County. According to data provided by the National Geophysical Data Center, the greatest MMI to impact the county was V (slightly strong) with a correlating Richter Scale measurement of approximately 4.8 (last reported on May 5, 1981). The epicenter of this earthquake was located 26.0 km away.
Landslide	As noted above in the landslide profile, the landslide data provided by the North Carolina Geological survey is incomplete. This provides a challenge when trying to determine an accurate extent for the landslide hazard. However, when using the USGS landslide susceptibility index, extent can be measured with incidence, which is low to high in Transylvania County. There is also low to high susceptibility throughout the county.
Hydrologic Hazards	
Dam Failure	Dam failure extent is defined using the North Carolina Division of Land Resources criteria (Table 5.23). Of the 87 dams in Transylvania County, 45 are classified as high-hazard.
Erosion	The extent of erosion can be defined by the measurable rate of erosion that occurs. There are no erosion rate records located in Transylvania County.
Flood	Flood extent can be measured by the amount of land and property in the floodplain as well as flood height and velocity. The amount of land in the floodplain accounts for 4.8 percent of the total land area in Transylvania County. Flood depth and velocity are recorded via United States Geological Survey stream gages throughout the region. While a gage does not exist for each participating jurisdiction, there is one at or near many areas. The greatest peak discharge recorded for the county was at the French Broad River at Blantyre on October 5, 1964. Water reached a discharge of 30,000 cubic feet per second and the stream gage height was recorded at 25.50 feet.
Other Hazards	
Hazardous Materials Incident	According to USDOT PHMSA, the largest hazardous materials incident reported in the county was 50 LGA released on the highway on December 17, 2001. It should be noted that larger events are possible.

Wildfire	Wildfire data was provided by the North Carolina Division of Forest Resources and is reported annually by county from 2003-2012. The greatest number of fires to occur in Transylvania County in any year was 35 in 2006. The greatest number of acres to burn in the county in a single year occurred in 2006 when 133 acres were burned. Although this data lists the extent that has occurred, larger and more frequent wildfires are possible throughout the county.

Priority Risk Index Results

In order to draw some meaningful planning conclusions on hazard risk for Transylvania County, the results of the hazard profiling process were used to generate countywide hazard classifications according to a "Priority Risk Index" (PRI). More information on the PRI and how it was calculated can be found in Section 5.18.2.

Table D.30 summarizes the degree of risk assigned to each category for all initially identified hazards based on the application of the PRI. Assigned risk levels were based on the detailed hazard profiles developed for this section, as well as input from the Regional Hazard Mitigation Planning Committee. The results were then used in calculating PRI values and making final determinations for the risk assessment.

TABLE D.30: SUMMARY OF PRI RESULTS FOR TRANSYLVANIA COUNTY

Hazard	Category/Degree of Risk					
	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Atmospheric Hazards						
Drought	Likely	Minor	Large	More than 24 hours	More than 1 week	**2.5**
Extreme Heat	Possible	Minor	Large	More than 24 hours	Less than 1 week	**2.1**
Hailstorm	Highly Likely	Limited	Moderate	Less than 6 hours	Less than 6 hours	**2.9**
Hurricane and Tropical Storm	Possible	Limited	Large	More than 24 hours	Less than 24 hours	**2.3**
Lightning	Highly Likely	Minor	Negligible	Less than 6 hours	Less than 6 hours	**2.2**
Thunderstorm / High Wind	Highly Likely	Critical	Moderate	6 to 12 hours	Less than 6 hours	**3.1**
Tornado	Possible	Critical	Small	Less than 6 hours	Less than 6 hours	**2.4**
Winter Storm and Freeze	Highly Likely	Critical	Large	More than 24 hours	Less than 1 week	**3.3**
Geologic Hazards						
Earthquake	Possible	Minor	Moderate	Less than 6 hours	Less than 6 hours	**2.0**
Landslide	Likely	Critical	Small	Less than 6 hours	Less than 6 hours	**2.5**
Hydrologic Hazards						
Dam and Levee Failure	Unlikely	Critical	Moderate	Less than 6 hours	Less than 6 hours	**2.3**
Erosion	Likely	Minor	Small	More than 24 hours	More than 1 week	**2.1**
Flood	Likely	Critical	Moderate	6 to 12 hours	Less than 1 week	**3.0**
Other Hazards						
Hazardous Materials Incident	Possible	Limited	Small	Less than 6 hours	Less than 24 hours	**2.2**
Wildfire	Likely	Limited	Small	Less than 6 hours	Less than 1 week	**2.6**

D.2.17 Final Determinations on Hazard Risk

The conclusions drawn from the hazard profiling process for Transylvania County, including the PRI results and input from the Regional Hazard Mitigation Planning Committee, resulted in the classification of risk for each identified hazard according to three categories: High Risk, Moderate Risk, and Low Risk (**Table D.31**). For purposes of these classifications, risk is expressed in relative terms according to the estimated impact that a hazard will have on human life and property throughout all of Transylvania County. A more quantitative analysis to estimate potential dollar losses for each hazard has been performed separately, and is described in Section 6: *Vulnerability Assessment* and below in Section D.3. It should be noted that although some hazards are classified below as posing low risk, their occurrence of varying or unprecedented magnitudes is still possible in some cases and their assigned classification will continue to be evaluated during future plan updates.

TABLE D.31: CONCLUSIONS ON HAZARD RISK FOR TRANSYLVANIA COUNTY

HIGH RISK	Winter Storm and Freeze Thunderstorm Wind / High Wind Flood Hailstorm
MODERATE RISK	Landslide Wildfire Drought Tornado Hurricane and Tropical Storm Dam and Levee Failure
LOW RISK	Lightning Hazardous Material Incident Extreme Heat Erosion Earthquake

D.3 TRANSYLVANIA COUNTY VULNERABILITY ASSESSMENT

This subsection identifies and quantifies the vulnerability of Transylvania County to the significant hazards previously identified. This includes identifying and characterizing an inventory of assets in the county and assessing the potential impact and expected amount of damages caused to these assets by each identified hazard event. More information on the methodology and data sources used to conduct this assessment can be found in Section 6: *Vulnerability Assessment*.

D.3.1 Asset Inventory

Table D.32 lists the number of parcels, total value of parcels, total number of parcels with improvements, and the total assessed value of improvements for Transylvania County and its participating jurisdictions (study area of vulnerability assessment).[19]

TABLE D.32: IMPROVED PROPERTY IN TRANSYLVANIA COUNTY

Location	Number of Parcels	Total Assessed Value of Parcels	Estimated Number of Buildings	Total Assessed Value of Improvements
Brevard	3,613	$5,555,744,965	2,944	$649,029,699
Rosman	232	$1,004,137,829	131	$23,565,880
Unincorporated Area	26,161	$31,785,590	13,579	$2,686,412,995
TRANSYLVANIA COUNTY TOTAL	**30,006**	**$6,591,668,384**	**16,654**	**$3,359,008,574**

Table D.33 lists the fire stations, police stations, emergency operations centers (EOCs), medical care facilities, schools and other critical facilities located in Transylvania County. Local governments at the county level provided a majority of the data for this analysis; however gaps in the data were filled using Hazus 2.1 to obtain the location of some critical facilities for which spatial data was not available. In addition, **Figure D.12** shows the locations of essential facilities in Transylvania County. **Table D.45**, near the end of this section, shows a complete list of the critical facilities by name, as well as the hazards that affect each facility. As noted previously, this list is not all-inclusive and only includes information provided by the county.

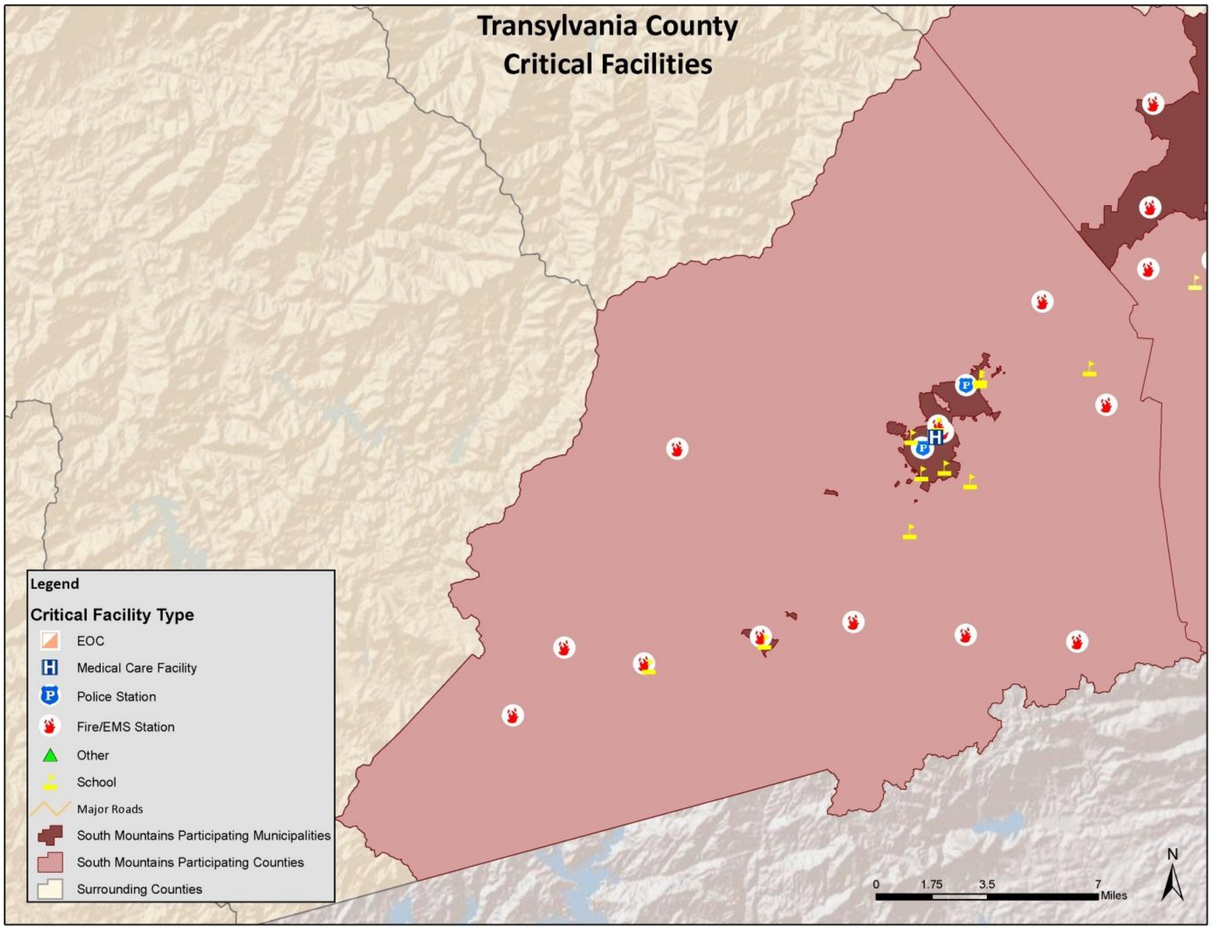
TABLE D.33: CRITICAL FACILITY INVENTORY IN TRANSYLVANIA COUNTY

Location	Fire Stations	Police Stations	Medical Care Facilities	EOC	Schools	Other
Brevard	3	2	1	0	6	0
Rosman	1	0	0	0	1	0
Unincorporated Area	9	0	0	0	5	0
TRANSYLVANIA COUNTY TOTAL	**13**	**2**	**1**	**0**	**12**	**0**

Source: Hazus-MH

[19] Total assessed values for improvements is based on tax assessor records as joined to digital parcel data. This data does not include dollar figures for tax-exempt improvements such as publicly-owned buildings and facilities. It should also be noted that, due to record keeping, some duplication is possible thus potentially resulting in an inflated value exposure for an area.

FIGURE D.12: CRITICAL FACILITY LOCATIONS IN TRANSYLVANIA COUNTY



Source: Hazus-MH 2.1

D.3.2 Social Vulnerability

In addition to identifying those assets potentially at risk to identified hazards, it is important to identify and assess those particular segments of the resident population in Transylvania County that are potentially at risk to these hazards.

Table D.34 lists the population by jurisdiction according to U.S. Census 2010 population estimates. Unfortunately, estimates were not available at the census block level, limited the results to county-wide estimates. The total population in Transylvania County according to Census data is 33,090 persons. Additional population estimates are presented above in Section D.1.

TABLE D.34: TOTAL POPULATION IN TRANSYLVANIA COUNTY

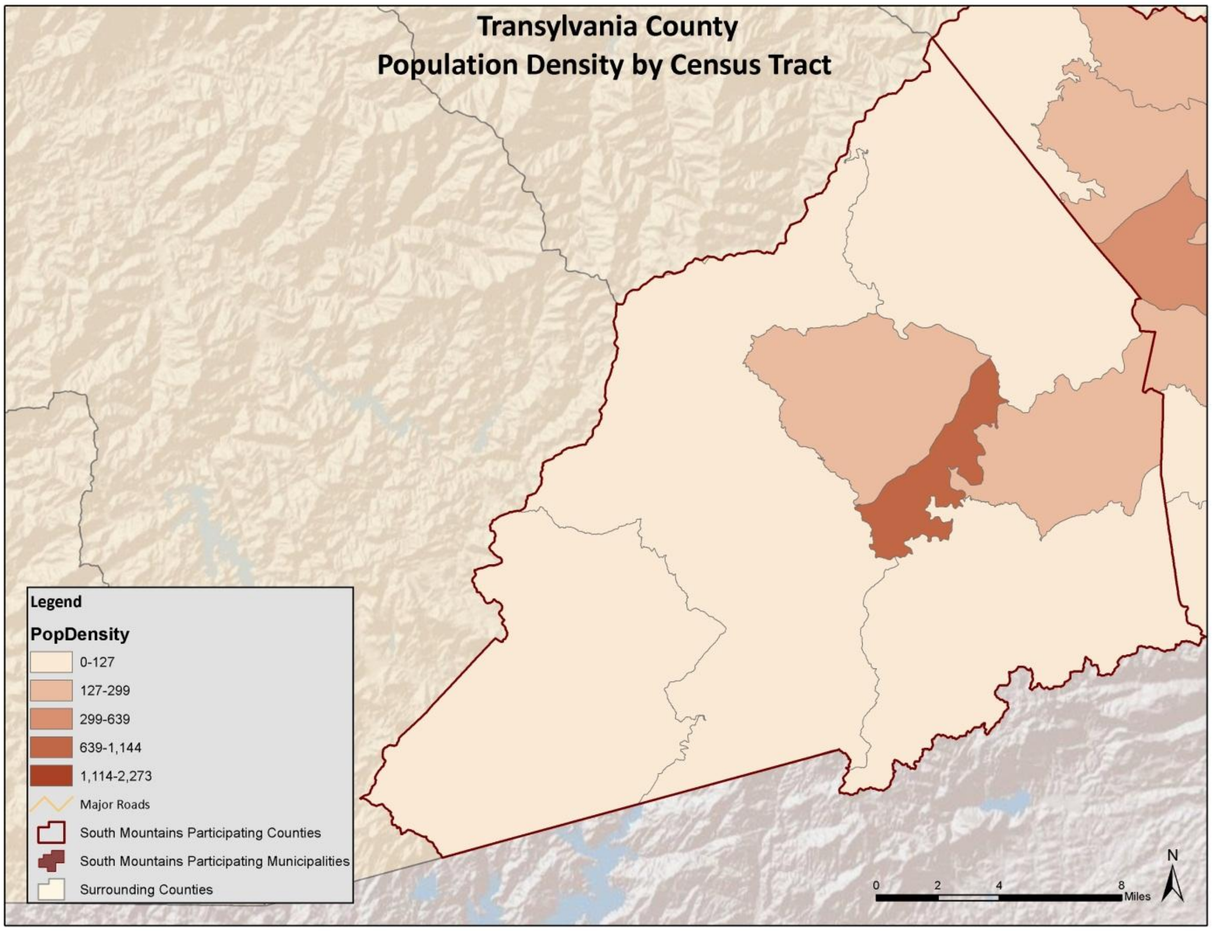
Jurisdiction	2010 Census Population
Transylvania County	**33,090**
City of Brevard	7,609

Jurisdiction	2010 Census Population
Town of Rosman	576

Source: U.S. Census 2010

In addition, **Figure D.13** illustrates the population density by census tract as it was reported by the U.S. Census Bureau in 2010.[20]

FIGURE D.13: POPULATION DENSITY IN TRANSYLVANIA COUNTY



Source: U.S. Census Bureau, 2010

D.3.3 Vulnerability Assessment Results

As noted in Section 6: *Vulnerability Assessment*, only hazards with a specific geographic boundary, modeling tool, or sufficient historical data allow for further analysis. Those results, specific to Transylvania County, are presented here. All other hazards are assumed to impact the entire planning region (drought, hailstorm, lightning, thunderstorm wind, tornado, and winter storm and freeze) or, due to lack of data, analysis would not lead to credible results (erosion, dam and levee failure). The total county exposure, and thus risk, was presented in **Table D.32**.

[20] Population by census block was not available at the time this plan was completed.

The annualized loss estimate for all hazards is presented at the end of this section in **Table D.45.**

The hazards presented in this section include: hurricane and tropical storm winds, earthquake, landslide, flood, hazardous materials incident, and wildfire.

Hurricane and Tropical Storm

Historical evidence indicates that Transylvania County has a significant risk to the hurricane and tropical storm hazard. Several tracks have come near or traversed through the county, as shown and discussed in Section D.3.3.

Hurricanes and tropical storms can cause damage through numerous additional hazards such as flooding, erosion, tornadoes, and high winds and precipitation, thus it is difficult to estimate total potential losses from these cumulative effects. The current Hazus-MH hurricane model only analyzes hurricane winds and is not capable of modeling and estimating cumulative losses from all hazards associated with hurricanes; therefore only hurricane winds are analyzed in this section. It can be assumed that all existing and future buildings and populations are at risk to the hurricane and tropical storm hazard. Hazus-MH 2.1 was used to determine annualized losses for the county as shown below in **Table D.35.** Only losses to buildings are reported, in order to best match annualized losses reported for other hazards. Hazus-MH reports losses at the U.S. Census tract level, so determining participating jurisdiction losses was not possible.

TABLE D.35: ANNUALIZED LOSS ESTIMATIONS FOR HURRICANE WIND HAZARD

Location	Total Annualized Loss
Transylvania County	$43,000

Source: Hazus-MH 2.1

In addition, probable peak wind speeds were calculated in Hazus. These are shown below in **Table D.36.**

TABLE D.36: PROBABLE PEAK HURRICANE / TROPICAL STORM WIND SPEEDS (MPH)

Location	50-year event	100-year event	500-year event	1,000-year event
Brevard	53	62	81	89
Rosman	52	62	80	87
MAXIMUM WIND SPEED REPORTED	**53**	**62**	**81**	**89**

Source: Hazus-MH 2.1

Social Vulnerability

Given equal susceptibility across the county, it is assumed that the total population is at risk to the hurricane and tropical storm hazard.

Critical Facilities

Given equal vulnerability across Transylvania County, all critical facilities are considered to be at risk. Some buildings may perform better than others in the face of such an event due to construction and age, among other factors. Determining individual building response is beyond the scope of this plan. However, this plan will consider mitigation actions for vulnerable structures, including critical facilities, to reduce the impacts of the hurricane wind hazard. A list of specific critical facilities and their associated risk can be found in **Table D.45** at the end of this section.

In conclusion, a hurricane event has the potential to impact many existing and future buildings, critical facilities, and populations in Transylvania County. Hurricane events can cause substantial damage in their wake including fatalities, extensive debris clean-up, and extended power outages.

Earthquake

For the earthquake hazard vulnerability assessment, a probabilistic scenario was created to estimate the annualized loss for Transylvania County. The results of the analysis reported at the U.S. Census tract level do not make it feasible to estimate losses at the jurisdiction level. Since the scenario is annualized, no building counts are provided. Losses reported included losses due to building damage and do not include losses to contents, inventory, or business interruption. **Table D.37** summarizes the findings.

TABLE D.37: ANNUALIZED LOSS ESTIMATIONS FOR EARTHQUAKE HAZARD

Location	Total Annualized Loss
Transylvania County	$18,000

Source: Hazus-MH 2.1

Social Vulnerability

It can be assumed that all existing future populations are at risk to the earthquake hazard.

Critical Facilities

The Hazus probabilistic analysis indicated that no critical facilities would sustain measurable damage in an earthquake event. However, all critical facilities should be considered at-risk to minor damage, should an event occur. A list of individual critical facilities and their risk can be found in **Table D.45**.

In conclusion, an earthquake has the potential to impact all existing and future buildings, facilities, and populations in Transylvania County. Minor earthquakes may rattle dishes and cause minimal damage while stronger earthquakes will result in structural damage as indicated in the Hazus scenario above. Impacts of earthquakes include debris clean-up, service disruption and, in severe cases, fatalities due to building collapse. Specific vulnerabilities for assets will be greatly dependent on their individual design and the mitigation measures in place, where appropriate. Such site-specific vulnerability determinations are outside the scope of this assessment but will be considered during future plan updates if data becomes available. Furthermore, mitigation actions to address earthquake vulnerability will be considered.

Landslide

In order to complete the vulnerability assessment for landslides in Transylvania County, GIS analysis was used. The potential dollar value of exposed land and property total can be determined using the USGS Landslide Susceptibility Index (detailed in Section D.3.9), county level tax parcel data, and GIS analysis. **Table D.38** presents the potential at-risk property where available. Nearly all areas of Transylvania County are identified as moderate or high incidence areas by the USGS landslide data. All areas are also of high landslide susceptibility. The incidence levels (high and moderate) were used to identify different areas of concern for the analysis below.

TABLE D.38: TOTAL POTENTIAL AT-RISK PARCELS FOR THE LANDSLIDE HAZARD

Location	Number of Parcels At Risk		Number of Improvements At Risk		Total Value of Improvements At Risk ($)	
Incidence Level	Moderate	High	Moderate	High	Moderate	High
Brevard	3,613	0	2,944	0	$649,029,699	$0
Rosman	232	0	131	0	$23,565,880	$0
Unincorporated Area	23,096	1,609	12,329	716	$2,497,370,554	$92,238,450
TRANSYLVANIA COUNTY TOTAL	**26,941**	**1,609**	**15,404**	**716**	**$3,169,966,133**	**$92,238,450**

Source: USGS

Social Vulnerability
Given high susceptibility across the entire county, it is assumed that the total population is at risk.

Critical Facilities
All critical facilities are located in a high susceptibility area. Twenty-six facilities in Transylvania County are located in the moderate incidence area (high susceptibility). One additional critical facility is located in the high landslide incidence/susceptibility area. A list of specific critical facilities and their associated risk can be found in **Table D.45** at the end of this section.

In conclusion, a landslide has the potential to impact all existing and future buildings, facilities, and populations in Transylvania County, though some areas are at a higher risk than others due to a variety of factors. For example, steep slopes and modified slopes bear a greater risk than flat areas. Specific vulnerabilities for county assets will be greatly dependent on their individual design and the mitigation measures in place, where appropriate. Such site-specific vulnerability determinations are outside the scope of this assessment but will be considered during future plan updates if data becomes available.

Flood
Historical evidence indicates that Transylvania County is susceptible to flood events. A total of 52 flood events have been reported by the National Climatic Data Center resulting in over $18 million dollars in damages. On an annualized level, these damages amounted to $925,884 for Transylvania County.

In order to assess flood risk, a GIS-based analysis was used to estimate exposure to flood events using Digital Flood Insurance Rate Map (DFIRM) data in combination with local tax assessor records for the county. The determination of assessed value at-risk (exposure) was calculated using GIS analysis by summing the total assessed building values for only those improved properties that were confirmed to be located within an identified floodplain. **Table D.39** presents the potential at-risk property. Both the number of parcels and the approximate value are presented.

TABLE D.39: ESTIMATED EXPOSURE OF PARCELS TO THE FLOOD HAZARD

	1.0-percent ACF			0.2-percent ACF		
Location	Approx. Number of Parcels	Approx. Number Improved Buildings	Approx. Improved Value of Buildings	Approx. Number of Parcels	Approx. Number Improved Buildings	Approx. Improved Value of Buildings
Brevard	423	328	$166,517,904	75	60	$16,923,625

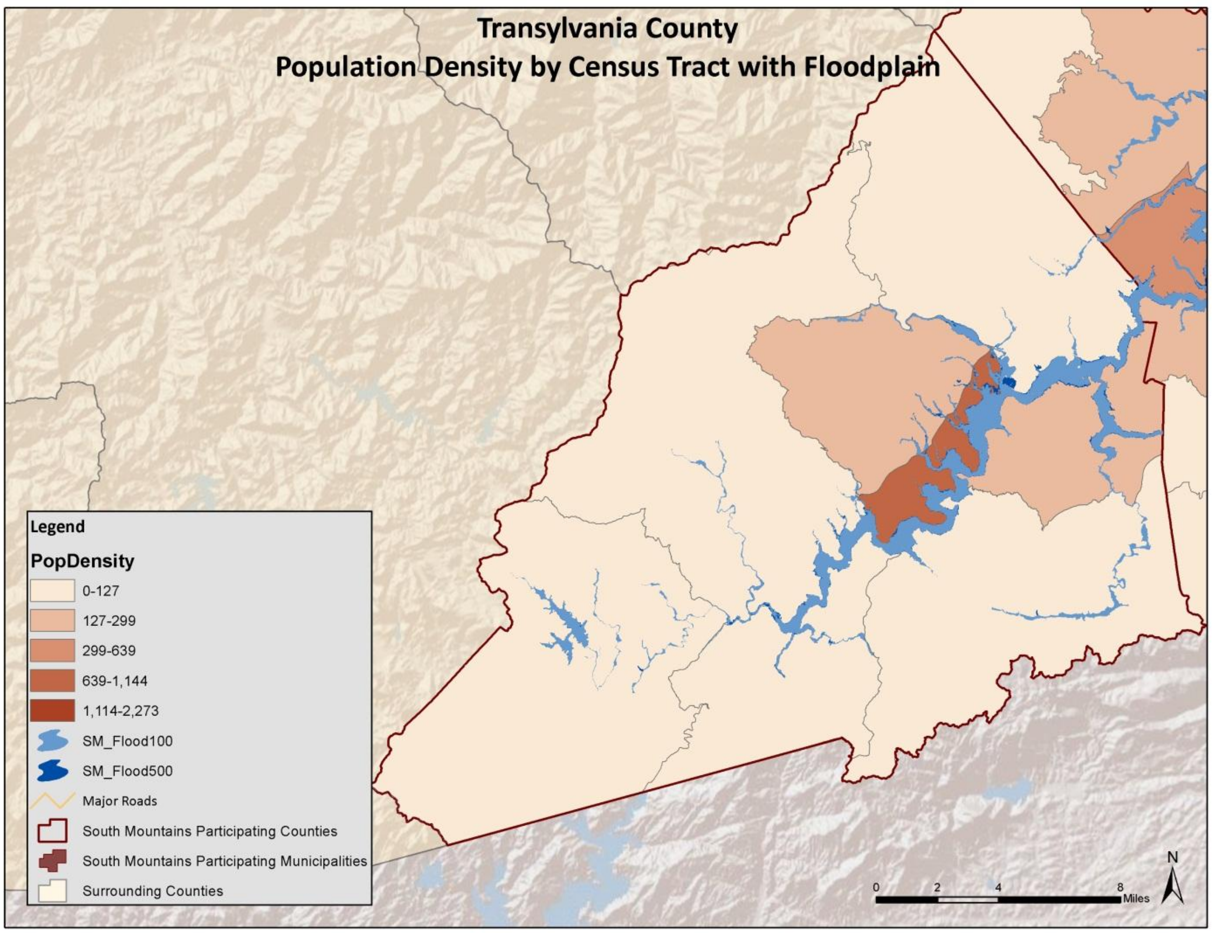
	1.0-percent ACF			0.2-percent ACF		
Location	Approx. Number of Parcels	Approx. Number Improved Buildings	Approx. Improved Value of Buildings	Approx. Number of Parcels	Approx. Number Improved Buildings	Approx. Improved Value of Buildings
Rosman	58	30	$3,665,740	27	18	$1,327,820
Unincorporated Area	2,542	1,492	$402,859,310	199	141	$50,632,340
TRANSYLVANIA COUNTY TOTAL	**3,023**	**1,850**	**$573,042,954**	**301**	**219**	**$68,883,785**

Source: FEMA DFIRM

Social Vulnerability

Since 2010 population was only available at the tract level, it was difficult to determine a reliable figure on population at-risk to flood due to tract level population data. **Figure D.14** is presented to gain a better understanding of at risk population.

FIGURE D.14 : POPULATION DENSITY NEAR FLOODPLAINS



Source: FEMA DFIRM, U.S. Census 2010

Critical Facilities

The critical facility analysis revealed that there are four critical facilities located in the Transylvania County 1.0-percent annual chance floodplain and 0.2-percent annual chance floodplain based on FEMA DFIRM boundaries and GIS analysis. A list of specific critical facilities and their associated risk can be found in **Table D.45** at the end of this section.

In conclusion, a flood has the potential to impact many existing and future buildings and populations in Transylvania County, though some areas are at a higher risk than others. All types of structures in a floodplain are at-risk, though elevated structures will have a reduced risk. As noted, the floodplains used in this analysis include the 100-year and 500-year FEMA regulated floodplain boundaries. It is certainly possible that more severe events could occur beyond these boundaries or urban (flash) flooding could impact additional structures. Such site-specific vulnerability determinations are outside the scope of this assessment but will be considered during future plan updates. Furthermore, areas subject to repetitive flooding should be analyzed for potential mitigation actions.

Hazardous Materials Incident

Although historical evidence and existing Toxic Release Inventory sites indicate that Transylvania County is susceptible to hazardous materials events, there are few reports of damage. Therefore, it is difficult to calculate a reliable annualized loss figure. It is assumed that while one major event could result in significant losses, annualizing structural losses over a long period of time would most likely yield a negligible annualized loss estimate for Transylvania County.

Most hazardous materials incidents that occur are contained and suppressed before destroying any property or threatening lives. However, they can have a significant negative impact. Such events can cause multiple deaths, completely shut down facilities for 30 days or more, and cause more than 50 percent of affected properties to be destroyed or suffer major damage. In a hazardous materials incident, solid, liquid, and/or gaseous contaminants may be released from fixed or mobile containers. Weather conditions will directly affect how the hazard develops. Certain chemicals may travel through the air or water, affecting a much larger area than the point of the incidence itself. Non-compliance with fire and building codes, as well as failure to maintain existing fire and containment features, can substantially increase the damage from a hazardous materials release. The duration of a hazardous materials incident can range from hours to days. Warning time is minimal to none.

In order to conduct the vulnerability assessment for this hazard, GIS intersection analysis was used for fixed and mobile areas and parcels.[21] In both scenarios, two sizes of buffers—500 and 2,500 meters—were used. These areas are assumed to respect the different levels of effect: immediate (primary) and secondary. Primary and secondary impact sites were selected based on guidance from FEMA 426, Reference Manual to Mitigate Potential Terrorist Attacks against Buildings and engineering judgment. For the fixed site analysis, geo-referenced TRI listed toxic sites in Transylvania County, along with buffers, were used for analysis, though there were no TRI sites in Transylvania County. For the mobile analysis, the major roads (Interstate highway, U.S. highway, and State highway) and railroads, where hazardous materials are primarily transported that could adversely impact people and buildings, were used for the GIS buffer analysis. **Figure D.15** shows the areas used for mobile toxic release buffer analysis. The results indicate the approximate number of parcels, improved value, as shown in **Table D.40** (mobile road sites) and **Table D.41** (mobile railroad sites).[22]

[21] This type of analysis will likely yield inflated results (generally higher than what is actually reported after an event).
[22] Note that parcels included in the 2,500 meter analysis are also included in the 500 meter analysis.

FIGURE D.15 : MOBILE HAZMAT BUFFERS IN TRANSYLVANIA COUNTY

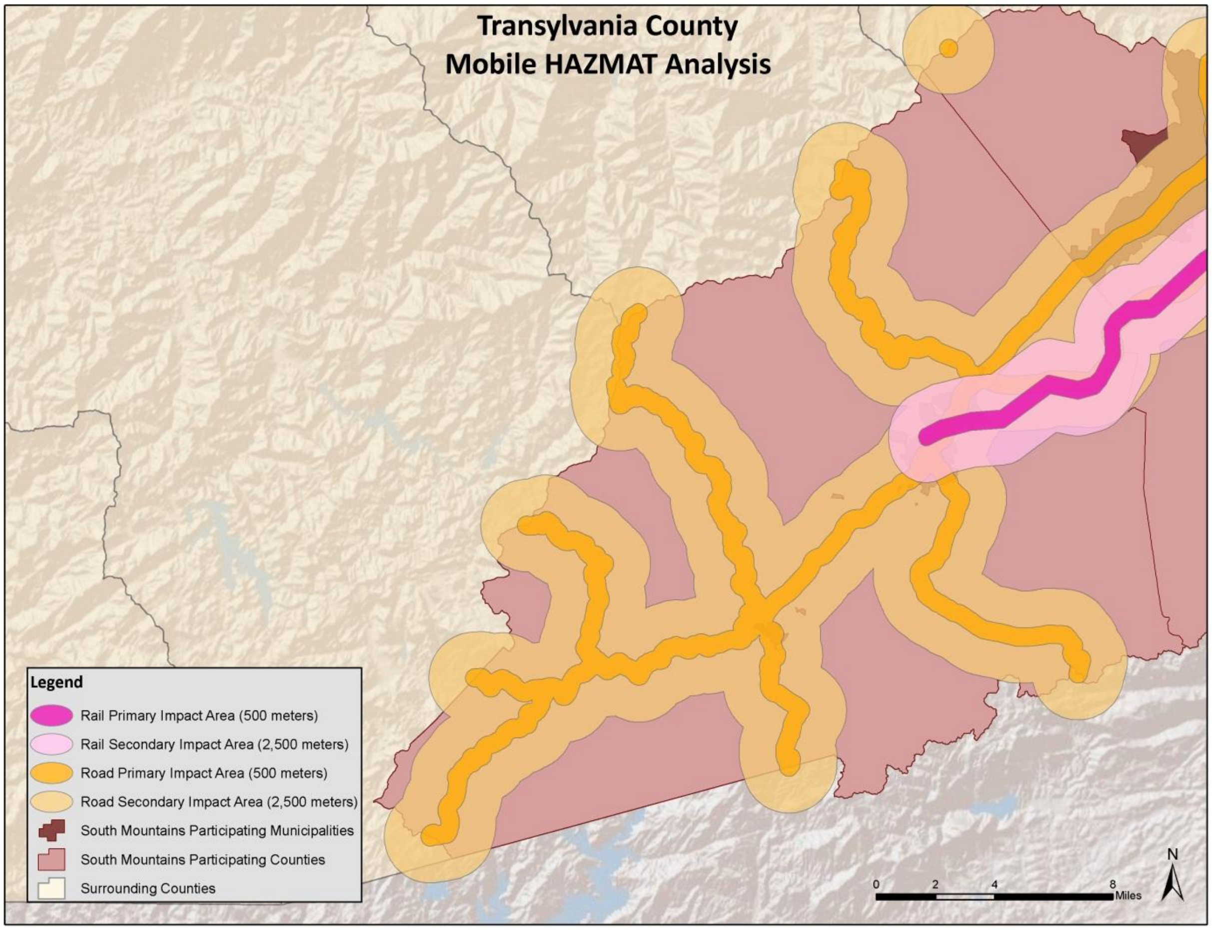


TABLE D.40: EXPOSURE OF IMPROVED PROPERTY TO HAZARDOUS MATERIALS SPILL (MOBILE ANALYSIS - ROAD)

Location	500-meter buffer			2,500-meter buffer		
	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value
Brevard	2,538	2,086	$486,167,349	3,613	2,944	$649,029,699
Rosman	213	116	$22,163,420	232	131	$23,565,880
Unincorporated Area	7,998	4,500	$754,826,576	20,839	11,260	$2,174,698,704
TRANSYLVANIA COUNTY TOTAL	**10,749**	**6,702**	**$1,263,157,345**	**24,684**	**14,335**	**$2,847,294,283**

TABLE D.41: EXPOSURE OF IMPROVED PROPERTY TO HAZARDOUS MATERIALS SPILL (MOBILE ANALYSIS - RAILROAD)

	500-meter buffer			2,500-meter buffer		
Location	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value
Brevard	679	593	147376080	3452	2818	631494299
Rosman	0	0	0	0	0	0
Unincorporated Area	877	577	94018495	3793	2388	398996505
TRANSYLVANIA COUNTY TOTAL	**1,556**	**1,170**	**$241,394,575**	**7,245**	**5,206**	**$1,030,490,804**

Social Vulnerability
Given high susceptibility across the entire county, it is assumed that the total population is at risk to a hazardous materials incident. It should be noted that areas of population concentration may be at an elevated risk due to a greater burden to evacuate population quickly.

Critical Facilities
Fixed Site Analysis:
The critical facility analysis for fixed TRI sites revealed that there are no Transylvania County facilities located in a HAZMAT risk zone because there are no TRI sites in Transylvania County. A list of specific critical facilities and their associated risk can be found in **Table D.45** at the end of this section.

Mobile Analysis:
The critical facility analysis for road and railroad transportation corridors in Transylvania County revealed that there are 27 critical facilities located in the primary and secondary mobile HAZMAT buffer areas for roads and 15 critical facilities located in the railroad HAZMAT buffer areas. It should be noted that many of the facilities located in the buffer areas for road are also located in the buffer areas for railroad and/or the fixed site analysis. A list of specific critical facilities and their associated risk can be found in **Table D.45** at the end of this section.

In conclusion, a hazardous material incident has the potential to impact many existing and future buildings, critical facilities, and populations in Transylvania County. Those areas in a primary buffer are at the highest risk, though all areas carry some vulnerability due to variations in conditions that could alter the impact area such direction and speed of wind, volume of release, etc. Further, incidents from neighboring counties could also impact the county and participating jurisdictions.

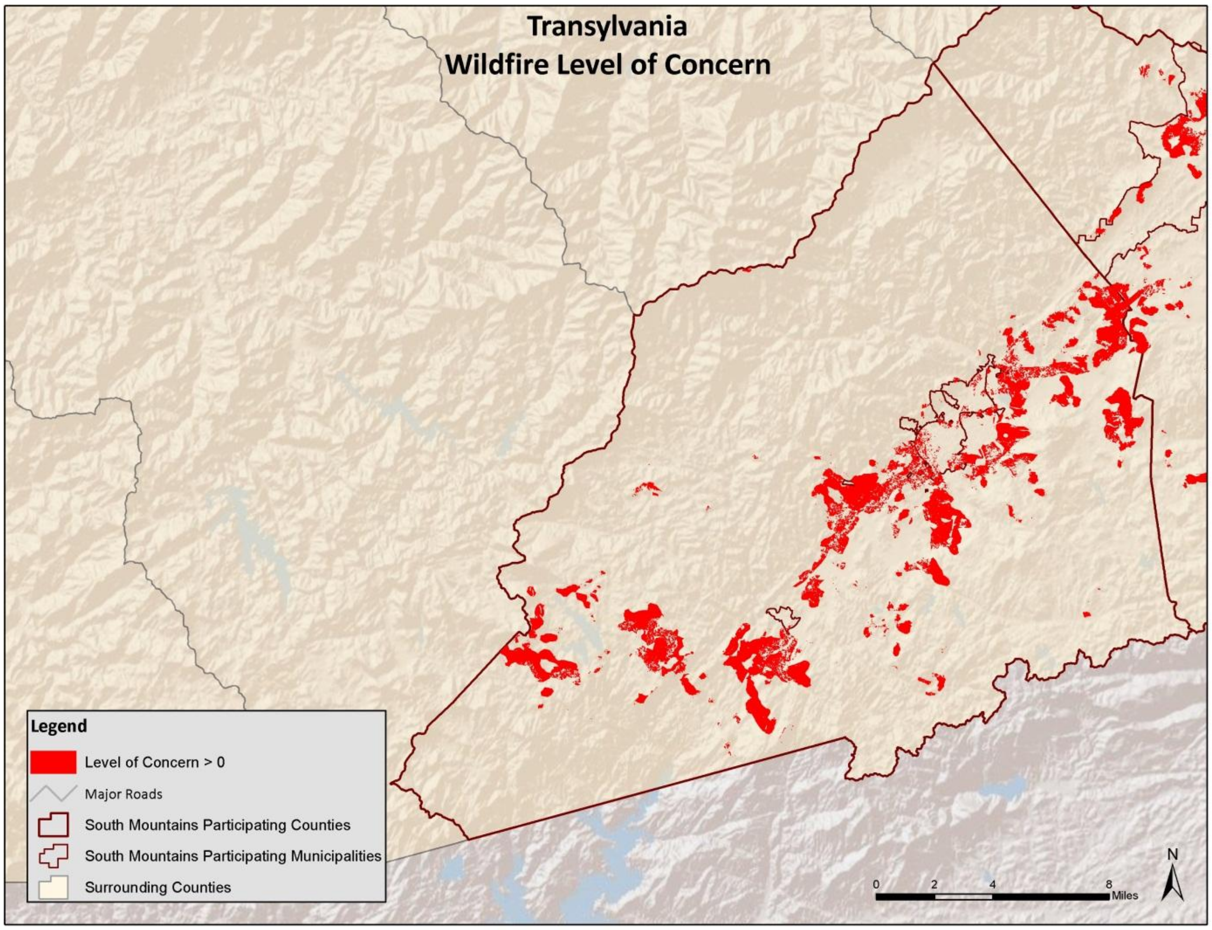
Wildfire
Although historical evidence indicates that Transylvania County is susceptible to wildfire events, there are few reports of damage. Therefore, it is difficult to calculate a reliable annualized loss figure. Annualized loss is considered negligible though it should be noted that a single event could result in significant damages throughout the county.

To estimate exposure to wildfire, the approximate number of parcels and their associated improved value was determined using GIS analysis. For the critical facility analysis, areas of concern were intersected with critical facility locations. **Figure D.16**, **Figure D.17**, and **Figure D.18**, show the Level of Concern data. Initially provided as raster data, it was converted to a polygon to allow for analysis. The

LOC data ranges from 1 – 100 with higher values being most severe (as noted previously, this is only a measure of relative risk). Eight was the highest level recorded in the Transylvania County planning area. Therefore, areas with a value above 1 were chosen to be displayed as areas of risk. The region contains some lands where the value falls into the at-risk category, though the region has somewhat less land labeled as at-risk compared to other regions of North Carolina. Since all of this land area is on the lower tenth of the overall LOC scale, there is likely considerably less risk in the region than in other areas of the country.

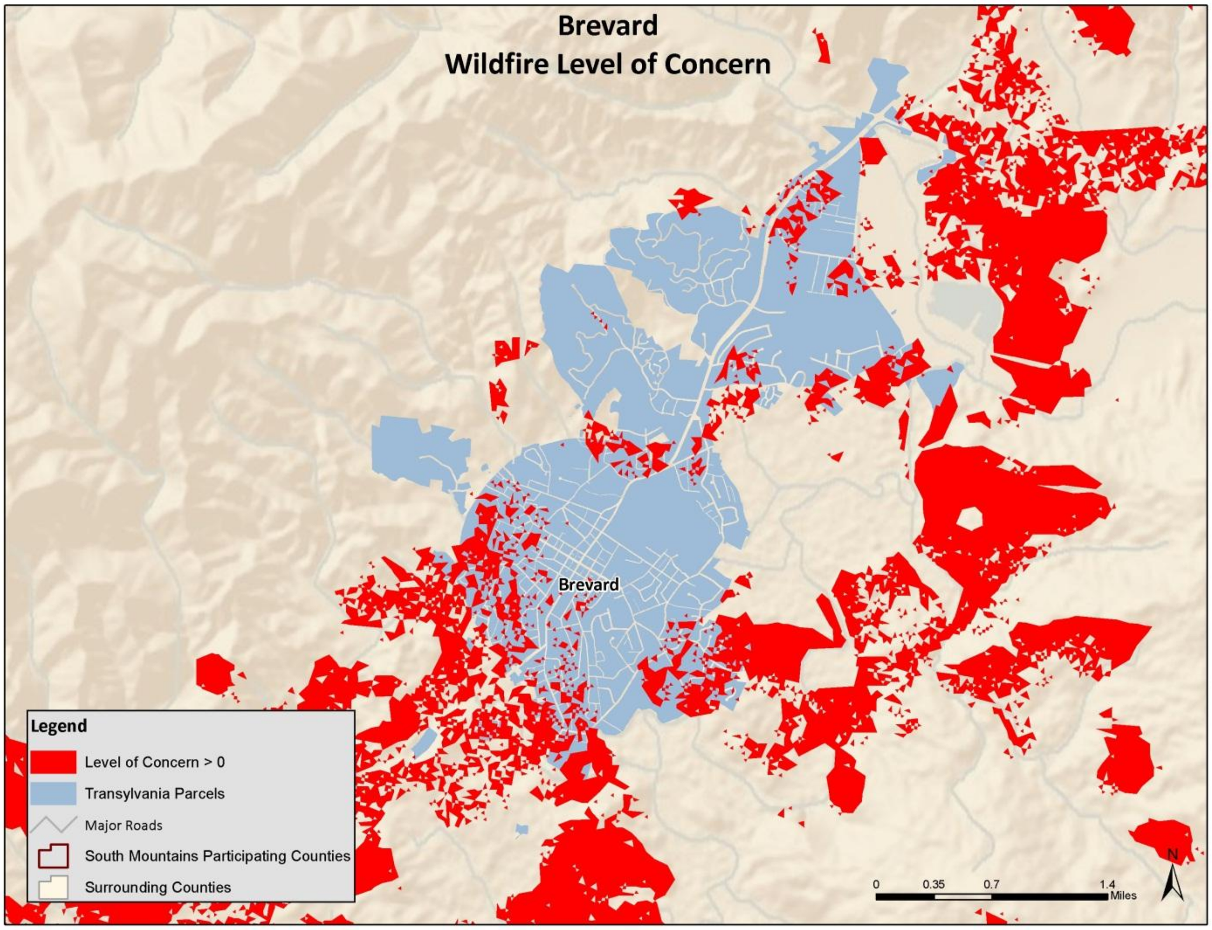
Table D.42 shows the results of the analysis.

FIGURE D.16: WILDFIRE RISK AREAS IN TRANSYLVANIA COUNTY



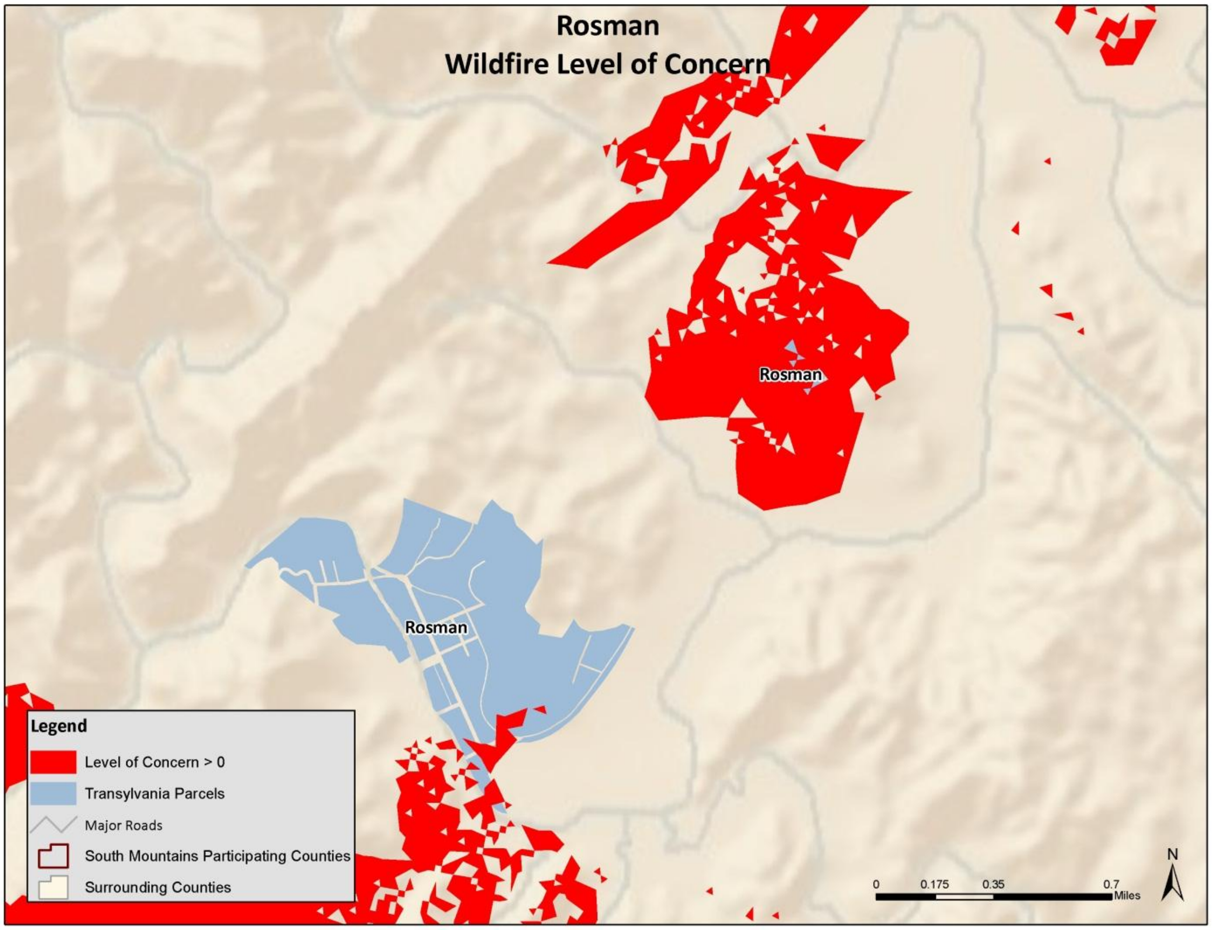
Source: Southern Wildfire Risk Assessment Data

FIGURE D.17: WILDFIRE RISK AREAS IN BREVARD



Source: Southern Wildfire Risk Assessment Data

FIGURE D.18: WILDFIRE RISK AREAS IN ROSMAN



Source: Southern Wildfire Risk Assessment Data

TABLE D.42: EXPOSURE OF IMPROVED PROPERTY TO WILDFIRE AREAS OF CONCERN

	HIGH WILDFIRE RISK AREA		
Location	**Approx. Number of Parcels**	**Approx. Number of Buildings**	**Approx. Improved Value**
Brevard	1,090	884	$187,804,233
Rosman	6	4	$342,650
Unincorporated Area	7,043	4,184	$705,749,200
TRANSYLVANIA COUNTY TOTAL	**8,139**	**5,072**	**$893,896,083**

Looking at jurisdictional level, unincorporated areas of the county face the highest level of concern areas. However, both Brevard and Rosman have some areas where the level of concern is above 1.

Social Vulnerability

Although not all areas have equal vulnerability, there is some susceptibility across the entire county. It is assumed that the total population is at risk to the wildfire hazard. Determining the exact number of people in certain wildfire zones is difficult with existing data and could be misleading.

Critical Facilities
The critical facility analysis revealed that there are five critical facilities located in wildfire areas of concern. It should also be noted, that several factors could impact the spread of a wildfire putting all facilities at risk. A list of specific critical facilities and their associated risk can be found in **Table D.45** at the end of this section.

In conclusion, a wildfire event has the potential to impact many existing and future buildings, critical facilities, and populations in Transylvania County.

Conclusions on Hazard Vulnerability

Table D.43 presents a summary of annualized loss for each hazard in Transylvania County. Due to the reporting of hazard damages primarily at the county level, it was difficult to determine an accurate annualized loss estimate for each municipality. Therefore, an annualized loss was determined through the damage reported through historical occurrences at the county level. These values should be used as an additional planning tool or measure risk for determining hazard mitigation strategies throughout the region.

TABLE D.43: ANNUALIZED LOSS FOR TRANSYLVANIA COUNTY

Event	Transylvania County
Dam Failure	Negligible
Drought	Negligible
Extreme Heat	Negligible
Erosion	Negligible
Hail	$177,080
Hurricane & Tropical Storm	$397,000
Landslide	$354,418
Lightning	$162,881
Thunderstorm Wind/High Wind	$232,394
Tornado	$54,351
Winter Storm & Freeze	$2,693,399
Flood	$2,131,140
Earthquake	$107,000
HAZMAT Incident	Negligible
Wildfire	Negligible

As noted previously, all existing and future buildings and populations (including critical facilities) are vulnerable to atmospheric hazards including drought, hailstorm, hurricane and tropical storm, lightning, thunderstorm wind, tornado, and winter storm and freeze. Some buildings may be more vulnerable to these hazards based on locations, construction, and building type. **Table D.44** shows the critical facilities vulnerable to additional hazards analyzed in this section. The table lists those assets that are determined to be exposed to each of the identified hazards (marked with an "**X**").

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TABLE D.44: AT-RISK CRITICAL FACILITIES IN TRANSYLVANIA COUNTY

		ATMOSPHERIC							GEOLOGIC			HYDROLOGIC		OTHER								
FACILITY NAME	FACILITY TYPE	Drought	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 500m	Fixed HAZMAT 2,500 meter	Mobile HZMT 500 METER (road)	Mobile HZMT 2,500 meter (road)	Mobile HZMT 500 METER (rail)	Mobile HZMT 2,500 METER (rail)	Wildfire
TRANSYLVANIA COUNTY																				
BREVARD ELEMENTARY	School	X	X	X	X	X	X	X	X		X					X	X		X	
BREVARD HIGH	School	X	X	X	X	X	X	X	X		X					X	X		X	
DAVIDSON RIVER SCHOOL	School	X	X	X	X	X	X	X	X		X		X			X	X		X	
BREVARD MIDDLE	School	X	X	X	X	X	X	X	X		X					X	X	X	X	
ROSMAN HIGH	School	X	X	X	X	X	X	X	X		X						X		X	
ROSMAN MIDDLE	School	X	X	X	X	X	X	X	X		X						X		X	
TRANSYLVANIA COMMUNITY HOSPITAL	Medical Care Facility	X	X	X	X	X	X	X	X		X	X				X	X		X	
ROSMAN ELEMENTARY	School	X	X	X	X	X	X	X	X		X					X	X			
PISGAH FOREST ELEMENTARY	School	X	X	X	X	X	X	X	X		X					X	X		X	
TC HENDERSON ELEMENTARY	School	X	X	X	X	X	X	X	X		X					X	X			X
ANCHOR BAPTIST	School	X	X	X	X	X	X	X	X		X					X	X	X	X	X
BETHANY CHRISTIAN SCHOOL	School	X	X	X	X	X	X	X	X		X	X					X			X
BREVARD ACADEMY	School	X	X	X	X	X	X	X	X		X						X			
TRANSYLVANIA COUNTY EMS BREVARD	Fire/EMS Station	X	X	X	X	X	X	X	X		X					X	X		X	
TRANSYLVANIA COUNTY EMS QUEBEC	Fire/EMS Station	X	X	X	X	X	X	X	X		X					X	X			X
TRANSYLVANIA COUNTY RESCUE SQUAD	Fire/EMS Station	X	X	X	X	X	X	X	X		X					X	X	X	X	
NORTH TRANSYLVANIA FIRE DEPT	Fire/EMS	X	X	X	X	X	X	X	X		X					X	X			

		ATMOSPHERIC							GEOLOGIC			HYDROLOGIC		OTHER						
FACILITY NAME	FACILITY TYPE	Drought	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 500m	Fixed HAZMAT 2,500 meter	Mobile HZMT 500 METER (road)	Mobile HZMT 2,500 meter (road)	Mobile HZMT 500 METER (rail)	Mobile HZMT 2,500 METER (rail)	Wildfire
	Station																			
CONNESTEE FIRE RESCUE	Fire/EMS Station	X	X	X	X	X	X	X	X		X						X			
LITTLE RIVER FIRE DEPT	Fire/EMS Station	X	X	X	X	X	X	X	X		X						X		X	
ROSMAN FIRE RESCUE	Fire/EMS Station	X	X	X	X	X	X	X	X		X					X	X			
LAKE TOAXAWAY FIRE RESCUE	Fire/EMS Station	X	X	X	X	X	X	X	X		X					X	X			
BREVARD FIRE DEPT	Fire/EMS Station	X	X	X	X	X	X	X	X		X					X	X		X	
BALSAM GROVE FIRE DEPT	Fire/EMS Station	X	X	X	X	X	X	X	X	X						X	X			
CEDAR MTN FIRE RESCUE	Fire/EMS Station	X	X	X	X	X	X	X	X			X				X	X			
LAKE TOXAWAY FIRE RESCUE #2	Fire/EMS Station	X	X	X	X	X	X	X	X		X					X	X			
CONNESTEE FIRE RESCUE #2	Fire/EMS Station	X	X	X	X	X	X	X	X		X									
CITY OF BREVARD POLICE DEPARTMENT	Police Station	X	X	X	X	X	X	X	X		X					X	X		X	
TRANSYLVANIA COUNTY SHERIFF DEPARTMENT	Police Station	X	X	X	X	X	X	X	X		X					X	X		X	X

D.4 TRANSYLVANIA COUNTY CAPABILITY ASSESSMENT

This subsection discusses the capability of Transylvania County to implement hazard mitigation activities. More information on the purpose and methodology used to conduct the assessment can be found in Section 7: *Capability Assessment*.

D.4.1 Planning and Regulatory Capability

Table D.45 provides a summary of the relevant local plans, ordinances, and programs already in place or under development for Transylvania County. A checkmark (✓) indicates that the given item is currently in place and being implemented. An asterisk (*) indicates that the given item is currently being developed for future implementation. Each of these local plans, ordinances, and programs should be considered available mechanisms for incorporating the requirements of the South Mountains Regional Hazard Mitigation Plan.

TABLE D.45: RELEVANT PLANS, ORDINANCES, AND PROGRAMS

Planning Tool/Regulatory Tool	Hazard Mitigation Plan	Comprehensive Land Use Plan	Floodplain Management Plan	Open Space Management Plan (Parks & Rec/Greenway Plan	Stormwater Management Plan/Ordinance	Natural Resource Protection Plan	Flood Response Plan	Emergency Operations Plan	Continuity of Operations Plan	Evacuation Plan	Disaster Recovery Plan	Capital Improvements Plan	Economic Development Plan	Historic Preservation Plan	Flood Damage Prevention Ordinance	Zoning Ordinance	Subdivision Ordinance	Unified Development Ordinance	Post-Disaster Redevelopment Ordinance	Building Code	Fire Code	National Flood Insurance Program (NFIP)	NFIP Community Rating System
TRANSYLVANIA COUNTY	✓	✓	✓	✓				✓				✓	✓		✓		✓			✓	✓	✓	
Brevard	✓	✓	✓	✓	✓			✓				✓	✓		✓	✓	✓	✓		✓	✓	✓	✓
Rosman	✓	✓	✓					✓					✓		✓					✓	✓	✓	

A more detailed discussion on the county's planning and regulatory capabilities follows.

Emergency Management

Hazard Mitigation Plan

Rutherford County has previously adopted a hazard mitigation plan. The City of Brevard and the Town of Rosman were also included in this plan.

Emergency Operations Plan

Transylvania County maintains a countywide emergency operations plan that covers all of its municipalities through its Emergency Management Department.

General Planning

Comprehensive Land Use Plan
Transylvania County has adopted a comprehensive plan that addresses land uses within the county and the Town of Rosman. The City of Brevard has adopted a city land use plan.

Capital Improvements Plan
Transylvania County and the City of Brevard have capital improvement plans.

Zoning Ordinance
Transylvania County does not have a zoning ordinance. However, the City of Brevard has adopted a zoning ordinance that is administered by the city.

Subdivision Ordinance
Transylvania County and the City of Brevard have also both adopted subdivision regulations.

Building Codes, Permitting, and Inspections
North Carolina has a state compulsory building code which applies throughout the state. Transylvania County enforces the building code for the county and both of its municipalities.

Floodplain Management

Table D.46 provides NFIP policy and claim information for each participating jurisdiction in Transylvania County.

TABLE D.46: NFIP POLICY AND CLAIM INFORMATION

Jurisdiction	Date Joined NFIP	Current Effective Map Date	NFIP Policies in Force	Insurance in Force	Closed Claims	Total Payments to Date
TRANSYLVANIA COUNTY†	01/02/80	04/19/10	157	$43,712,400	21	$305,983
Brevard	09/29/78	04/19/10	109	$26,894,400	11	$150,815
Rosman	06/02/72	04/19/10	15	$3,030,100	21	$93,223

†Includes unincorporated areas of county only
Source: NFIP Community Status information as of 9/5/13; NFIP claims and policy information as of 6/30/13

All jurisdictions listed above that are participants in the NFIP will continue to comply with all required provisions of the program and will work to adequately comply in the future utilizing a number of strategies. For example, the jurisdictions will coordinate with NCEM and FEMA to develop maps and regulations related to special flood hazard areas within their jurisdictional boundaries and, through a consistent monitoring process, will design and improve their floodplain management program in a way that reduces the risk of flooding to people and property.

Community Rating System
The City of Brevard is the only jurisdiction that currently participates in the CRS. Brevard is a Class 8 community.

Flood Damage Prevention Ordinance
All communities participating in the NFIP are required to adopt a local flood damage prevention ordinance. Transylvania County, the City of Brevard, and the Town of Rosman all participate in the NFIP and have adopted flood damage prevention regulations.

Floodplain Management Plan
Transylvania County has a floodplain management plan that contains information about the location of floodplains within the jurisdictions.

Open Space Management Plan
Transylvania County and the City of Brevard have adopted a join comprehensive parks and recreation master plan.

Stormwater Management Plan
The City of Brevard is the only jurisdiction that has a stormwater management plan in place.

D.4.2 Administrative and Technical Capability

Table D.47 provides a summary of the capability assessment results for Transylvania County with regard to relevant staff and personnel resources. A checkmark (✓) indicates the presence of a staff member(s) in that jurisdiction with the specified knowledge or skill.

TABLE D.47: RELEVANT STAFF / PERSONNEL RESOURCES

Staff / Personnel Resource	Planners with knowledge of land development/land management practices	Engineers or professionals trained in construction practices related to buildings and/or infrastructure	Planners or engineers with an understanding of natural and/or human-caused hazards	Emergency Manager	Floodplain Manager	Land Surveyors	Scientists familiar with the hazards of the community	Staff with education or expertise to assess the community's vulnerability to hazards	Personnel skilled in GIS and/or Hazus	Resource development staff or grant writers
TRANSYLVANIA COUNTY	✓	✓	✓	✓	✓		✓	✓	✓	
Brevard	✓	✓	✓	✓	✓		✓	✓	✓	
Rosman	✓	✓	✓	✓	✓		✓	✓	✓	

Credit for having a floodplain manager was given to those jurisdictions that have a flood damage prevention ordinance, and therefore an appointed floodplain administrator, regardless of whether the appointee was dedicated solely to floodplain management. Credit was given for having a scientist familiar with the hazards of the community if a jurisdiction has a Cooperative Extension Service or Soil and Water Conservation Department. Credit was also given for having staff with education or expertise to assess the community's vulnerability to hazards if a staff member from the jurisdiction was a participant on the existing hazard mitigation plan's planning committee.

D.4.3 Fiscal Capability

Table D.48 provides a summary of the results for Transylvania County with regard to relevant fiscal resources. A checkmark (✓) indicates that the given fiscal resource is locally available for hazard mitigation purposes (including match funds for state and federal mitigation grant funds) according to the previous county hazard mitigation plan.

TABLE D.48: RELEVANT FISCAL RESOURCES

Fiscal Tool / Resource	Capital Improvement Programming	Community Development Block Grants (CDBG)	Special Purpose Taxes (or taxing districts)	Gas/Electric Utility Fees	Water/Sewer Fees	Stormwater Utility Fees	Development Impact Fees	General Obligation, Revenue, and/or Special Tax Bonds	Partnering Arrangements or Intergovernmental Agreements	Other: HMGP, FMA, PDM, PA, SBA, other federal grants, etc.
TRANSYLVANIA COUNTY	✓	✓	✓						✓	✓
Brevard	✓	✓	✓						✓	✓
Rosman	✓	✓	✓						✓	✓

D.4.4 Political Capability

The previous hazard mitigation plan indicates that opposition to mitigation measures is not evident in Transylvania County or its incorporated municipalities. In fact, Transylvania County has taken a proactive approach to mitigation through the development of governing documents which promote the mitigation process. The Transylvania County Governing Board is well educated on the hazards that threaten the county and has advisory boards that specialize in specific areas of hazard reduction. The county (its governing board, staff, and citizenry) appears highly capable and willing to promote the economic efficiency and social utility of the mitigation measures contained in this plan. In addition, they appear willing to assist all local municipalities in the implementation of strategies identified herein and specific to municipal jurisdictions.

D.4.5 Conclusions on Local Capability

Table D.49 shows the results of the capability assessment using the designed scoring methodology described in Section 7: *Capability Assessment*. The capability score is based solely on the information found in existing hazard mitigation plans and readily available on the jurisdictions' government websites. According to the assessment, the average local capability score for the county and its municipalities is 36.0, which falls into the moderate capability ranking.

TABLE D.49: CAPABILITY ASSESSMENT RESULTS

Jurisdiction	Overall Capability Score	Overall Capability Rating
TRANSYLVANIA COUNTY	41	High
Brevard	41	High
Rosman	26	Moderate

D.5 TRANSYLVANIA COUNTY MITIGATION STRATEGY

This subsection provides the blueprint for Transylvania County to follow in order to become less vulnerable to its identified hazards. It is based on general consensus of the Regional Hazard Mitigation Planning Committee and the findings and conclusions of the capability assessment and risk assessment. Additional Information can be found in Section 8: *Mitigation Strategy* and Section 9: *Mitigation Action Plan*.

D.5.1 Mitigation Goals

Transylvania County developed five mitigation goals in coordination with the other participating South Mountains Region jurisdictions. The regional mitigation goals are presented in **Table D.50**.

TABLE D.50: SOUTH MOUNTAINS REGIONAL MITIGATION GOALS

	Goal
Goal #1	Improve public education/awareness
Goal #2	Protect human life, safety and welfare by minimizing the potential for damage to personal property, infrastructure, and loss of life due to natural and human caused hazards.
Goal #3	Protect and maintain emergency services infrastructure and equipment to support emergency responders and improve disaster response time/operations.
Goal #4	Improve technical, legal, and institutional capability to respond to and recover from disasters.
Goal #5	Reduce or eliminate the risk of natural disasters.

D.5.2 Mitigation Action Plan

The mitigation actions proposed by Transylvania County, the City of Brevard, and the Town of Rosman are listed in the following individual Mitigation Action Plans.

Transylvania County Mitigation Action Plan

Transylvania County Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Perform a County Building Inspection Residential Home Plan Review.	FL	Moderate	Local Funds		Building Inspections/ Board of Commission ers	Completed	This action is in place, each new building permit request is reviewed by the county building department to ensure current building codes are in place. The owner is given printed material in reference to exterior preparation concerning urban fire interface, water mitigation measures, etc.
Property Protection								
PP-1								
Natural Resource Protection								
NRP-1								

Transylvania County Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Emergency Services								
ES-1	Obtain inundation maps for high hazard dams that pose the greatest risk to life and property.	FL/D	Low			ES	2019	The emergency management office continues to work with local dam owners and engineers in the preparation of inundation maps and preplanning based on NC DENR recommendations and protocols. As plans are approved by DENR, copies are submitted to the local emergency management office and the inundation mapping is incorporated into the GIS system. The county will continue to work on this action going forward.
ES-2	Install a new reverse 911 system.	All	High	Local Funds	$30,000	County Communications Director	Completed	The county has updated the community notification system to incorporate the latest technology trends such as cell phone sms, email, calling, etc. The latest system was installed in 2012.

Transylvania County Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Structural Projects								
SP-1	Elevate Green Road Bridge.	FL/HU	High		$1,000,000	County Manager	Aim for 2019	No funding has been located for this project as yet. The project is on hold until funding can be located.
Public Education and Awareness								
PEA-1	Hold a hazard mitigation seminar, including information on preparedness for all hazards significant to Transylvania County, Brevard, and Rosman and promotion of participation in FireWise.	All	High	NCEM and Local Funds		County Manager	2016	The event was held on June 18, 2012. Several agencies participated in the event with educational material and speakers for the public to learn about things they could do around their own home to mitigate dangers to themselves and others. The county will look to hold additional seminars going forward.
PEA-2	Educate contractors about principles for quality redevelopment and safe housing development through written materials or a County sponsored workshop.	All	High	Local Funds		Building Inspections	2015, Annual review and update	Printed material was developed and is distributed through the county building department. This material is reviewed and updated annually.

Transylvania County Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
PEA-3	Provide new home and property buyers with information on quality redevelopment, safe housing development, and FireWise Communities. The information is probably most efficiently dispersed at the community administration buildings.	All	High	Local Funds		Building Inspector	2015, Annual review and update	The printed material was developed and is distributed through the county building department, county administrative offices, city of Brevard administrative offices, and the town of Rosman administrative offices. This material is reviewed and updated annually.
PEA-4	Manually disperse and have a website posting on the County and City websites, which provides information about the Multi-Jurisdictional Hazard Mitigation Plan for Transylvania County, and relevant mitigation measures the public can take. In addition, provide a response/reply section where residents can comment on the effectiveness of the current plan and where they can make suggestions for future revisions on the plan.	All	High	Local Funds		County Manager	2015, Annual review and update	The plan is linked on all the local government websites and a feedback channel through the website is monitored for comment and suggestion. The county evaluates and updates its outreach plan on an annual basis

FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake
LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees TH = Thunderstorms ES = Transylvania County Emergency Services

City of Brevard Mitigation Action Plan

City of Brevard Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Continue participation in the Community Rating System Program	FL/ER/HU/T	High	Local Funds		CRS Coordinator-Planning Dept.	Completed	Complete, the city participates in the CRS program and will continue to do so.
P-2	Update components of existing Storm water Management Plan.	FL	High	Local Funds		Floodplain Manager-Planning Department	2014	Although a Stormwater Management Plan is in place, a review and update of the plan is necessary.
P-3	Perform a County Building Inspection Residential Home Plan Review.	FL/HU	Moderate	Local Funds		Building Inspections	Completed	This action is in place, each new building permit request is reviewed by the county building department to ensure current building codes are in place. The owner is given printed material in reference to exterior preparation concerning urban fire interface, water mitigation measures, etc.
P-4	Increase the culvert at Cherry Street and Old Hendersonville Highway.	FL/HU	Moderate	State Funds	$70,000	NCDOT	2016	The culvert increase has not been completed, but is on schedule to be completed by 2016.

City of Brevard Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Property Protection								
PP-1	Continue enforcement of "No Adverse Impact" requirements for all development in designated Special Flood Hazard Areas.	FL	High	Local Funds		Planning Department	Completed	This requirement is in place and is being enforced. It will continue to be enforced going forward.
Natural Resource Protection								
NRP-1	Continue Enforcement of "Steep Slope" development regulations	LS	High	Local Funds		Planning Department	Completed	This regulation is in place and is being enforced. It will continue to be enforced going forward.
NRP-2	Continue Enforcement of Sedimentation and Erosion Control regulations	ES/LS	High	Local Funds		Planning Department	Completed	This regulation is in place and is being enforced. It will continue to be enforced going forward.
NRP-3	Continue Enforcement of Surface Water Protection Areas	FL	High	Local Funds		Planning Department	Completed	This regulation is in place and is being enforced. It will continue to be enforced going forward.
NRP-1								

City of Brevard Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
ES-1	Obtain inundation maps for high hazard dams that pose the greatest risk to life and property.	FL/D	Low			ES	2019	The emergency management office continues to work with local dam owners and engineers in the preparation of inundation maps and preplanning based on NC DENR recommendations and protocols. As plans are approved by DENR, copies are submitted to the local emergency management office and the inundation mapping is incorporated into the GIS system. The county will continue to work on this action going forward.
ES-2	Install a new reverse 911 system.	All	High	Local Funds	$30,000	County Communications Director	Completed	The county has updated the community notification system to incorporate the latest technology trends such as cell phone sms, email, calling, etc. The latest system was installed in 2012.

City of Brevard Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Structural Projects								
SP-1	Elevate Old Hendersonville HWY between Osborne Road and Cherry Street and between Cherry Street and Dodson Flats.	FL/HU	Low		$1,500,000	NCDOT	2019	This action is the responsibility of NCDOT and is being evaluated/carried out through the NCSTIP. The project has not been completed, but will continue to be worked on through the NCSTIP.
SP-2	Elevate Island Ford Road between Walnut Hollow Road and S. County Club Road.	FL/HU	High		$1,000,000	City Manager	Deleted	This action is being deleted from the city's action plan as it is not a city responsibility.
Public Education and Awareness Activities								
PEA-1	Hold a hazard mitigation seminar, including information on preparedness for all hazards significant to Transylvania County, Brevard, and Rosman and promotion of participation in FireWise.	All	High	NCEM and Local Funds		City Manager	Completed	The event was held on June 18, 2012. Several agencies participated in the event with educational material and speakers for the public to learn about things they could do around their own home to mitigate dangers to themselves and others.
PEA-2	Educate contractors about principles for quality redevelopment and safe housing development through written materials or a County sponsored workshop.	All	High	Local Funds		Building Inspections	2015, Annual review and update	Printed material was developed and is distributed through the county building department. This material is reviewed and updated annually.

City of Brevard Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
PEA-3	Provide new home and property buyers with information on quality redevelopment, safe housing development, and FireWise Communities. The information is probably most efficiently dispersed at the community administration buildings.	All	High	Local Funds		Planning Department	2015, Annual review and update	The printed material was developed and is distributed through the county building department, county administrative offices, city of Brevard administrative offices, and the town of Rosman administrative offices. This material is reviewed and updated annually.
PEA-4	Manually disperse and have a website posting on the County and City websites, which provides information about the Multi-Jurisdictional Hazard Mitigation Plan for Transylvania County, and relevant mitigation measures the public can take. In addition, provide a response/reply section where residents can comment on the effectiveness of the current plan and where they can make suggestions for future revisions on the plan.	All	High	Local Funds		City Manager	2015, Annual review and update	The plan is linked on all the local government websites and a feedback channel through the website is monitored for comment and suggestion. The county evaluates and updates its outreach plan on an annual basis

FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake
LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees TH = Thunderstorms ES = Transylvania County Emergency Services City = City of Brevard

Town of Rosman Mitigation Action Plan

Town of Rosman Existing Mitigation Actions								
Action #	**Description**	**Hazard(s) Addressed**	**Relative Priority**	**Funding Sources**	**Estimated Cost**	**Responsible Party**	**Target Completion Date**	**2014 Action Implementation Status**
Prevention								
P-1	Develop a Stormwater Management Plan.	FL	Low	Local Funds		Floodplain Manager	2018	Funding for the project has not been located yet, so this action will be deferred with more effort pending to complete the plan.
P-2	Perform a County Building Inspection Residential Home Plan Review.	FL	Moderate	Local Funds		Building Inspections	Completed	That action is in place, each new building permit request is reviewed by the county building department to ensure current building codes are in place. The owner is given printed material in reference to exterior preparation concerning urban fire interface, water mitigation measures, etc.
Property Protection								
PP-1								
Natural Resource Protection								
NRP-1								

Town of Rosman Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
Emergency Services								
ES-1	Obtain inundation maps for high hazard dams that pose the greatest risk to life and property.	FL/D	Low			ES	2019	The emergency management office continues to work with local dam owners and engineers in the preparation of inundation maps and preplanning based on NC DENR recommendations and protocols. As plans are approved by DENR, copies are submitted to the local emergency management office and the inundation mapping is incorporated into the GIS system.
ES-2	Install a new reverse 911 system.	All	High	Local Funds	$30,000	County Communications Director	Completed	The county has updated the community notification system to incorporate the latest technology trends such as cell phone sms, email, calling, etc. The latest system was installed in 2012.
ES-3	Purchase and install generators for the Town's four wells.	All	Moderate	NCEM and Local Funds	$60,000	Town Mayor	2018	The town is still attempting to locate grant funds for this project so that it can install the generators. It will work to complete this action in the future.

Town of Rosman Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
Structural Projects								
SP-1	Elevate Main Street between Depot Street and Old Rosman Highway.	FL	High		$300,000	Town Mayor	2019	The town is trying to locate funding sources for this project. It could be potential split between the state and the town since both maintain the roadway.
Public Education and Awareness Activities								
PEA-1	Hold a hazard mitigation seminar, including information on preparedness for all hazards significant to Transylvania County, Brevard, and Rosman and promotion of participation in FireWise.	All	High	NCEM and Local Funds		City Manager	Completed	The event was held on June 18, 2012. Several agencies participated in the event with educational material and speakers for the public to learn about things they could do around their own home to mitigate dangers to themselves and others
PEA-2	Educate contractors about principles for quality redevelopment and safe housing development through written materials or a County sponsored workshop.	All	High	Local Funds		Building Inspections	2015, Annual review and update	Printed material was developed and is distributed through the county building department. This material is reviewed and updated annually.

Town of Rosman Existing Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Estimated Cost	Responsible Party	Target Completion Date	2014 Action Implementation Status
PEA-3	Provide new home and property buyers with information on quality redevelopment, safe housing development, and FireWise Communities. The information is probably most efficiently dispersed at the community administration buildings.	All	High	Local Funds		Building Inspector	2015, Annual review and update	The printed material was developed and is distributed through the county building department, county administrative offices, city of Brevard administrative offices, and the town of Rosman administrative offices. This material is reviewed and updated annually.
PEA-4	Manually disperse and have a website posting on the County and City websites, which provides information about the Multi-Jurisdictional Hazard Mitigation Plan for Transylvania County, and relevant mitigation measures the public can take. In addition, provide a response/reply section where residents can comment on the effectiveness of the current plan and where they can make suggestions for future revisions on the plan.	All	High	Local Funds		Town Mayor	2015, Annual review and update	The plan is linked on all the local government websites and a feedback channel through the website is monitored for comment and suggestion. The county evaluates and updates its outreach plan on an annual basis

FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake
LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees TH = Thunderstorms ES = Transylvania County Emergency Services Town = Town of Rosman

Appendix A
Plan Adoption

This appendix includes the local adoption resolutions for each of the participating jurisdictions.

Appendix B
Planning Tools

This appendix includes the following:

1. Blank Public Participation Survey
2. GIS Data Inventory Sheet
3. Scoring Criteria for Capability Assessment
4. Blank Mitigation Action Worksheet

PUBLIC PARTICIPATION SURVEY
FOR HAZARD MITIGATION PLANNING

We need your help!

The Counties of Henderson, Polk, Rutherford, and Transylvania are currently engaged in a planning process to become less vulnerable to natural disasters, and your participation is important to us!

The Counties, along with participating local jurisdictions and other participating partners, are now working to prepare a multi-jurisdictional *Hazard Mitigation Plan*. The purpose of this Plan is to identify and assess our community's natural hazard risks and determine how to best minimize or manage those risks. Upon completion, the Plan will represent a comprehensive multi-jurisdictional *Hazard Mitigation Plan* for the four-county region.

This survey questionnaire provides an opportunity for you to share your opinions and participate in the mitigation planning process. The information you provide will help us better understand your hazard concerns and can lead to mitigation activities that should help lessen the impact of future hazard events.

Please help us by completing this survey by January 31, 2014 and returning it to:

Sara Reynolds, Atkins
1616 E Millbrook Road, Suite 310
Raleigh, NC 27609

Surveys can also be faxed to: (919) 876-6848 or emailed to sara.reynolds@atkinsglobal.com

If you have any questions regarding this survey or would like to learn about more ways you can participate in the development of the *South Mountains Regional Hazard Mitigation Plan*, please contact Atkins, planning consultant for the project. You may reach Nathan Slaughter (Atkins) at 919-431-5251 or by email at nathan.slaughter@atkinsglobal.com.

1. Where do you live?

- ❑ Unincorporated Henderson County
- ❑ Unincorporated Polk County
- ❑ Unincorporated Rutherford County
- ❑ Unincorporated Transylvania County
- ❑ Bostic
- ❑ Brevard
- ❑ Chimney Rock Village
- ❑ Columbus
- ❑ Ellenboro
- ❑ Flat Rock
- ❑ Fletcher
- ❑ Forest City
- ❑ Hendersonville
- ❑ Lake Lure
- ❑ Laurel Park
- ❑ Mills River
- ❑ Rosman
- ❑ Ruth
- ❑ Rutherfordton
- ❑ Saluda
- ❑ Spindale
- ❑ Tryon
- ❑ Other

2. Have you ever experienced or been impacted by a disaster?

- ❑ Yes
- ❑ No

a. If "Yes," please explain:

3. How concerned are you about the possibility of our community being impacted by a disaster?

- ❑ Extremely concerned
- ❑ Somewhat concerned
- ❑ Not concerned

4. Please select the <u>one</u> hazard you think is the *highest threat* to your neighborhood:

- ❑ Dam / Levee Failure
- ❑ Drought
- ❑ Extreme Heat
- ❑ Earthquake
- ❑ Erosion
- ❑ Flood
- ❑ Hailstorm
- ❑ Hazardous Materials Incident
- ❑ Hurricane / Tropical Storm
- ❑ Land Subsidence / Sink Hole
- ❑ Landslide
- ❑ Lightning
- ❑ Severe Winter Storm / Freeze
- ❑ Severe Thunderstorm / High Wind
- ❑ Tornado
- ❑ Wildfire

5. Please select the <u>one</u> hazard you think is the *second highest threat* to your neighborhood:

- ❑ Dam / Levee Failure
- ❑ Drought
- ❑ Extreme Heat
- ❑ Earthquake
- ❑ Erosion
- ❑ Flood
- ❑ Hailstorm
- ❑ Hazardous Materials Incident
- ❑ Hurricane / Tropical Storm
- ❑ Land Subsidence / Sink Hole
- ❑ Landslide
- ❑ Lightning
- ❑ Severe Winter Storm / Freeze
- ❑ Severe Thunderstorm / High Wind
- ❑ Tornado
- ❑ Wildfire

6. Is there another hazard not listed above that you think is a wide-scale threat to your neighborhood?

- ❑ Yes (please explain): ____
- ❑ No

7. Is your home located in a floodplain?

- ❑ Yes
- ❑ No
- ❑ I don't know

8. Do you have flood insurance?

- ❑ Yes
- ❑ No
- ❑ I don't know

a. If "No," why not?

- ❑ Not located in floodplain
- ❑ Too expensive
- ❑ Not necessary because it never floods
- ❑ Not necessary because I'm elevated or otherwise protected
- ❑ Never really considered it
- ❑ Other (please explain): ____

9. Have you taken any actions to make your home or neighborhood more resistant to hazards?

- ❑ Yes
- ❑ No

a. If "Yes," please explain:

10. Are you interested in making your home or neighborhood more resistant to hazards?

- ❑ Yes
- ❑ No

11. Do you know what office to contact regarding reducing your risks to hazards in your area?

- ❑ Yes
- ❑ No

12. **What is the most effective way for you to receive information about how to make your home and neighborhood more resistant to hazards?**

- ❑ Newspaper
- ❑ Television
- ❑ Radio
- ❑ Internet
- ❑ Mail
- ❑ Public workshops/meetings
- ❑ School meetings
- ❑ Other (please explain): ____

13. **In your opinion, what are some steps your local government could take to reduce or eliminate the risk of future hazard damages in your neighborhood?**

14. **Are there any other issues regarding the reduction of risk and loss associated with hazards or disasters in the community that you think are important?**

15. **A number of community-wide activities can reduce our risk from hazards. In general, these activities fall into one of the following six broad categories. Please tell us how important you think each one is for your community to consider pursuing.**

Category	Very Important	Somewhat Important	Not Important
1. Prevention Administrative or regulatory actions that influence the way land is developed and buildings are built. Examples include planning and zoning, building codes, open space preservation, and floodplain regulations.	❑	❑	❑
2. Property Protection Actions that involve the modification of existing buildings to protect them from a hazard or removal from the hazard area. Examples include acquisition, relocation, elevation, structural retrofits, and storm shutters.	❑	❑	❑
3. Natural Resource Protection Actions that, in addition to minimizing hazard losses, also preserve or restore the functions of natural systems. Examples include: floodplain protection, habitat preservation, slope stabilization, riparian buffers, and forest management.	❑	❑	❑
4. Structural Projects Actions intended to lessen the impact of a hazard by modifying the natural progression of the hazard. Examples include dams, levees, detention/retention basins, channel modification, retaining walls, and storm sewers.	❑	❑	❑
5. Emergency Services Actions that protect people and property during and immediately after a hazard event. Examples include warning systems, evacuation planning, emergency response training, and protection of critical emergency facilities or systems.	❑	❑	❑
6. Public Education and Awareness Actions to inform citizens about hazards and the techniques they can use to protect themselves and their property. Examples include outreach projects, school education programs, library materials, and demonstration events.	❑	❑	❑

THANK YOU FOR YOUR PARTICIPATION!

This survey may be submitted anonymously; however, if you provide us with your name and contact information below we will have the ability to follow up with you to learn more about your ideas or concerns (optional):

Name: ____

Address: ____

____

Phone: ______________ **E-Mail:** _________________________

GIS Data Request Sheet
South Mountains Regional Hazard Mitigation Plan

Data requested	Available?	Received?	Potential Sources
Tax Parcel Data			Tax Assessor
including replacement value			
Building Footprints			Tax Assessor/GIS office
Critical Facilities (in GIS or list form with addresses)			Tax Assessor/GIS office
examples include:			
government buildings			
hospitals			
senior care			
police/fire/EMS/EOC			
locally significant buildings			
schools			
Local hazard studies			public works, natural resources, planning
examples include:			
Flood Studies (HEC-RAS, Risk MAP)			
Local Hazard History Articles			
Areas of Concern Studies			

If you have any questions, please contact:

Nathan Slaughter
nathan.slaughter@atkinsglobal.com
919-431-5251

Points System for Capability Ranking

0-19 points = Limited overall capability **20-39 points = Moderate overall capability** **40-68 points = High overall capability**

I. Planning and Regulatory Capability
(Up to 43 points)

Yes = 3 points
Under Development = 1 point
Included under County plan/code/ordinance/program = 1 point
No = 0 points

- Hazard Mitigation Plan
- Comprehensive Land Use Plan
- Floodplain Management Plan
- National Flood Insurance Program
- NFIP Community Rating System

Yes = 2 points
Under Development = 1 point
Included under County plan/code/ordinance/program = 1 point
No = 0 points

- Open Space Management Plan / Parks & Recreation Plan
- Stormwater Management Plan
- Natural Resource Protection Plan
- Flood Response Plan
- Emergency Operations Plan
- Continuity of Operations Plan
- Evacuation Plan
- Disaster Recovery Plan
- Flood Damage Prevention Ordinance
- Post-disaster Redevelopment / Reconstruction Ordinance

Yes = 1 point
No = 0 points

- Capital Improvements Plan
- Economic Development Plan
- Historic Preservation Plan
- Zoning Ordinance
- Subdivision Ordinance
- Unified Development Ordinance
- Building Code
- Fire Code

II. Administrative and Technical Capability
(Up to 15 points)

Yes = 2 points
Service provided by County = 1 point
No = 0 points

- Planners with knowledge of land development and land management practices
- Engineers or professionals trained in construction practices related to buildings and/or infrastructure
- Planners or engineers with an understanding of natural and/or human-caused hazards
- Emergency manager
- Floodplain manager

Yes = 1 point
No = 0 points

- Land surveyors
- Scientist familiar with the hazards of the community
- Staff with education or expertise to assess the community's vulnerability to hazards
- Personnel skilled in Geographical Information Systems (GIS) and/or Hazus
- Resource development staff or grant writers

III. Fiscal Capability
(Up to 10 points)

Yes = 1 point
No = 0 points

- Capital Improvement Programming
- Community Development Block Grants (CDBG)
- Special Purpose Taxes (or tax districts)
- Gas / Electric Utility Fees
- Water / Sewer Fees
- Stormwater Utility Fees
- Development Impact Fees
- General Obligation / Revenue / Special Tax Bonds
- Partnering arrangements or intergovernmental agreements
- Other

MITIGATION ACTION WORKSHEETS

Mitigation Action Worksheets are used to identify potential hazard mitigation actions that participating jurisdictions in the South Mountains Region will consider to reduce the negative effects of identified hazards. The worksheets provide a simple yet effective method of organizing potential actions in a user-friendly manner that can easily be incorporated into the Region's Hazard Mitigation Plan.

The worksheets are to be used as part of a strategic planning process and are designed to be:

a.) completed electronically (worksheets and instructions will be e-mailed to members of the Hazard Mitigation Council following the Mitigation Strategy Workshop);
b.) reviewed with your department/organization for further consideration; and
c.) returned according to the contact information provided below.

Please return all completed worksheets no later than April 18, 2014 to:

Nathan Slaughter, Project Manager Atkins

Electronic copies may be e-mailed to: nathan.slaughter@atkinsglobal.com

Hard copies may be faxed to: 919-876-6848 (Attn: Nathan Slaughter)

INSTRUCTIONS

Each mitigation action should be considered to be a separate local project, policy or program and each individual action should be entered into a separate worksheet. By identifying the implementation requirements for each action, the worksheets will help lay the framework for engaging in distinct actions that will help reduce the community's overall vulnerability and risk. Detailed explanations on how to complete the worksheet are provided below.

Proposed Action: Identify a specific action that, if accomplished, will reduce vulnerability and risk in the impact area. Actions may be in the form of local policies (i.e., regulatory or incentive-based measures), programs or structural mitigation projects and should be consistent with any pre-identified mitigation goals and objectives.

Site and Location: Provide details with regard to the physical location or geographic extent of the proposed action, such as the location of a specific structure to be mitigated, whether a program will be citywide, countywide or regional, etc.

History of Damages: Provide a brief history of any known damages as it relates to the proposed action and the hazard(s) being addressed. For example, the proposed elevation of a repetitive loss property should include an overview of the number of times the structure has flooded, total dollar amount of damages if available, etc.

Hazard(s) Addressed: List the hazard(s) the proposed action is designed to mitigate against.

Category: Indicate the most appropriate category for the proposed action as discussed during the Mitigation Strategy Workshop (Prevention; Property Protection; Natural Resource Protection; Structural Projects; Emergency Services; Public Education and Awareness).

Priority: Indicate whether the action is a "high" priority, "moderate" priority or "low" priority based generally on the following criteria:

1. Effect on overall risk to life and property
2. Ease of implementation / technical feasibility
3. Project costs versus benefits
4. Political and community support
5. Funding availability

Estimated Cost: If applicable, indicate what the total cost will be to accomplish this action. This amount will be an estimate until actual final dollar amounts can be determined. Some actions (such as ordinance revisions) may only cost "local staff time" and should be noted so.

Potential Funding Sources: If applicable, indicate how the cost to complete the action will be funded. For example, funds may be provided from existing operating budgets or general funds, a previously established contingency fund, a cost-sharing federal or state grant program, etc.

Lead Agency/Department Responsible: Identify the local agency, department or organization that is best suited to implement the proposed action.

Implementation Schedule: Indicate when the action will begin and when the action is expected to be completed. Remember that some actions will require only a minimal amount of time, while others may require a long-term or continuous effort.

Comments: This space is provided for any additional information or details that may not be captured under the previous headings.

	MITIGATION ACTION
Proposed Action:	
BACKGROUND INFORMATION	
Site and Location:	
History of Damages:	

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	
Category:	
Priority (High, Moderate, Low):	
Estimated Cost:	
Potential Funding Sources:	
Lead Agency/Department Responsible:	
Implementation Schedule:	

COMMENTS

Appendix C
Local Mitigation Plan Review Tool

Appendix D
Planning Process Documentation

This appendix includes:

1. Meeting Agendas
2. Meeting Minutes
3. Meeting Sign-In Sheets
4. Public Survey Summary Results

AGENDA

South Mountains Regional Hazard Mitigation Plan
Hazard Mitigation Planning Team Kickoff Meeting

October 3, 2013
10:00 PM – Noon

1) **Introductions**

2) **Overview of Mitigation/Icebreaker Exercise**

3) **Project Overview**
   a) Key Objectives
   b) Project Tasks
   c) Project Schedule
   d) Project Staffing

4) **Data Collection**
   a) GIS Data Inventory
   b) Capability Assessment Survey
   c) Public Participation Survey
   d) Existing Mitigation Actions

5) **Roles & Responsibilities**
   a) Atkins
   b) County Leads
   c) Participating Jurisdictions

6) **Next Steps**
   a) Data collection efforts
   b) Begin public outreach
   c) Discuss next Hazard Mitigation Planning Team meeting

7) **Questions, Issues, or Concerns**

ATKINS

AGENDA

South Mountains Regional Hazard Mitigation Plan
Hazard Mitigation Planning Team Mitigation Strategy Meeting

April 4, 2014
10AM – Noon

1) **Introductions**

2) **Recap – What We're Doing Today**

3) **Risk Assessment Findings**
   a) Hazard History and Profiles
   b) Conclusions on Risk: PRI

4) **Capability Assessment Findings**
   a) Indicators
   b) Results

5) **Mitigation Strategy**
   a) Current Goals/Actions
   b) New Actions
   c) Discussion

6) **Next Steps**
   a) Mitigation Actions
   b) Continue public outreach

7) **Questions, Issues, or Concerns**

ATKINS

Meeting Minutes
Cabarrus Stanly Union Regional Hazard Mitigation Plan
Project Kickoff Meeting
October 3, 2013

Nathan Slaughter. Project Manager from the project consulting team, Atkins started the meeting by welcoming the representatives from the Counties, participating municipal jurisdictions and other stakeholders. Mr. Slaughter led the kickoff meeting and began by providing an overview of the items to be discussed at the meeting and briefly reviewed each of the handouts that were distributed in the meeting packets (agenda, project description, and presentation slides). He then asked each of the meeting attendees to introduce themselves. Following introductions, he provided a brief overview of mitigation and discussed the Disaster Mitigation Act of 2000 and NC Senate Bill 300.

He discussed the key objectives of the planning process and gave a list of the participating jurisdictions for the regional plan and asked if there were any changes that needed to be made to the list. Mr. Slaughter then explained the six different categories of mitigation techniques (emergency services; prevention; natural resource protection; structural projects; public education and awareness; and property protection) and gave examples of each. This explanation culminated in an Ice Breaker Exercise for the attendees.

Mr. Slaughter instructed attendees on how to complete the exercise. Attendees were given an equal amount of fictitious FEMA money and asked to spend it in the various mitigation categories. Money could be thought of grant money that communities received towards mitigation. Attendees were asked to target their money towards areas of mitigation that are of greatest concern for their community. Ideally, the exercise helps pinpoint areas of mitigation that the community may want to focus on when developing mitigation grants. The Ice Breaker Exercise results were to be reviewed and presented at the conclusion of the meeting.

Mr. Ryan Wiedenman, Planner for Atkins, then explained the mitigation planning process and specific tasks to be accomplished for this project, including the planning process, risk assessment, capability assessment, mitigation strategy and action plan, and plan maintenance procedures.

The project schedule was presented along with the project staffing chart, which demonstrates the number of experienced individuals that will be working on this project. Mr. Wiedenman then reviewed the roles and responsibilities of Atkins, the counties, and the participating jurisdictions. The presentation concluded with a discussion of the next steps to be taken in the project development, which included determining the members of the Hazard Mitigation Planning Team that should be present for the next meeting, addressing issues of regulation compliance, and fulfilling data collection needs.

The meeting was adjourned.

Meeting Minutes
South Mountains Regional Hazard Mitigation Plan
Mitigation Strategy Meeting
April 4, 2014

Mr. Slaughter initiated the meeting with a review of the meeting handouts, which included an agenda, presentation slides, proposed goals for the regional plan, mitigation actions from each county's existing plan, and mitigation action worksheets for collecting information for any new mitigation actions. Mr. Slaughter reviewed the project schedule and stated that a draft of the Hazard Mitigation Plan would be presented to the Regional Hazard Mitigation Council in April.

Ryan Wiedenman with Atkins then presented the findings of the risk assessment. He reviewed the Presidential Disaster Declarations that have impacted the region. He then explained the process for preparing Hazard Profiles and discussed how each hazard falls into one of four basic categories: Atmospheric, Hydrologic, Geologic, and Other. He indicated that each hazard must be evaluated and formally ruled out if it is not applicable to the study area, even where it seems obvious (such as in the case of volcano).

Mr. Wiedenman reviewed the Hazard Profiles and the following bullets summarize the information presented:

- DROUGHT. There have been ten years (out of the past fourteen, 2000-2013) where drought conditions have been reported as severe, extreme or exceptional in the South Mountains Region and future occurrences are likely.

- EXTREME HEAT. There has not been any recorded extreme heat events reported since 1950 although additional significant heat extremes were reported. Future occurrences are possible.

- HAILSTORM. There have been 329 recorded events since 1963. Future occurrences are highly likely.

- LIGHTNING. There have been 46 recorded lightning events since 1995, causing 38 injuries, and $2.2 million in reported property damages. Future occurrences are highly likely.

- TORNADOES. There have been 16 recorded tornado events reported in the region since 1973. $3 million in property damages. Thirty injuries have been reported. Future occurrences are possible.

- HURRICANES AND TROPICAL STORMS. NOAA data shows that 30 storm tracks have come within 75 miles of the South Mountains Region since 1850. Future occurrences are possible.

- SEVERE THUNDERSTORM WINDS. There have been 501 severe thunderstorm events reported since 1959 with $8.8 million in reported property damages. Two deaths and nine injuries have been reported. Future occurrences are highly likely.

- WINTER STORM. There have been 303 recorded winter events in the South Mountains Region since 1993 resulting in $53.9 million in reported property damages. Future occurrences are highly likely.

- EARTHQUAKES. There have been 135 recorded earthquake events in the South Moutains Region since 1886. The strongest had a recorded magnitude of VI MMI. Future occurrences are possible.

- LANDSLIDE. There have been 47 recorded landslide events in the South Mountains. Future occurrences are possible.

- DAM FAILURE. There are 324 dams in the South Mountains Region, 118 of which are classified as high hazard dams. There have been no reported significant failure but a few smaller breaches have occurred. Future occurrences are unlikely.

- EROSION. Erosion was included in some of the previous County level plans but impacts were described as minimal. Future occurrences are possible.

- FLOOD. There have been 160 flood events recorded in the South Mountains Region since 1993, resulting in $40.6 million in property damage. There have been 215 NFIP losses since 1978 and approximately $2.9 million in claims. 26 repetitive loss properties in the region account for 85 of the recorded losses. Future occurrences are likely.

- HAZARDOUS MATERIALS INCIDENTS. There have been 46 reported hazardous materials events reported in the region. Two serious events reported. Future occurrences are possible.

- WILDFIRE. There is an average of 140 fires per year reported in the South Mountains Region. Future occurrences are likely but major events are not common.

In concluding the review of Hazard Profiles, Mr. Wiedenman stated if anyone had additional information for the hazard profiles, or disagreed with any of the data presented, they should call or email him with their concerns.

The results of the hazard identification process were used to generate a Priority Risk Index (PRI), which categorizes and prioritizes potential hazards as high, moderate or low risk based on probability, impact, spatial extent, warning time, and duration. The highest PRI was assigned to Winter Storm and Freeze followed by Thunderstorm/High Wind, Flood and Hailstorm.

Mr. Slaughter presented the Capability Assessment Findings. Atkins has developed a scoring system that was used to rank the participating jurisdictions in terms of capability in four major areas (Planning and Regulatory; Administrative and Technical; Fiscal; Political). Important capability indicators include National Flood Insurance Program (NFIP) participation, Building Code Effective Grading Schedule (BCEGS) score, Community Rating System (CRS) participation, and the Local Capability Assessment Survey conducted by Atkins.

Mr. Slaughter reviewed the Relevant Plans and Ordinances, Relevant Staff/Personnel Resources, and Relevant Fiscal Resources. All of these categories were used to rate the overall capability of the participating counties and jurisdictions. Most jurisdictions are in the moderate range for Planning and Regulatory Capability and in the moderate range for Fiscal Capability. There is variation between the jurisdictions for Administrative and Technical Capability, mainly with respect to availability of planners and grant writers. Based upon the scoring methodology developed by Atkins, it was determined that over half of the participating jurisdictions have moderate capability to implement hazard mitigation programs and activities.

Mr. Slaughter also discussed the results of the public participation survey that was posted on several of the participating counties' and municipal websites. As of the meeting date, 156 responses had been received. Based on preliminary survey results, respondents felt that severe winter storms and severe thunderstorms posed the greatest threat to their neighborhood, followed by wildfire, flood, hurricane and lightning. 81 percent of the respondents were interested in making their homes more resistant to hazards. However, 75 percent don't know who to contact regarding reducing their risks to hazards.

Mr. Slaughter then gave the results of the icebreaker exercise from the first Regional Hazard Mitigation Council meeting, where attendees were given "money" to spend on various hazard mitigation techniques. The results were as follows:

- Emergency Services $150
- Natural Resource Protection $86
- Prevention $76
- Structural Projects $46
- Property Protection $43
- Public Education and Awareness $39

Mr. Slaughter gave an overview of Mitigation Strategy Development and presented the proposed goals for the regional plan based on a review of the goals in the four existing county plans. The Regional Hazard Mitigation Council accepted the proposed goals for the regional plan. Mr. Slaughter then provided an overview and examples of suggested mitigation actions specifically tailored for the South Mountains Counties. Mr. Slaughter then asked each county, and the municipalities to provide a status update for their existing mitigation actions (completed, deleted, or deferred) by April 18, 2014. Mr. Slaughter also discussed the Mitigation Action Worksheets to be completed for any new mitigation actions and requested that all worksheets be returned by April 18, 2014.

Mr. Slaughter thanked the group for taking the time to attend and the meeting was adjourned.

South Mountains Regional Hazard Mitigation Plan
Hazard Mitigation Planning Team Kickoff Meeting

October 3, 2013

10:00 AM - Noon

Name	Agency	City	Phone Number	E-mail Address
Ryan Wiedeman	Atkins	Raleigh, NC	919 431-5295	ryan.wiedeman@atkinsglobal.com
WALLY HOLLIS	HCFMO	HENDERSONVILLE	828-697-4728	WHOLLIS@HENDERSON COUNTY NC.ORG
Tommy Blanton	Town of Rutherfordton Fire	Rutherfordton	828-287-7367	tommyblanton@bellsouth.net
Mike Barnett	Henderson Co EMS	Hendersonville	828 697-4825	mbarnett@hendersoncountync.org
Rocky Hyder	Henderson Co EM	Hendersonville	828-697-4728	rhyder@hendersoncountync.org
Katie Doherty	Rutherford GIS	Rutherfordton	828-447-4480	katie.doherty@rutherfordcountync.gov
Daniel C. Elliott	Rutherford County Fire Marshal's Office	Spindale	828-287-6315	daniel.elliott@rutherfordcountync.gov
Roger Hollifield	Rutherford County EM	Spindale	828 287-6090	roger.hollifield@rutherfordcountync.gov

Name	Agency	City	Phone Number	E-mail Address
Daniel Cobb	City of Brevard	Brevard	885-5630	Daniel.Cobbecityofbrevard.com
Eric Rufa	Town of Fletcher	Fletcher	687-3985	e.rufa@fletchernc.org
Jim Ball	Laurel Park		693-4840	jball@laurelpark.org
Michael Crater	Polk County	Columbus	828 894 3067	mcrater@polknc.org
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Jaime Laughter	Town of Mills River	Mills River	8902901	jaime.laughter@millsriver.org
Autumn Radcliff	Henderson Co.		697-4819	autumnr@hendersoncountync.org

Name	Agency	City	Phone Number	E-mail Address
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PHIL HARRIS	BREVARD POLICE DEPT.	BREVARD	828-883-2212 C-828-577-2517	PHIL.HARRIS@CITYOFBREVARD.COM
Tom Wooten	City of Hendersonville	COH	828-697-3084	twooten@cityofhendersonville.org
Lee Smith	Hendersonville Water and Sewer	Hendersonville	(828) 233-3211	lsmith@cityofhendersonville.org
RON MORGAN	LAKE LURE FIRE/EM	LAKE LURE	828-625-9333	llfire@bellsouth.net

South Mountains Regional Hazard Mitigation Plan
Hazard Mitigation Planning Team Kickoff Meeting

April 4, 2014

10:00 AM - Noon

Name	Agency	City	Phone Number	E-mail Address
Mike Barnett	Henderson Co EMS	Hendersonville	828 697-4825	mbarnett@hendersoncountync.org
Rocky Hyder	Henderson Co EM	Hendersonville	828-697-4728	rhyder@Hendersoncountync.org
Kevin Shook	Transylvania Co EM	Brevard	828 884-3108	kevin.shook@transylvaniacounty.org
Bobby Arledge	Polk Co EM	Columbus	828-894-6342	barledge@polknc.org
Jerry Bateman	Flat Rock VDFR	Flat Rock	828-697-8100	administrator@villageofflatrock.org
Roger Hollifield	Rutherford Co EM	Spindale	828 287-6090	roger.hollifield@rutherfordcountync.gov
Daniel Elliott	Rutherford Co. Fire Marshal's Office	Spindale	828-748-0999	daniel.elliott@rutherfordcountync.gov
Jaime Laughter	Town of Mills River	Mills River	828 890-2901	jaime.laughter@millsriver.org

Name	Agency	City	Phone Number	E-mail Address
Alisa Melnikova	Town of Laurel Park	LP	693-4840	amelnikova@laurelpark.org
Matt Cable	Henderson Co.		694-6557	mcable@hendersoncountync.org
Tom Wooten	City of Hendersonville		697-3054	twooten@cityofhendersonville.org
Lee Smith	City of Hendersonville		233-3211	lsmith@cityofhendersonville.org
PHIL HARRIS	CITY OF BREVARD - P.D.		828-577-2517	PHIL.HARRIS@CITYOFBREVARD.COM
MARCUS JONES	HENDERSON CTY		828-694-6560	majones@hendersoncountync.org


Photo Source: FEMA

South Mountains
Regional Hazard Mitigation Plan

Public Participation Survey Results

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Public Participation Survey

- Provides an opportunity for the public to share opinions and participate in the planning process
- Link to survey posted on County websites
- 156 completed surveys received

Public Participation Survey Highlights

- 81% of respondents are interested in making their homes more resistant to hazards
- 40% have already taken action to make their homes more hazard resistant
- 75% do not who to contact regarding risk reduction

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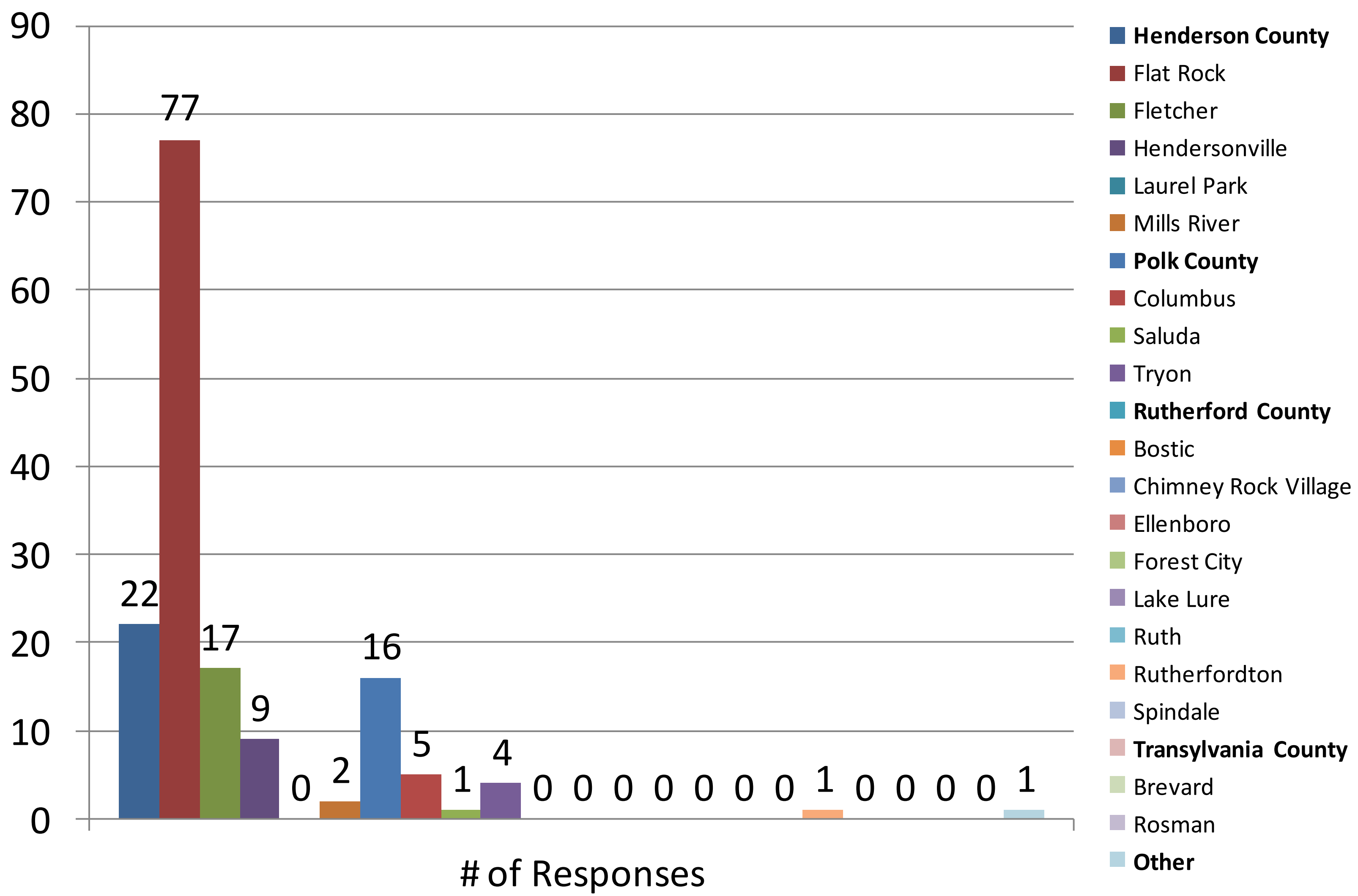
1. Where do you live?



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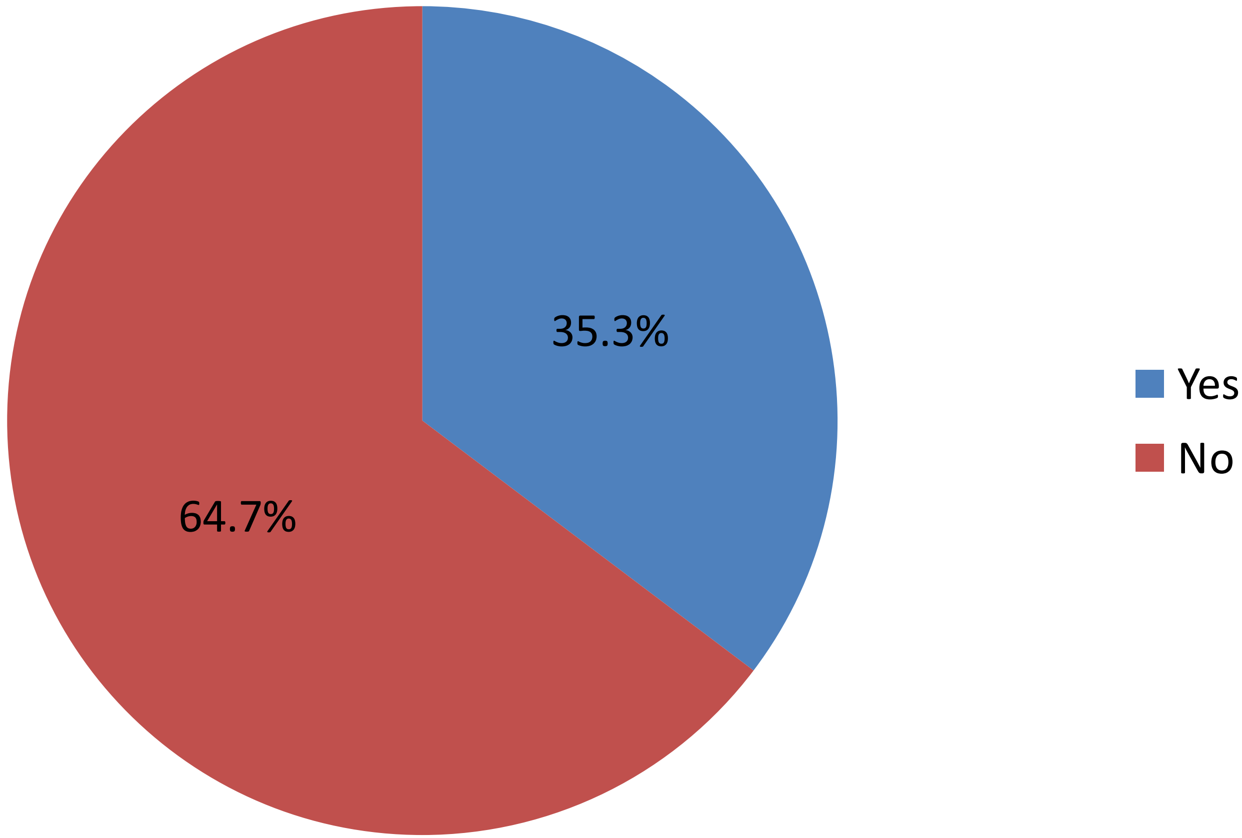
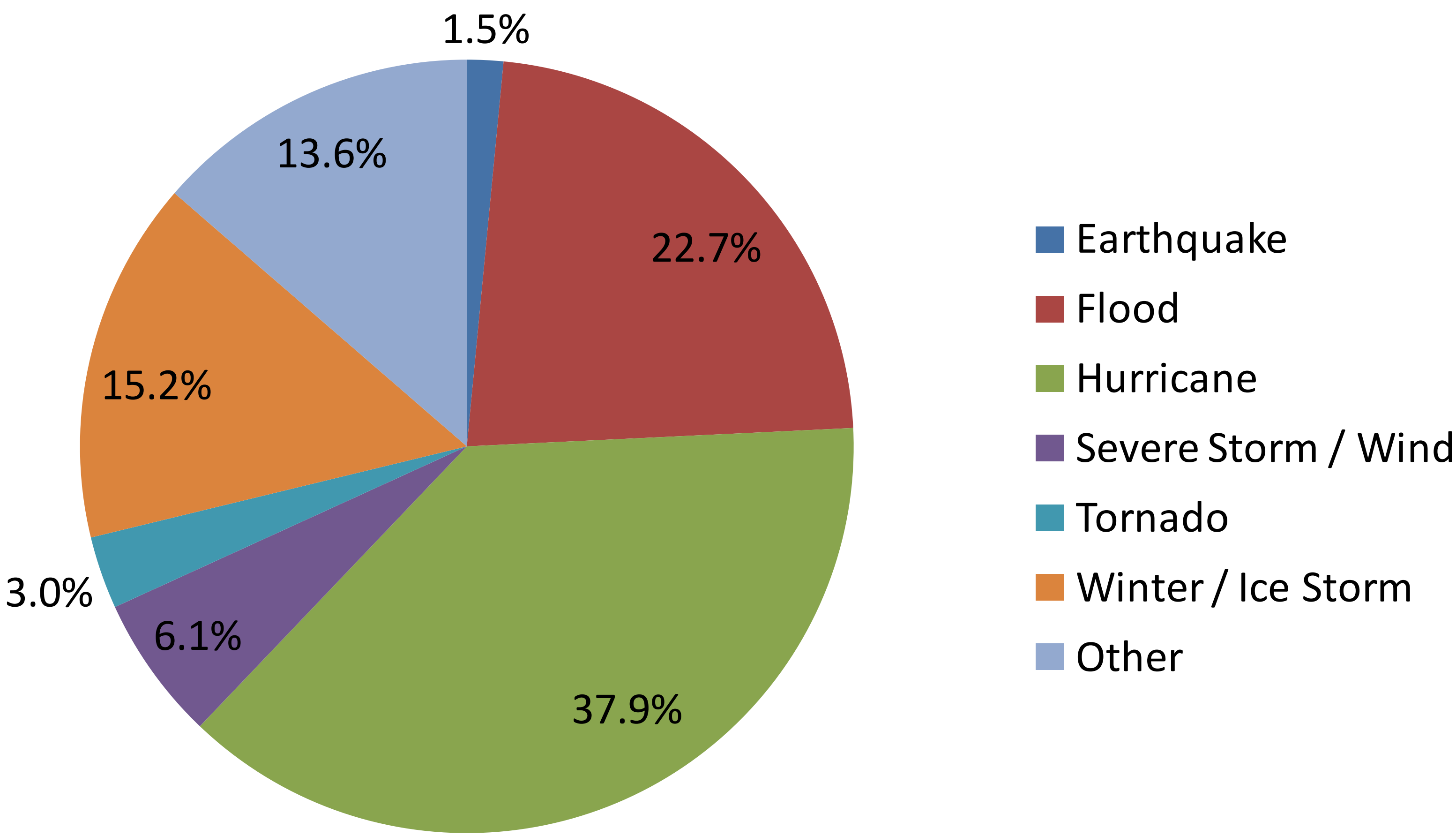
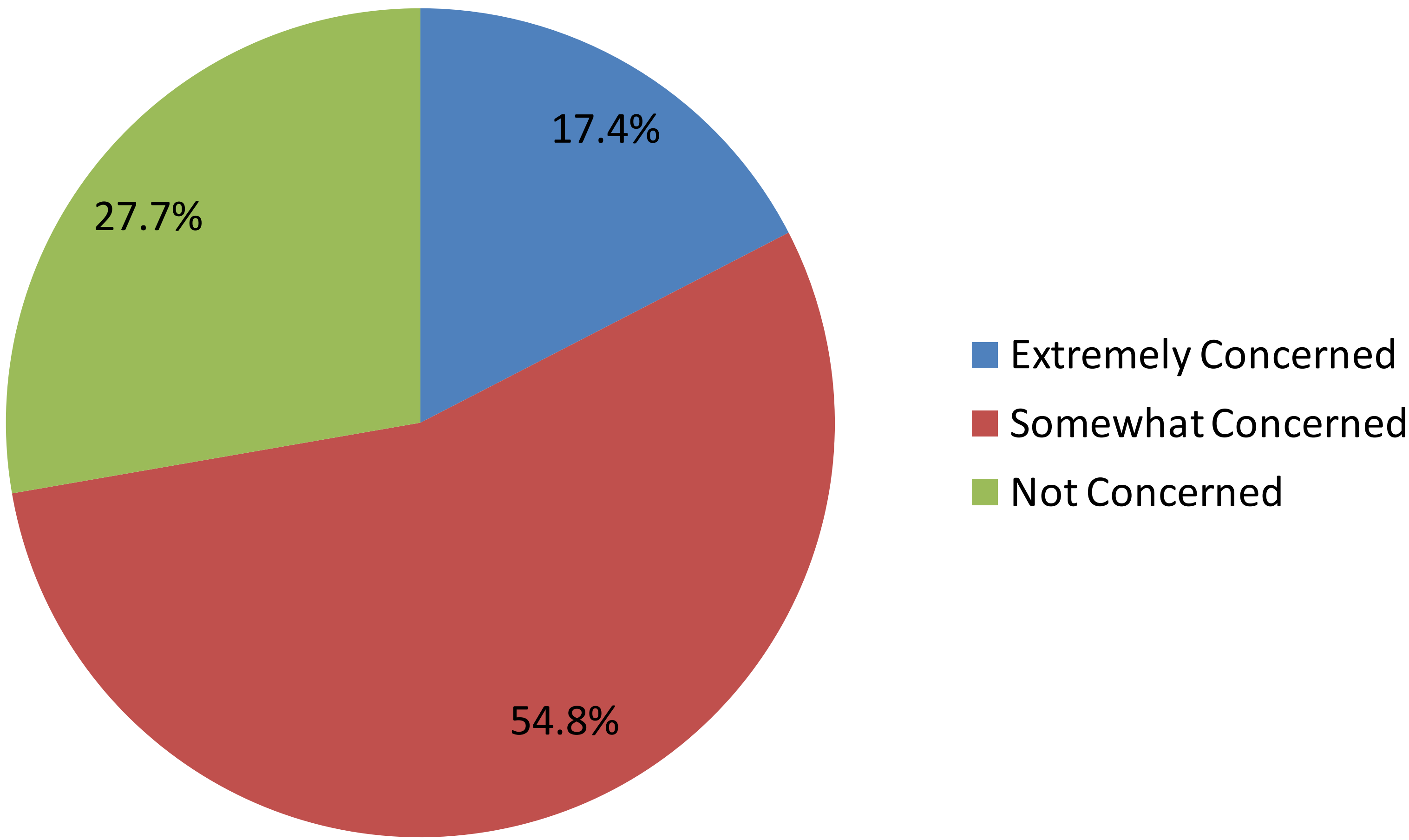
2. Have you experienced a disaster?



2. Examples of disasters experienced



3. How concerned about possibility of disaster?



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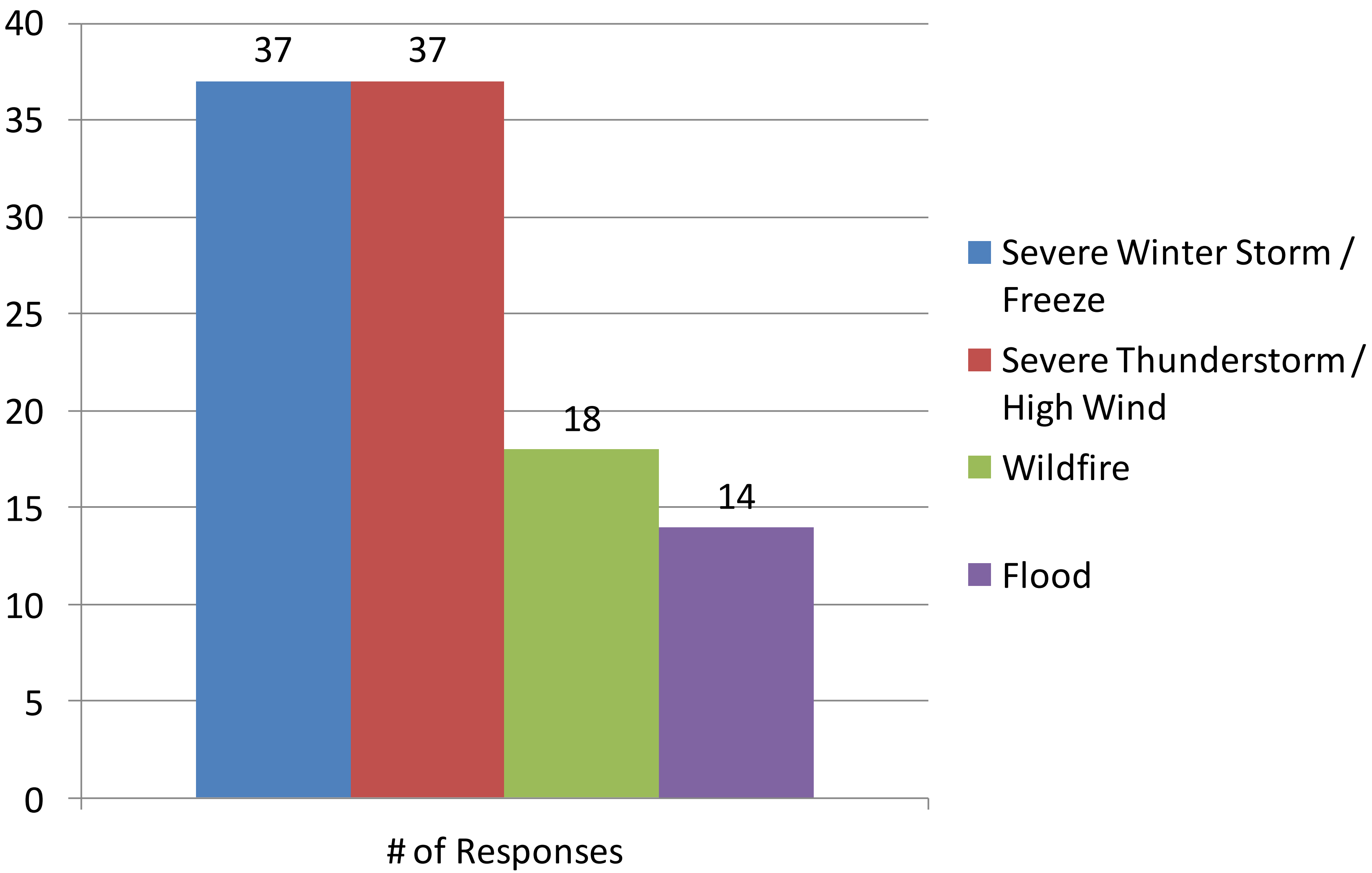
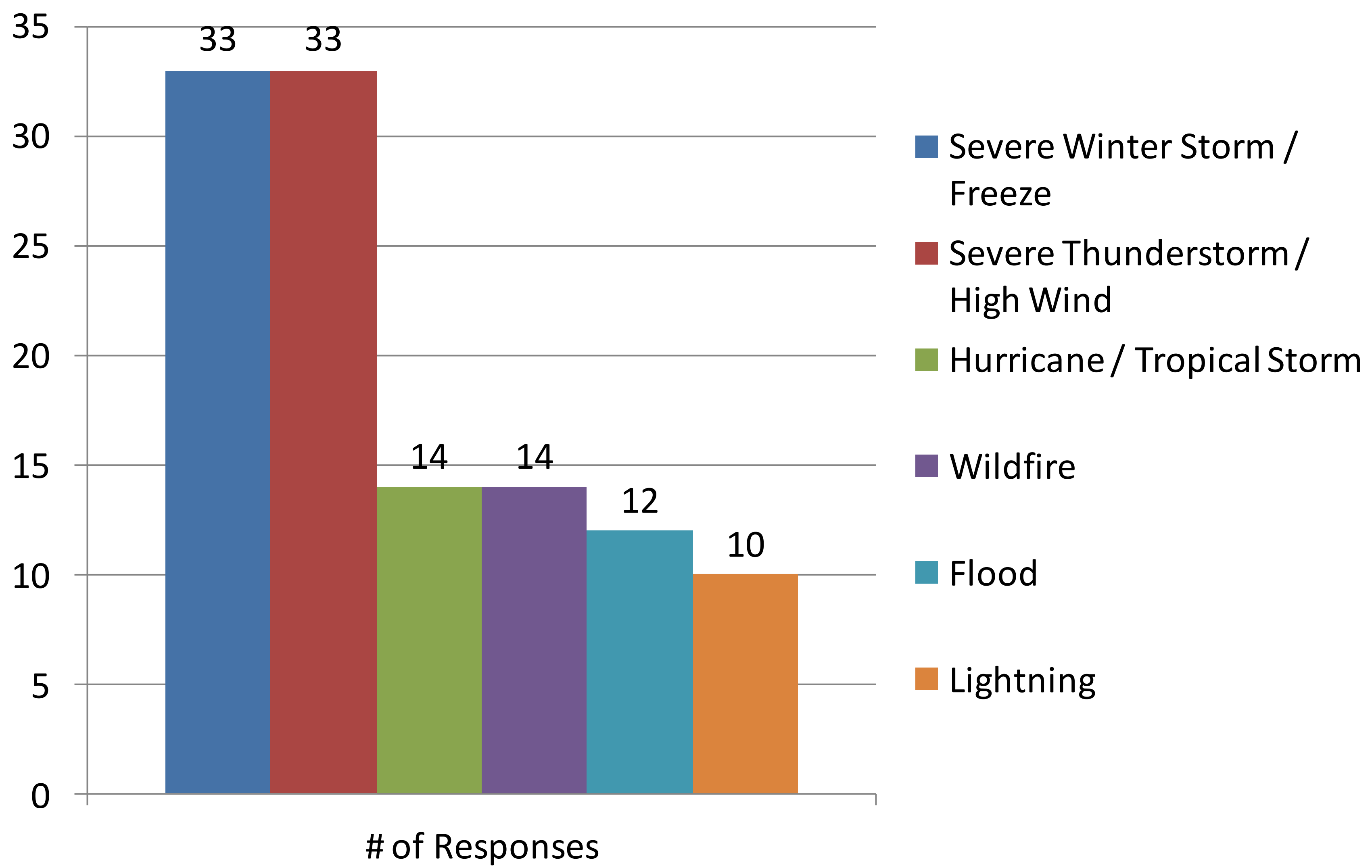
4. Highest hazard threat?



5. Second highest hazard threat?



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6. Other hazards not listed?

- Brewery in area
- Civil unrest
- Electrical grid failure
- Falling trees
- Spreading house fires
- Nuclear disaster
- Railroad accident
- Clear-cutting forests
- Looting
- Polluted drinking water
- Solar flare
- Wood debris
- Stormwater runoff (from new development)

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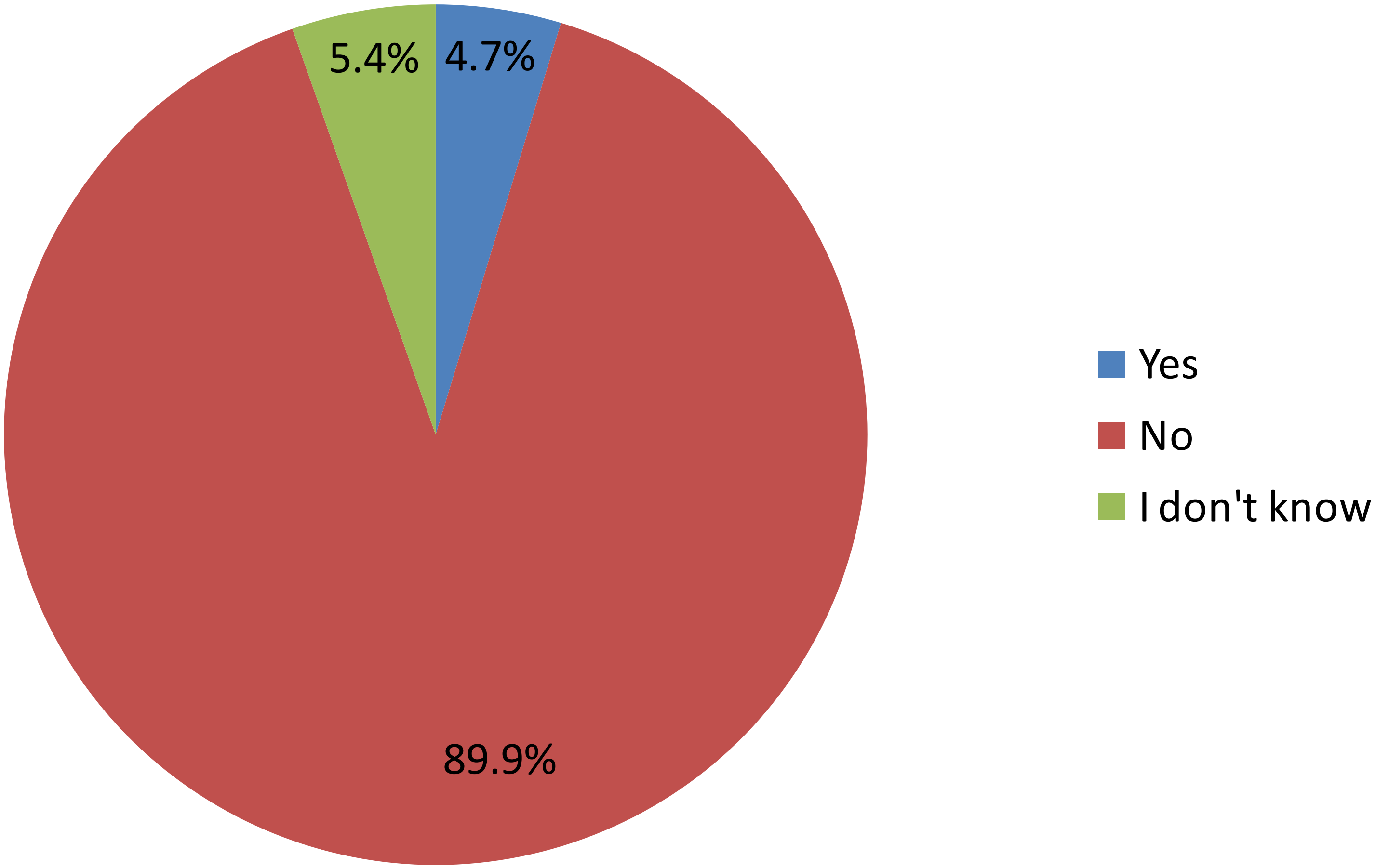
7. Is your home in a floodplain?



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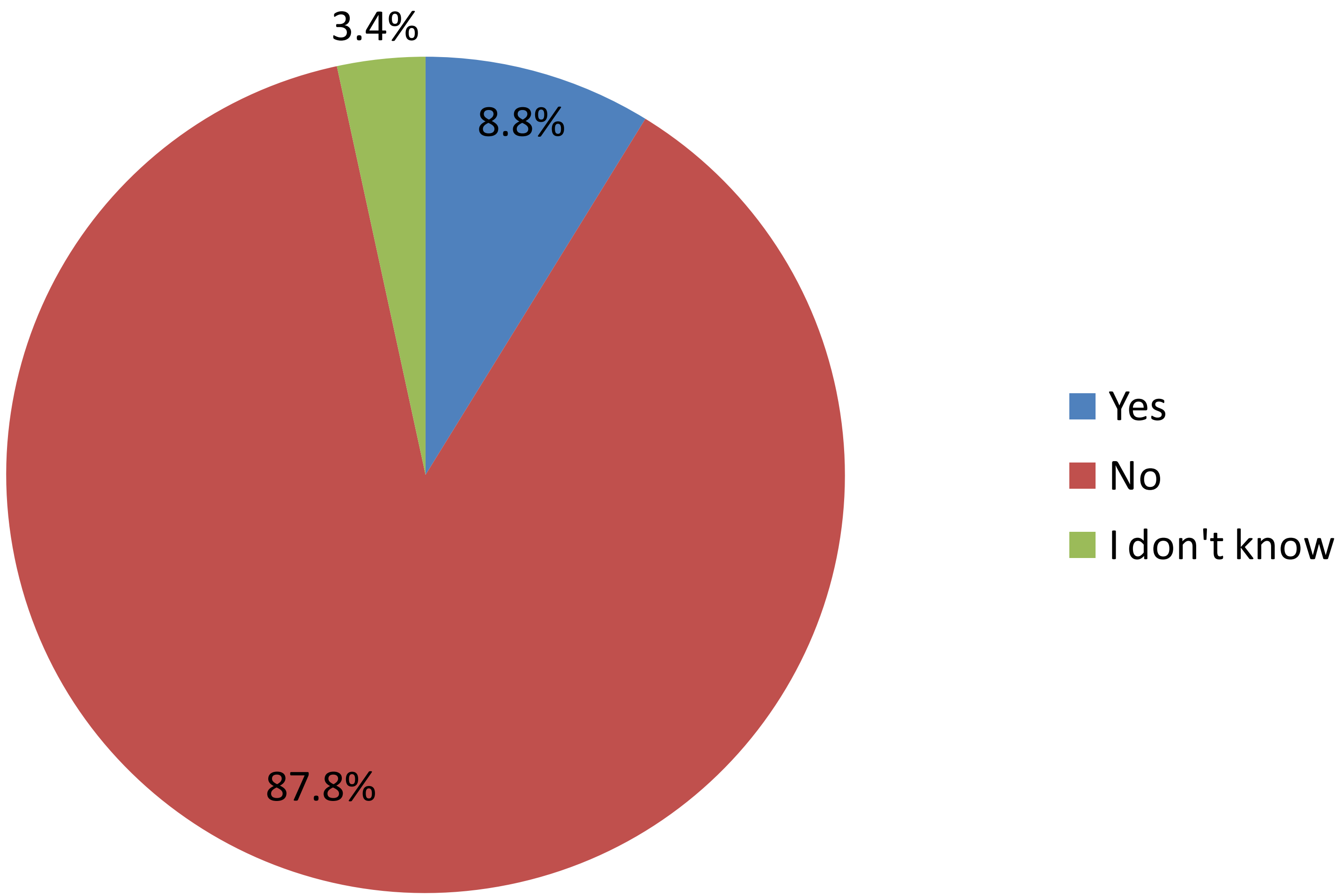
8. Do you have flood insurance?



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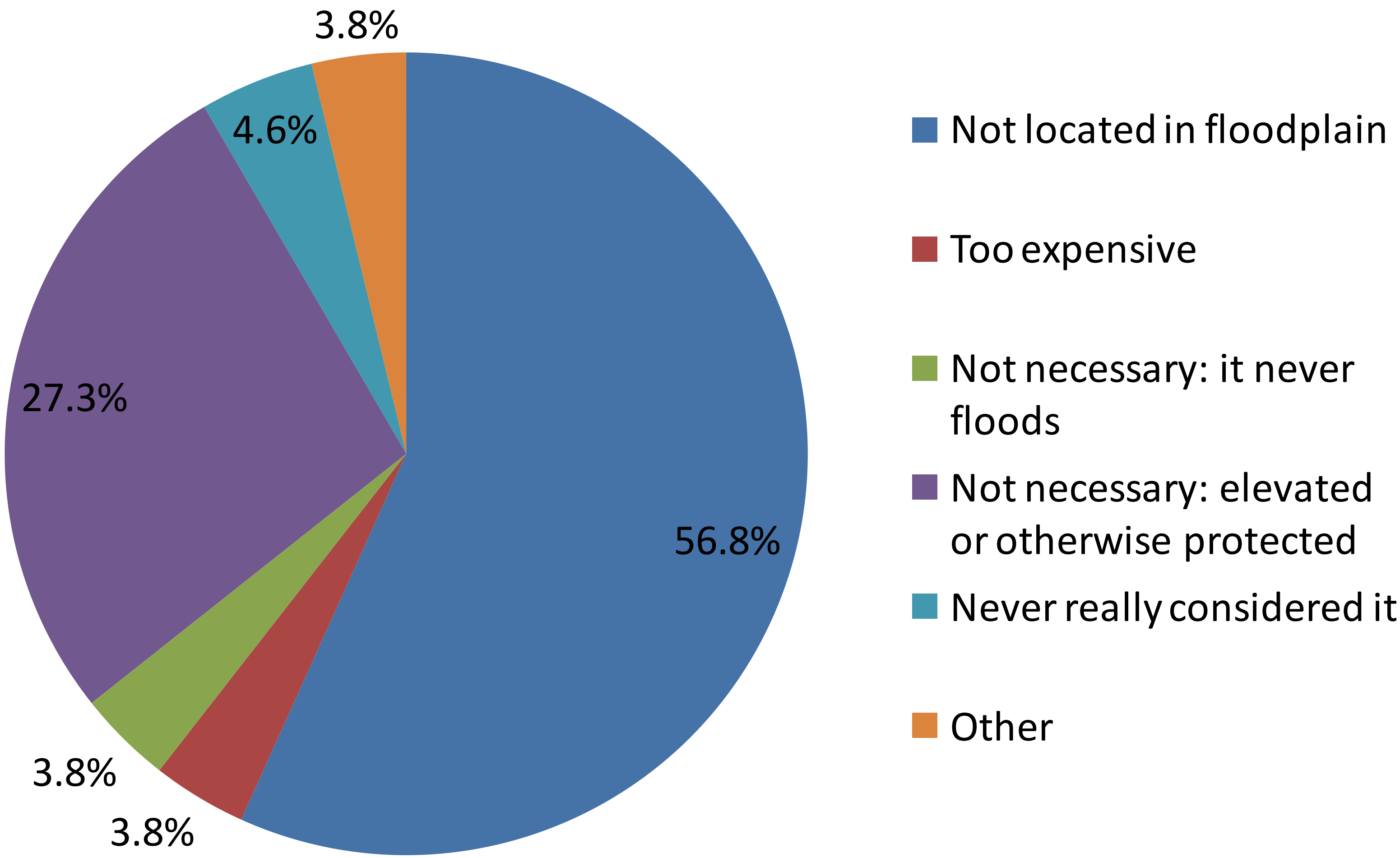
8. Why no flood insurance?



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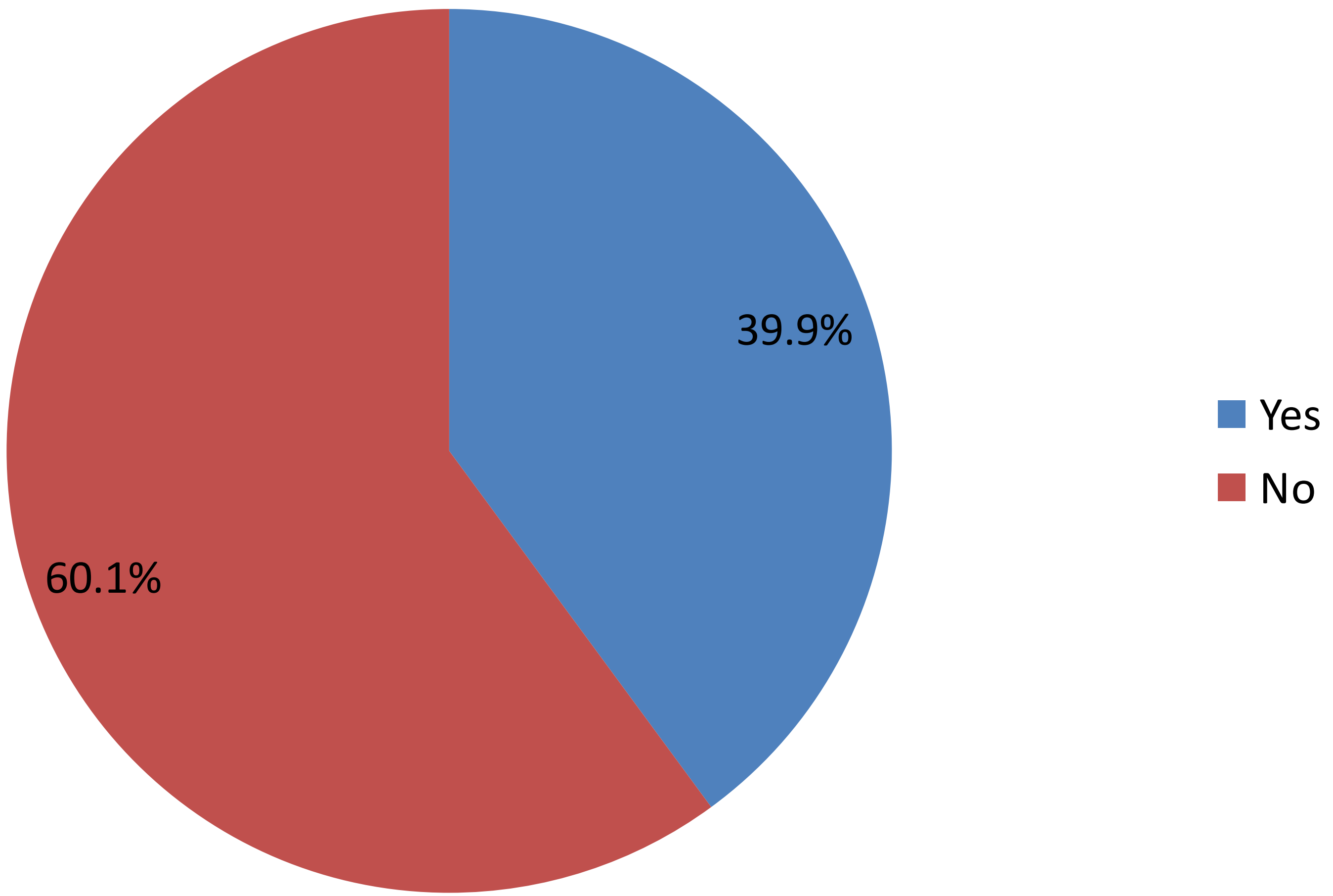
9. Taken action to be more hazard resistant?



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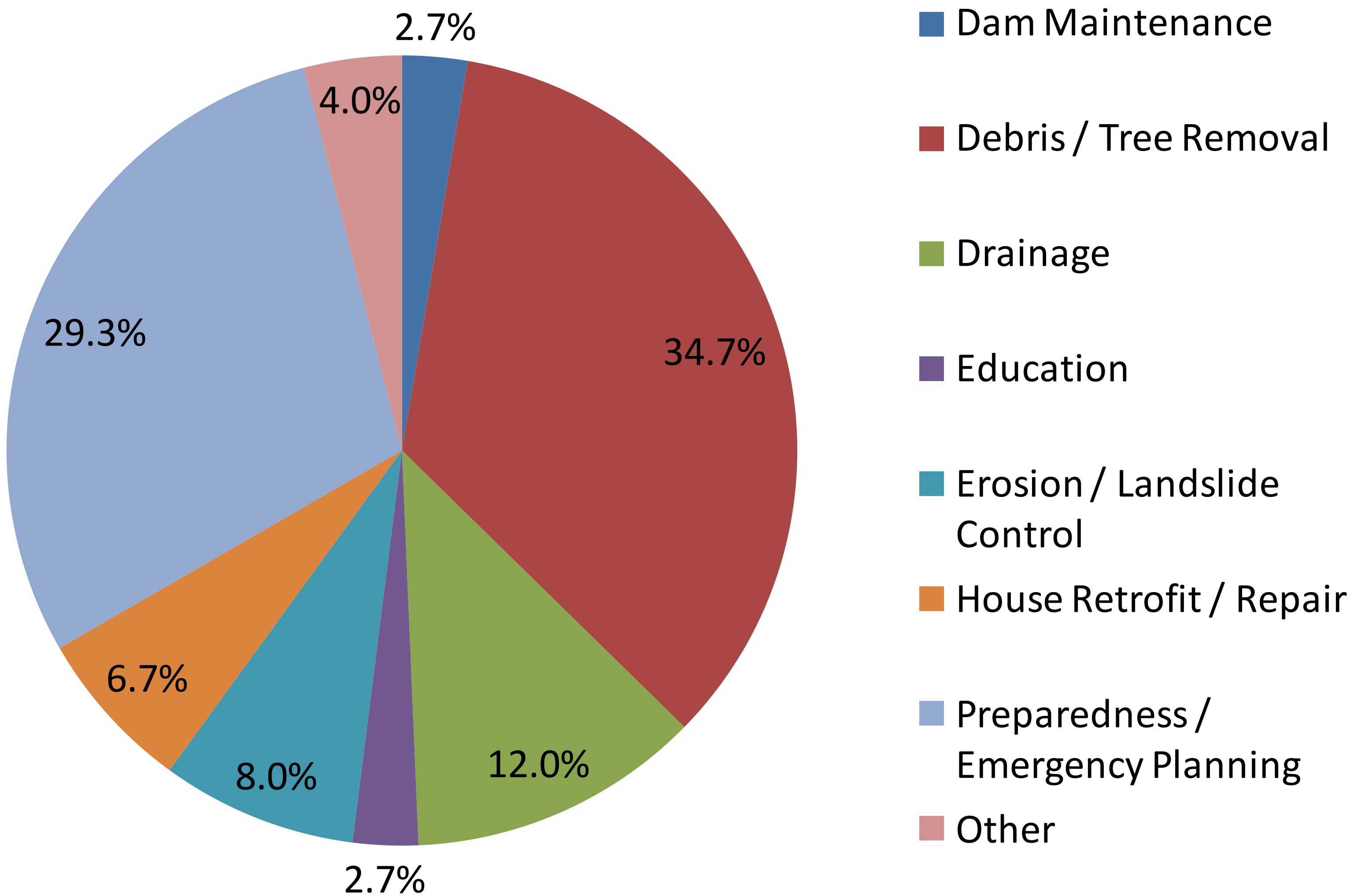
9. Examples of actions taken



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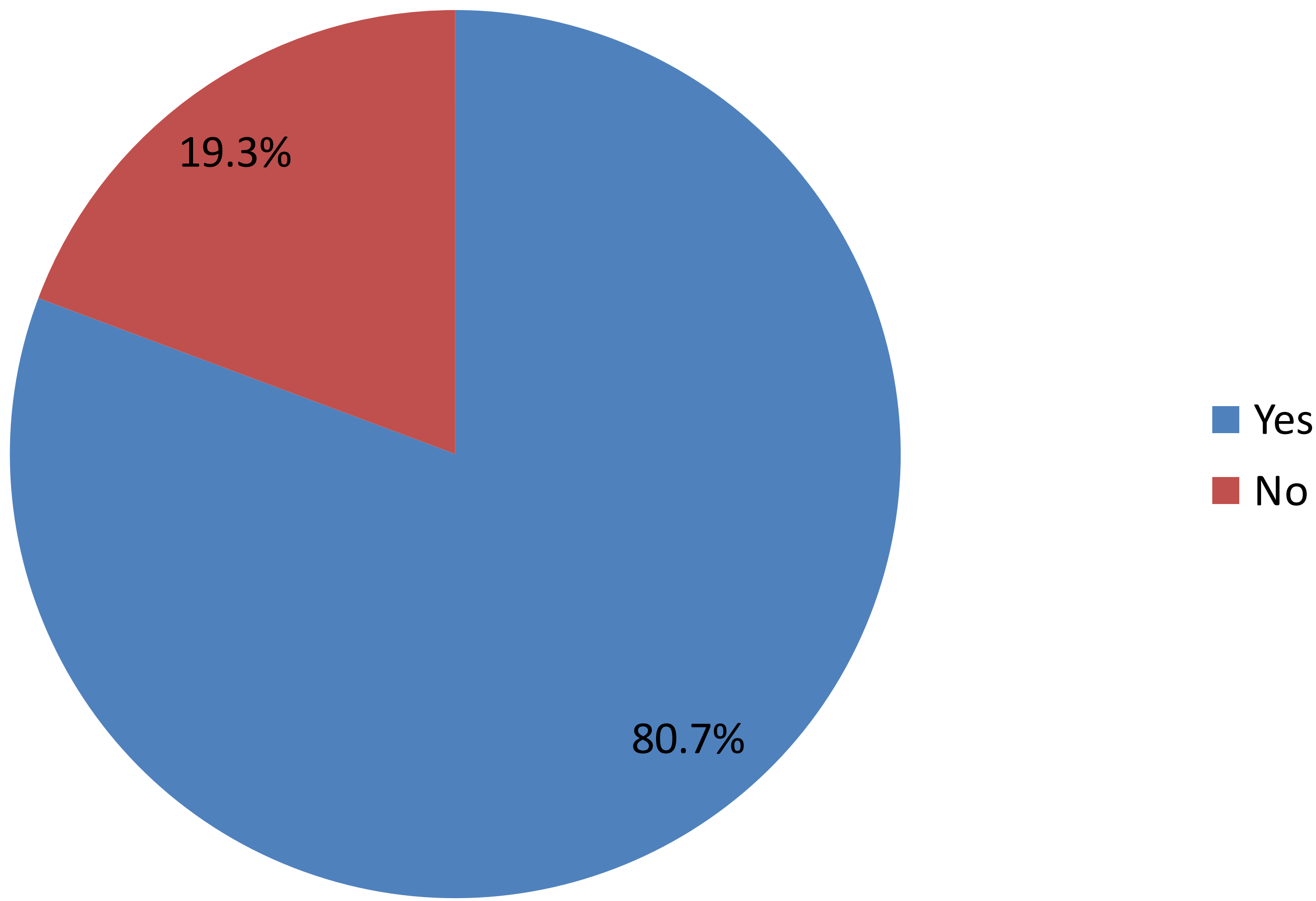
10. Interested in being more hazard resistant?



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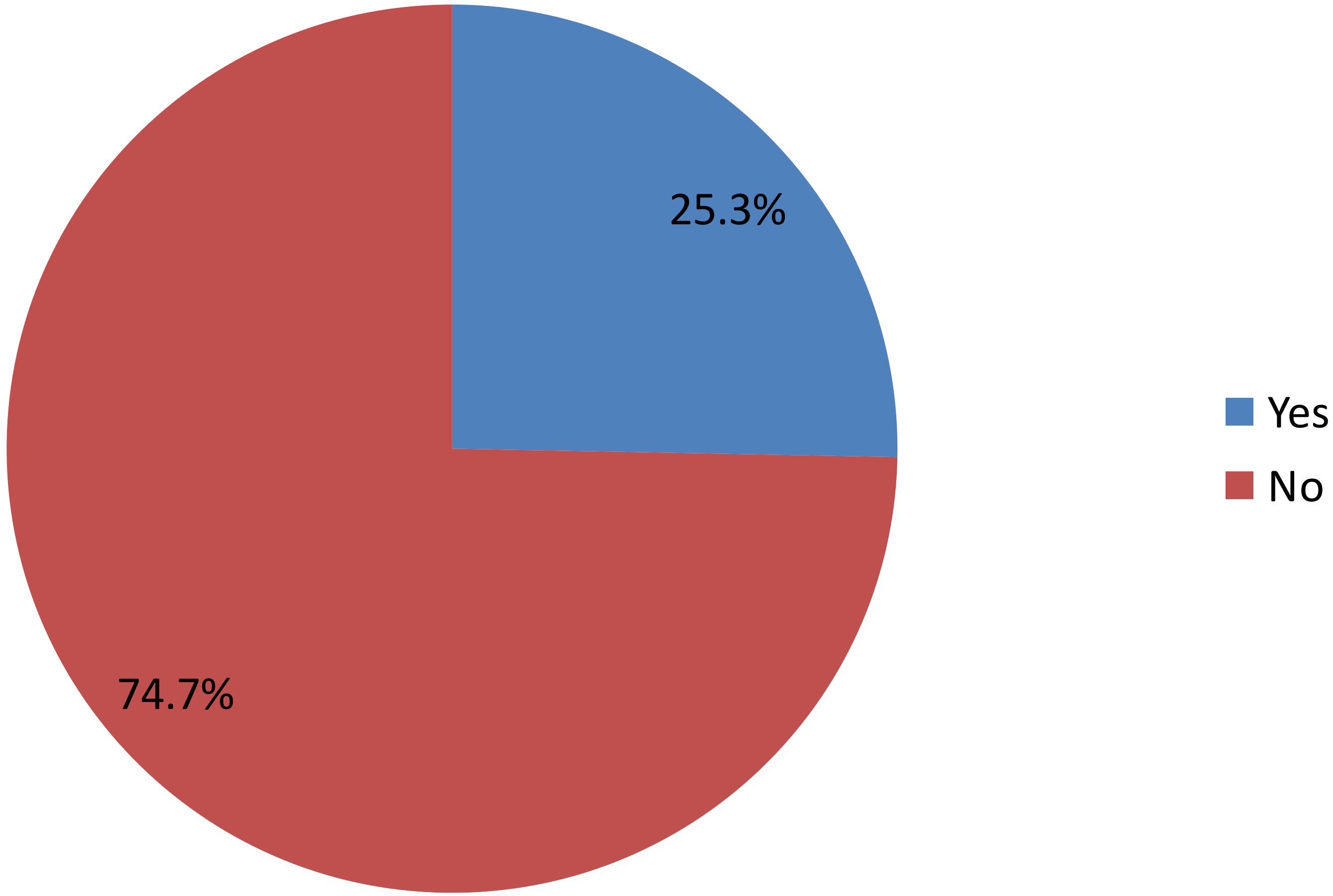
11. Know who to contact for reducing risks?



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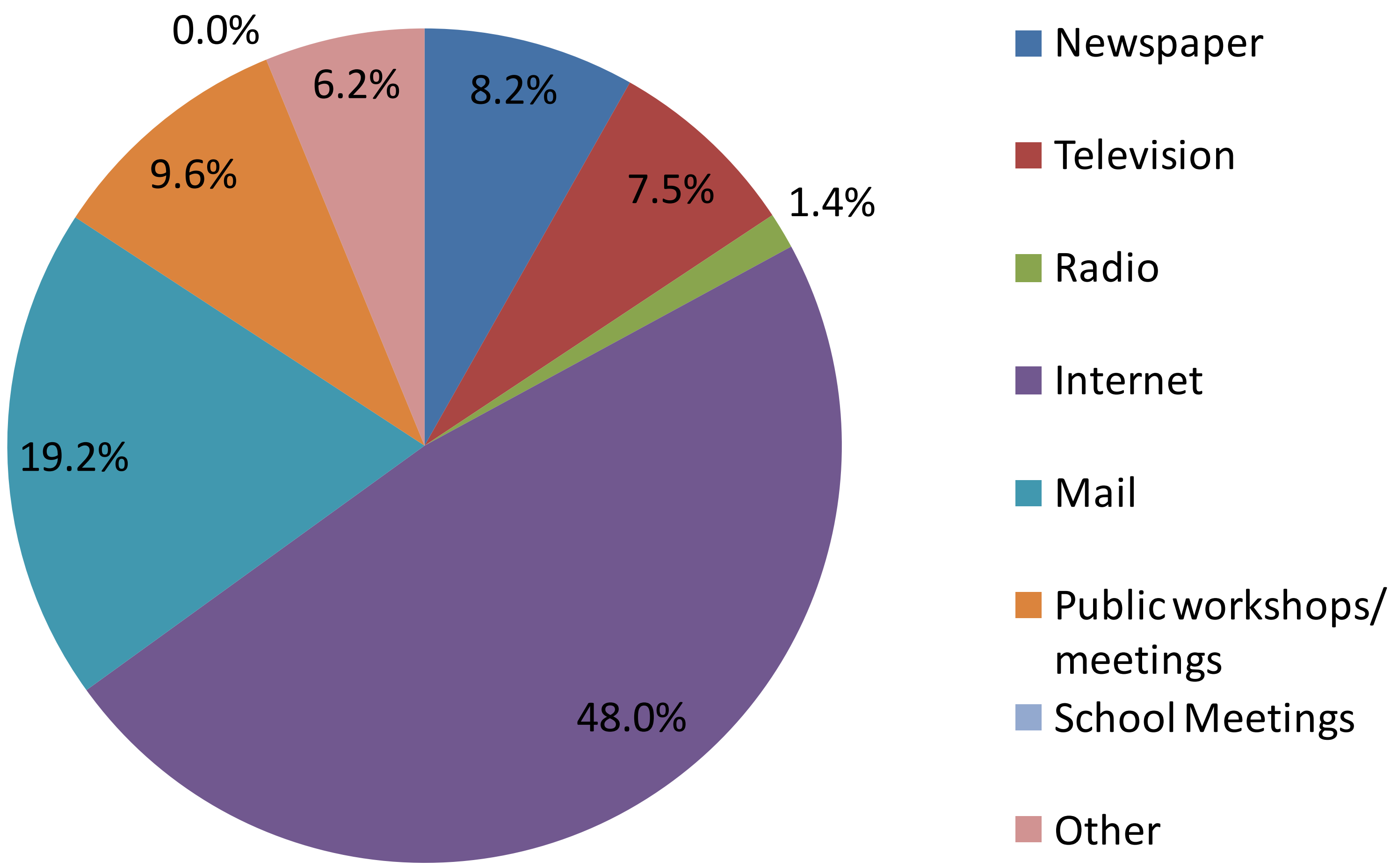
12. Most effective way to receive information?



12. Other ways to receive information

- HOA
- Town newsletter
- Text messages
- Email
- Twitter
- Local government (office/staff)

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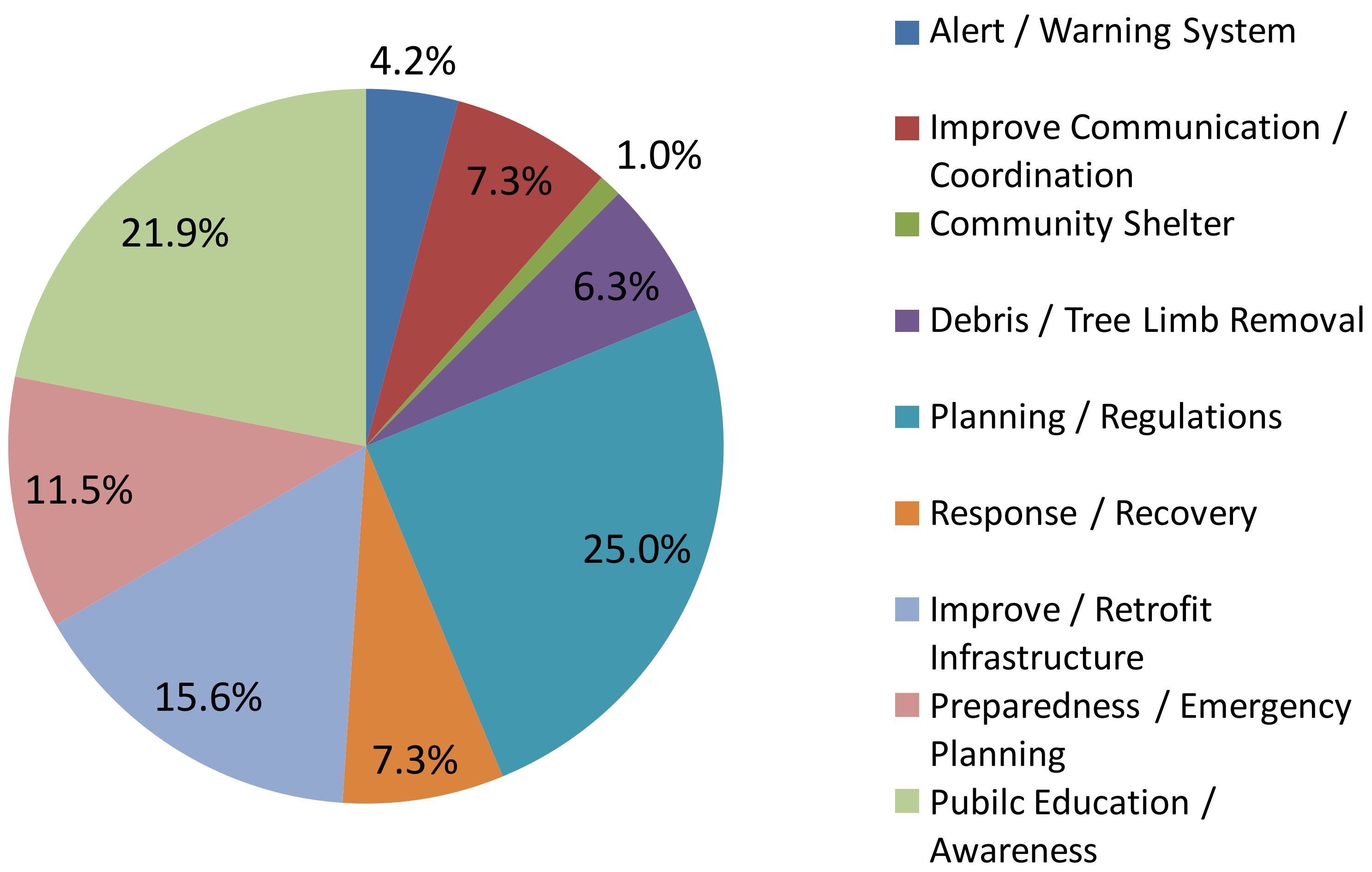
13. Steps local gov't could take to reduce risk



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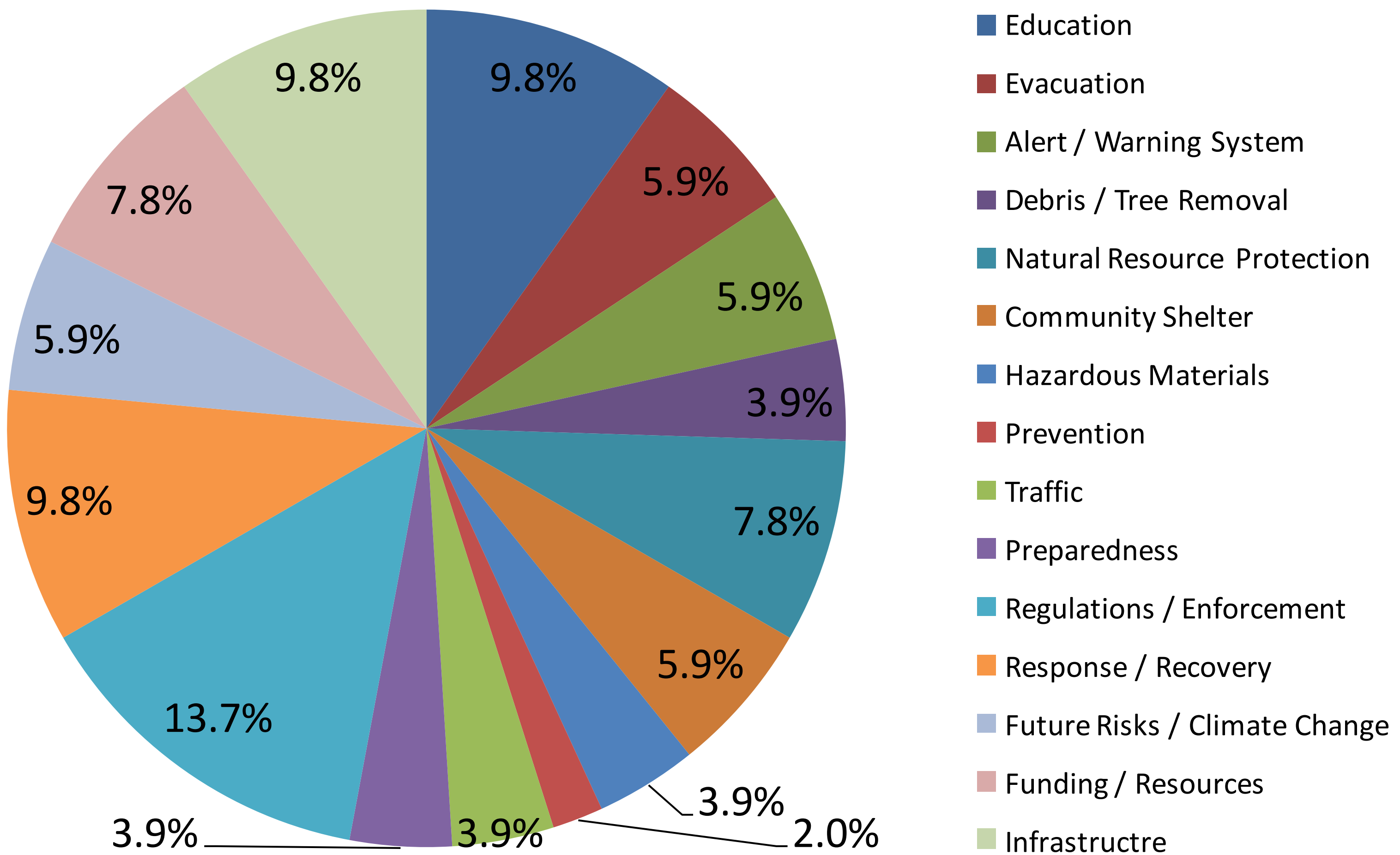
14. Other issues regarding risk and loss



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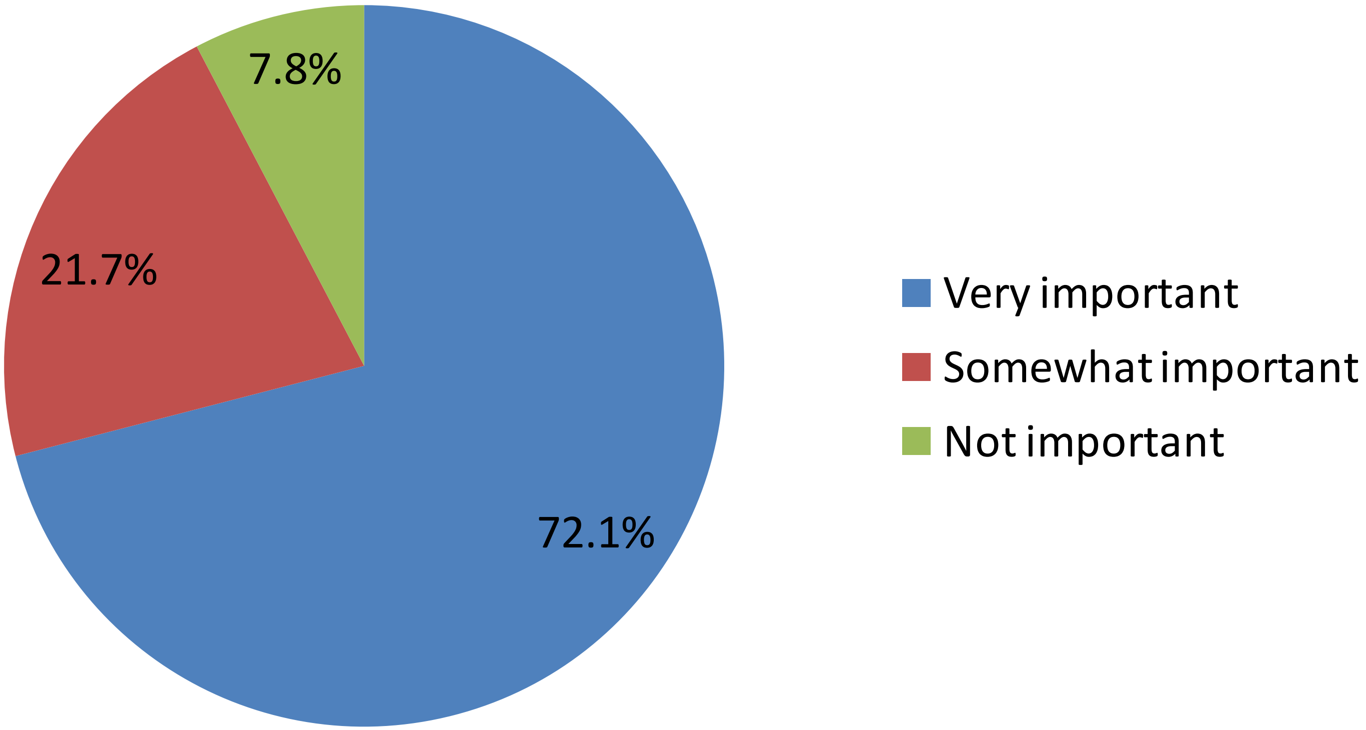
15. Mitigation Actions: Prevention



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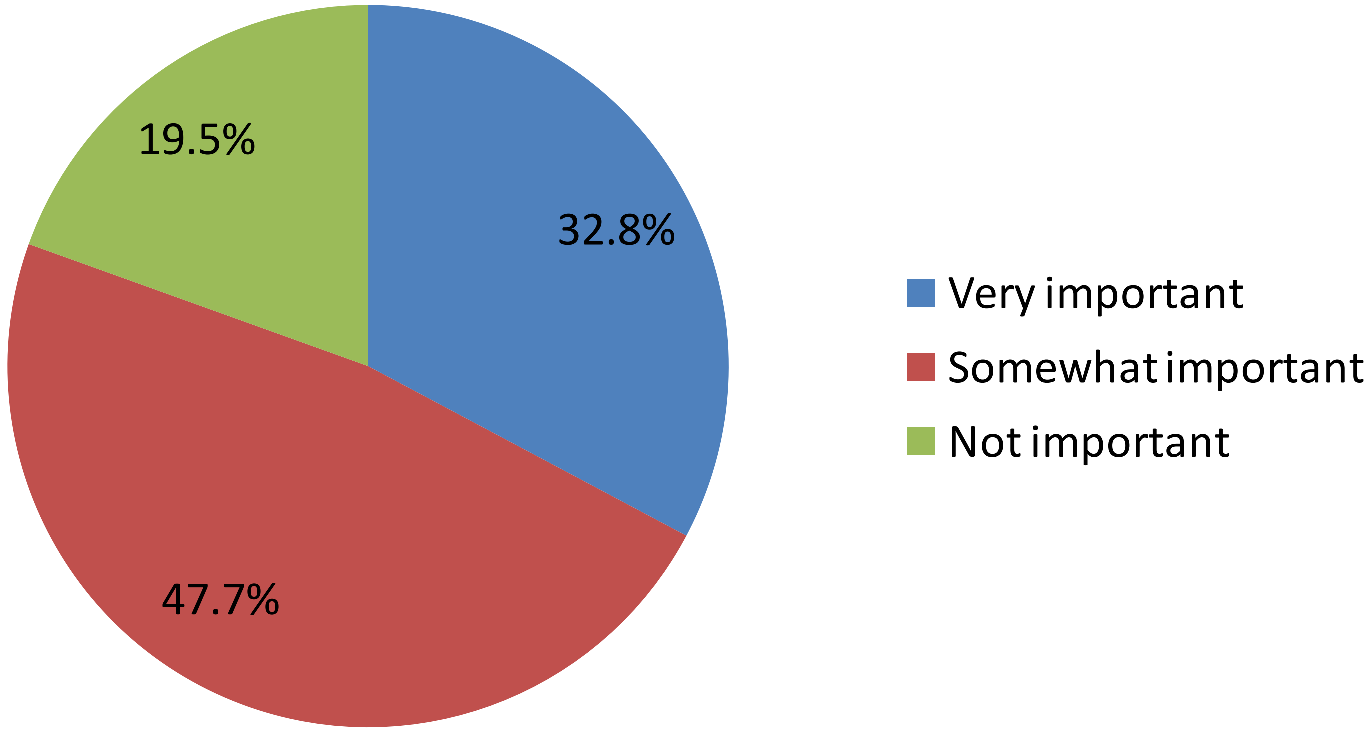
15. Mitigation Actions: Property Protection



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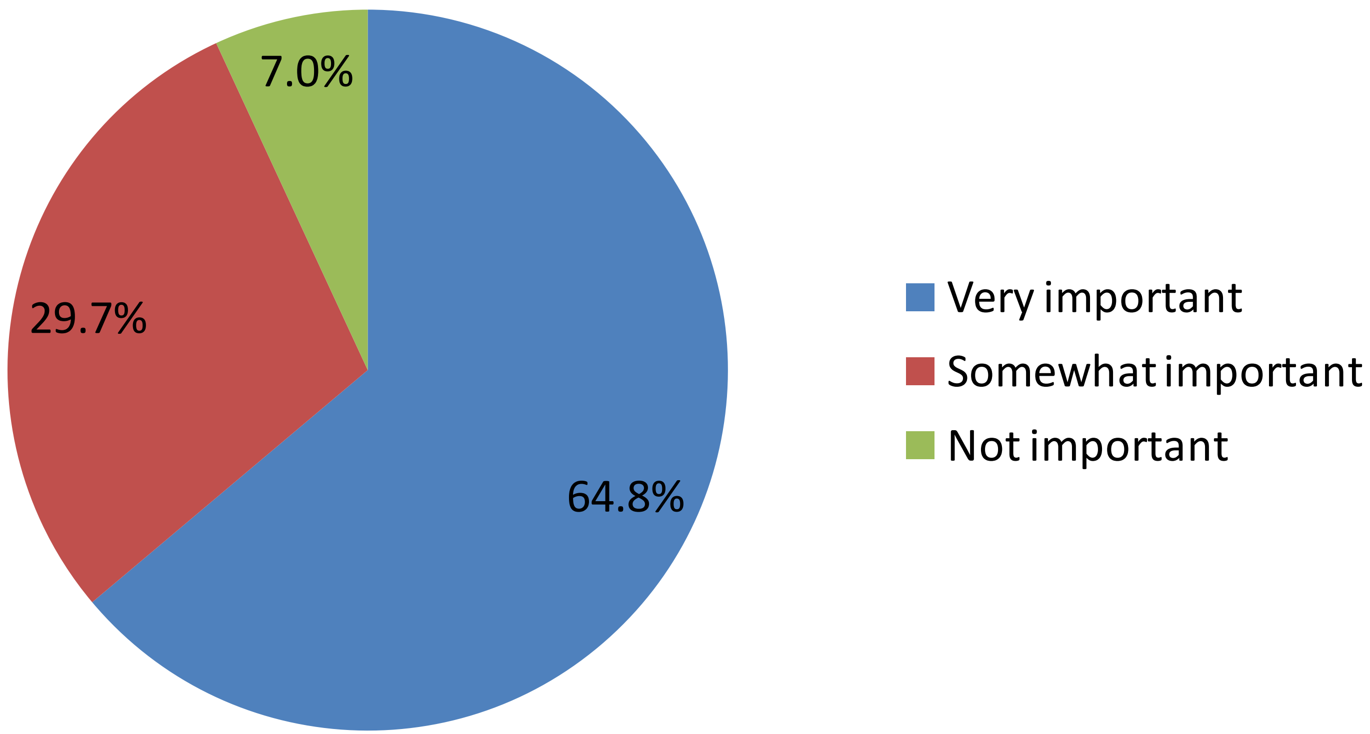
15. Mitigation Actions: Natural Resource Protection



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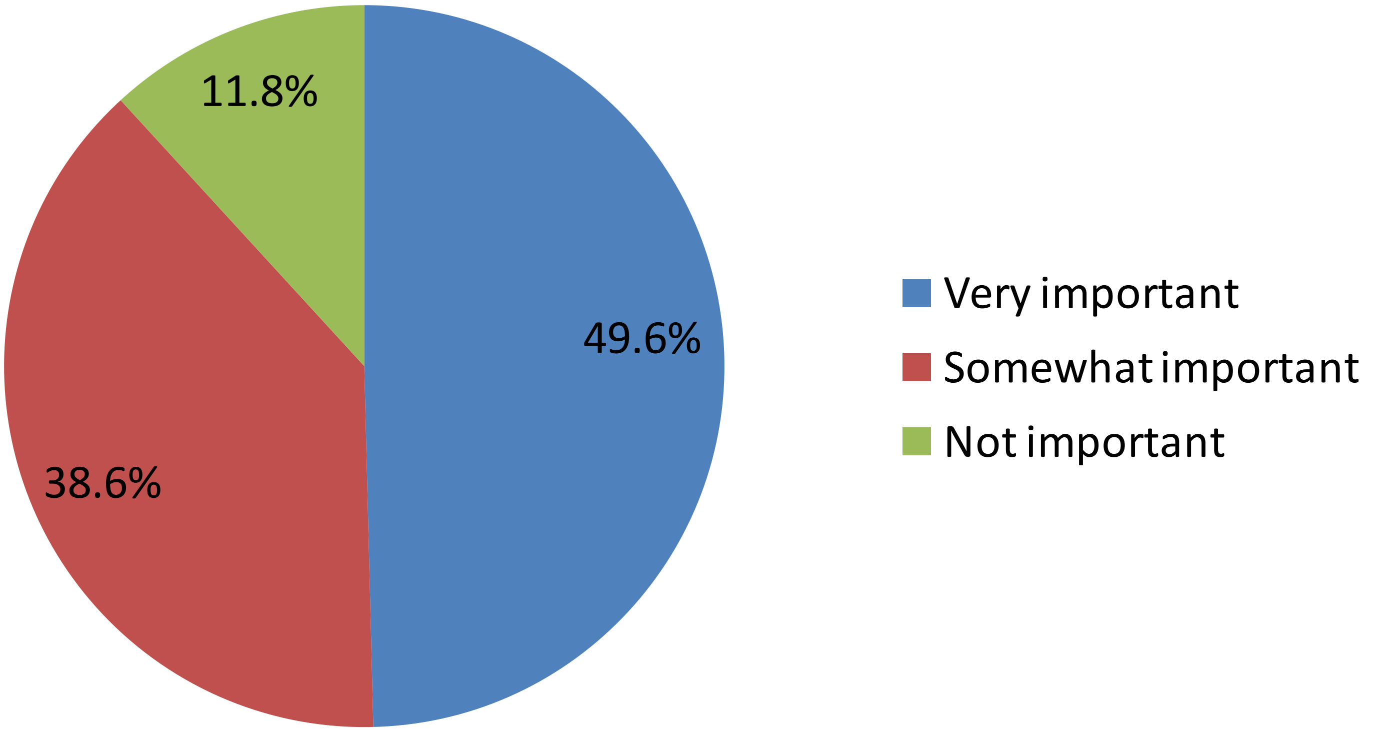
15. Mitigation Actions: Structural Projects



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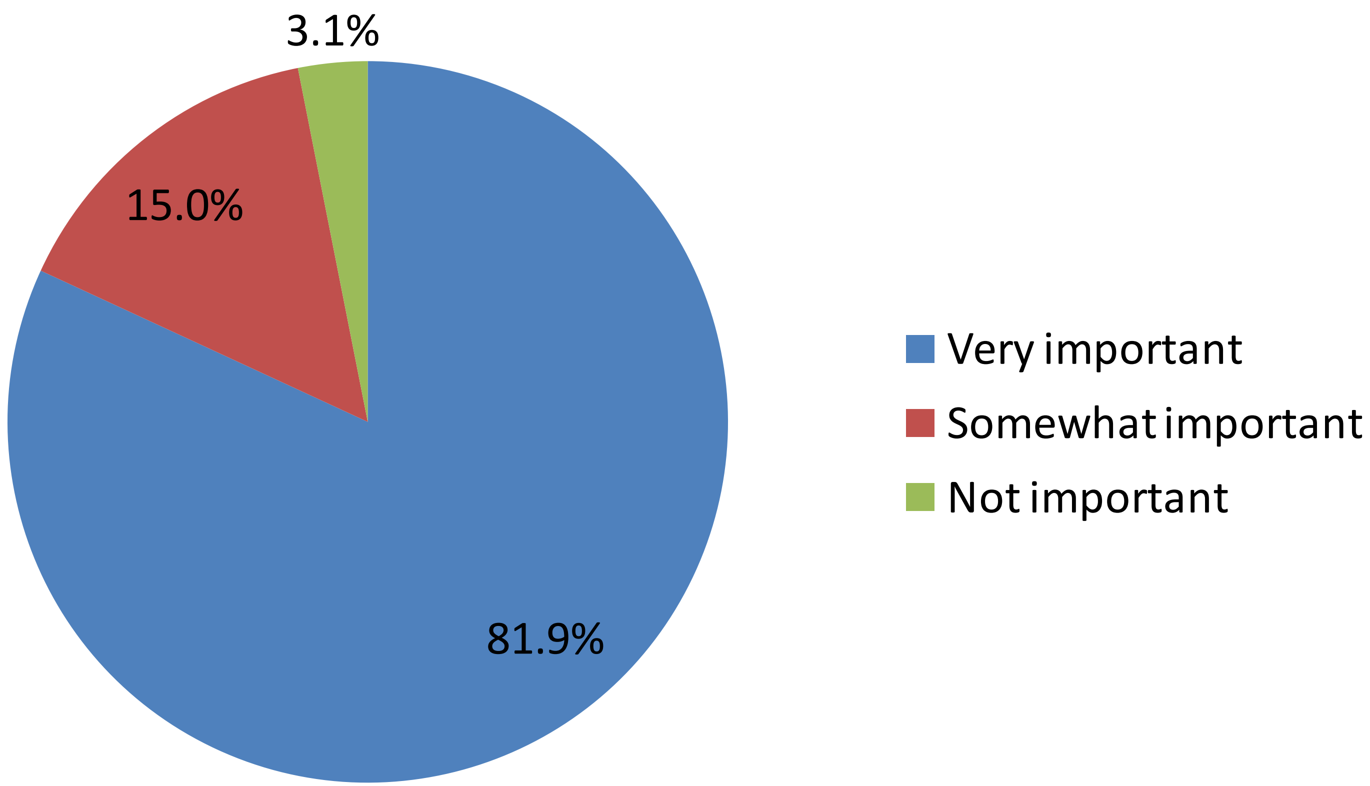
15. Mitigation Actions: Emergency Services



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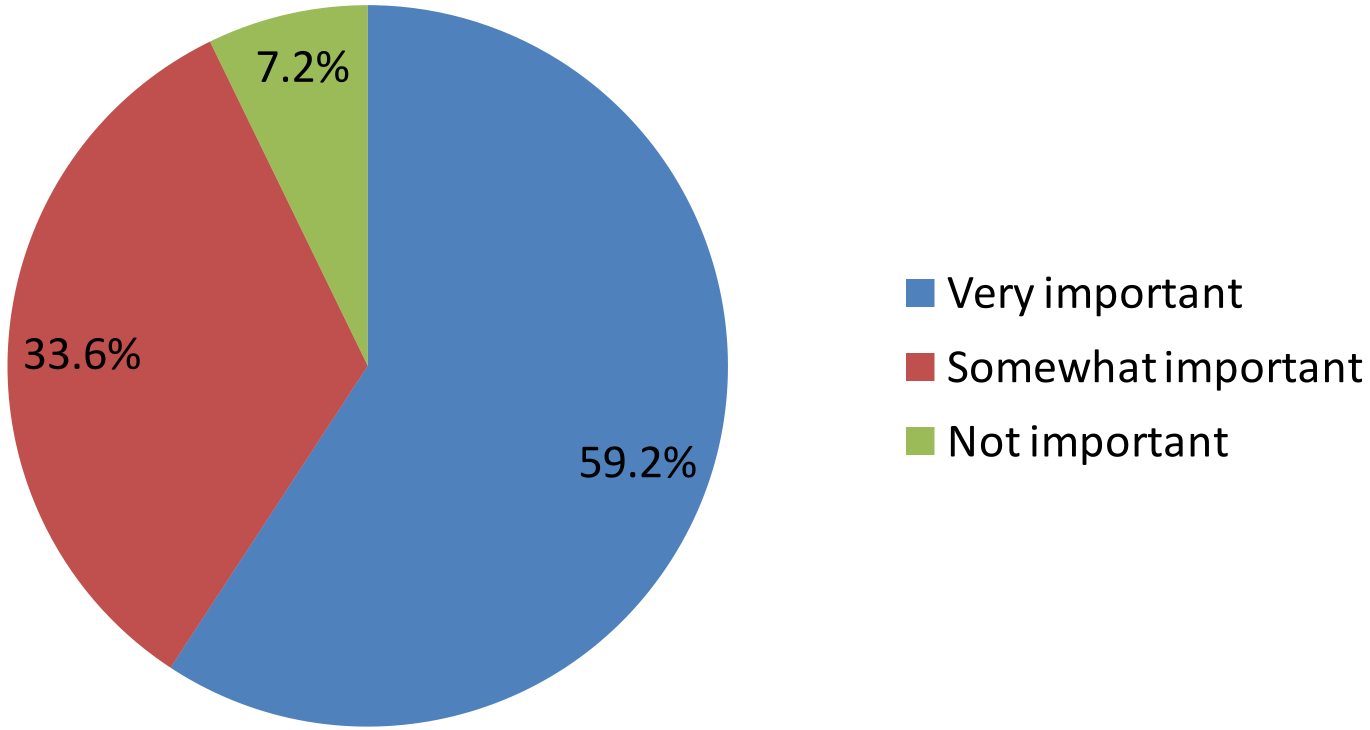
15. Mitigation Actions: Public Education & Awareness



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15. Mitigation Actions: Summary

- Highest importance
  - Emergency Services
  - Prevention
- Moderate importance
  - Natural Resource Protection
  - Public Education & Awareness
- Lowest importance
  - Structural Projects
  - Property Protection

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Photo Source: FEMA

South Mountains Regional Hazard Mitigation Plan

Public Participation Survey Results

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