Sevier County

Multi-Jurisdiction Hazard Mitigation Plan Update - 2020

Sevier County
TENNESSEE

Mitigation Plan Update

Prepared for:

Sevier County
TENNESSEE

Prepared by:

Geoinformatics and Disaster Science Lab

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Cover photos credit: National Park Service, Scott & Alice Herbert, GADS Lab, and WYMT News

2020 Sevier County Multi-Jurisdiction Hazard Mitigation Plan Update

This 2020 Sevier County Hazard Mitigation Plan Update was coordinated by the Sevier County Hazard Mitigation Plan Steering Committee, in collaboration with the participating jurisdictions as well as community stakeholders and the general public. The participating jurisdictions are made up of the following communities:

Sevier County
City of Gatlinburg
City of Pigeon Forge
Town of Pittman Center
City of Sevierville

Special thanks is directed to all of those who assisted in contributing feedback and expertise on this document. The Sevier County Steering Committee consists of the following individuals, who are credited in the creation of this document:

Larry Waters	**Sevier County Mayor**
Bryan McCarter	**Sevier County Vice Mayor**
Mike Werner	**Mayor, City of Gatlinburg**
Cindy Ogle	**City Administrator, City of Gatlinburg**
David Wear	**Mayor, City of Pigeon Forge**
Earlene Teaster	**City Administrator, City of Pigeon Forge**
Michael Borders	**Town Administrator, Pittman Center**
Bryan C. Atchley	**Mayor, City of Sevierville**
Russell Treadway	**City Administrator, City of Sevierville**
Joe Ayers	**Director, Sevier County EMA**
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Acknowledgements:

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John Reasons, ETSU Department of Geosciences – Graduate Student (*Currently ESRI Solutions Analyst)*

The plan was prepared for Sevier County, Tennessee by the Geoinformatics and Disaster Science (GADS) Lab at East Tennessee State University in coordination with the ETSU Emergency Management Specialist and the Tennessee Emergency Management Agency (TEMA). The plan was funded by the Federal Emergency Management Agency's (FEMA) Hazard Mitigation Grant Program (HMGP).

<Space Reserved for FEMA Approval Letter and Other Internal Approval Documents>

U. S. Department of Homeland Security
Region IV
3005 Chamblee Tucker Road
Atlanta, GA 30341

FEMA

November 3, 2020

Mr. Doug Worden
State Hazard Mitigation Officer
Tennessee Emergency Management
Agency 3041 Sidco Drive
Nashville, Tennessee 37204

Reference: Multi-Jurisdictional Hazard Mitigation Plan: Sevier County

Dear Mr. Worden:

We are pleased to inform you the Sevier County Hazard Mitigation Plan update is in compliance with the Federal hazard mitigation planning requirements resulting from the Disaster Mitigation Act of 2000, as contained in 44 CFR 201.6. Effective November 3, 2020 the plan is approved for a period of five (5) years, to November 2, 2025.

This plan approval extends to the following participating jurisdictions that provided copies of their resolutions adopting the plan:

- Sevier County Unincorporated
- City of Gatlinburg
- Town of Pittman Center

The approved participating jurisdictions are hereby eligible applicants through the State for the following mitigation grant programs administered by the Federal Emergency Management Agency (FEMA):

- Hazard Mitigation Grant Program (HMGP)
- Flood Mitigation Assistance (FMA)
- Building Resilient Infrastructure and Communities (BRIC)

National Flood Insurance Program (NFIP) participation is required for some programs.

We commend the participants of Sevier County Hazard Mitigation Plan for the development of a solid, workable plan that will guide hazard mitigation activities over the coming years. Please note that all requests for funding will be evaluated individually according to the specific eligibility and other requirements of the particular program under which the application is submitted. For example, a specific mitigation activity or project identified in the plan may not meet the eligibility requirements for FEMA funding, and even eligible mitigation activities are not automatically approved for FEMA funding under any of the aforementioned programs.

We strongly encourage each community to perform an annual review and assessment of the effectiveness of their hazard mitigation plan; however, a formal plan update is required at least every five (5) years. We also encourage each community to conduct a plan update process within one (1) year of being included in a Presidential Disaster Declaration or of the adoption of major modifications to their local Comprehensive

Land Use Plan or other plans that affect hazard mitigation or land use and development. When you prepare a comprehensive plan update, it must be resubmitted through the State as a "plan update" and is subject to a formal review and approval process by our office. If the plan is not updated prior to the required five (5) year update, please ensure that the draft update is submitted at least six (6) months prior to expiration of this plan.

The State and the participants in the Sevier County Hazard Mitigation Plan should be commended for their close coordination and communications with our office in the review and subsequent approval of the plan. If you or Sevier County have any questions or need any additional information, please do not hesitate to contact Harlie Clark, of the Hazard Mitigation Assistance Branch, at (770) 220-5219, or Robin Berzins, of my staff, at (678) 822-8516.

Sincerely,

Kristen M. Martinenza

Kristen M. Martinenza, P.E., CFM
Branch Chief
Risk Analysis
FEMA Region IV

U. S. Department of Homeland Security
Region IV
3005 Chamblee Tucker Road
Atlanta, GA 30341

FEMA

November 5, 2020

Mr. Doug Worden
State Hazard Mitigation Officer
Tennessee Emergency Management Agency
3041 Sidco Drive
Nashville, Tennessee 37204

Reference: Sevier County Multi-Jurisdictional Hazard Mitigation Plan

Dear Mr. Worden:

This is a follow-up to our previous correspondence of November 3, 2020, in which we approved the Sevier County Multi-Jurisdictional Hazard Mitigation Plan and all the participating communities that submitted their resolutions at the time of plan approval. We have recently received from your office the following resolution for inclusion within this plan and subsequently have approved the jurisdiction under the approved Sevier County Multi-Jurisdictional Hazard Mitigation Plan effective November 3, 2020.

- City of Pigeon Forge

The approved participating communities are hereby eligible applicants through the State for the following mitigation grant programs administered by the Federal Emergency Management Agency (FEMA):

- Hazard Mitigation Grant Program (HMGP)
- Building Resilient Infrastructure and Communities (BRIC)
- Flood Mitigation Assistance (FMA)

National Flood Insurance Program (NFIP) participation is required for some programs.

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plan update. If the Plan is not updated prior to the required five (5) year update, please ensure that the Draft update is submitted at least six (6) months prior to expiration of this plan approval.

If you or the participants in Sevier County Multi-Jurisdictional Hazard Mitigation Plan have any further questions or need any additional information, please do not hesitate to contact Harlie Clark, of the Hazard Mitigation Assistance Branch, at (770) 220-5219 or Robin Berzins, of my staff, at (678) 822-8516.

Sincerely,

Kristen M. Martinenza, P.E., CFM
Branch Chief
Risk Analysis
FEMA Region IV

U. S. Department of Homeland Security
Region IV
3005 Chamblee Tucker Road
Atlanta, GA 30341

FEMA

February 22, 2021

Mr. Doug Worden
State Hazard Mitigation Officer
Tennessee Emergency Management Agency
3041 Sidco Drive
Nashville, TN 37204

Reference: Sevier County Multi-Jurisdictional Hazard Mitigation Plan

Dear Mr. Worden:

This is a follow-up to our previous correspondence of November 3, 2020, in which we approved the Sevier County Multi-Jurisdictional Hazard Mitigation Plan and all the participating communities that submitted their resolutions at the time of plan approval. We have recently received from your office the following resolution for inclusion within this plan and subsequently have approved the jurisdiction under the approved Sevier County Multi-Jurisdictional Hazard Mitigation Plan effective February 22, 2021.

- City of Sevierville

The approved participating communities are hereby eligible applicants through the State for the following mitigation grant programs administered by the Federal Emergency Management Agency (FEMA):

- Hazard Mitigation Grant Program (HMGP)
- Building Resilient Infrastructure and Communities (BRIC)
- Flood Mitigation Assistance (FMA)

National Flood Insurance Program (NFIP) participation is required for some programs.

We commend the participants in Sevier County Multi-Jurisdictional Hazard Mitigation Plan for the development of a solid, workable plan that will guide hazard mitigation activities over the coming years. Please note that all requests for funding will be evaluated individually according to the specific eligibility and other requirements of the particular program under which the application is submitted. For example, a specific mitigation activity or project identified in the plan may not meet the eligibility requirements for FEMA funding, and even eligible mitigation activities are not automatically approved for FEMA funding under any of the aforementioned programs.

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If you or the participants in Sevier County Multi-Jurisdictional Hazard Mitigation Plan have any further questions or need any additional information, please do not hesitate to contact Harlie Clark, of the Hazard Mitigation Assistance Branch, at (770) 220-5219 or Robin Berzins, of my staff, at (678) 822-8516.

Sincerely,

Kristen M. Martinenza, P.E., CFM
Branch Chief
Risk Analysis
FEMA Region IV

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Executive Summary

In an effort to reduce the Nation's mounting natural disaster losses, Congress passed the Disaster Mitigation Act of 2000 (DMA 2000). Section 322 of DMA 2000 requires all state and local governments to develop a hazard mitigation plan to remain eligible for pre- and post-disaster mitigation funding. These funds include the Hazard Mitigation Grant Program (HMGP), Hazard Mitigation Assistance (HMA), and the Pre-Disaster Mitigation (PDM) program, which are administered by the Federal Emergency Management Agency (FEMA). Communities, eligible private non-profits, and universities with an adopted and federally approved hazard mitigation plan are eligible for available mitigation funds before and after the next disaster impacts the community.

The purpose of the Sevier County Multi-Jurisdiction Hazard Mitigation Plan Update is to provide guidance for hazard mitigation within the jurisdictional boundaries of Sevier County. It identifies and updates hazard mitigation goals, objectives, and recommended mitigation actions for the county that will reduce injury and damage from natural and man-made hazard incidents.

Hazard mitigation, defined by FEMA is any action taken to eliminate or reduce the long-term risks to human life and property from natural and technological hazards, is crucial to the residents in Sevier County. Because of the risk and exposure to many kinds of natural and man-made hazard incidents, Sevier County understands the need for improved information for decision-making in disaster planning.

The Sevier County Multi-Jurisdiction Hazard Mitigation Plan Update adheres to the guidelines outlined in 44 CFR, Section 201.6. The plan includes natural hazards where there is a historical record of damage caused to people and property or where the potential for such damage exists. Additionally, consideration has been given to the threat of technological and human-caused hazards.

For each jurisdiction, hazard risk is determined by calculating the Risk Factor for each hazard using the Enhanced Priority Risk Index (EPRI). A summary of the EPRI is found in Table 2-4. Overall, scores range from low (1) to very high (4). The conclusions drawn from the qualitative and quantitative assessments are grouped into three categories based on High, Moderate, or Low designations (Table 2-5). Hazards identified as high risk have risk factors of 2.5 or greater. Risk factors ranging from 2.0 to 2.4 represent moderate risk hazards. Hazards with risk factors of less than 2.0 are considered low risk. The following tables provide an overview of the risk assessment for each jurisdiction profiled in the hazard mitigation plan.

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Table 1: Risk Assessment for Sevier County (Unincorporated Area).

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Overall Risk
Wildfires/ Conflagration	4	4	4	2	4	3.0	**3.6**
Winter Storms	4	3	4	2	4	2.0	**3.1**
Extreme Temperatures	4	3	4	1	3	2.0	**3.0**
Civil Disobedience/ Terrorism	1	4	4	4	1	2.7	**2.9**
Thunderstorms (Hail)	4	2	4	3	1	2.0	**2.7**
Thunderstorms (Wind)	4	2	4	3	1	2.0	**2.7**
Floods Including Extreme Precipitation	3	2	3	3	2	3.0	**2.7**
Communicable Disease	4	2	3	4	2	1.7	**2.6**
Drought	3	2	4	1	4	2.0	**2.6**
Mass Wasting	3	2	2	4	4	2.3	**2.6**
Dam Failure	1	3	2	4	4	2.0	**2.4**
Infrastructure	1	3	2	4	3	2.0	**2.3**
Tornadoes	3	2	2	4	3	1.2	**2.2**
Sinkholes	4	2	1	4	1	1.2	**2.1**
Severe Wind	2	2	2	4	1	2.0	**2.1**
Earthquakes	1	1	4	4	1	1.3	**1.8**
Thunderstorms (Lightning)	2	1	2	3	1	2.0	**1.8**
Tropical Cyclones	1	1	4	1	2	1.0	**1.5**

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Table 2: Risk Assessment for the City of Gatlinburg.

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Overall Risk
Wildfires/ Conflagration	4	4	4	2	4	4.0	**3.9**
Winter Storms	4	3	4	2	4	2.9	**3.3**
Thunderstorms (Hail)	4	2	4	3	1	4.0	**3.2**
Thunderstorms (Wind)	4	2	4	3	1	4.0	**3.2**
Extreme Temperatures	4	3	4	1	3	2.1	**3.0**
Civil Disobedience/ Terrorism	1	4	4	4	1	3.0	**2.9**
Mass Wasting	3	2	2	4	4	3.2	**2.8**
Floods Including Extreme Precipitation	3	2	3	3	2	3.0	**2.7**
Communicable Disease	4	2	3	4	2	1.6	**2.6**
Infrastructure	1	3	2	4	3	3.0	**2.5**
Drought	3	2	4	1	4	1.6	**2.5**
Severe Wind	2	2	2	4	1	3.6	**2.5**
Thunderstorms (Lightning)	2	1	2	3	1	4.0	**2.3**
Tornadoes	3	2	2	4	3	1.0	**2.2**
Dam Failure	1	3	1	3	3	1.0	**1.8**
Earthquakes	1	1	4	4	1	1.0	**1.7**
Sinkholes	2	2	1	4	1	1.0	**1.7**
Tropical Cyclones	1	1	4	1	2	1.0	**1.5**

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Table 3: Risk Assessment for the City of Pigeon Forge.

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Overall Risk
Wildfires/ Conflagration	4	4	4	2	4	4.0	**3.9**
Winter Storms	4	3	4	2	4	3.0	**3.4**
Extreme Temperatures	4	3	4	1	3	1.9	**2.9**
Civil Disobedience/ Terrorism	1	4	4	4	1	2.8	**2.9**
Thunderstorms (Hail)	4	2	4	3	1	2.6	**2.9**
Thunderstorms (Wind)	4	2	4	3	1	2.6	**2.9**
Floods Including Extreme Precipitation	3	2	3	3	2	3.2	**2.7**
Communicable Disease	4	2	3	4	2	1.6	**2.6**
Mass Wasting	3	2	2	4	4	2.0	**2.5**
Dam Failure	1	3	2	4	4	2.6	**2.5**
Tornadoes	3	2	2	4	3	2.0	**2.4**
Drought	3	2	4	1	4	1.3	**2.4**
Severe Wind	2	2	2	4	1	3.1	**2.3**
Infrastructure	1	3	2	4	3	2.0	**2.3**
Sinkholes	4	2	1	4	1	1.0	**2.1**
Earthquakes	1	1	4	4	1	2.4	**2.0**
Thunderstorms (Lightning)	2	1	2	3	1	2.6	**1.9**
Tropical Cyclones	1	1	4	1	2	1.0	**1.5**

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Table 4: Risk Assessment for the Town of Pittman Center.

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Overall Risk
Wildfires/ Conflagration	4	4	4	2	4	3.0	**3.6**
Winter Storms	4	3	4	2	4	2.0	**3.1**
Extreme Temperatures	4	3	4	1	3	2.0	**3.0**
Civil Disobedience/ Terrorism	1	4	4	4	1	2.7	**2.9**
Thunderstorms (Hail)	4	2	4	3	1	2.0	**2.7**
Thunderstorms (Wind)	4	2	4	3	1	2.0	**2.7**
Floods Including Extreme Precipitation	3	2	3	3	2	3.0	**2.7**
Communicable Disease	4	2	3	4	2	1.7	**2.6**
Drought	3	2	4	1	4	2.0	**2.6**
Mass Wasting	3	2	2	4	4	2.3	**2.6**
Infrastructure	1	3	2	4	3	2.0	**2.3**
Tornadoes	3	2	2	4	3	1.2	**2.2**
Severe Wind	2	2	2	4	1	2.0	**2.1**
Dam Failure	1	3	1	3	3	1.0	**1.8**
Earthquakes	1	1	4	4	1	1.3	**1.8**
Thunderstorms (Lightning)	2	1	2	3	1	2.0	**1.8**
Sinkholes	2	2	1	4	1	1.2	**1.7**
Tropical Cyclones	1	1	4	1	2	1.0	**1.5**

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Table 5: Risk Assessment for the City of Sevierville.

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Overall Risk
Winter Storms	4	3	4	2	4	1.6	**3.0**
Floods Including Extreme Precipitation	4	3	3	3	2	2.2	**2.9**
Extreme Temperatures	4	3	4	1	3	1.6	**2.8**
Civil Disobedience/ Terrorism	1	4	4	4	1	2.4	**2.8**
Communicable Disease	4	2	3	4	2	1.7	**2.6**
Dam Failure	1	3	2	4	4	2.9	**2.6**
Thunderstorms (Hail)	4	2	4	3	1	1.5	**2.6**
Infrastructure	1	3	2	4	3	2.9	**2.5**
Thunderstorms (Wind)	4	2	4	3	1	1.0	**2.5**
Wildfires/ Conflagration	2	4	2	2	4	1.0	**2.4**
Drought	3	2	4	1	4	1.0	**2.3**
Mass Wasting	3	2	2	4	4	1.0	**2.3**
Tornadoes	3	2	2	4	3	1.0	**2.2**
Sinkholes	4	2	1	4	1	1.0	**2.1**
Severe Wind	2	2	2	4	1	1.0	**1.8**
Thunderstorms (Lightning)	2	1	2	3	1	1.9	**1.7**
Earthquakes	1	1	4	4	1	1.0	**1.7**
Tropical Cyclones	1	1	4	1	2	1.0	**1.5**

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1. Introduction

1.1 Overview

Sevier County is subject to a wide range of natural, technological, and human-caused hazards. The Sevier County Multi-Jurisdiction Hazard Mitigation Plan Update addressed all of the natural hazards which pose a significant risk to Sevier County and its jurisdictions. Additionally, technological and human-caused hazards that pose a significant risk to the community were addressed. The Sevier County Multi-Jurisdiction Hazard Mitigation Plan Update includes incidents such as localized flooding that may impact only a small portion of the community. The plan also addresses incidents such as winter storms which may affect much or all of Sevier County. The Sevier County Multi-Jurisdiction Hazard Mitigation Plan Update has several key elements including the following:

- Each hazard which impacts Sevier County and its jurisdictions is reviewed to determine the probability, frequency, and severity of a hazard incident.
- The vulnerability of Sevier County and its jurisdictions to each hazard is evaluated to estimate the likely extent of physical damages, casualties, and economic impacts.
- A range of mitigation alternatives are evaluated to identify those with the greatest potential to reduce future damages and losses in Sevier County and its jurisdictions, to protect facilities deemed critical to the community's well-being, and that are desirable from the county's political and economic perspectives.

The overall purpose of the Sevier County Multi-Hazard Mitigation Plan Update is to reduce the impacts of future disasters in Sevier County by making the county more disaster-resistant and disaster-resilient, by reducing the vulnerability to disasters and enhancing the capability to respond effectively to and recover quickly from future disasters. Completely eliminating the risk of future disasters in Sevier County is neither technologically possible nor economically feasible. However, substantially reducing the negative impacts of future disasters is achievable with the adoption of risk reduction strategies.

1.2 Scope

For the purpose of this plan, Sevier County consists of the unincorporated area of the county and four jurisdictions:

- Sevier County (Unincorporated Area)
- City of Gatlinburg
- City of Pigeon Forge
- Town of Pittman Center
- City of Sevierville

This plan covers the aforementioned county and jurisdictions. This plan will identify cost effective and environmentally sound mitigation strategies that will reduce or eliminate long-term risk to human life and property from the identified hazards. Implementation of this plan can reduce the enormous cost of disasters to property owners and all levels of government. Mitigation strategies often include protecting critical community facilities, reducing exposure to liability, and minimizing community disruption. Land

development planning, adoption of building codes, elevation of homes, and acquisition and relocation of homes away from floodplains are just a few examples of mitigation strategies.

1.3 Jurisdiction Profiles

1.3.1 Sevier County Profile

Sevier County covers 598 square miles and is located in eastern Tennessee along the Tennessee-North Carolina border. The southern portion of Sevier County is located within the Great Smoky Mountains which is a part of the Great Smoky Mountains National Park. The northern parts of the county are located within the Ridge and Valley Appalachians which is a physiographic region of the larger Appalachian division. Sevier County is bordered by Jefferson County to the north; Cocke County to the east; Haywood County, North Carolina to the southeast; Swain County, North Carolina to the south; Blount County to the west; and Knox County to the northwest. Sevier County also contains parts of the Appalachian Trail, Foothills Parkway, and Great Smoky Mountains National Park which are national protected areas.

Sevier County is drained primarily by the French Broad River, which passes through the northern part of Sevier County. A portion of the French Broad is part of Douglas Lake, an artificial reservoir created by Douglas Dam in the northeastern part of the county. The three forks of the Little Pigeon River (East, Middle, and West) flow northward from the Great Smoky Mountains, converge near Sevierville, and empty into the French Broad north of Sevierville. The West Fork is the best known, as it flows through the popular tourist areas of Gatlinburg and Pigeon Forge.

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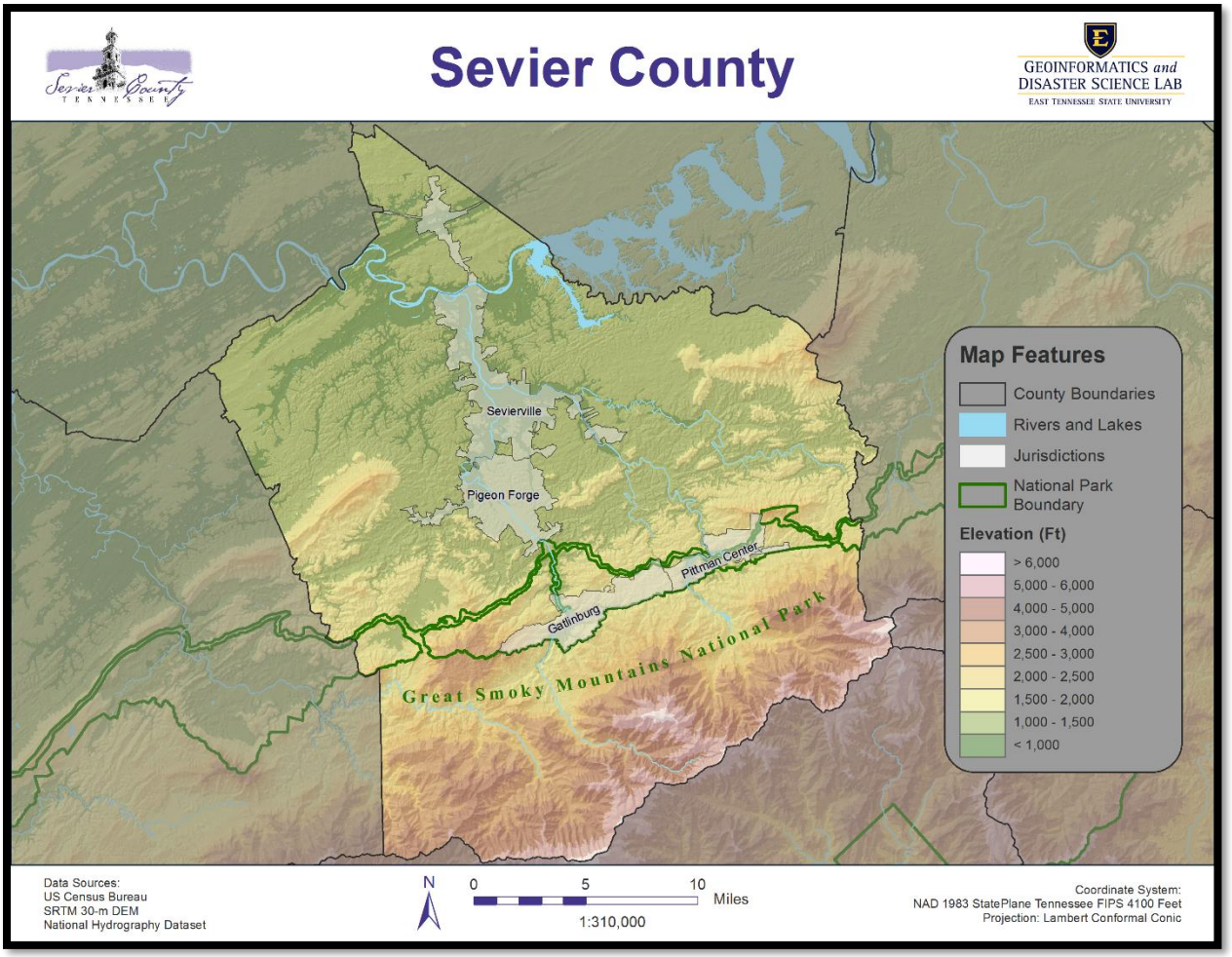

Figure 1-1: Sevier County and Jurisdictions within the County.

1.3.2 City of Gatlinburg

Gatlinburg has a total area of 10.1 square miles. It is surrounded on all sides by high ridges, with the LeConte and Sugarland Mountain massifs rising to the south, Cove Mountain to the west, Big Ridge to the northeast, and Grapeyard Ridge to the east. The main watershed is the West Fork of the Little Pigeon River, which flows from its source on the slopes of Mount Collins to its junction with the Little Pigeon at Sevierville.

U.S. Route 441 is the main traffic artery in Gatlinburg, running through the center of town from north to south. Pigeon Forge is approximately 6 miles to the north, and Great Smoky Mountains National Park is approximately 2 miles to the south. TN-73 (Little River Road) forks off from 441 in the Sugarlands and heads west for roughly 25 miles, connecting the Gatlinburg area with Townsend and Blount County. U.S. Route 321 enters Gatlinburg from Pigeon Forge and Wears Valley to the north before turning east and connecting the city to Newport and Cosby.

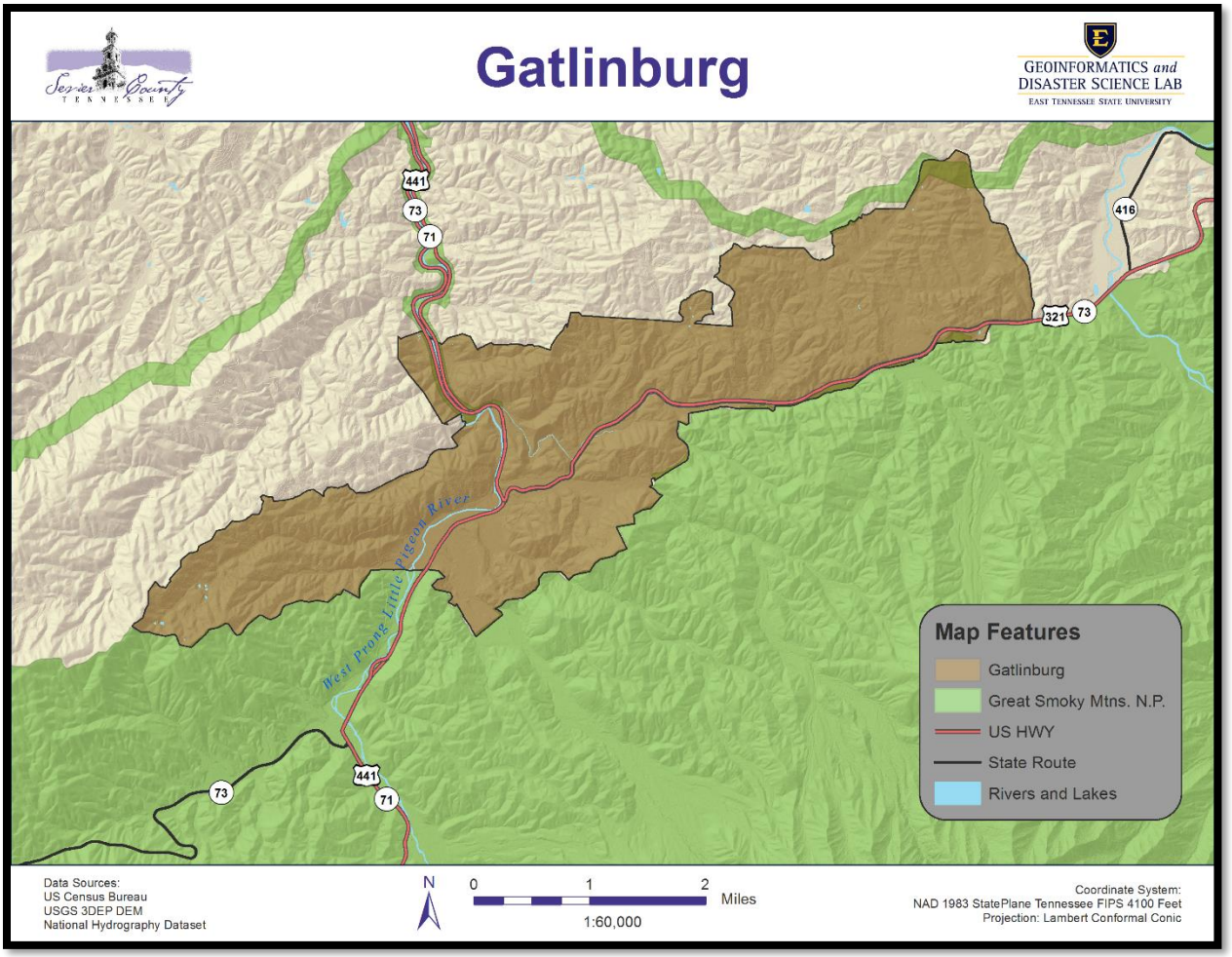

Figure 1-2: City of Gatlinburg Location.

1.3.3 City of Pigeon Forge

Pigeon Forge is located on the West Fork of the Little Pigeon River. The city has a total area of 11.6 square miles, and is located approximately 5 miles north of the Great Smoky Mountains National Park. The West Fork of the Little Pigeon River flows north from its source high on the slopes of Mount Collins through Sevier County before linking up with the Middle Fork in Sevierville. Pigeon Forge occupies a narrow valley along this river between Sevierville and Gatlinburg. High ridges surround Pigeon Forge on three sides, with Pine Mountain to the west, Shields Mountain to the east, and Cove Mountain to the south. A bend in the Little Pigeon provides the city's northern border with Sevierville, and a narrow gorge cut by the river between Cove Mountain and Shields Mountain acts as the city's buffer with Gatlinburg.

U.S. Route 441, known as "The Parkway", runs through the middle of Pigeon Forge en route to Gatlinburg and the Great Smoky Mountains National Park, where it crests at Newfound Gap before descending to Cherokee, North Carolina. The strip along 441 contains most of Pigeon Forge's tourist attractions. U.S. Route 321 (known as Wears Valley Road in Pigeon Forge) connects the town with Wears Valley and Townsend to the west. Upper Middle Creek Road (a section of which is called Dollywood Lane) connects Pigeon Forge with Dollywood and the rural areas of eastern Sevier County.

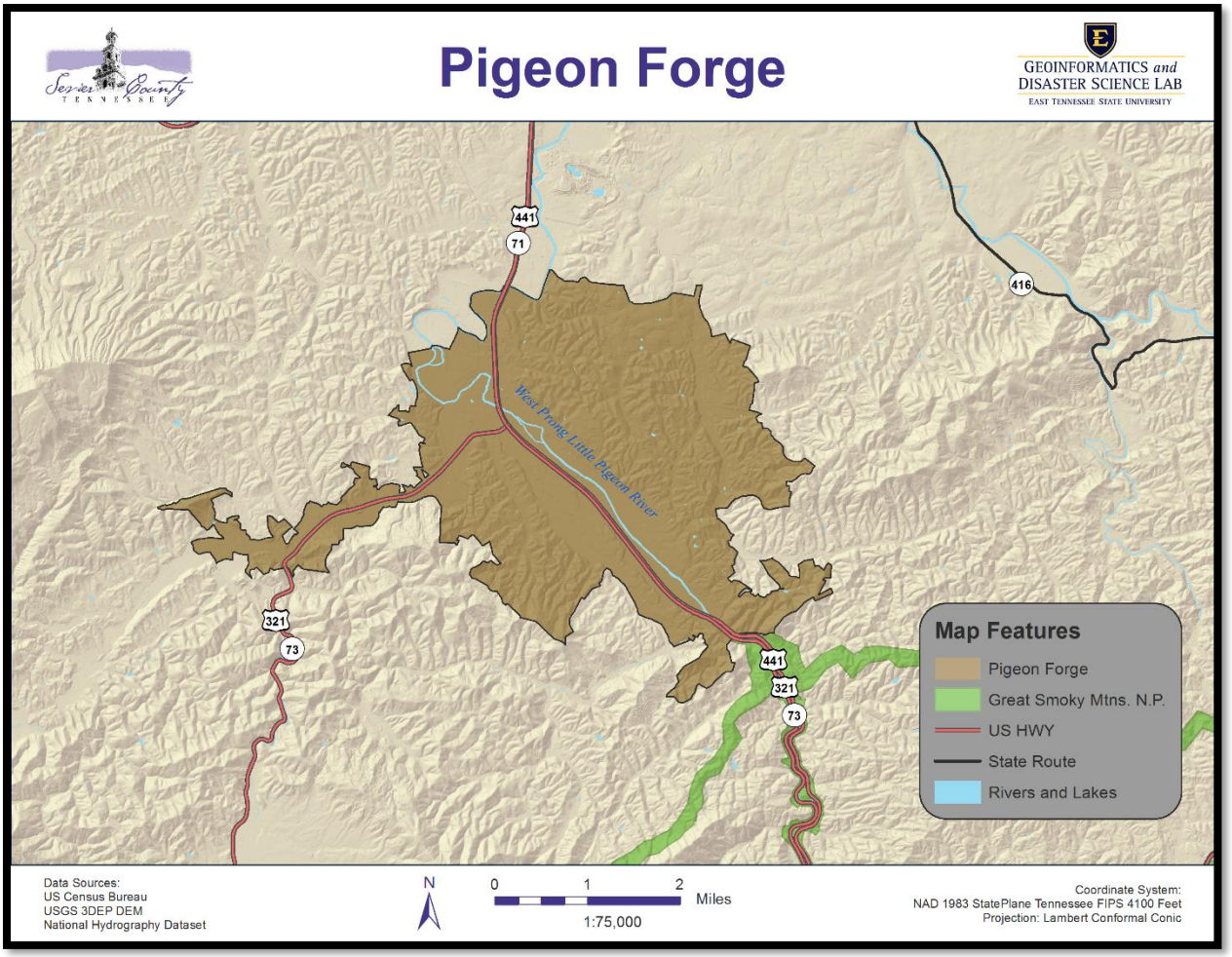

Figure 1-3: City of Pigeon Forge Location.

1.3.4 Town of Pittman Center

Pittman Center is situated in Emerts Cove, a broad valley along the Middle Fork of the Little Pigeon River. The Great Smoky Mountains National Park borders Pittman Center to the south, and the town's history and economy are largely intertwined with that of the Smokies. It is also the birthplace of entertainer Dolly Parton, who was born in a one-room cabin on the banks of the Little Pigeon River.

Pittman Center has a total area of 6 square miles and spans most of Emerts Cove, which is located just north of the Greenbrier section of the Smokies. The cove cuts into Webb Mountain, a low ridge that runs roughly parallel to the national park boundary. The main section of Pittman Center, which includes its city hall and maintenance buildings, an elementary school, and Burnett Memorial Chapel, is situated just above the confluence of Webb Creek and the Middle Fork of the Little Pigeon at the northern tip of the cove. Tennessee Route 416, which connects U.S. Route 321 at the park border with U.S. Route 411 in Sevierville, is Pittman Center's main road. Pittman Center's road signs are distinguished by gold lettering on an olive green background.

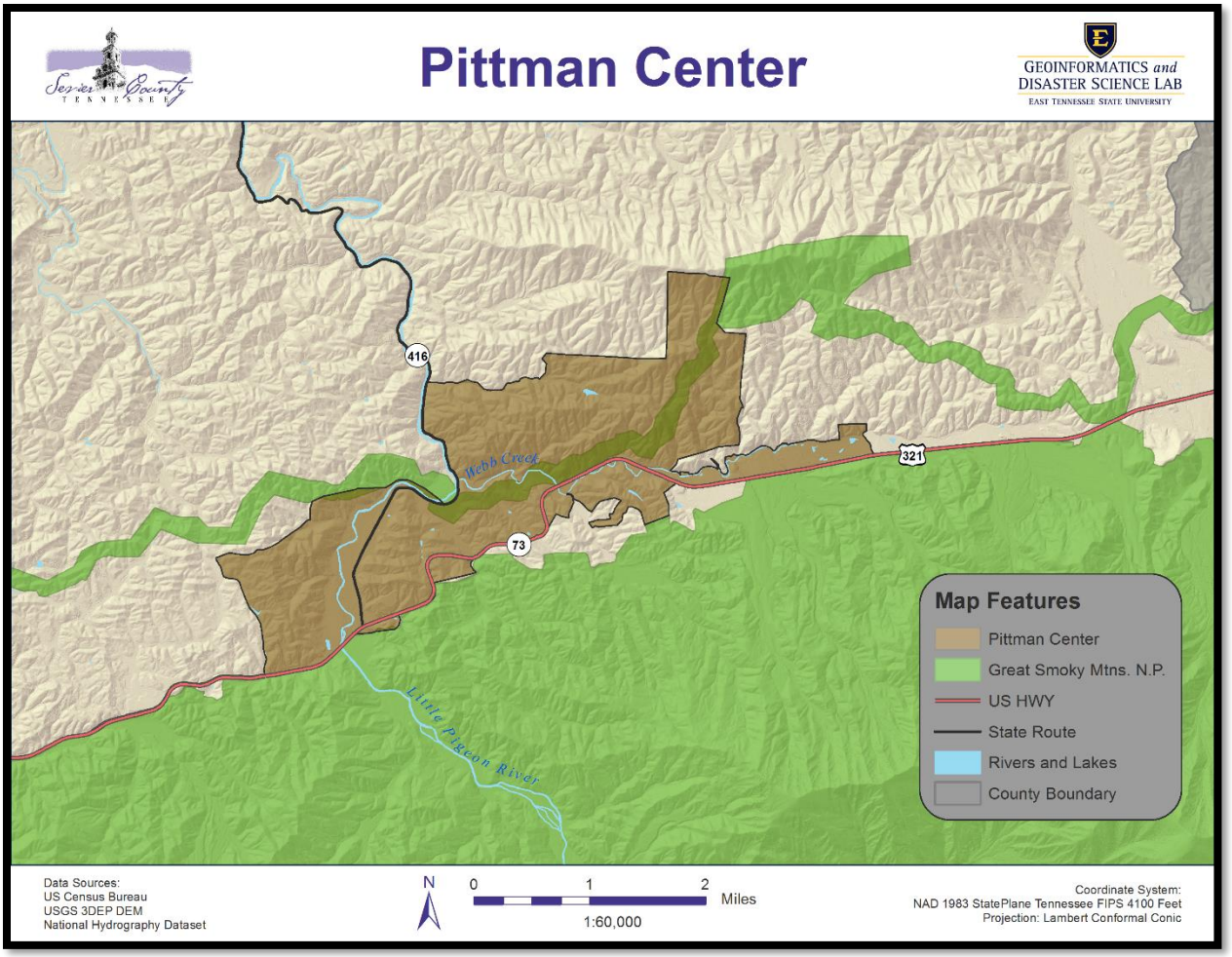

Figure 1-4: Town of Pittman Center Location.

1.3.5 City of Sevierville

Sevierville has a total area of 24.24 square miles, and serves as the county seat of Sevier County. In the town's eastern section, the Little Pigeon River is formed by the confluence of its East Fork and Middle Fork, both of which flow down from their sources high in the Great Smoky Mountains. Five miles downstream to the west, the Little Pigeon absorbs its West Fork before turning north and flowing for another five miles to its mouth along the French Broad River. Sevierville is centered on the stretch of land between these two junctions of the East and Middle Fork and the West Fork, known traditionally as Forks-of-the-Pigeon or Forks-of-the-River.

Situated in an area where the Foothills of the Great Smoky Mountains give way to the Tennessee Valley, Sevierville has long acted as a nexus between Knoxville to the northwest and the Appalachian towns in the mountains to the south. Great Smoky Mountains National Park is located approximately ten miles south of Sevierville. Several major state and federal highways intersect in Sevierville. U.S. Route 441, commonly called "The Parkway," connects Sevierville with Knoxville to the northwest and the national park and Cherokee, North Carolina, to the south. The Sevierville section of U.S. 441 has been named "Forks-of-the-River Parkway." State Route 66, also called Winfield Dunn Parkway, connects Sevierville

with Interstate 40 to the north. U.S. Route 411 traverses Sevierville from east to west, connecting Sevierville with Blount and Cocke counties. State Route 416 connects Sevierville with Pittman Center and U.S. Route 321 at the park boundary to the southeast.

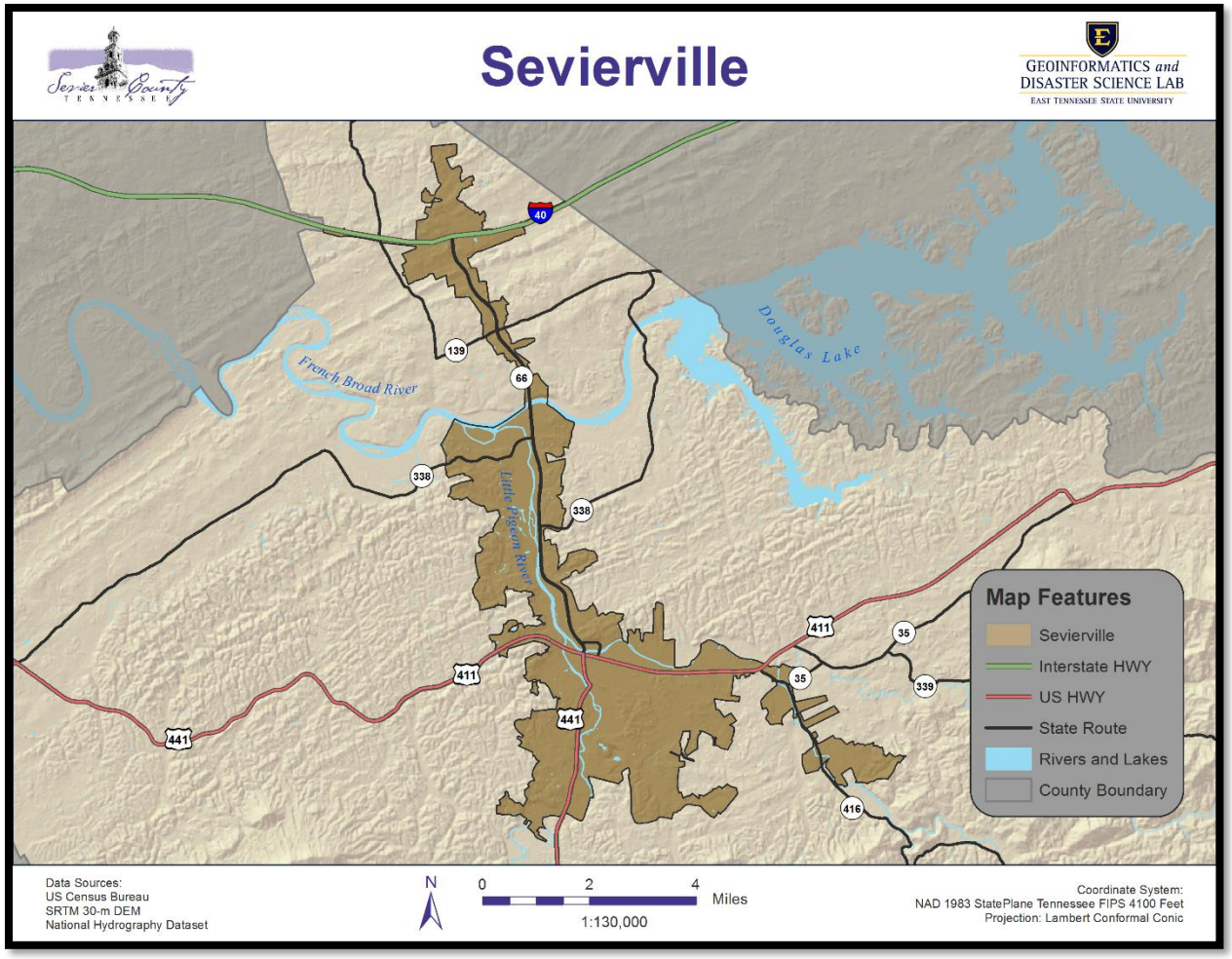

Figure 1-5: City of Sevierville Location.

1.4 Climate

Sevier County contains two distinct climatic zones, based mainly on elevation change within the county. These two zones are described by the Köppen climate classifications Cfa (Humid Subtropical) and Cfb (Oceanic/Highland). The Cfa climate class, which covers the lower elevation areas of the county, is a mid-latitude climate; which is defined as having the temperature of the warmest month greater than or equal to 10˚C (50˚F) and the temperature of the coldest month between -3˚C and 18˚C (26.6˚F to 64.4˚F), precipitation distributed throughout the year, and a hot summer, defined as the average temperature of the warmest month greater than or equal to 22˚C (71.6˚F). The Cfb climate class has the same characteristics as Cfa, except the temperature of the warmest month is less than or equal to 22˚C (71.6˚F), in Sevier County this condition is met for locations generally at or above 4,000 feet in elevation.

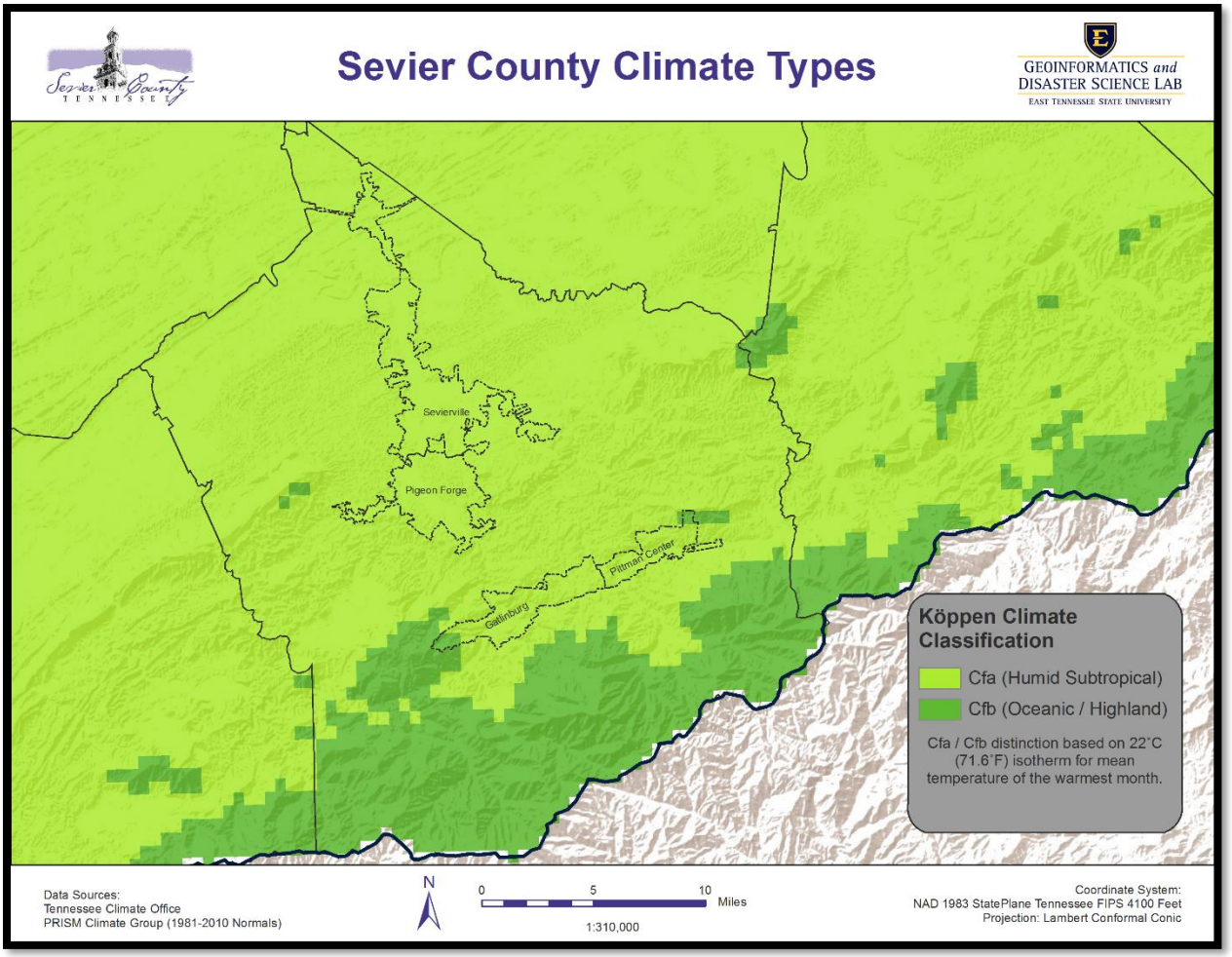

Figure 1-6: Köppen Climate Classifications for Sevier County.

Average precipitation across the county is highly dependent on elevation, and ranges from about 45 inches per year in the northern portion of the county, to as much as 85 inches in the highest elevations of the south-central area of the county.

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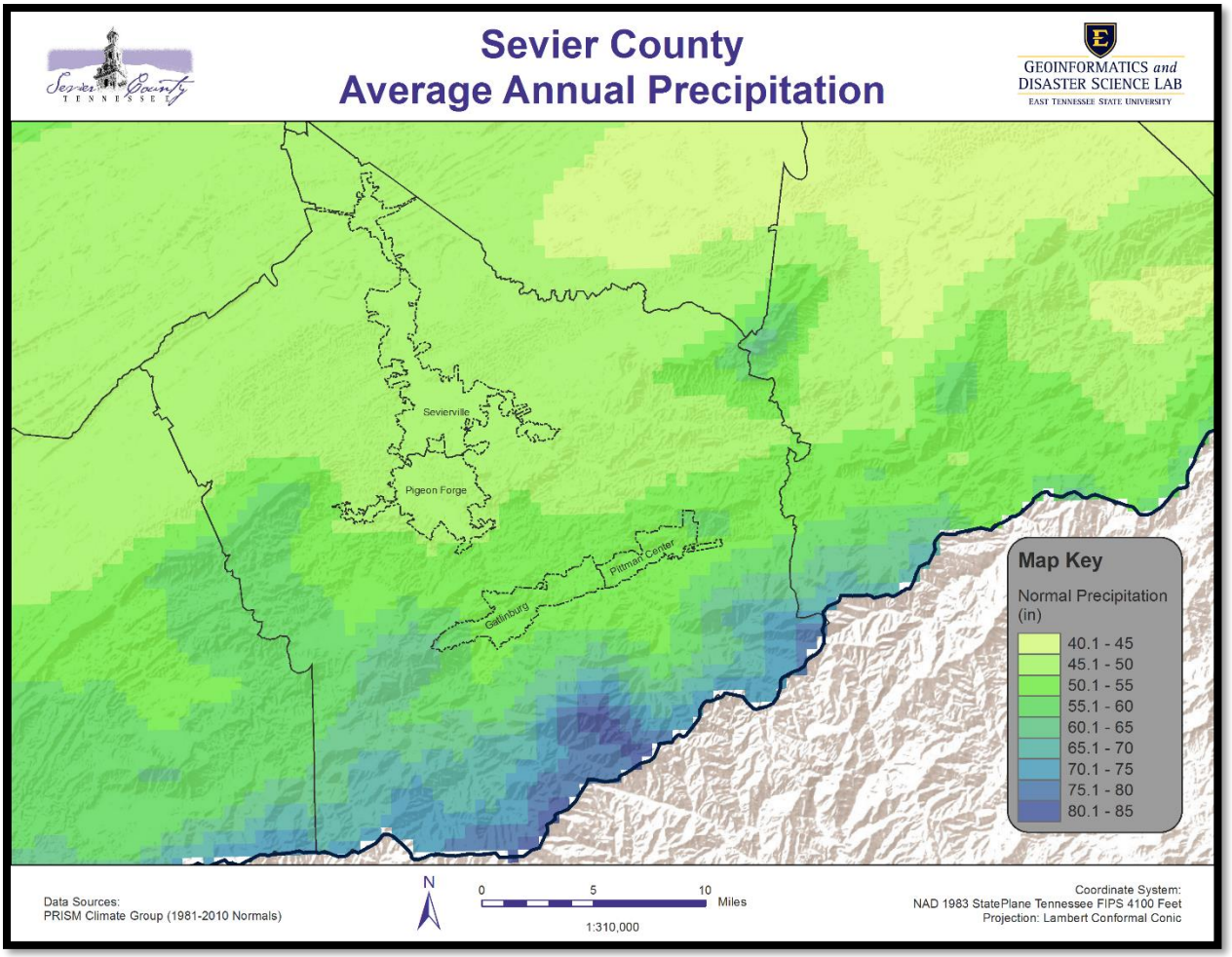

Figure 1-7: Sevier County Average Annual Precipitation.

Temperatures across the county are highly dependent on elevation, with mean annual temperatures ranging from 58˚F in the northern portion of the county to 46˚F in the high elevations in the southern sections of the county.

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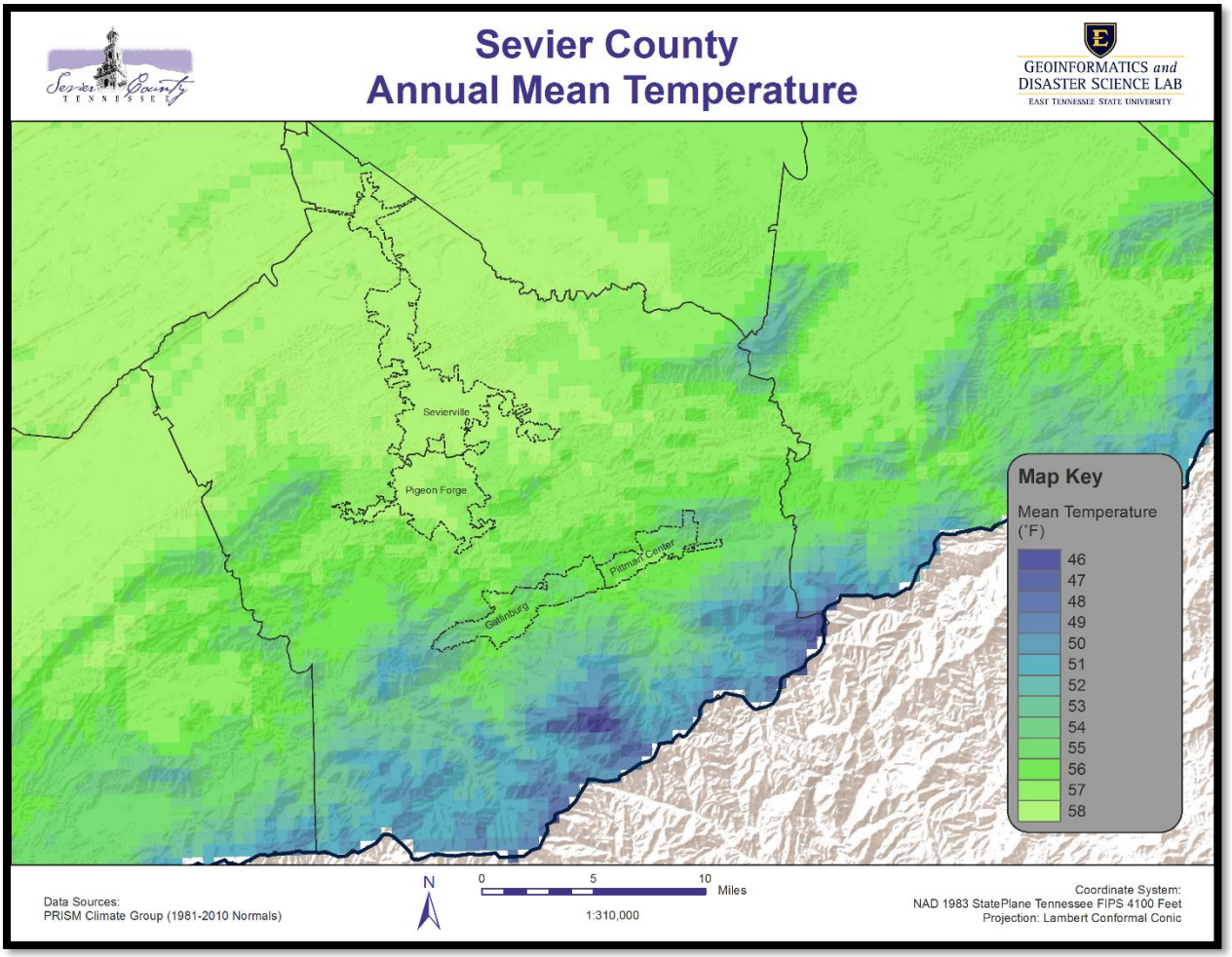

Figure 1-8: Sevier County Annual Mean Temperature.

The climograph (Figure 1-9) was developed from the 1981-2010 monthly climate normals for the Sevierville, TN USC00408179 weather station located at 35.9296° N 83.5983° W and an elevation of 899-feet. The Sevierville weather station averages 45.08 inches of rain and 4.8 inches of snow per year. It has an annual average temperature of 58˚F, but exhibits a large annual temperature range with an average of 40.6 days with a temperature at or above 90˚F and an average of 94.4 days with temperature below 32˚F each year.

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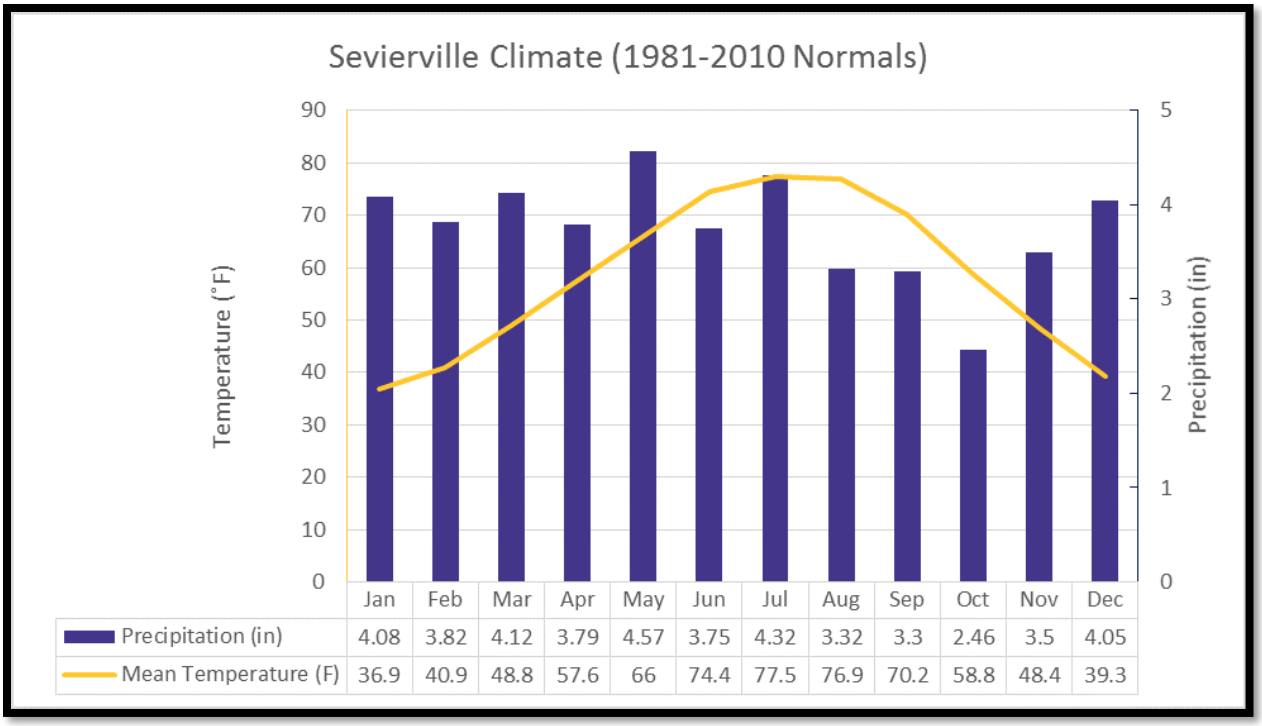

Figure 1-9: Sevier County Climograph 1981 - 2010.

1.5 Economy and Development

1.5.1 Socioeconomics

In 2017, the most common employment sectors for residents of Sevier County are (1) accommodation and food services, (2) retail trade, and (3) health care and social assistance. These three sectors represented approximately 43% of the county's total employment of 45,945 in 2017. The following table provides a summary of the overall economy based upon employment.

Table 1-1: Sevier County Top 10 Employment Industries.
(Source: U.S. Census Bureau)

Industry	Number	Percentage
Accommodation & Food Service	9,213	20.1%
Retail Trade	6,782	14.8%
Health Care & Social Assistance	3,570	7.8%
Construction	3,402	7.4%
Manufacturing	3,252	7.1%
Arts, Entertainment, & Recreation	3,209	7.0%
Educational Services	2,636	5.7%
Administrative & Support & Waste Management Services	2,421	5.3%
Public Administration	1,648	3.6%
Professional, Scientific, & Technical Services	1,622	3.5%

1.5.2 Economy

As of 2017, Households in Sevier County have a median annual income of $44,473 which is less than the median annual income of $60,336 across the entire United States. This is in comparison to a median income of $42,586 in 2016, which represents a 4.43% annual growth. Economic business data for Sevier County (2016) is shown in the following table.

Table 1-2: 2016 Sevier County Business Patterns.
(Source: U.S. Census Bureau)

Industry Code	Industry Code Description	Number of Establishments	Paid Employees	Annual Payroll ($1000)
00	Total for all sectors	2,748	39,789	1,090,727
11	Agriculture, forestry, fishing, and hunting	2	0 to 19	Withheld
21	Mining, quarrying, and oil and gas extraction	3	20 to 99	Withheld
22	Utilities	2	20 to 99	Withheld
23	Construction	170	1,239	49,917
31-33	Manufacturing	96	1,602	68,701
42	Wholesale trade	39	355	17,704
44-45	Retail trade	704	8,728	192,117
48-49	Transportation and warehousing	29	288	10,708
51	Information	28	241	11,405
52	Finance and insurance	128	910	45,080
53	Real estate and rental and leasing	168	1,505	49,222
54	Professional, scientific, and technical services	149	777	36,353
55	Management of companies and enterprises	13	121	8,495
56	Administrative and support and waste management and remediation services	121	1,447	40,966
61	Educational services	11	185	4,391
62	Health care and social assistance	165	2,523	86,713
71	Arts, entertainment, and recreation	122	4,637	113,465
72	Accommodation and food services	573	13,879	316,775
81	Other services (except public administration)	222	1,286	35,829
99	Industries not classified	3	0 to 19	Withheld

1.5.3 Development

Sevier County has experienced significant growth from 2000 to 2017. The county's population increased by 26.3% from 2000 to 2010, which equated to an annual growth rate of approximately 2.6%. The population continued to increase from 2010 to 2017 by 6.3%, which equated to an annual growth rate of 0.9%. Gatlinburg, Pigeon Forge, Pittman Center, and Sevierville all experienced a population increase during the 2000 to 2010 period. Sevierville experienced the largest increase in population during this time with an annual growth rate of 2.6%, followed by Gatlinburg at 1.7%, Pigeon Forge at 1.6%, and Pittman

Center at 0.5%. Population continued to increase from 2010 to 2017, but at a slightly slower pace. Pittman Center experienced the largest increase in population during this time with an annual growth rate of 13.3%, followed by Sevierville at 10.7%, Pigeon Forge at 6.2%, and Gatlinburg at 4.6%.

Table 1-3: Population Growth and Growth Rates in Sevier County.

Total Population	Sevier County (Total)	Gatlinburg	Pigeon Forge	Pittman Center	Sevierville
Census 2000	71,170	3,382	5,083	477	11,757
Census 2010	89,889	3,944	5,875	502	14,807
July 1, 2017	95,523	4,126	6,238	569	16,387
Population Growth 2000 - 2010	26.3%	16.6%	15.6%	5.2%	25.9%
Average Annual Growth Rate 2000 - 2010	2.6%	1.7%	1.6%	0.5%	2.6%
Population Growth 2010 - 2017	6.3%	4.6%	6.2%	13.3%	10.7%
Average Annual Growth Rate 2010 - 2017	0.90%	0.66%	0.88%	1.91%	1.52%

Sevier County also experienced a significant rise in housing units from 2000 to 2010. Total housing units went from 37,252 in 2000 to 55,918 in 2010. This equated to an overall increase of 50.1% during the 10-year period with Pigeon Forge experiencing the largest growth with an annual growth rate of 8.5%, followed by Pittman Center at 6.9%, Gatlinburg at 4.6%, and Sevierville at 3.4%. Housing development slowed slightly from 2010 to 2017 with two jurisdictions (Pittman Center and Sevierville) experiencing a loss in housing units. Both Pigeon Forge (1.5% annual growth rate) and Gatlinburg (3.1% annual growth rate) experienced an increase in housing units during this 7-year period.

Table 1-4: Housing Growth and Housing Growth Rates in Sevier County.

Total Housing	Sevier County (Total)	Gatlinburg	Pigeon Forge	Pittman Center	Sevierville
Census 2000	37,252	3,993	2,799	321	5,787
Census 2010	55,918	5,825	5,187	544	7,764
July 1, 2017	56,894	6,007	5,714	510	7,574
Housing Growth 2000 - 2010	50.1%	45.9%	85.3%	69.5%	34.2%
Average Annual Growth Rate 2000 - 2010	5.0%	4.6%	8.5%	6.9%	3.4%
Housing Growth 2010 - 2017	1.7%	3.1%	10.2%	-6.3%	-2.4%

Total Housing	Sevier County (Total)	Gatlinburg	Pigeon Forge	Pittman Center	Sevierville
Average Annual Growth Rate 2010 - 2017	0.2%	0.4%	1.5%	-0.9%	-0.3%

1.5.4 Inventory of Assets

As part of the risk assessment, the planning team identified the building assets of the county and each jurisdiction. Total replacement cost was calculated for seven occupancy categories: agricultural, commercial, government, industrial, religion, residential, and education. Within the entire planning area, there is an estimated value of $11,616,622,000 in structures. The table below provides the total replacement value for the structures by occupancy.

Table 1-5: Estimated Replacement Cost of All Structures by Occupancy.
(Source: HAZUS - 2016)

Occupancy	Sevier County (Unincorporated)	Gatlinburg	Pigeon Forge	Pittman Center	Sevierville
Agricultural	$11,072,000	$14,517,000	$1,021,000	$457,000	$4,574,000
Commercial	$407,205,000	$293,097,000	$315,926,000	$9,949,000	$548,354,000
Government	$17,059,000	$882,000	$6,236,000	$1,473,000	$22,256,000
Industrial	$133,525,000	$15,556,000	$38,858,000	$907,000	$144,409,000
Religion	$102,908,000	$18,598,000	$22,596,000	$404,000	$57,342,000
Residential	$6,006,173,000	$1,165,192,000	$952,045,000	$107,452,000	$1,101,300,000
Education	$60,135,000	$5,936,000	$10,319,000	$1,145,000	$17,744,000
Total	**$6,738,077,000**	**$1,513,778,000**	**$1,347,001,000**	**$121,787,000**	**$1,895,979,000**

1.6 Zoning and Land Use

Sevier County has extensive zoning regulations, which address use and height of buildings, density of population, open space limitation, and lot and occupancy requirements. The purpose of the zoning resolution is to promote the health, safety, convenience, order, prosperity, and welfare, of both the present and future residents of Sevier County. For this purpose, zoning regulations are implemented for a less congested and more efficient transportation system, safety from fire, and adequate light and air for buildings, structures, and their inhabitants. The zoning resolution addresses many different types of areas in the county ranging from urban, suburban, and industrial.

The Sevier County Land Use table and map are provided below. Residential, commercial, and industrial areas account for only 11% of the county's land use. Forest land at 270,248 acres is the largest category of land use in the county accounting for 70.6% of total land. The county also consists of water areas (0.6%) and wetlands (0.1%).

Table 1-6: Sevier County Land Use Table.

Land Use	Acres	Percentage	2011 to 2016 Change
Agricultural Land, Cropland, and Pasture	67,519	17.6%	-0.309%
Wetlands	413	0.1%	+0.003%
Forest Land (not including forested wetlands)	270,248	70.6%	+0.222%
Urban/Development	42,116	11.0%	+0.110%
Water	2,424	0.6%	-0.026%

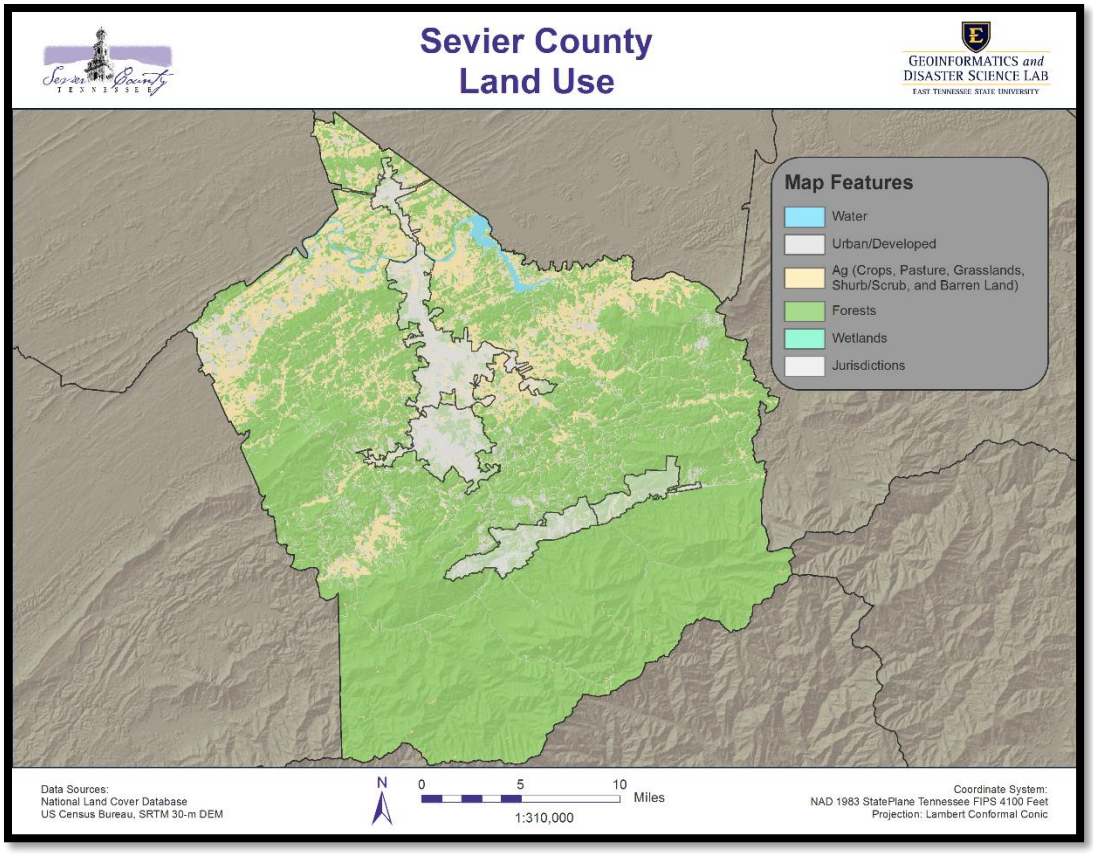

Figure 1-10: Sevier County Land Use Land Classification Map.

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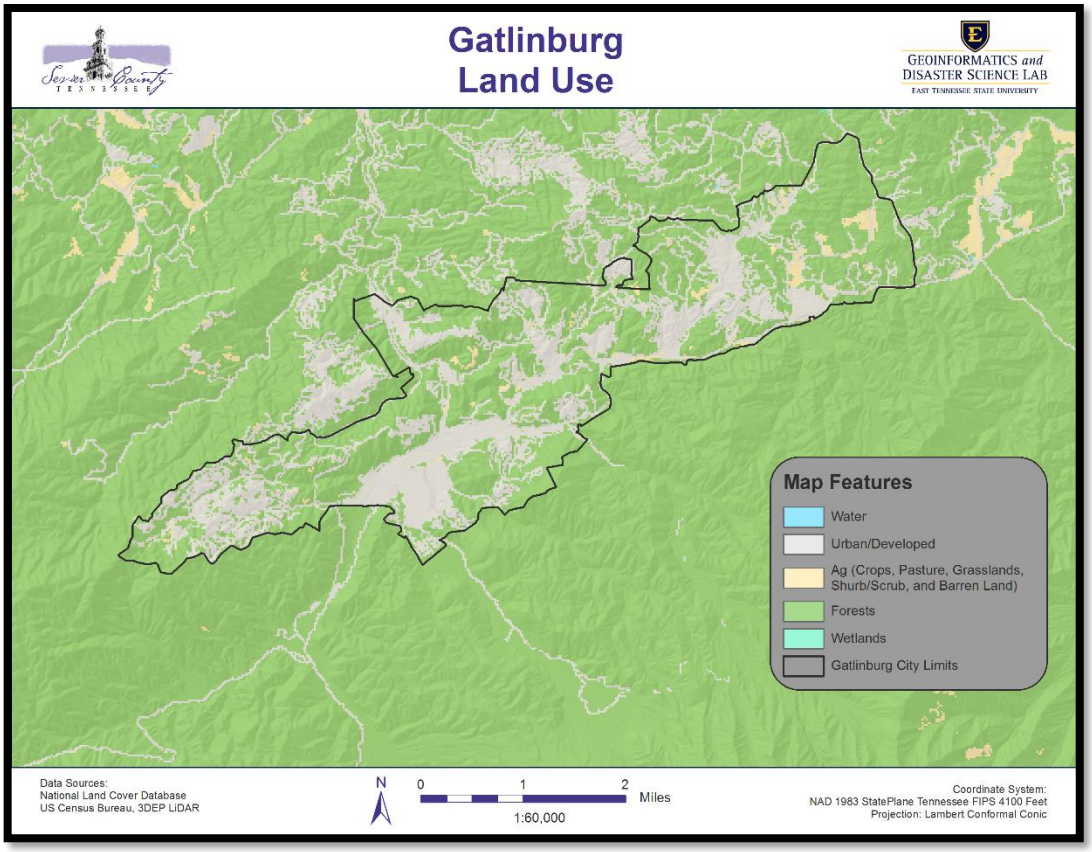

Figure 1-11: City of Gatlinburg Land Use Land Classification Map.

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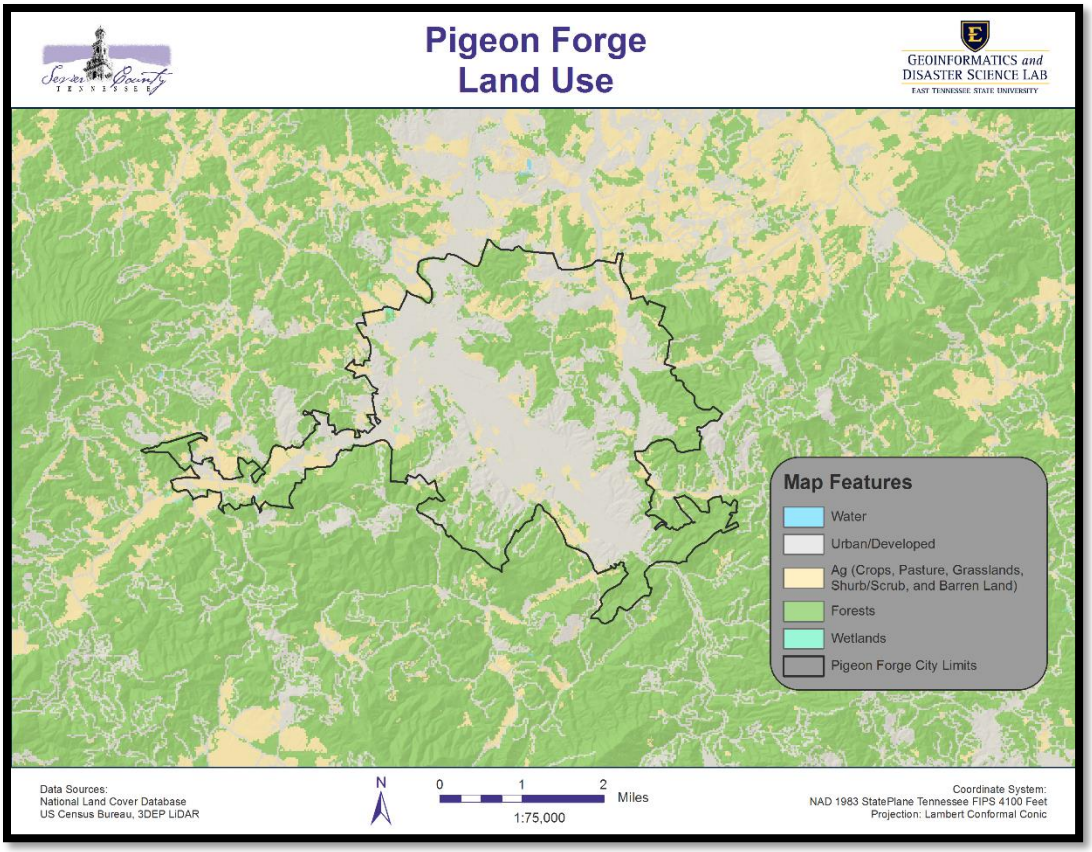

Figure 1-12: City of Pigeon Forge Land Use Land Classification Map.

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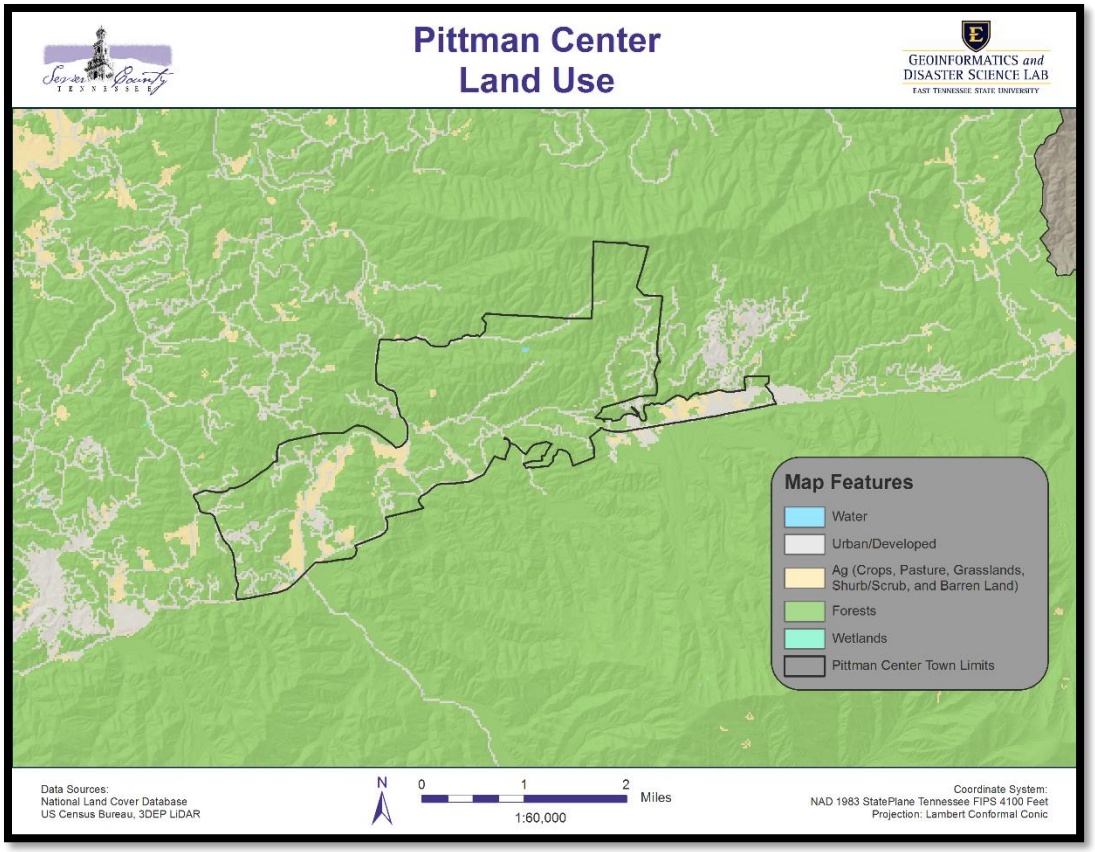

Figure 1-13: Town of Pittman Center Land Use Land Classification Map.

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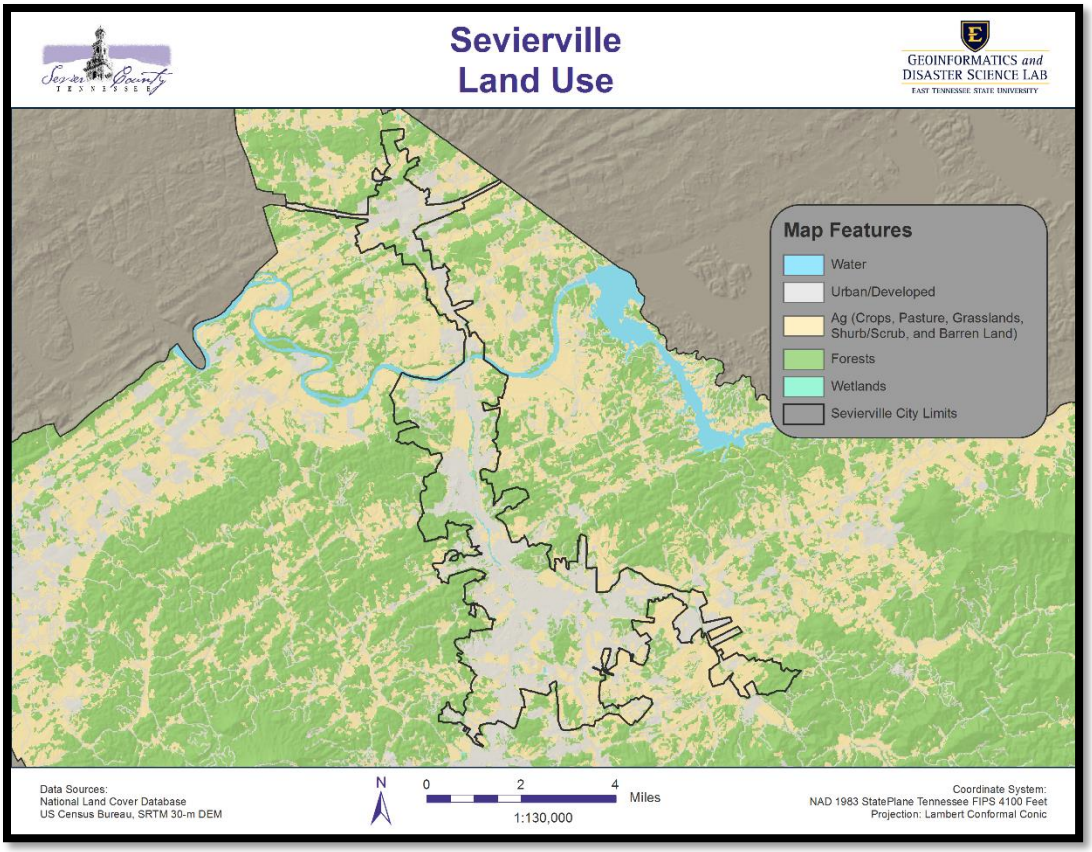

Figure 1-14: City of Sevierville Land Use Land Classification Map.

1.7 2020 Plan Update

The 2020 plan update proceeds with the three previous goals of the 2011 Sevier County Hazard Mitigation plan with two additional goals. The updated goals are as follows:

Goal 1: Protect the lives and health of citizens and visitors from the effects of hazards.

Goal 2: Emphasize mitigation planning to decrease vulnerability of existing and new structures.

Goal 3: Encourage public support and commitment to hazard mitigation by communicating mitigation benefits.

Goal 4: Facilitate sound building practices in the county and jurisdictions so as to reduce or eliminate the potential impact of hazards.

Goal 5: Improve the ability of the county and jurisdictions to rapidly recover and restore facilities and services to the public.

The plan update makes a number of textual changes throughout, but the most obvious changes are structural. First, all of the sections were updated to reflect the most current information and the most current vision of the plan update. Second, instead of four sections, the plan update has eleven sections.

The most significant changes are 1) newly developed hazard profiles, 2) updated risk assessments, 3) stand-alone sections for each jurisdiction for easy reference, 4) a new, comprehensive list of mitigation strategies. The 2020 plan update is organized as follows:

- Section 1: Introduction
- Section 2: Planning Process
- Section 3: Community Lifelines and Critical Infrastructure
- Section 4: Hazard Profiles
- Section 5: Sevier County – Unincorporated Area (Risk Assessment, Vulnerability Assessment, Capability Assessment, and Summary)
- Section 6: Gatlinburg (Risk Assessment, Vulnerability Assessment, Capability Assessment, and Summary)
- Section 7: Pigeon Forge (Risk Assessment, Vulnerability Assessment, Capability Assessment, and Summary)
- Section 8: Pittman Center (Risk Assessment, Vulnerability Assessment, Capability Assessment, and Summary)
- Section 9: Sevierville (Risk Assessment, Vulnerability Assessment, Capability Assessment, and Summary)
- Section 10: Mitigation Strategies
- Section 11: Plan Maintenance

Table 1-7: Plan Change Crosswalk.

2011 Plan	Revised Plan (2020)
Section 1: Planning Process	Section 1: Introduction
Section 2: Risk Assessment	Section 2: Planning Process
Section 3: Mitigation Strategy	Section 3: Community Lifelines and Critical Infrastructure
Section 4: Plan Maintenance	Section 4: Hazard Profiles
	Section 5: Sevier County – Unincorporated Area*
	Section 6: Gatlinburg*
	Section 7: Pigeon Forge*
	Section 8: Pittman Center*
	Section 9: Sevierville*
	Section 10: Mitigation Strategies
	Section 11: Plan Maintenance

*Sections contain Risk Assessment, Vulnerability Assessment, Capability Assessment, and Summary.

2. Planning Process

The Sevier County Multi-Jurisdiction Hazard Mitigation Plan Update follows DMA 2000 planning requirements and FEMA guidance. The guidance is structured into four phases:

1. Organize resources for the effort to involve stakeholders and the public;
2. Assess the hazards and risks exposure for each jurisdiction;
3. Develop mitigation strategies and goals including measures to achieve them;
4. Evaluate the Plan by adopting, implementing, and revising the Plan regularly.

2.1 What is Hazard Mitigation?

Mitigation refers to the policies and activities that will reduce the area's vulnerability to damage from future natural disasters in the long term. Generally, these measures are programs that can be put in place before a disaster occurs. There are a multitude of different types of mitigation programs that can be implemented. In general, these programs fall into two categories: structural and non-structural. Structural mitigation measures attempt to minimize the effect of hazards on people, buildings, and infrastructure. This includes actions such as building dams and levees, flood-proofing homes, constructing tornado shelters, and instituting building codes that require wind-resistant construction.

Non-structural mitigation measures typically concentrate on identifying hazard-prone areas and restricting their use. Examples include the selection of building sites, planning for at-risk populations, insurance programs, and removing populace from the path of a hazard.

2.2 Disaster Mitigation Act of 2000

The plan is designed to meet the requirements of the Federal Disaster Mitigation Act of 2000. The DMA 2000 established new hazard mitigation project funding mechanisms and new state and local planning requirements as conditions of project funding eligibility. The DMA 2000 also provides specific criteria for the preparation and adoption of an all-hazards mitigation plan. The Sevier County Multi-Jurisdiction Hazard Mitigation Plan was prepared to support the requirements of a mitigation plan for Sevier County and its jurisdictions as defined in the scope. DMA requirements specify that the following elements must be included in the plan:

- Adoption by the local governing body. The plan must include documentation that the local governing body has formally adopted the plan.
- All local units represented in the plan must participate in the planning process.
- The plan must document how the plan was prepared and who was involved in the planning process.
- A risk assessment section should include:
    - Identification of the hazards likely to affect the planning area, noting data limitations and providing an explanation for eliminating hazards from further consideration.
    - A discussion of past incidents and description of their severity and resulting effects.
    - A description of the vulnerability in terms of land use and development so that mitigation options can be considered in future land-use decisions.
- The plan must include a hazard mitigation strategy describing:
    - Goals to reduce or avoid long-term vulnerabilities to the identified hazards.

- A range of specific mitigation actions and projects to be considered, with particular emphasis on new and existing buildings and infrastructure.
- An action plan identifying how the actions will be prioritized, implemented, and administered by the local jurisdiction.
- Emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.
- Provisions for reviewing, monitoring, and evaluating progress of the plan's implementation. The plan must also be updated at least every five years and re-approved.

2.3 Parts of the Plan

The plan is divided into eleven parts to address FEMA requirements for a local hazard mitigation plan. The eleven parts are:

- Part 1: Introduction
- Part 2: Planning Process
- Part 3: Community Lifelines and Critical Infrastructure
- Part 4: Hazard Profiles
- Part 5: Sevier County – Unincorporated Area ((Risk Assessment, Vulnerability Assessment, Capability Assessment, and Summary)
- Part 6: Gatlinburg (Risk Assessment, Vulnerability Assessment, Capability Assessment, and Summary)
- Part 7: Pigeon Forge (Risk Assessment, Vulnerability Assessment, Capability Assessment, and Summary)
- Part 8: Pittman Center (Risk Assessment, Vulnerability Assessment, Capability Assessment, and Summary)
- Part 9: Sevierville (Risk Assessment, Vulnerability Assessment, Capability Assessment, and Summary)
- Part 10: Mitigation Strategies
- Part 11: Plan Maintenance

2.3 Documentation of the Planning Process

A comprehensive description of the planning process informs citizens and other readers about the manner in which the plan was developed. Retention of leadership, staffing, and in-house knowledge may fluctuate over time. Therefore, the description of the planning process serves as a permanent record that explains how decisions were reached through stakeholder input. Once adopted, leaders can then continue to make decisions in a pre- and post-disaster environment to decrease vulnerability to community hazards.

2.3.1 Planning Team

The Sevier County Multi-Jurisdiction Hazard Mitigation Plan Update was prepared by the Geoinformatics and Disaster Science (GADS) Lab at East Tennessee State University under the direction of the Sevier County Emergency Management Agency; all in cooperation with major stakeholder groups representing the county and jurisdictions' interests. The Planning Team oversaw the plan development strategy and coordination of the development process for the strategy. The following tables and charts provide an

overview of the Planning Team comprised of GADS Lab personnel, county employees, and jurisdiction representatives.

Table 2-1: Sevier County Hazard Mitigation Planning Team – GADS Lab Representatives.

Name	Title
T. Andrew Joyner	Director
Andrew Worley	Emergency Management Specialist
Joseph B. Harris	Lab Coordinator
William Tollefson	Director of Geospatial & Hazards Analysis

Table 2-2: Sevier County Hazard Mitigation Planning Team – County and Jurisdictions Representatives.

Name	Title	Department
Joe Ayers	Director	Sevier Co EMA
Mike Williams	Asst. Director	Sevier Co EMA
Stacey Whaley	Director	Sevier Co GIS
Jeff Ownby	County Planner	Sevier Co Planning
Terry Smith	Safety Director	Sevier Co Board of Education
Joe Manning	Chief	Sevierville PD
Gary Waldroup	Asst. Chief	Gatlinburg PD
Matt Henderson	Chief	Sevierville FD
Donnie Shular	Emergency Manager	Sevierville FD
David Ball	City Planner	City of Gatlinburg
Jackie Leatherwood		Greystone Lodge
Wayne Brandenburg	Asst. Chief	Gatlinburg FD
Steve Ebb	EMA Tech	Sevier Co
Donnie Adams	Operations Manager	Sevier Co Highway Dept
Jeff Hedrick	Director of Engineering and Operations	Sevier Co Electric System
Dustin Smith	City Planner	City of Sevierville
David Taylor	City Planner	City of Pigeon Forge
Dough Sawyer	Inspector	Sevier Co Highway Dept
Doyle Clabo	Director	Sevier Co Stormwater
Michael Borders	City Administrator	Towne of Pittman Center
Tony Watson	Chief	Pigeon Forge FD
Jared St. Claire	District Chief	Great Smoky Mountain National Park
David Puckett	Fire Administrator	Sevier Co
Charles Powers	Deputy Chief	City of Pigeon Forge
Chris Jenkins	Building Inspector	Sevier Co
Alan Bruhin	Sevier Co Director	UT Agriculture Extension
Karl Kries	City Planner	City of Pigeon Forge
Chris Brien	Training Officer	Gatlinburg PD

Sam Hinson	Captain	Sevierville PD
Jana Chambers	Director	Sevier Co Health Dept

The "GADS Lab" Planning Team met weekly with the first meeting occurring on March 1, 2019 to discuss the day-to-day development of the 2020 Sevier County Multi-Jurisdiction Hazard Mitigation Plan Update. The "County/Jurisdictions Representatives" Planning Team (comprised of at least one representative from each incorporated jurisdiction within Sevier County) met together at Stakeholder Meetings (described in the next section) and communicated in-person and digitally on multiple other occasions throughout the planning process. Sevier County, the City of Sevierville, Pigeon Forge, Gatlinburg, and Pittman Center equally participated in the development of the Sevier County Hazard Mitigation Plan. The planning committee was comprised of multiple disciplines from each jurisdiction as well. The "County/Jurisdictions Representative" Planning Team included private industry representatives, further increasing public participation in plan development.

2.3.2 Stakeholder Meetings

To ensure extensive stakeholder involvement, the planning team conducted events which allowed for an interactive and inclusive planning process to take place among representatives of county, jurisdictions, and other concerned organizations. Below is a brief review of each event with a detailed itinerary.

2.3.2.1 Kick-Off and Hazard Identification Meeting (June 5, 2019)

The purpose of the first meeting was to introduce stakeholders to the planning process, start a discussion on hazardous areas and incidents that have occurred in the planning area, identify hazards and threats that impact the planning area, begin the risk assessment process, and collaborate on determining data needs and availability. The meeting participants engaged in dialogue revolving around the planning process, key hazards that impact the county, and current mitigation strategies. Members also shared sources of applicable data (Geographic Information Systems (GIS) files, official reports, plans, etc.) that their respective agencies/departments maintain and made arrangements to share with the planning team for the purpose of preparing the risk assessment section of the plan. Below is a detailed itinerary of the meeting and scanned sign-in sheets:

Wednesday, June 5th

- 9:00am – Preliminary/Logistics Meeting – **Joe Ayers**
- 9:30am - Noon – Overview of Hazards Identified/Profiled & Risk Assessment Status – All **Jurisdiction Representatives** and **Identified Stakeholders**
    - This will be a presentation to provide information about hazards GADS Lab has identified to be included in the HMP. Discussion and input is encouraged.
- Lunch Break (Noon - 1:00pm)
- Meeting and Open Forums
    - Tollefson & Harris:
        - 1:00-3:00pm – Department of GIS: **Stacey Whaley**
    - Worley & Joyner:
        - 1:00-3:00pm – Open Forum (Available to discuss and expand on topics discussed in earlier presentation)

- 3:00-5:00pm – Sevier County Overview: **Joe Ayers, EMA Staff, and Others**
    - Very flexible, but we would like to use this time to become more familiar with the county and specific building/facilities that are unique to the county. We would also like to discuss known problem areas/structures (e.g., repetitive flooding, damaged areas from previous storms/incidences, etc.) and high (vulnerable) population facilities (e.g., daycare, schools, etc.).

Figure 2-1: June 5th, Sevier County Hazard Mitigation Plan Update Kick-Off and Hazard Identification Meeting.

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Sevier County Emergency Management
Agency
321 Court Avenue
Sevierville, TN 37862
(865) 453-4919

Meeting Topic: 2019 Sevier County Hazard Mitigation Planning

Date: 6/6/2019

Time: 9:00am-12:00pm **Total Meeting Hours:** 3 hours

Location: Sevier County Court House

	Name	Agency	Email Address	Contact #
1	Terry Smith	Sevier County Board of Ed	TerrySmith@Sevier.org	865-654-7954
2	Joe Manning	Sevierville P.D.	jmanning@sevierville.org	865-453-3586
3	Gary Waldroup	Gatlinburg P.D	garyW@gatlinburgTN.GOV	865-680-5594
4	Matt Henderson	Sevierville FD	MHenderson@SevierVilleTN.org	865-654-5369
5	Donnie Shular	Sevierville FD	dshular@sevierville tn.org	865-368-2635
6	Rob Taylor	TEMA	robert.L.taylor@tn.gov	865-407-5479
7	DAVID BALL	CITY OF GATLINBURG	dball@gatlinburgtn.gov	865-436-7792
8	Jackie Leatherwood	The Greystone Lodge	jleatherwood@greystonelodgetn.com	865.604.9465
9	MIKE WILLIAMS	SEVIER COUNTY EMA	MWILLIAMS@SEVIERCOUNTYTN.GOV	865-388-7114
10	Stacey Whaley	Sevier County GIS	swhaley@sevircountytn.gov	865-851-6972
11	Wayne Brandenburg	Gatlinburg Fire	wayneb@gatlinburgtn.gov	865-850-1909
12	Steven Ebb	Sevier Co. EMA	Sebb@Sevircountytn.gov	865 430 7558
13	Donnie Adams	Sevier Co Hwy	drock7684@aol.com	865 453 8093
14	JEFF HEDRICK	SEVIER CO ELECT. SYSTEM	jhedrick@sces.net	865 774-6217
15	Dustin Smith	City of Sevierville	dsmith@sevierville tn.org	865-868-0941
16	David Taylor	City of Pigeon Forge	DTaylor@cityofpigeonforgeTN.gov	865-429-7312
17	Doug Sawyer	Sevier Co. Hwy	Sdd74@gmail.com	865-429-4585
18	Doyle Clabo	Sevier Co. Stormwater	dclabo@Sevircounty.Gov	865-429-4580
19	Michael Borders	Pittman Center	mborders@pittmancentertn.gov	865-436-5499
20	Tony WATson	Pigeon forge fire Dept	TWATson@cityofPigeonforgeTN.GOV	865 257-5911
21	William Tollefson	ETSU GADS	tollefson@etsu.edu	423-439-4162
22	Andrew Worley	ETSU GADS	worleyp@etsu.edu	423-439-6114
23	Jason Harris	ETSU GADS	HARRIJ@ETSU.EDU	423-439-4162
24	Andrew Joyner	ETSU GADS	joynert@etsu.edu	423-439-4183
25	Jared St.Clair	NPS GSMNP	jared_St_Clair@NPS.gov	865-[illegible]4598
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Figure 2-2: Sevier County Hazard Mitigation Plan Update Kick-off and Hazard Identification Meeting Sign in Sheet.

2.3.2.2 Risk Assessment Overview and Mitigation Strategy Meeting (August 7, 2019)

The purpose of the second meeting was to review mitigation strategies with members of the planning team, county representatives, and representatives from each jurisdiction. The meeting participants engaged in dialogue revolving around the proposed mitigation strategies. Additionally, the current status of the Hazard Mitigation Plan Update (including Profiles, Risk Assessment, Vulnerability Assessment, and Geodatabase update) was presented to the stakeholders. Below is a detailed itinerary of the meeting and scanned sign-in sheets:

Wednesday, August 7th

- 9:00am – Introduction and Updates: Andrew Worley
- 9:10 – 9:45am – Overview of Current Risk Assessment: William Tollefson
    - Sevier County (Unincorporated)
    - Gatlinburg
    - Pigeon Forge
    - Pittman Center
    - Sevierville

  This will be a presentation to provide information about the current state of the assessment for each jurisdiction, primarily showing maps and other media developed as of August 5th – discussion input will be encouraged.

- 9:45 – 10:00am – Explanation of Enhanced Priority Risk Index (EPRI) and Vulnerability Assessment Worksheets: Andrew Joyner
- 10:00 – 10:30am – Jurisdiction-level small group discussions focused on EPRI-based vulnerability assessment scores
    - GADS staff will walk around answering questions as you develop your scores
- Break 10:30 – 10:45am
    - GADS staff will review worksheets and enter vulnerability scores into overall table during break
- 10:45 – 11:15am – Vulnerability Assessment score discussion and overview of draft risk matrix
- 11:15am – 12:15pm – Mitigation Strategies Discussion (jurisdiction-level small groups)
- 12:15 – 12:30pm – Broad full group discussion highlighting similar and/or unique strategies discussed in the small groups and final Q&A
- 12:30pm – GADS is available for post-meeting discussions

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Figure 2-3: August 7th, Sevier County Hazard Mitigation Plan Update Mitigation Strategy and Risk Assessment Overview Meeting.

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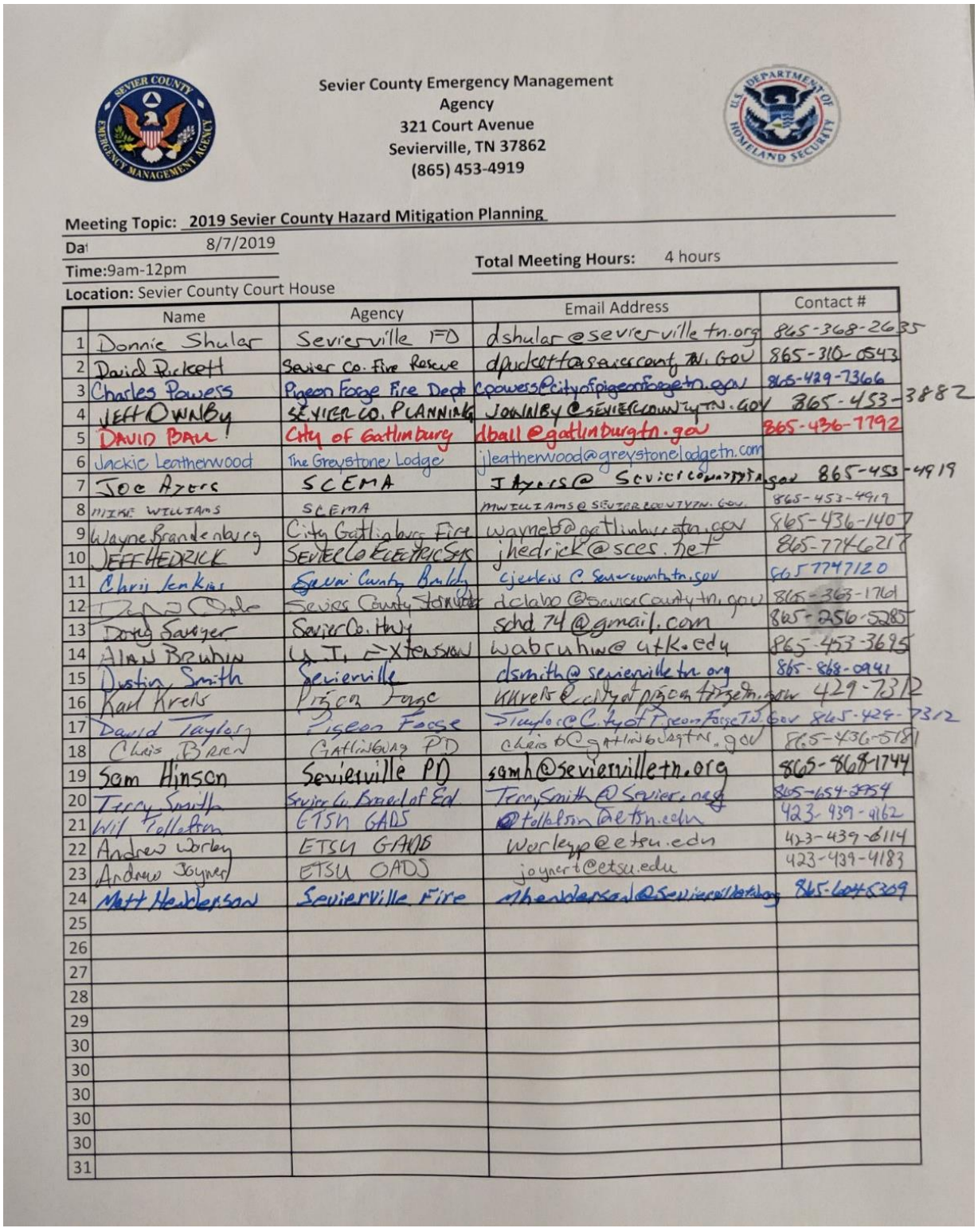

Sevier County Emergency Management Agency
321 Court Avenue
Sevierville, TN 37862
(865) 453-4919

Meeting Topic: 2019 Sevier County Hazard Mitigation Planning
Date: 8/7/2019
Time: 9am-12pm
Total Meeting Hours: 4 hours
Location: Sevier County Court House

	Name	Agency	Email Address	Contact #
1	Donnie Shular	Sevierville FD	dshular@sevierville tn.org	865-368-2635
2	David Puckett	Sevier Co. Fire Rescue	dpuckett@sevierco unty TN. GOV	865-310-0543
3	Charles Powers	Pigeon Forge Fire Dept	cpowers@cityofpigeonforge tn.gov	865-429-7366
4	JEFF OWNBY	SEVIER CO. PLANNING	JOWNBY@SEVIERCOUNTY TN.GOV	865-453-3882
5	DAVID BALL	City of Gatlinburg	dball@gatlinburgtn.gov	865-436-7792
6	Jackie Leatherwood	The Greystone Lodge	jleatherwood@greystonelodgetn.com	
7	Joe Ayers	SCEMA	JAyers@ Sevierco...gov	865-453-4919
8	MIKE WILLIAMS	SCEMA	MWILLIAMS@ SEVIERCOUNTYTN. GOV.	865-453-4919
9	Wayne Brandenburg	City Gatlinburg Fire	waynebb@gatlinburgtn.gov	865-436-1407
10	JEFF HEDRICK	SEVIER CO ELECTRIC SYS	jhedrick@sces.net	865-774-6218
11	Chris Jenkins	Sevier County Building	cjenkins C. Seviercountytn.gov	865 774 7120
12	[illegible]	Sevier County Storm Water	dclabo @SevierCounty tn.gov	865-363-1761
13	Doug Sawyer	SevierCo. Hwy	schd 74@gmail.com	865-256-5285
14	ALAN BRUBIN	U.T. Extension	wabruhin@utk.edu	865-453-3695
15	Dustin Smith	Sevierville	dsmith@sevierville tn.org	865-868-0941
16	Karl Kreis	Pigeon Forge	kkreis@cityofpigeonforge tn.gov	429-7312
17	David Taylor	Pigeon Forge	DTaylor@CityofPigeonForgeTN.Gov	865-429-7312
18	Chris Breen	GATLINBURG PD	cbreen@gatlinburgtn.gov	865-436-5181
19	Sam Hinson	Sevierville PD	samh@seviervilletn.org	865-868-1744
20	Terry Smith	Sevier Co. Board of Ed	Terry.Smith@Sevier.org	865-654-3554
21	Will Tollefson	ETSU GADS	tollefson@etsu.edu	423-439-4162
22	Andrew Worley	ETSU GADS	Worleyp@etsu.edu	423-439-6114
23	Andrew Joyner	ETSU OADS	joynert@etsu.edu	423-439-4183
24	Matt Henderson	Sevierville Fire	[illegible]	865-604-5309
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Figure 2-4: Sevier County Hazard Mitigation Plan Update Mitigation Strategy and Risk Assessment Overview Meeting Sign in Sheet.

2.3.2.3 Risk Assessment Overview and Mitigation Strategy Meeting (October 17, 2019)

The purpose of the third meeting was to discuss and finalize all mitigation strategies with members of the planning team, county representatives, and representatives from each jurisdiction. Additional mitigation strategies were proposed, along with updates to previously proposed strategies. This meeting was organized by Joe Ayers and new strategies/updates were sent to the GADS Lab team for inclusion in the Plan. Below is a scanned sign-in sheet:

Sevier County Emergency Management Agency
321 Court Avenue
Sevierville, TN 37862
(865) 453-4919

Meeting Topic: 2019 Hazard Mitigation Planning Committee Proposed Project Review
Date: 10/17/2019
Time: 10am-11am **Total Meeting Hours:** 1
Location: Sevier Co EOC

	Name	Agency	Email Address	Contact #
1	MIKE WILLIAMS	SCEMA	MWILLIAMS@SEVIERCOUNTYTN.GOV	865-388-7114
2	Donnie Shular	Sevierville Fire	dshular@bellsouth.net	865-368-2635
3	Dennie Adams	SCHD	Crock7684@aol.com	865-453-8093
4	Wayne Braddenburg	Gatlinburg Fire	waynebr@gatlinburgtn.gov	865-850-1904
5	Roger Sims	Sevier Co. Water	rsims@sevier-countytn.gov	865-323-6156
6	JEFF HEDRICK	SCES	jhedrick@sces.net	865-774-6217
7	Tony L. Watson	Pigeon Forge FIRE	TWatson@cityofPigeonForgeTN.gov	865 257-5511
8	Charles Powers	Pigeon Forge Fire	cpowers@cityofpigeonforge.tn.gov	865-255-7280
9	JEFF OWNBY	SC PLANNING	JOWNBY@SEVIERCOUNTYTN.GOV	865-453-3882
10	DUSTIN SMITH	SEVIERVILLE	DSMITH@SEVIERVILLETN.ORG	865-868-0941
11	ROBBIE FOX	SEVIERVILLE/DOLLYWOOD	RFOX@DOLLYWOOD.COM	(865) 755-3343
12	Gary Waldroop	Gatlinburg Police	garyw@gatlinburgTN.GOV	865-430-5594
13	Sam Hinson	Sevierville PD	samh@seviervillethe.org	865-368-1633
14	David Ball	City of Gat. Planning	dball@gatlinburgtn.gov	865-436-7792
15	Matt Henderson	City of Sevierville	MHenderson@sevierville.tn.org	865-654-5309
16	David Rachoff	SCFR	drachoff@sevierco.tn.org	310-0543
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Figure 2-5: Sevier County Hazard Mitigation Plan Update Mitigation Strategy Discussion and Finalization Meeting.

2.3.3 Public Involvement

To ensure extensive public involvement, the planning team conducted two public meetings which allowed the public and community to participate and provide input concerning the hazard mitigation plan and process. Public meetings were held in Sevierville and Gatlinburg to increase public access and participation. Public meetings were announced through local news sources (e.g., The Mountain Press: https://themountainpress.com/news/3937/emergency-management-seeks-input-on-hazard-mitigation-plan/), social media (e.g., Sevier County EMA Facebook page), and the CodeRED system. Additionally, public participation was encouraged through a survey, with the public being notified via social media and the CodeRED system.

Open Public Meetings

Wednesday, September 11th

Sevier County Public Meeting #1 (Sevierville, Pigeon Forge, and Unincorporated):

10:00am to Noon at Sevier County Courthouse

- Welcome & Introduction (Joey Ayers & Andrew Worley)
- Hazard Mitigation Process (Andrew Worley)
- Hazard Identification and Results of the Public Survey (Andrew Worley)
- Overview of Current Risk Assessments by Jurisdiction (William Tollefson)
- Vulnerability Assessment Results by Jurisdiction (Andrew Joyner)
- Mitigation Strategies Overview (Explained with specific examples) (Andrew Joyner)
- Process for implementing and updating the final Hazard Mitigation Plan (Andrew Joyner)
- Steps to TEMA & FEMA approval and local adoption (Andrew Joyner)
- Open Q&A (All)

Sevier County Public Meeting #2 (Gatlinburg, Pittman Center, and Unincorporated):

3:00pm to 5:00pm at American Legion Post 202

- Welcome & Introduction (Joey Ayers & Andrew Worley)
- Hazard Mitigation Process (Andrew Worley)
- Hazard Identification and Results of the Public Survey (Andrew Worley)
- Overview of Current Risk Assessments by Jurisdiction (William Tollefson)
- Vulnerability Assessment Results by Jurisdiction (Andrew Joyner)
- Mitigation Strategies Overview (Explained with specific examples) (Andrew Joyner)
- Process for implementing and updating the final Hazard Mitigation Plan (Andrew Joyner)
- Steps to TEMA & FEMA approval and local adoption (Andrew Joyner)
- Open Q&A (All)

Figure 2-6: September 11th, Sevier County Hazard Mitigation Public Meetings.

Sevier County
TENNESSEE

The Sevier County Hazard Mitigation Planning committee will hold public meetings for public input and review of the Sevier County Hazard Mitigation Plan. The purpose of these meetings is to gather input from the public during the drafting stage of the Sevier County Hazard Mitigation Plan. This Plan includes: Sevier County, Sevierville, Pigeon Forge, Gatlinburg, and Pittman Center. Residents of Sevier County are also requested to complete a Hazard Mitigation Plan Online Survey to assist local officials in identifying hazards within Sevier County. Please go to www.seviercountytn.gov to complete the online survey.

The Planning Committee will meet:

Sevier County Court House
September 11, 2019
9am-11am
3rd Floor Court Room
125 Court Ave
Room 306W
Sevierville, TN, 37862

Gatlinburg American Legion Building
September 11, 2019
2pm-4pm
1222 East Parkway
Gatlinburg, TN, 37738

9/6/19

Emergency Management seeks input on hazard mitigation plan

BY JEFF FARRELL
Staff Writer

SEVIERVILLE — Sevier County Emergency Management Agency is looking for public input on updates to its hazard mitigation plan with public meetings next Wednesday and an online survey.

The hazard mitigation plan aims to identify potential hazards — from the possibility of wildfires to the threat of terrorist attacks at a public venue — and come up with plans to lower the risks from those threats, EMA Director Joe Ayers said.

"It's a plan where we are trying to develop strategies to lessen the impact (of potential disasters or emergencies)," Ayers said.

In the case of flood-prone areas, for example, recommendations might include converting the area to a public park, Ayers said.

Part of the process is looking at the areas that are deemed to be major risks.

The previous plan, developed before the Chimney Top 2 Fires in 2016, didn't include a mitigation plan for wildland fires — a decision they expect to see changed once the new plan is adopted.

Right now, they're asking for pubic input either through an online survey that can be found on the county web site at seviercountytn.gov or by attending two meetings on Wednesday, Sept. 11.

They'll be at the Sevier County Courthouse from 9-11 a.m., in the meeting room on the third floor. Then, from 2 to 4 p.m. they'll be in the Gatlinburg American Legion Building.

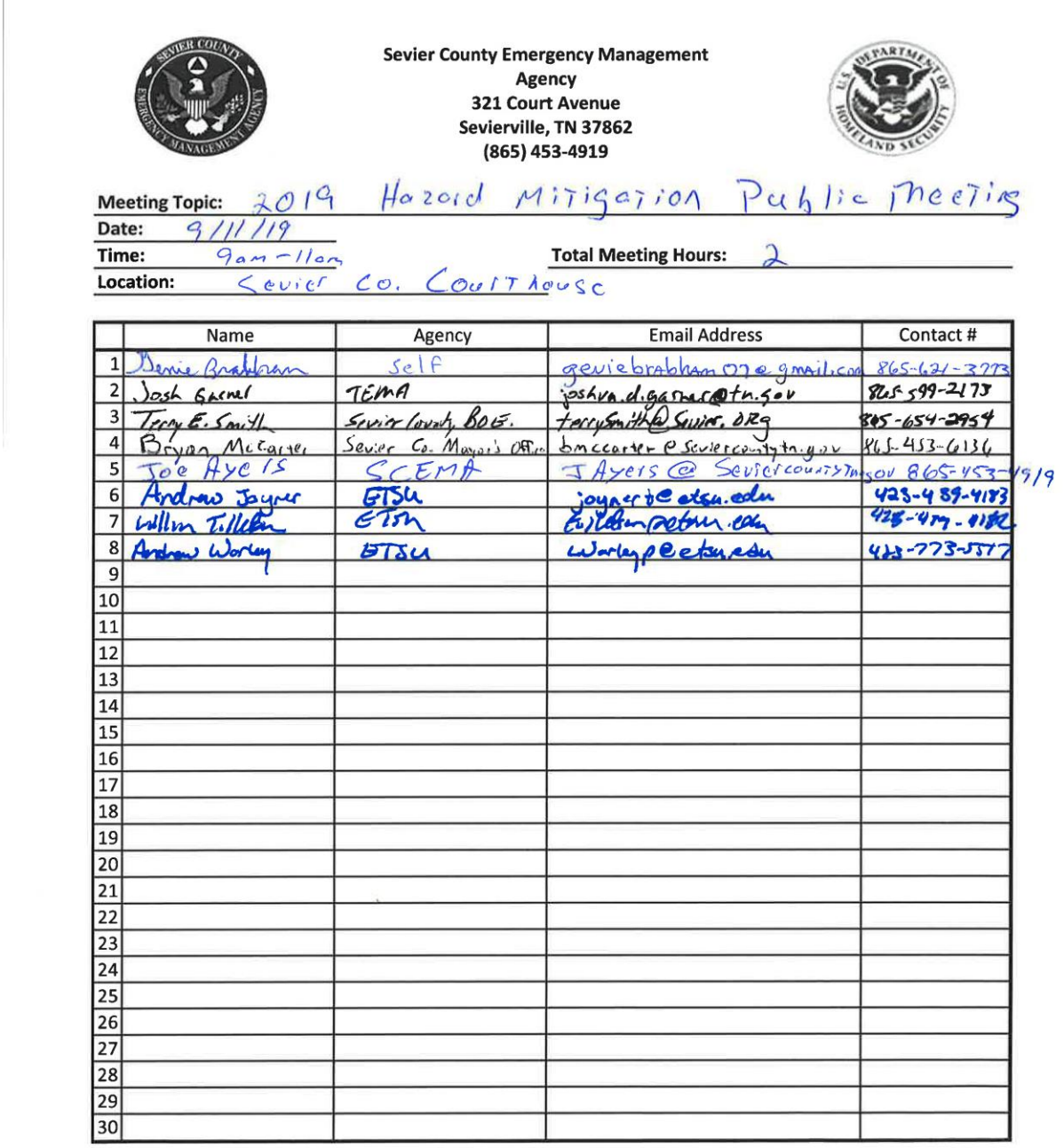
The plan covers the county and all four municipalities, so all stakeholders are invited to provide input, Ayers said.

"This is an opportunity for them to have input to give examples of what hazards they think the community is susceptible to and to give input on what projects they recommend," Ayers said.

The results will be used in considering future projects that could help reduce the threat from potential disasters, and the plan can be used in applying for federal funds to help pay for those projects.

Contact Jeff at jfarrell@themountainpress.com, or on Twitter at @jeffmtnpress

Figure 2-7: Announcements from Sevier County government and The Mountain Press for public meetings.



Sevier County Emergency Management Agency
321 Court Avenue
Sevierville, TN 37862
(865) 453-4919

Meeting Topic: 2019 Hazard Mitigation Public Meeting
Date: 9/11/19
Time: 9am-11am
Total Meeting Hours: 2
Location: Sevier Co. Courthouse

	Name	Agency	Email Address	Contact #
1	Genie Brabham	self	geniebrabham07@gmail.com	865-621-3773
2	Josh Gasmer	TEMA	joshua.d.gasmer@tn.gov	865-599-2173
3	Terry E. Smith	Sevier County BOE.	terrySmith@Sevier.org	865-654-2954
4	Bryan McCarter	Sevier Co. Mayor's Office	bmccarter@seviercounty tn.gov	865-453-6136
5	Joe Ayers	SCEMA	JAyers@SevierCountyTN.gov	865-453-4919
6	Andrew Joyner	ETSU	joyner@etsu.edu	423-439-4183
7	William Tillotson	ETSU	tillotson@etsu.edu	423-439-4182
8	Andrew Worley	ETSU	worleyp@etsu.edu	423-773-5577
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Figure 2-8: Sevier County Hazard Mitigation Plan Update Public Meeting for Sevierville, Pigeon Forge, and Unincorporated Sevier County.

Sevier County Emergency Management Agency
321 Court Avenue
Sevierville, TN 37862
(865) 453-4919

Meeting Topic: Sevier Co Hazard Mitigation Plan Update Public Meeting
Date: 9/11/19
Time: 2pm - 4pm
Total Meeting Hours: 2
Location: Gatlinburg American legion

	Name	Agency	Email Address	Contact #
1	Pete Jucker	Chalet Vlg. Firewise	petejucker@gmail.com	865-776-0446
2	Wayne Brandenburg	Gatlinburg Fire	waynelb@gatlinburgtn.gov	865-850-1909
3	Randall Brackins	Gatlinburg Police	randyb@gatlinburgtn.gov	865-680-5469
4	Gary DeBrango	Gatlinburg Police	GaryD@GatlinburgTN.gov	865-430-1581
5	Josh Garner	TEMA	joshua.garner@tn.gov	865-599-2173
6	Genie Brabham	Self	geniebrabham07@gmail.com	865-621-3773
7	Andrew Joyner	ETSU	joynerb@etsu.edu	423-439-4183
8	William Tilley	ETSU	Tilleyw@etsu.edu	423-439-4182
9	Andrew Warley	ETSU	warleya@etsu.edu	423-773-5517
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Figure 2-9: Sevier County Hazard Mitigation Plan Update Public Meeting for Gatlinburg, Pittman Center, and Unincorporated Sevier County.

Public Survey

A public survey was conducted in August and September (2019) to better understand public perception of hazards and risks in Sevier County, and to allow the public to submit photos, descriptions, and other information related to hazards impacting them. Results of the survey can be found in Appendix B.

Summary of Public Involvement

Public participation was incorporated in three separate routes. The public was invited to participate via an online survey, public comment meetings, and we integrated private business into the planning committee to ensure that a full scope of public participation was incorporated into the Sevier County Hazard Mitigation planning process. The Survey allowed the public to identify hazards within the community, and it allowed them to provide additional recommendations for consideration by the planning committee. The extensive mitigation strategies list in Chapter 10 was heavily influenced by public participation through both the meetings and Survey. Multiple pictures submitted through the Survey were used to add additional information about repetitive problem areas (mostly flood-related). The upper-right photo on the HMP cover page was submitted by a Sevier County resident through the Survey and shows flooding on a roadway that is not fully part of the 100-year DFIRM boundaries. Individuals who attended the public meetings provided feedback about the 2016 wildfire response and asked questions regarding how proposed mitigation strategies may improve future events. No additional comments related to the development of a Hazard Mitigation Plan were provided.

2.4 Incorporation of Existing Planning Mechanisms

The planning team reviewed several local, regional, and state data and planning mechanisms to identify programs and policies that currently promote or could potentially further mitigation initiatives for Sevier County and its jurisdictions. The following is a list of data, reports, plans, and manuals containing information that was incorporated into the 2020 Sevier County Multi-Jurisdiction Hazard Mitigation Plan Update:

- Reports
    - State of Risk: Tennessee (Environmental Defense Fund)
    - Updated Digital Flood Insurance Rate Maps (DFIRMs)
    - Letters of Map Revisions in compliance with the National Flood Insurance Program (NFIP)
    - Final Report for Pigeon Forge, Tennessee – October 2018 (Community Planning Assistance for Wildfire)
- Plans and Manuals
    - Sevier County Emergency Preparedness Plan
    - Tennessee Hazard Mitigation Plan 2018
    - Sevier County Hazard Mitigation Plan 2011
    - Sevier County Comprehensive Plan
    - City of Gatlinburg Comprehensive Plan
    - City of Sevierville Comprehensive Plan
    - City of Gatlinburg Capital Improvements Plan
    - City of Sevierville Capital Improvements Plan
- Policies
    - Sevier County Emergency Management Agency Mission Statement
    - Sevier County Emergency Preparedness Plan

2.5 Identifying Hazards

The plan identifies a large variety of natural, technological, and human-caused threats and hazards that impact Sevier County and its jurisdictions. Several emergency management and hazard mitigation

documents at the state and local level were reviewed to identify a comprehensive list of hazards that may impact the county and each jurisdiction. These documents address both natural, technological, and human-caused hazards that have the potential to impact the planning area. The reviewed documents that were integral in providing key information are listed in the following table.

Table 2-3: List of Resources Referenced in Selecting Hazards and Threats Impacting the Planning Area.

Resource
State of Tennessee Hazard Mitigation Plan 2018
Sevier County Hazard Mitigation Plan 2011

2.6 Risk Assessment Overview

The risk assessments describe the risks associated with each identified hazard of concern. Each section describes the hazard's extent, probability, and worst-case scenarios for the jurisdiction. The following steps were used to define the risk of each hazard:

- Profile and describe each hazard
  - Hazard Profiles (Section 4)
    - This section provides a description of the hazard (natural, man-made, or technological) that has historically and potentially will continue to affect Sevier County. If the hazard is measured on a scale, the scale has been included and described.
  - Location & Extent
    - This subsection provides the geographic area and potential extent of impacts affected by each natural hazard identified as a threat in Sevier County.
  - Previous Occurrences
    - This subsection details the hazards history in Sevier County. If reliable data were recorded on the previous occurrences, their summaries have been included.
  - Incidents & Probability
    - This subsection details data from previous occurrences and if geographic data exists to map the threat and/or exposure locations of the hazard, GIS maps have been included.
- Determine exposure to each hazard – Exposure was determined by overlaying hazard maps with an inventory of structures, facilities, and systems to determine which of them would be exposed to each hazard.

The primary source for historical data used throughout the risk assessment is the National Centers for Environmental Information (NCEI) Storm Events Database, which provides natural hazard event data from 1950 to the present. In staying consistent with climatological studies, the NCEI Storm Events Database was evaluated for the last 23 years (1996 to 2018) to determine future probability and frequency of a hazard occurring.

2.6.1 Data Limitations

Throughout the planning process, every effort was made to use the best available data. Much of the historic natural-hazard occurrence information was obtained through the National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information (NCEI). The NCEI storm events database contains data from January 1950 to present (i.e., within the past few months); however, there are some issues with events recorded prior to 1996. From the years 1950 to 1954, the NCEI storm events database only contains information on tornado events, until thunderstorm wind and hail events were added to the database for the time period between 1955 and 1992. All event types identified in the NWS Directive 10-1605 (48 in total) are recorded from 1996 to the present. Additionally, property damage and crop damage estimates from the NCEI storm events database is a "best guess" based on all available data at the time of the event publication.

The NCEI storm events database does not record all events, only occurrences that have sufficient intensity to cause loss of life, injuries, significant property damage, and/or disruption to commerce. Also, events such as tornadoes or hailstorms rely heavily on eye-witness accounts which creates a reporting bias in urban areas. The inception of Doppler radar in 1980 significantly decreased this bias especially for tornado events, but records prior to 1980 are not as detailed or complete as post-1980 records.

The Storm Prediction Center (SPC) National Severe Weather Database browser examines convective/thunderstorm related winds only and does not include wind data from hurricane or non-thunderstorm wind damage. These data contain measured and estimated wind gusts including wind damage without estimated wind speeds. For many observations, this results in several thunderstorm wind events with no estimated or actual wind speed estimates.

The vulnerability estimates provided herein use the best data currently available, and the methodologies applied result in an approximation of risk. These estimates may be used to understand relative risk from hazards and potential losses. However, uncertainties are inherent in any loss estimation methodology, arising in part from incomplete scientific knowledge concerning hazards and their effects on the built environment, as well as approximations and simplifications that are necessary for a comprehensive analysis.

2.7 Assessing Vulnerability Overview

The purpose of assessing vulnerability is to quantify and/or qualify exposure and determine how various threats and hazards impact life, property, the environment, and critical operations in Sevier County. Vulnerability can be defined as the manifestation of the inherent states of the system (e.g., physical, technical, organizational, cultural) that can be exploited to adversely affect (cause harm or damage to) that system. For example, identifying areas in the county that suffer disproportional damages compared with other areas, or overall exposure of the county to winter storms. Identifying and understanding vulnerability to each threat and hazard provides a strong foundation for developing and pursuing mitigation actions.

The Vulnerability Assessment section for each hazard builds upon the information provided in the Risk Assessment by assessing the potential impact and amount of damage that each hazard has in each jurisdiction. To complete the assessment, best available data were collected from a variety of sources, including local, state, and federal agencies, and multiple analyses were performed qualitatively and

quantitatively. The estimates provided in the Vulnerability Assessment should be used to understand relative risk from each hazard and the potential losses that may be incurred; however, uncertainties are inherent in any loss estimation methodology, arising in part from incomplete scientific knowledge concerning specific hazards and their effects on the built environment, as well as incomplete datasets and from approximations and simplifications that are necessary to provide a meaningful and complete analysis. Further, most datasets used in this assessment contain relatively short periods of records, which increases the uncertainty of any statistically-based analysis.

2.7.1 Vulnerability Assessment Methodology

To direct the vulnerability assessment effort for Sevier County and each jurisdiction, two distinct methodologies were applied. The first includes a quantitative analysis that relies upon the best available data and technology, while the second methodology includes a qualitative analysis that relies more on local knowledge and rational decision making. Upon completion, the methodologies are combined to create a Vulnerability Assessment that allows for some degree of quality control and assurance. The quantitative assessment focuses on potential hazard loss estimates, while the qualitative assessment is comprised of a scoring system built around values assigned by the Planning Team as to the likelihood of occurrence, spatial extent, and potential impact of each hazard studied.

Quantitative Methodology

The quantitative methodology consists of utilizing Hazus, a geographic information system (GIS)-based loss estimation software available from FEMA, as well as a detailed GIS-based approach independent of the Hazus software. These two GIS-based studies together help form a quantitative vulnerability assessment. GIS technology allowed for the identification and analysis of potentially at-risk community assets such as people and infrastructure. This analysis was completed for hazards that can be spatially defined in a meaningful manner (i.e., hazards with an official and scientific determined geographic extent) and for which GIS data were readily available.

Qualitative Methodology

The qualitative assessment relies less on technology, but more on historical and anecdotal data regarding expected hazard impacts. The qualitative assessment completed for Sevier County is based on the Priority Risk Index (PRI). The purpose of the PRI is to prioritize all potential hazards, and then group them into three categories of high, moderate, or low risk to identify and prioritize mitigation opportunities. For Sevier County, an additional category (Vulnerability) was developed that measured each jurisdictions vulnerability to a hazard based on the impact each hazard would have on the public; responders; continuity of operations including continued delivery of services; property, facilities and infrastructure; the environment; the economic condition of the jurisdiction; and public confidence in the jurisdiction's governance.

The PRI is a good practice to use when prioritizing hazards because it provides a standardized numerical value for hazards to be compared. With the addition of Vulnerability, adapted PRI scores were calculated using six categories and the scale referenced is the Enhanced Priority Risk Index (EPRI):

- Probability
- Impact
- Spatial Extent
- Warning Time

- Duration
- Vulnerability

Each degree of risk is assigned a value (1-4) and a weighting factor. To calculate the Risk Factor for a given hazard, the assigned risk value for each category is multiplied by the weighted factor, and the sum of all six categories is totaled together for a final score. The highest possible Risk Factor is 4.0.

Risk Factor = [(Probability * 0.20) + (Impact * 0.25) + (Spatial Extent * 0.15) + (Warning Time *0.075) + (Duration * 0.075) + (Vulnerability *0.25)]

2.7.2 Enhanced Priority Risk Index and Hazard Risk

Hazard risk is determined by calculating the Risk Factor for each hazard in Sevier County and each jurisdiction. A summary of the EPRI is found in Table 2-4. The conclusions drawn from the qualitative and quantitative assessments are grouped into three categories based on High, Moderate, or Low designations (

Table 2-5). Hazards identified as high risk have risk factors of 2.5 or greater. Risk factors ranging from 2.0 to 2.4 represent moderate risk hazards. Hazards with risk factors of less than 2.0 are considered low risk.

Table 2-4: Summary of the Enhanced Priority Risk Index.

PRI Category	Degree of Risk			Assigned Weighting Factor
	Level	Criteria	Index Value	
Probability	Unlikely	Less than 1% annual probability	1	20%
	Possible	Between 1 and 10% annual probability	2	
	Likely	Between 10 and 100% 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	25%
	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 a 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	15%
	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	7.5%
	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	7.5%
	Less than 24 hours	Self-explanatory	2	
	Less than one week	Self-explanatory	3	
	More than one week	Self-explanatory	4	
Vulnerability	Low	Minimal exploitable weaknesses and multiple or redundant countermeasures.	1	25%
	Medium	Moderate exploitable weaknesses and some countermeasures.	2	
	High	Multiple exploitable weaknesses and few countermeasures.	3	
	Very High	Critical exploitable weaknesses and no countermeasures.	4	

Table 2-5: Associated Risk Factor with PRI Value Range.

Risk Factor	PRI Range
High Risk	2.5 to 4.0
Moderate Risk	2.0 to 2.4
Low Risk	0 to 1.9

2.7.3 Consequence and Vulnerability Analysis

A consequence and vulnerability analysis was conducted to determine the vulnerability score for each hazard and to consider the impact on the public; responders; continuity of operations including continued delivery of services; property, facilities and infrastructure; the environment; the economic condition of the jurisdiction; and public confidence in the jurisdiction's governance. Qualitative and quantitative assessments of the hazard as a whole were included to provide an overall ranking of the consequence and vulnerability (i.e., Low, Medium, High, Very High), which was used in the vulnerability category of the enhanced priority risk index. Impacts on public confidence in the jurisdiction's governance were determined in a round-table meeting involving the Planning Team which took into consideration all known variables that could influence public confidence. Below is the degree of vulnerability formula for each sector.

Vulnerability = [(Public * 0.15) + (Responders * 0.15) + (Continuity of Operations * 0.15) + (Property, Facilities, and Infrastructure *0.15) + (Environment * 0.15) + (Economic Condition * 0.15) + (Public Confidence * 0.10)]

Table 2-6: Ranking Scale Summary for Assessing Impact.

Ranking	Description
Very High (4)	Catastrophic impact on the sector. Extremely high number of deaths and/or injuries possible. More than 50% of property impacted. Complete shutdown of critical operations for 30 days or more. Between 50% and 100% of the area possibly impacted.
High (3)	High impact on the sector. Multiple deaths and injuries possible. More than 25% of property impacted. Between 10% and 50% of the area possibly impacted.
Medium (2)	Minimal impact on the sector. Minor injuries only. More than 10% of property impacted. Between 1% and 10% of the area possibly impacted.
Low (1)	Little to no impact on the sector. Minor injuries, damage, and/or disruptions to services. Less than 1% of the area impacted.

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3. Community Lifelines and Critical Infrastructure

3.1 Community Lifelines

The 2017 hurricane season FEMA after-action report identified the need to create a new operational prioritization and response tool which would 1) characterize the incident and identify the root causes of priority issue areas in order to create effective solutions and 2) distinguish the highest priorities and most complex issues from other incident information. This led to the development of community lifelines which is a construct for outcome-based stabilization efforts. A community lifeline enables the continuous operation of government functions and critical business, and is essential to human health and safety or economic security. Lifelines are designed to highlight priority areas and interdependencies, focus attention on actions being taken, communicate coordination efforts towards stabilization, and integrate information. Each lifeline is comprised of multiple components and essential elements of information needed to stabilize an incident. See the following link for more information on Community Lifelines:

https://www.fema.gov/media-library/assets/documents/177222#

Community lifelines are comprised of seven main categories, the components that make up each category, and essential elements of information that inform each category. Critical infrastructure maps for each lifeline and jurisdiction are available in Appendix C. The seven main categories that comprise the community lifelines and the components associated with each are the following:

- Safety and Security
  - Law Enforcement and Security
  - Search and Rescue
  - Fire Services
  - Government Service
  - Responder Safety
  - Imminent Hazard Mitigation
- Food, Water, and Sheltering
  - Evacuations
  - Food/Potable Water
  - Shelter
  - Durable Goods
  - Water Infrastructure
  - Agriculture
- Health and Medical
  - Medical Care
  - Patient Movement
  - Public Health
  - Fatality Management
  - Health Care Supply Chain
- Energy
  - Power (Grid)
  - Temporary Power

    - Fuel
- Communications
    - Infrastructure
    - Alerts, Warnings, Messages
    - 911 and Dispatch
    - Responder Communications
    - Financial Services
- Transportation
    - Highway/Roadway
    - Mass Transit
    - Railway
    - Aviation
    - Maritime
    - Pipeline
- Hazardous Material
    - Facilities
    - Hazardous Debris, Pollutants, Contaminants

The following are the components and essential elements of information associated with each community lifeline category:

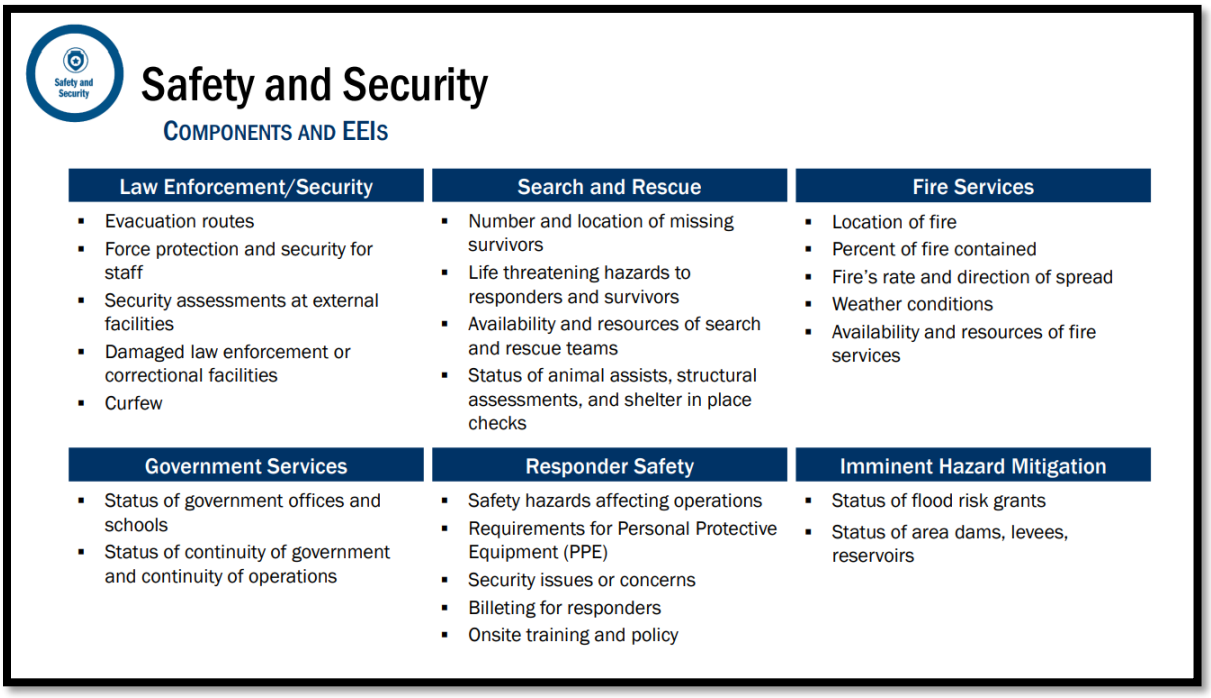

Figure 3-1: Safety and Security Components and Essential Elements of Information.

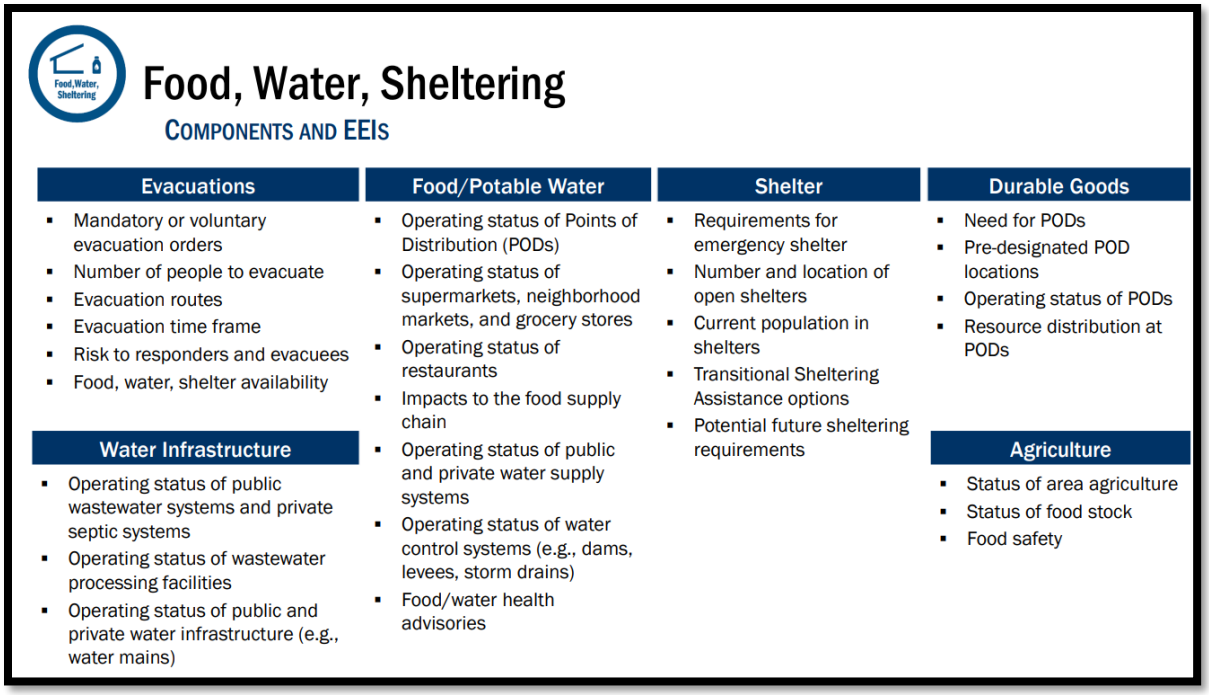

Figure 3-2: Food, Water, and Sheltering Components and Essential Elements of Information.

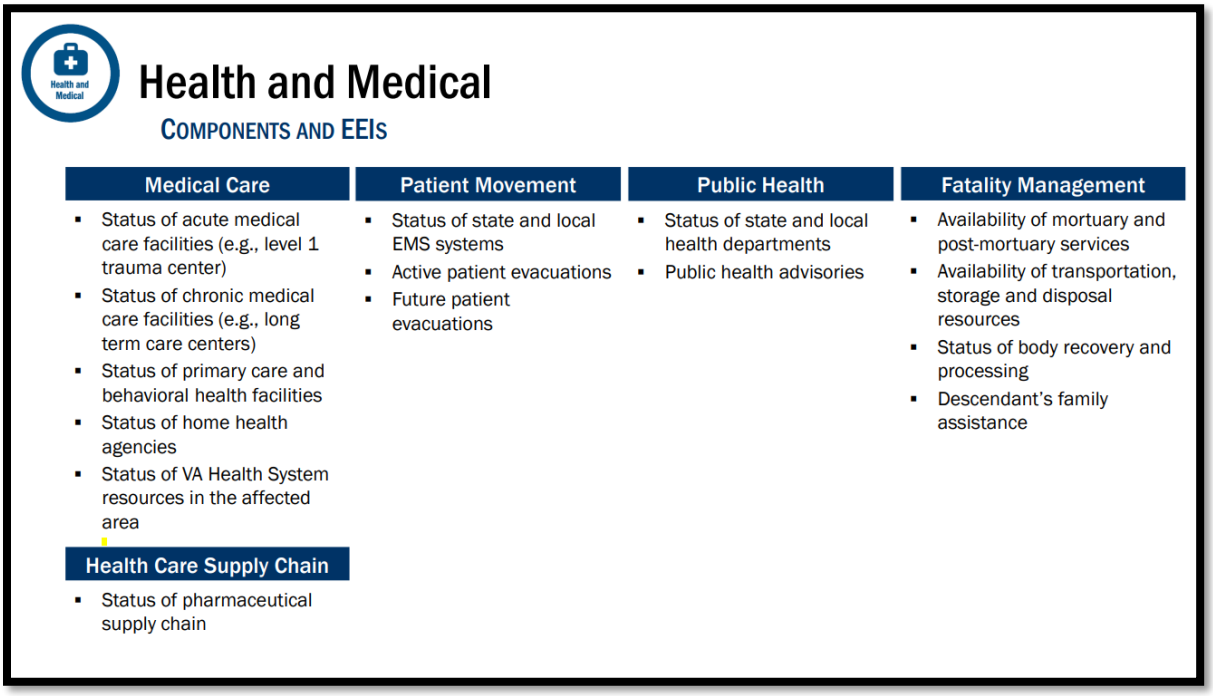

Figure 3-3: Health and Medical Components and Essential Elements of Information.

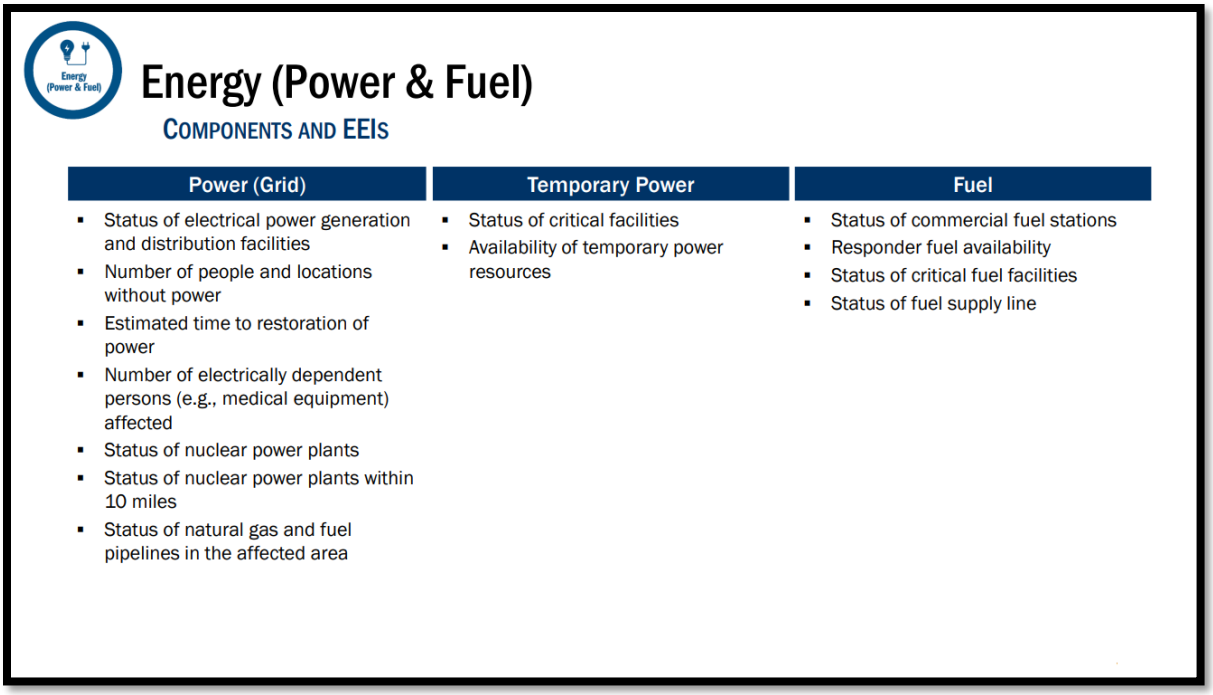

Figure 3-4: Energy Components and Essential Elements of Information.

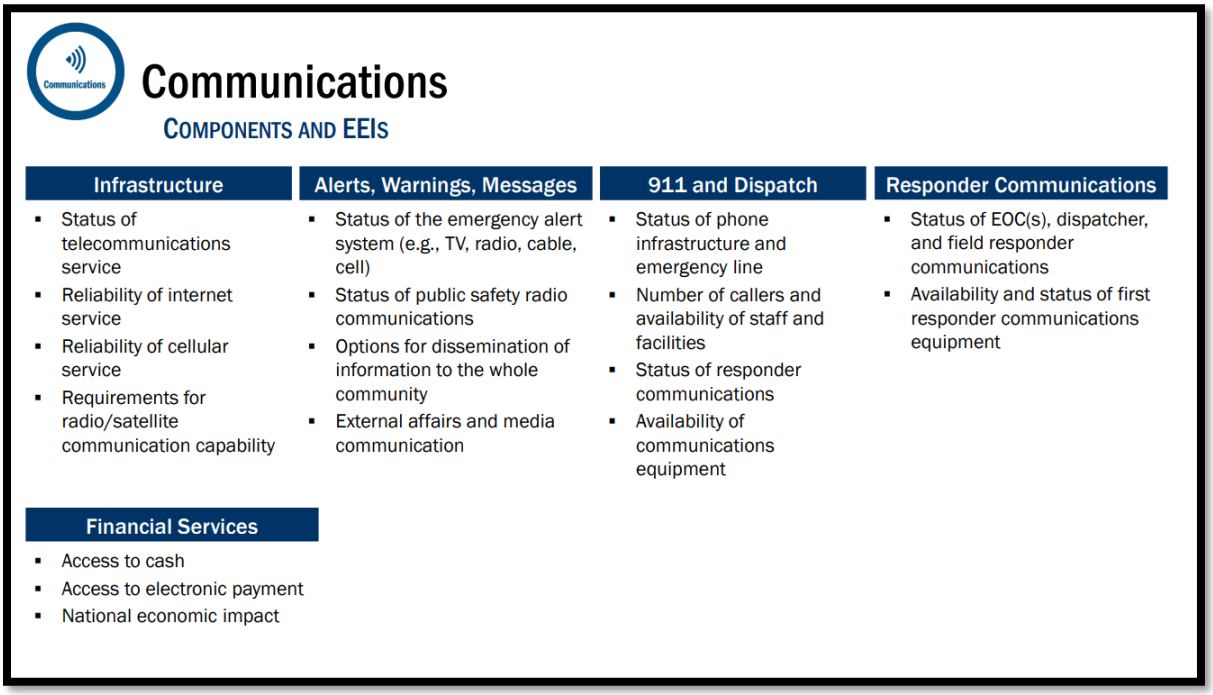

Figure 3-5: Communications Components and Essential Elements of Information.

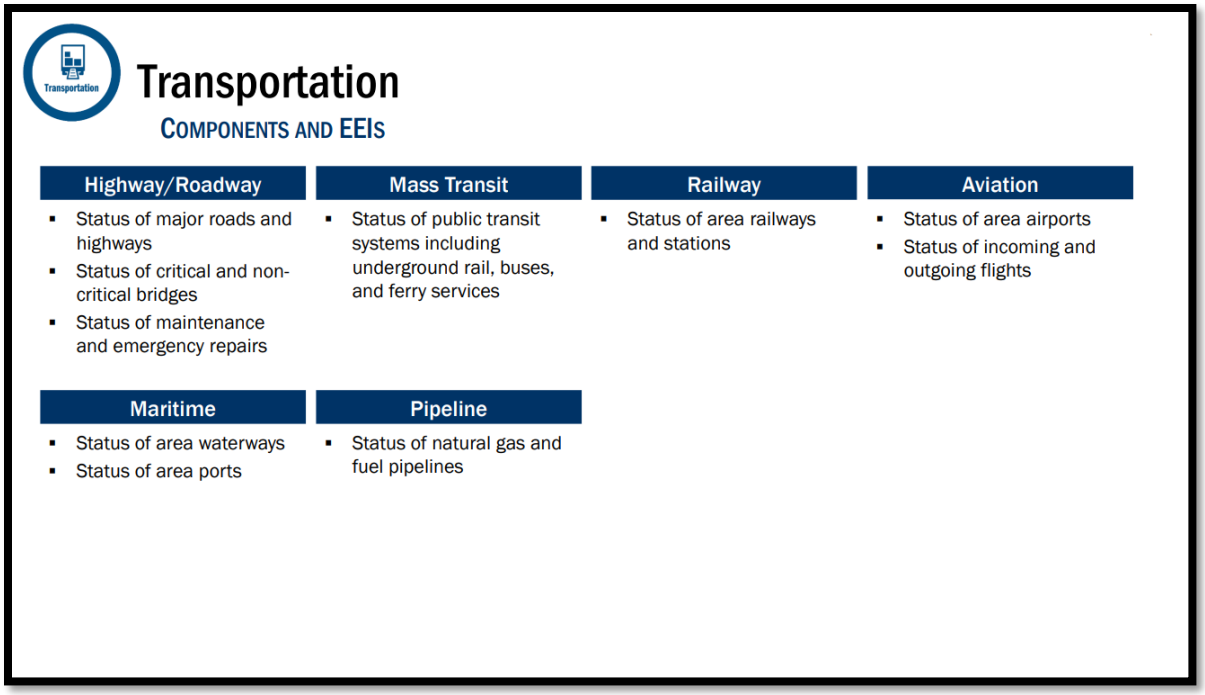

Figure 3-6: Transportation Components and Essential Elements of Information.

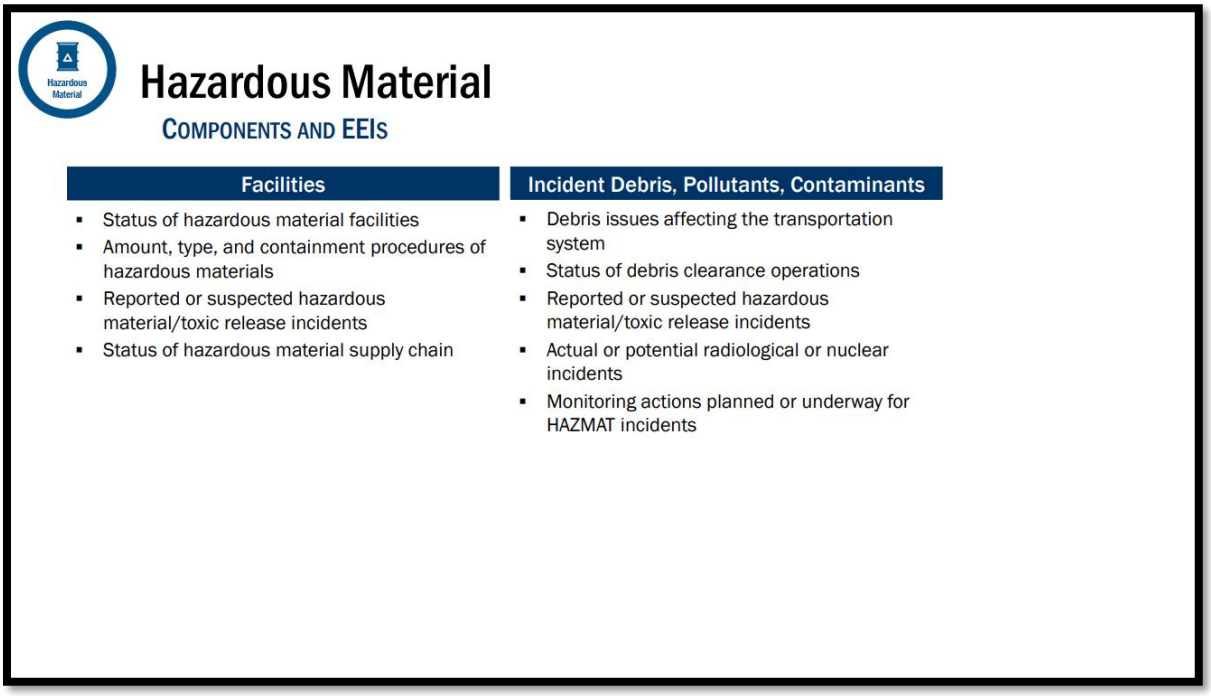

Figure 3-7: Hazardous Material Components and Essential Elements of Information.

4. Hazard Profiles

This section provides a complete overview and definition of each hazard that could potentially affect Sevier County and its jurisdictions. A complete understanding of each hazard better prepares decision makers, local agencies, and residents on the causes of, potential damages contributed to, and possible scenarios of each hazard. The table below provides an overview of the hazards profiled for each jurisdiction.

The table below provides an overview of the hazards that have been previously profiled in the Sevier County Hazard Mitigation Plan published in 2011, the hazards that were identified in the State of Tennessee Hazard Mitigation Plan published in 2018, and the hazards that are profiled in the 2020 Sevier County Multi-Jurisdiction Hazard Mitigation Plan Update.

Table 4-1: Hazard Profile Summary.

Hazard	State of Tennessee HMP	2011 Sevier County HMP	2020 Sevier County Update
Civil Disobedience/Terrorism	X		X
Communicable Diseases	X		X
Dam Failure	X		X
Droughts	X		X
Earthquakes	X		X
Extreme Temperatures	X		X
Floods Including Extreme Precipitation	X	X	X
Geological Hazards	X		O
Infrastructure Failure	X		X
Levee Failure	X		
Mass Wasting			X
Severe Storms	X	X	O
Severe Wind	X		X
Sinkholes			X
Thunderstorms (Hail, Lightning, and Wind)	O		X
Tornadoes	X	X	X
Tropical Cyclones	X		X
Wildfires/Conflagration	X		X
Winter Storms		X	X

O - Hazard profiled, but under a different category.

The profile section provides the historical context for identifying the hazards. The following table displays past presidential declaration occurrences which provides background on the type of natural disasters that have affected the Sevier County planning area. Table 4-2 displays the number of FEMA disaster declarations in Sevier County.

Table 4-2: Major Disaster Declarations for Sevier County.

Disaster Declaration Number	Date	Type of Disaster
331	5/15/1972	HEAVY RAINS & FLOODING
366	3/21/1973	HEAVY RAINS & FLOODING
3095	3/13/1993	SEVERE SNOWFALL, WINTER STORM
1022	3/25/1994	EXTENSIVE RAINFALL AND FLASH FLOODING
1197	1/6/1998	SEVERE STORMS AND FLOODING
1215	4/16/1998	SEVERE STORMS, TORNADOES AND FLOODING
1260	12/23/1998	SEVERE WINTER STORM
2346	10/30/2000	TN - KNOXVILLE FIRE COMPLEX - 11/02/00
2389	11/12/2001	TN - RIDGE CREST FIRE - 11/14/2001
1408	1/23/2002	SEVERE STORMS AND FLOODING
1464	5/4/2003	SEVERE STORMS, TORNADOES, AND FLOODING
3217	8/29/2005	HURRICANE KATRINA EVACUATION
4211	2/15/2015	SEVERE WINTER STORM AND FLOODING
4293	11/28/2016	WILDFIRES
4320	5/27/2017	SEVERE STORMS, STRAIGHT-LINE WINDS, AND FLOODING

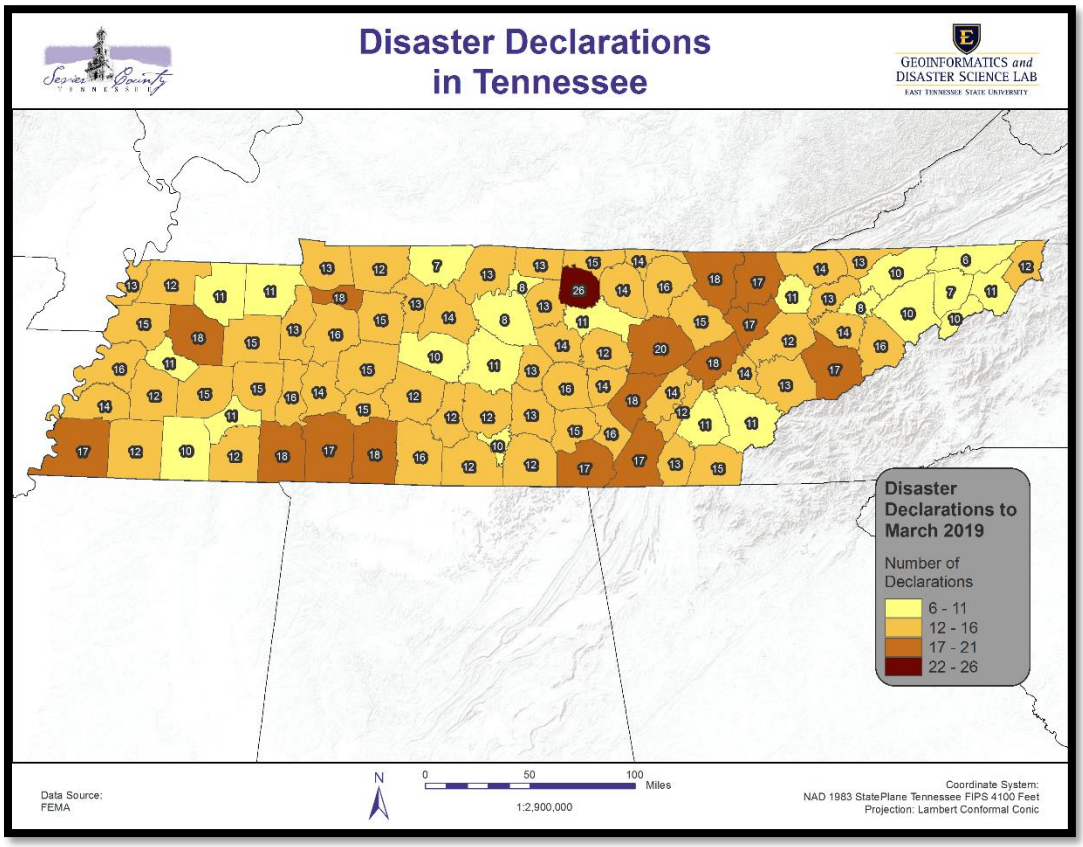

Figure 4-1: FEMA Disaster Declarations by County (1952-2019).
(Source: FEMA Disaster Declarations Summary: Open Government Dataset)

4.1 Natural Hazards

Natural hazards are natural incidents that threaten lives, property, and other assets. Natural hazards tend to occur repeatedly in the same geographical locations because they are related to weather patterns and physical characteristics of an area.

4.1.1 Communicable Disease

Communicable diseases encompass a wide variety of pathogens along with multiple mediums for transmission, and pose one of the most flexible and rapidly evolving public health threats in Tennessee and FEMA Region IV at large. The scope of these threats, and the multiple agencies often required to respond to even singular incidents make protocols and timely dissemination of public health information of particular importance. Further, communicable diseases that are not generalized public health threats can spread quickly in close quarters or through contaminated public resources immediately following an emergency and relocation of large populations. Protocols must be in place for proper sanitation, timely triaging, and reporting of cases when overcrowding due to displacement is present in temporary housing, shelters, or residential facilities. The Emergency Provider Infection Control Manual must also be referenced during the course of emergencies to institute protocols that prevent patient to provider transmission of infectious diseases.

A Communicable Disease Emergency occurs when urgent or extensive public health or medical interventions are necessary because the risk of disease outbreak or biologic threat carries the potential for morbidity and mortality in Tennessee, a specific region, at county or municipal levels or nationally. The CEDEP participates in the Emerging Infections Program (EIP) in conjunction with Tennessee Department of Health, Vanderbilt University School of Medicine, Department of Preventive Medicine, and the CDC. This program allows for the combined resources of these entities to assess the public health impact of emerging infections and to evaluate methods for their prevention and control. The EIP operates in conjunction with nine other states: California, Colorado, Connecticut, Georgia, Maryland, Minnesota, New Mexico, New York, and Oregon. The EIP was established by the CDC, but is operated at the state level to facilitate: surveillance, prevention, and control of emerging infectious diseases. EIP activities go beyond the routine functions of health departments by:

- Addressing the most important issues in infectious diseases and selecting projects that the EIP network is particularly suited to investigate
- Maintaining sufficient flexibility for emergency response and addressing new problems as they arise
- Developing and evaluating public health interventions and ultimately transferring what is learned to public health agencies
- Incorporating training as a key function of EIP activities
- Giving high priority to projects that lead directly to the prevention of disease

Pandemic

A pandemic is a worldwide epidemic that, according to the World Health Organization (WHO), has to meet three conditions:

- The microbe infects and causes serious illness in humans.
- Humans do not have immunity against the virus.

- The virus spreads easily from person-to-person and survives within humans.

Pandemic refers to a microbe that has the ability to spread across the world. The word "pandemic" means that a disease has caused illness in a person on nearly every continent. Many diseases throughout the history of the world have caused pandemics. A pandemic disease has widespread economic and societal implications on a community. Response and recovery to a pandemic disease will likely be lengthy.

4.1.2 Drought

A drought is a deficiency in water availability over an extended period of time, caused by precipitation totals and soil water storages that do not satisfy the environmental demand for water, either by evaporation or transpiration through plant leaves. It is important to note that the lack of precipitation alone does not constitute drought; the season during which the precipitation is lacking has a major impact on whether drought occurs. For example, a week of no precipitation in July, when the solar energy to evaporate water and vegetation's need for water to carry on photosynthesis are both high, may trigger a drought, while a week of no precipitation in January when evapotranspiration is low may not initiate a drought.

Drought is a unique and insidious hazard. Unlike other natural hazards, no specific threshold of "dryness" exists for declaring a drought. In addition, the definition of drought depends on stakeholder needs. For instance, the onset (and demise) of agricultural drought is quick, as crops need water every few days; once they get rainfall, they improve. But hydrologic drought sets in (and is alleviated) only over longer time periods. A few dry days will not drain a reservoir, but a few rain showers cannot replenish it either. Moreover, different geographical regions define drought differently based on the deviation from local, normal precipitation. Drought can occur anywhere, triggered by changes in the local-to-regional-scale atmospheric circulation over an area, or by broader-scale circulation variations such as the expansion of semi-permanent oceanic high-pressure systems or the stalling of an upper-level atmospheric ridge in place over a region. The severity of a drought depends upon the degree and duration of moisture deficiency, as well as the size of the affected area. Periods of drought also tend to be associated with other hazards, such as wildfires and/or heat waves. Lastly, drought is a slow onset occurrence, causing less direct—but tremendous indirect—damage. Depletion of aquifers, crop loss, and livestock and wildlife mortality rates are examples of direct impacts. Since the groundwater found in aquifers is the source of about 38% of all county and city water supplied to households (and comprises 97% of the water for all rural populations that are not already supplied by cities and counties), droughts can potentially have direct, disastrous effects on human populations. The indirect consequences of drought, such as unemployment, reduced tax revenues, increased food prices, reduced outdoor recreation opportunities, higher energy costs as water levels in reservoirs decrease and consumption increases, and water rationing, are not often fully known. This complex web of impacts causes drought to affect people and economies well beyond the area physically experiencing the drought.

This hazard is often measured using the Palmer Drought Severity Index (PDSI, also known operationally as the Palmer Drought Index). The PDSI, first developed by Wayne Palmer in a 1965 paper[1] for the U.S. Weather Bureau, measures drought through recent precipitation and temperature data with regard to a

[1] Wayne Palmer, "Meteorological Drought". Research paper no.45, U.S. Department of Commerce Weather Bureau, February 1965 (58 pgs)

basic supply-and-demand model of soil moisture. It is most effective in long-term calculations. Three other indices used to measure drought are the Palmer Hydrologic Drought Index (PHDI), the Crop Moisture Index (CMI), which is derived from the PDSI, and the Keetch-Byram Drought Index (KBDI), created by John Keetch and George Byram in 1968 for the U.S. Forest Service[2]. The KBDI is used mainly for predicting the likelihood of wildfire outbreaks. As a compromise, the PDSI is used most often for droughts since it is a medium-response drought indicator. The objective of the PDSI is to provide measurements of moisture conditions that are standardized so that comparisons using the index can be made between locations and between months.

The following tables display the range and Palmer classifications of the PDSI index, and the United States Drought Monitor intensity scale. In 2016, varying drought conditions were observed across the contiguous United States (Figure 4-2), with major drought and wildfire impacts felt in Sevier County.

Table 4-3: Palmer Drought Severity Index Classification and Range.

Range	Palmer Classification
4.0 or more	Extremely Wet
3.0 to 3.99	Very Wet
2.0 to 2.99	Moderately Wet
1.0 to 1.99	Slightly Wet
0.5 to 0.99	Incipient Wet Spell
0.49 to -0.49	Near Normal
-0.5 to -0.99	Incipient Dry Spell
-1.0 to -1.99	Mild Drought
-2.0 to -2.99	Moderate Drought
-3.0 to -3.99	Severe Drought
-4.0 or less	Extreme Drought

Table 4-4: U.S. Drought Monitor Drought Intensity Scale.
(Source: National Drought Mitigation Center)

Range/Category	Description	PDSI Equivalent
D0	Abnormally Dry	-1.0 to -1.99
D1	Moderate Drought	-2.0 to -2.99
D2	Severe Drought	-3.0 to -3.99
D3	Extreme Drought	-4.0 to -4.99
D4	Exceptional Drought	-5.0 or less

[2] Keetch JJ, Byram GM. A drought index for forest fire control. Res. Pap. SE-38. Asheville, NC: US Department of Agriculture, Forest Service, Southeastern Forest Experiment Station. 1968 (35 pgs)

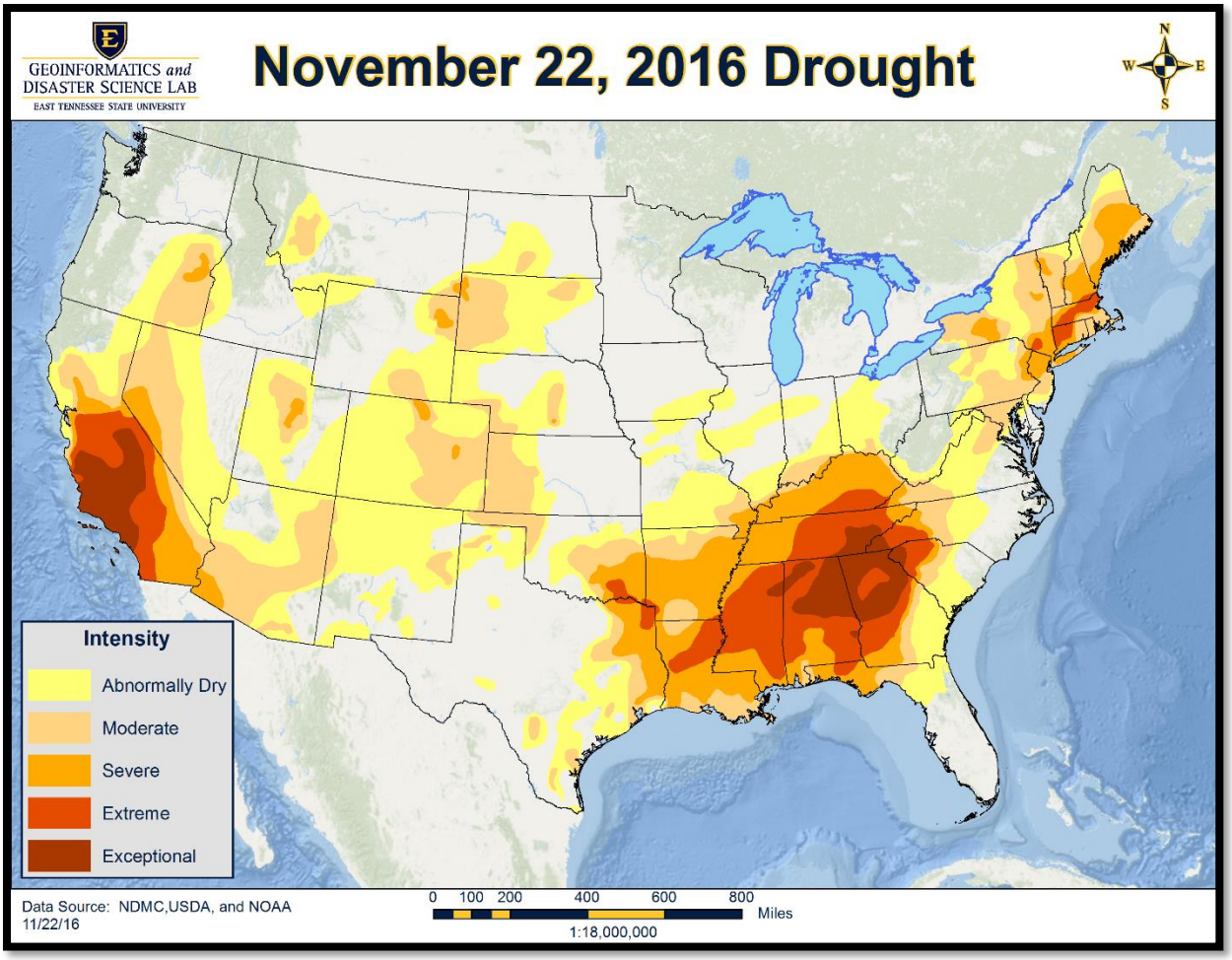

Figure 4-2: Drought severity across the contiguous United States that highlights extreme drought conditions across parts of Tennessee (Cartographer: Jana Archer).

4.1.3 Earthquakes

An earthquake is defined as an abrupt movement or slip of a segment of the earth's crust resulting from a sudden release of energy. Earthquakes typically occur along faults, wherein two fault boundaries are forced against each other and massive amounts of strain energy are accumulated until it is instantly released during an earthquake event. This energy is in the form of waves and vibrations which can be violent and very destructive. Seismic waves can travel for hundreds of miles, although the intensity of shaking can be amplified or weakened locally by geologic conditions. 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. Earthquakes are often triggered through natural processes, including plate tectonics and volcanic activity, landslides, or the collapse of caverns, but can also be triggered by human activities such as deep mining, drilling, and wastewater injection (a byproduct of fracking).

Although not always present, warning signs for an impending earthquake include increased micro-seismicity/seismic waves (foreshocks), unusual animal behavior, change in well water quality, and deformation of the ground surface. Following an earthquake event, there is the potential for aftershocks, or more seismic waves. Due to the typically compromised infrastructure following a major event, aftershocks can be especially devastating.

Earthquake magnitude, or the amount of energy released, can be measured on the Richter Scale and the Moment-Magnitude Scale. The intensity of the event is defined via the shaking resulting from seismic waves and is measured by the Modified Mercalli Intensity (MMI) scale. While this scale is not mathematically based it is more useful to scientists because it allows intensity to be measured relative to each location. This is important because two locations equidistant from the epicenter of an earthquake can experience different effects due to differences in geologic conditions, etc.

Table 4-5: Modified Mercalli Intensity Scale.

Intensity	Effects
I	Not felt except by a very few under especially favorable circumstances.
II	Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing.
III	Felt quite noticeably indoors, but many people do not recognize it as an earthquake. Vibration like passing of truck. Duration estimated.
IV	During the day felt indoors by many, outdoors by few. At night some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing cars rocked noticeably.
V	Felt by nearly everyone, many awakened. Some dishes, windows, etc., broken; a few instances of cracked plaster; unstable objects overturned. Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks stop, start, change rate.
VI	Felt by all, many frightened and run outdoors; persons walk unsteadily. Small bells ring. Some heavy furniture moved; a few instances of fallen plaster or damaged chimneys. Damage slight.
VII	Everyone runs outdoors; difficult to stand. Noticed by persons driving cars. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken.
VIII	Steering of cars affected. Damage slight in specially designed structures; considerable in ordinary substantial buildings, with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water.
IX	General panic. Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb; great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken.

Intensity	Effects
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from river banks and steep slopes. Shifted sand and mud. Water splashed over banks.
XI	Few, if any, masonry structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.
XII	Damage total. Practically all works of construction are damaged greatly or destroyed. Waves seen on ground surface. Line of sight and level are distorted. Objects are thrown into the air.

Seismic risk can be determined from peak ground acceleration. Peak ground acceleration (PGA) is the rate of change of speed of horizontal and vertical ground movements and is expressed in percent gravity (%g, g=9.8 m/s^2). Any area with 3% g (0.03) peak acceleration or more is considered at seismic risk.

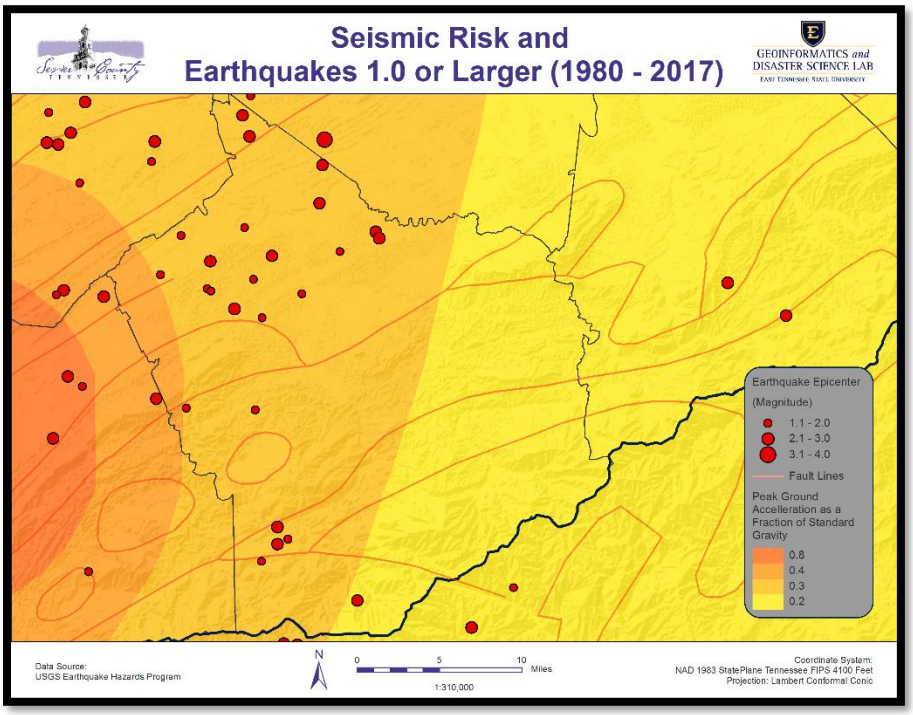

Figure 4-3: Seismic Risk and Fault Lines Across East Tennessee. (Source: USGS)

4.1.4 Extreme Temperatures

Extreme temperature includes both hot and cold occurrences, which can have a significant impact on human health and primary/secondary effects on infrastructure (e.g., burst pipes and power failure). What constitutes "extreme cold" or "extreme heat" can vary across different areas of the country, based on the extent that the population is accustomed to or prepared for extreme temperature occurrences.

Extreme Cold

Extreme cold events depend on what is considered normal climate for a region. Extremely cold temperatures occur when local temperatures drop well below normal. Temperature drops combined with increased wind speed cause heat to rapidly leave the human body and increase risk of frostbite or hypothermia, which can become life-threatening. Infants and the elderly are most susceptible. Pipes may freeze and burst in housing or commercial buildings that are without heat or otherwise poorly insulated.

There are a number of health hazards resulting from exposure to extreme cold temperatures including wind chill, frostbite, and hypothermia.

- **Wind chill** is based on the rate of heat loss from exposed skin caused by wind and cold, not the actual temperature. As wind speed increases, heat is lost from the body at an accelerated rate which drives down the internal body temperature. In 2001, the National Weather Service (NWS) updated the Wind Chill Temperature (WTC) index which describes relative discomfort/danger resulting from the combined wind and temperature. A Wind Chill Advisory is issued by NWS when combined wind and temperature produce wind chill values of 18 degrees below zero to 25 degrees below zero.
- **Frostbite** is damage to body tissue inflicted by extreme cold. Frostbite can cause a loss of feeling and a white or pale appearance in extremities. A wind chill of -20°F will cause frostbite in 30 minutes and can become life-threatening.
- **Hypothermia** occurs when internal body temperature drops below 95°F. Warning signs of this condition include uncontrollable shivering, memory loss, disorientation, incoherence, slurred speech, drowsiness, and apparent exhaustion. Body temperatures become so low that the brain is affected, making it a challenge for the afflicted to think clearly or move well. This is particularly dangerous as the victim may not understand what is happening to them or what they can do to help themselves.

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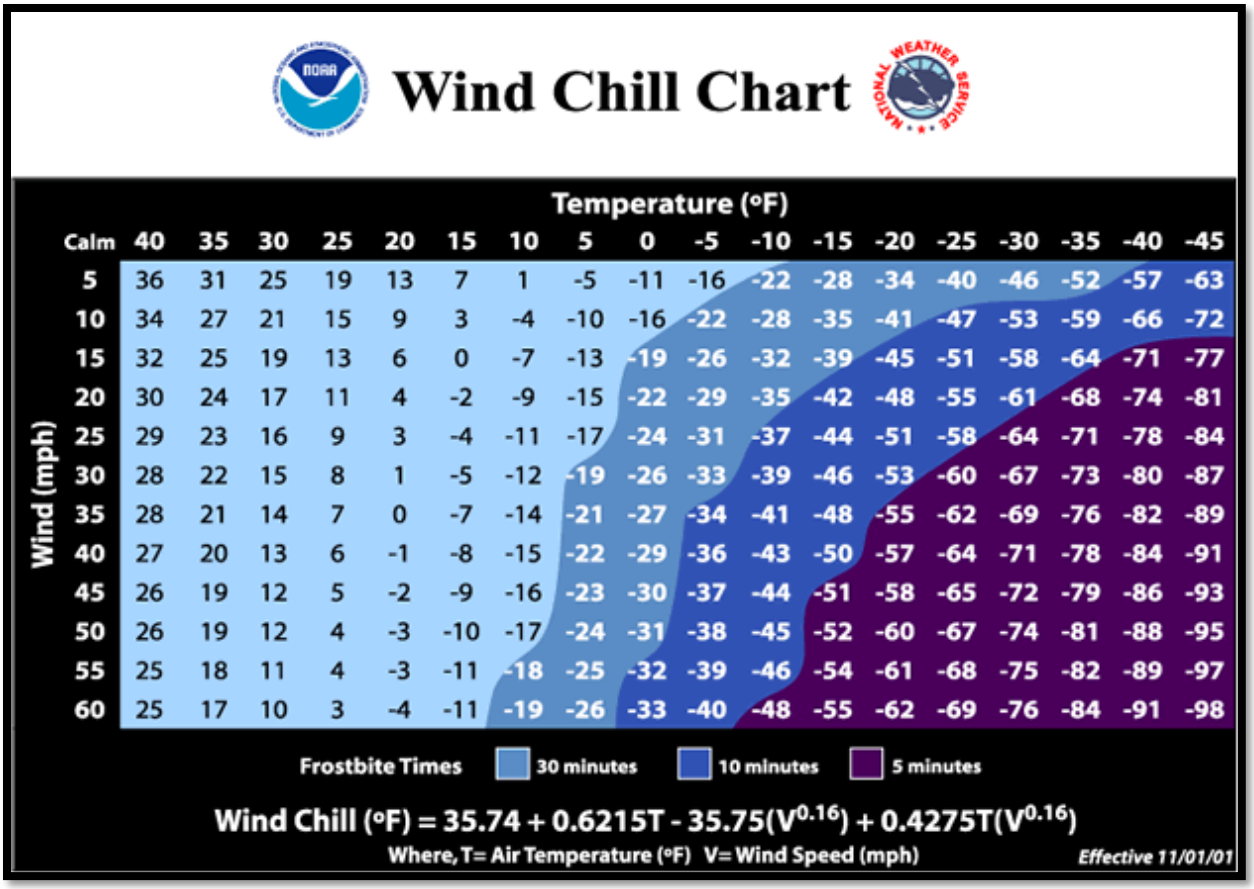

Figure 4-4: Wind Chill Temperature Index and Frostbite Risk.
(Source: National Weather Service)

The following table displays the National Weather Service Weather Forecast Office in Morristown, Tennessee warning and advisory thresholds for extreme cold.

Table 4-6: NWS Morristown Warning and Advisory Thresholds for Extreme Cold.

Warning/Advisory Type	Description
Wind Chill Warning	Wind chill index ≤ -15°F with winds ≥10mph for at least 3 hours
Wind Chill Advisory	Wind chill index between -5°F and -14°F with winds ≥10mph for at least 3 hours

Extreme Heat

Extreme heat conditions occur when temperatures are 10 degrees or more above local average high temperatures for a prolonged period of time (e.g. several weeks). A period of extreme heat of three or more consecutive days is known as a heat wave and is often accompanied by high humidity. Humid or muggy conditions exist when high atmospheric pressure traps hazy, damp air near the ground.

While extreme heat can damage buildings and infrastructure, the most significant threat of extreme heat is to human health and safety. Health hazards derived from extreme heat include heat cramps, heat exhaustion, heat syncope, and heat stroke. Heat disorders are associated with the inability of the body to shed excess heat by circulatory changes and sweating or a chemical (salt) imbalance caused by too much sweating. The NWS created a Heat Index (HI) which includes likelihood of a heat disorder based on temperature and relative humidity (Figure 4-5). The HI is used as a common guideline for the issuance of excessive heat alerts—when the maximum daytime HI is expected to equal or exceed 105°F and a nighttime minimum HI of 80°F or higher for at least two consecutive days.

- **Heat cramps** are muscular pains and spasms due to heavy exertion and are often the first signal that the body is experiencing distress due to high temperatures.
- **Heat exhaustion** is a mild form of shock which results in increased blood flow to the skin and consequently causes decreased blood flow to vital organs. Left untreated, heat exhaustion can result in heat stroke. Heat exhaustion is common in hot, humid places where people lose excessive body fluids through heavy sweating.
- **Heat stroke** is a life-threatening event in which the victim's temperature control system stops working. The internal body temperature can rise high enough to cause brain damage and death.
- **Heat syncope** is a sudden loss of consciousness caused by a circulatory instability response to excess heat.

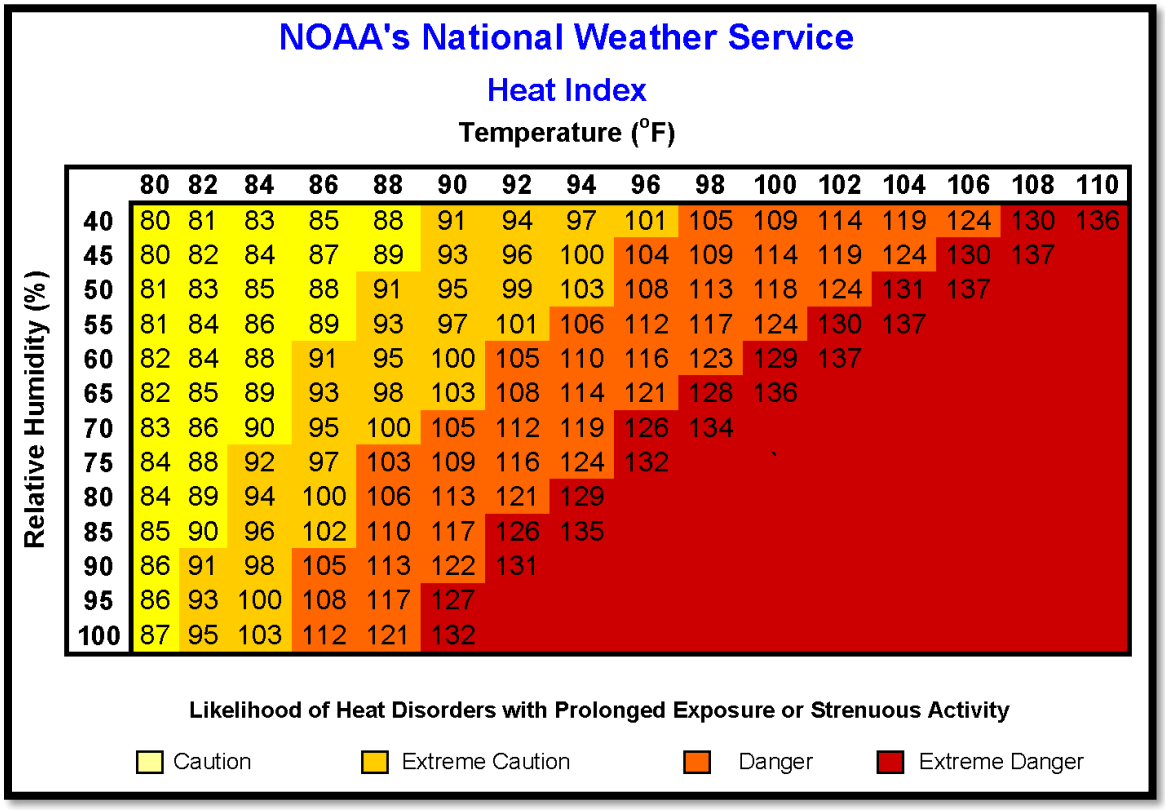

Figure 4-5: Heat Index Chart with Likelihood of Heat Disorders due to Exposure or Strenuous Activity. (Source: National Weather Service)

The following table displays the National Weather Service (Morristown) warning and advisory thresholds for extreme heat.

Table 4-7: NWS Morristown Warning and Advisory Thresholds for Extreme Heat.

Warning/Advisory Type	Description
Excessive Heat Warning	Daytime heat indices of > 110˚F or Temperature >105˚F
Heat Advisory	Daytime heat indices of >105˚F or Temperature >103˚F

4.1.5 Floods Including Extreme Precipitation

A flood is the overflow of water onto land that is usually not inundated. The National Flood Insurance Program defines a flood as:

> *A general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties from overflow of inland or tidal waves, unusual and rapid accumulation or runoff of surface waters from any source, mudflow, or collapse or subsidence of land along the shore of a lake or similar body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels that result in a flood as defined above.*

Factors influencing the type and severity of flooding include natural variables such as precipitation, topography, vegetation, soil texture, and seasonality, as well as anthropogenic factors such as urbanization (extent of impervious surfaces), land use (agricultural and forestry tend to remove native vegetation and accelerate soil erosion), and the presence of flood-control structures such as levees and dams.

Extreme precipitation, produced from mid-latitude cyclones, thunderstorms, or hurricanes, is often the major initiating condition for flooding. During the cooler months, slow-moving frontal weather systems produce heavy rainfalls, while the summer and autumn seasons produce major precipitation in isolated thunderstorm occurrences (often on warm afternoons) that may lead to localized flooding. During these warmer seasons, floods are overwhelmingly of the flash flood variety, as opposed to the slower-developing river floods caused by heavy stream flow during the cooler months.

Six specific types of flooding are of main concern: riverine, flash, ponding, backwater, urban, and coastal.

- **Riverine flooding** occurs along a river or smaller stream. It is the result of runoff from heavy rainfall or intensive snow or ice melt. The speed with which riverine flood levels rise and fall depends not only on the amount of rainfall, but even more on the capacity of the river itself, as well as the shape and land cover of its drainage basin. The smaller the river, the faster that water levels rise and fall. For example, the Charles River levels rise and fall slowly due to its large capacity. Generally, elongated and intensely-developed drainage basins will reach faster peak discharges and faster falls than circular-shaped and forested basins of the same area.
- **Flash flooding** occurs when locally intense precipitation inundates an area in a short amount of time, resulting in local stream flow and drainage capacity being overwhelmed.

- **Ponding** occurs when concave areas (e.g., parking lots, roads, and clay-lined natural low areas) collect water and are unable to drain.
- **Backwater flooding** occurs when water slowly rises from a normally unexpected direction where protection has not been provided.
- **Urban flooding** is similar to flash flooding but is specific to urbanized areas. It takes place when storm water drainage systems cannot keep pace with heavy precipitation, and water accumulates on the surface. Most urban flooding is caused by slow-moving thunderstorms or torrential rainfall.
- **Coastal flooding** can appear similar to any of the other flood types, depending on its cause. It occurs when normally dry coastal land is flooded by seawater, but may be caused by direct inundation (when the sea level exceeds the elevation of the land), overtopping of a natural or artificial barrier, or the breaching of a natural or artificial barrier (i.e., when the barrier is broken down by the sea water). Coastal flooding is typically caused by storm surge, tsunamis, or gradual sea level rise. *(Coastal flooding is not an issue in Tennessee.)*

Based on stream gauge levels and precipitation forecasts, the National Weather Service (NWS) posts flood statements, watches, and warnings. The NWS issues the following weather statements with regard to flooding:

- Flood Categories
    - Minor Flooding: Minimal or no property damage, but possibly some public threat.
    - Moderate Flooding: Some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations.
    - Major Flooding: Extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations.
    - Record Flooding: Flooding which equals or exceeds the highest stage or discharge at a given site during the period of record keeping.

- Flood Warning
    - Issued along larger streams when there is a serious threat to life or property.

- Flood Watch
    - Issued when current and developing hydrometeorological conditions are such that there is a threat of flooding, but the occurrence is neither certain nor imminent.

Floods are measured mainly by probability of occurrence. A 10-year flood occurrence, for example, is an occurrence of small magnitude (in terms of stream flow or precipitation) but with a relatively high annual probability of recurrence (10%). A 100-year flood occurrence is larger in magnitude, but it has a smaller chance of recurrence (1%). A 500-year flood is significantly larger than both a 100-year occurrence and a 10-year occurrence, but it has a lower probability than both to occur in any given year (0.2%). It is important to understand that an X-year flood occurrence does not mean an occurrence of that magnitude occurs only once in X years. Instead, it means that on average, we can expect a flood occurrence of that magnitude to occur once every X years. Given that such statistical probability terms are inherently difficult for the general population to understand, the Association of State Floodplain Managers (ASFPM)

promotes the use of more tangible expressions of flood probability. As such, the ASFPM also expresses the 100-year flood occurrence as having a 25% chance of occurring over the life of a 30-year mortgage.

The 100-year flood occurrence is of particular significance since it is the regulatory standard that determines the obligation (or lack thereof) to purchase flood insurance. Flood insurance premiums are set depending on the flood zone, as modeled by National Flood Insurance Program (NFIP) Rate Maps. The NFIP and FEMA suggest insurance rates based on Special Flood Hazard Areas (SFHAs), as diagrammed in Figure 4-6.

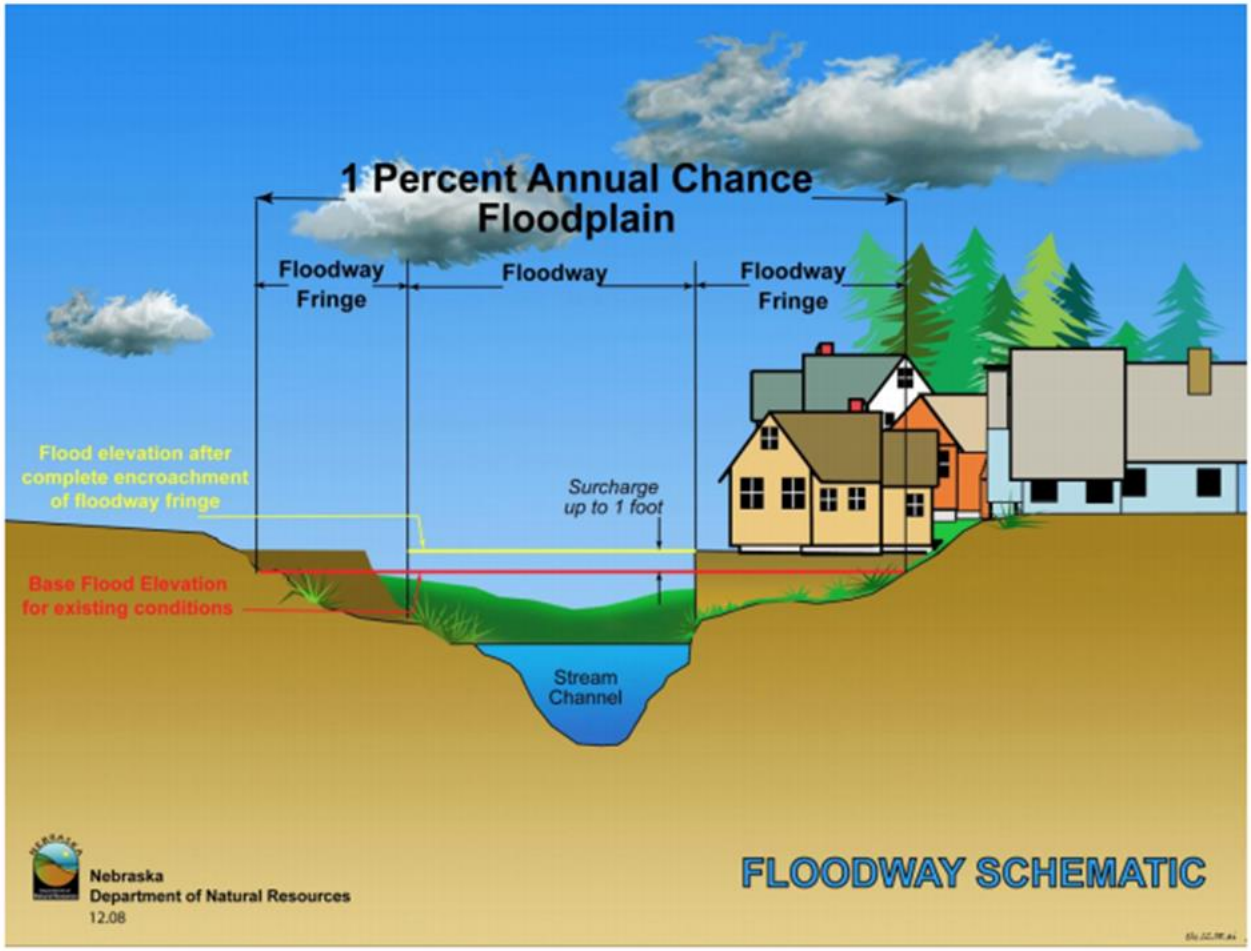

Figure 4-6: Schematic of 100-Year Floodplain. The Special Flood Hazard Area (SFHA) extends to the end of the floodway fringe.
(Source: Nebraska Department of Natural Resources)

A SFHA is the land area covered by the floodwaters of the base flood (red line in the above figure), where the NFIP's floodplain management regulations must be enforced and the area where the mandatory purchase of flood insurance applies. Flood zones for Northeast Tennessee are shown in Figure 4-7.

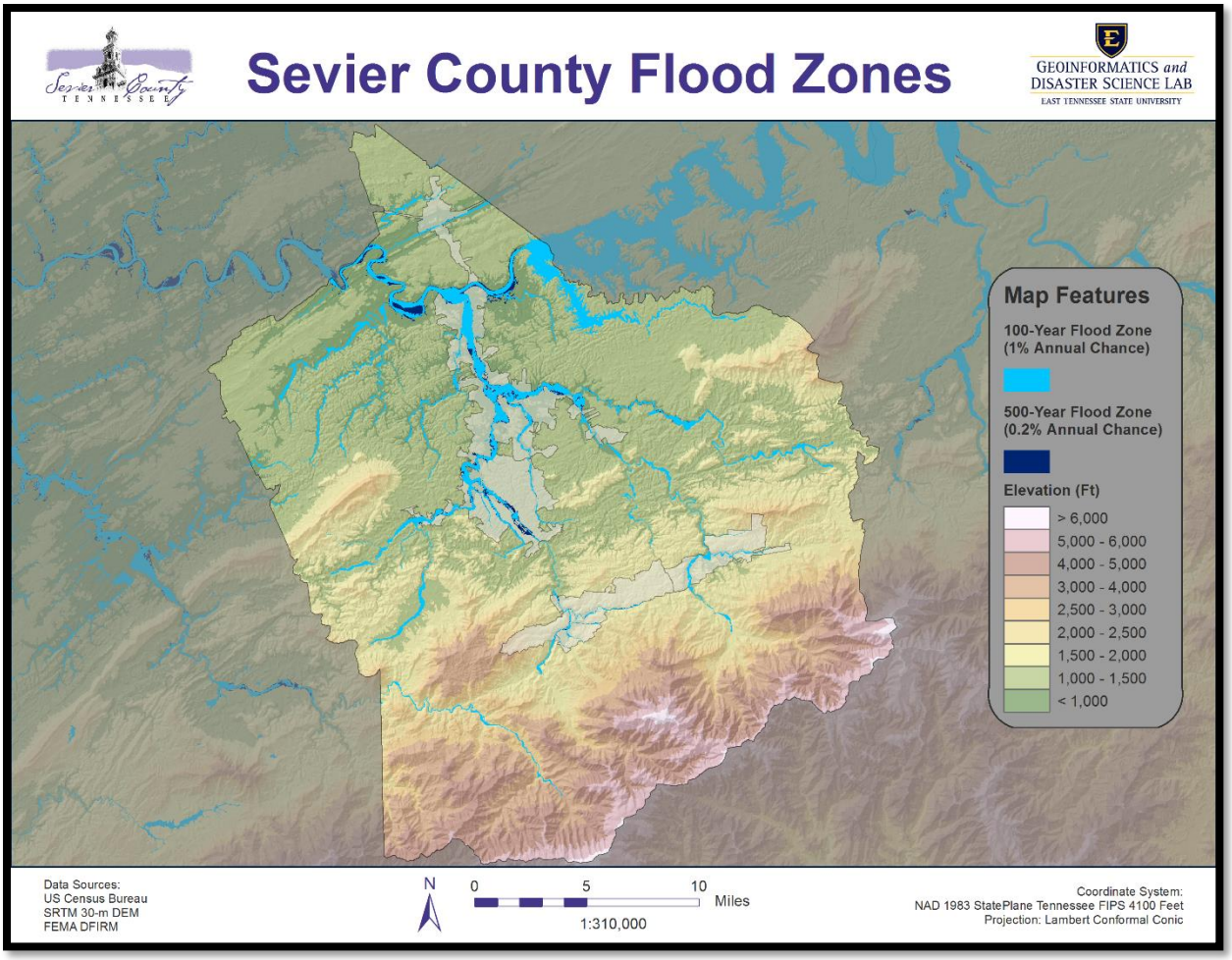

Figure 4-7: FEMA Flood Zone Designations for Sevier County in Tennessee.

Extreme precipitation, primarily the type that contributes to flash flooding and not widespread areal flooding as identified by FEMA SFHA zones, can also be quantified through return period analysis. The 100-year (1% probability of recurrence) 60-minute rainfall and 100-year 24-hour rainfall estimates are shown in Figure 4-8. A 100-year rainfall anomaly does not always indicate that a 100-year flood will occur.

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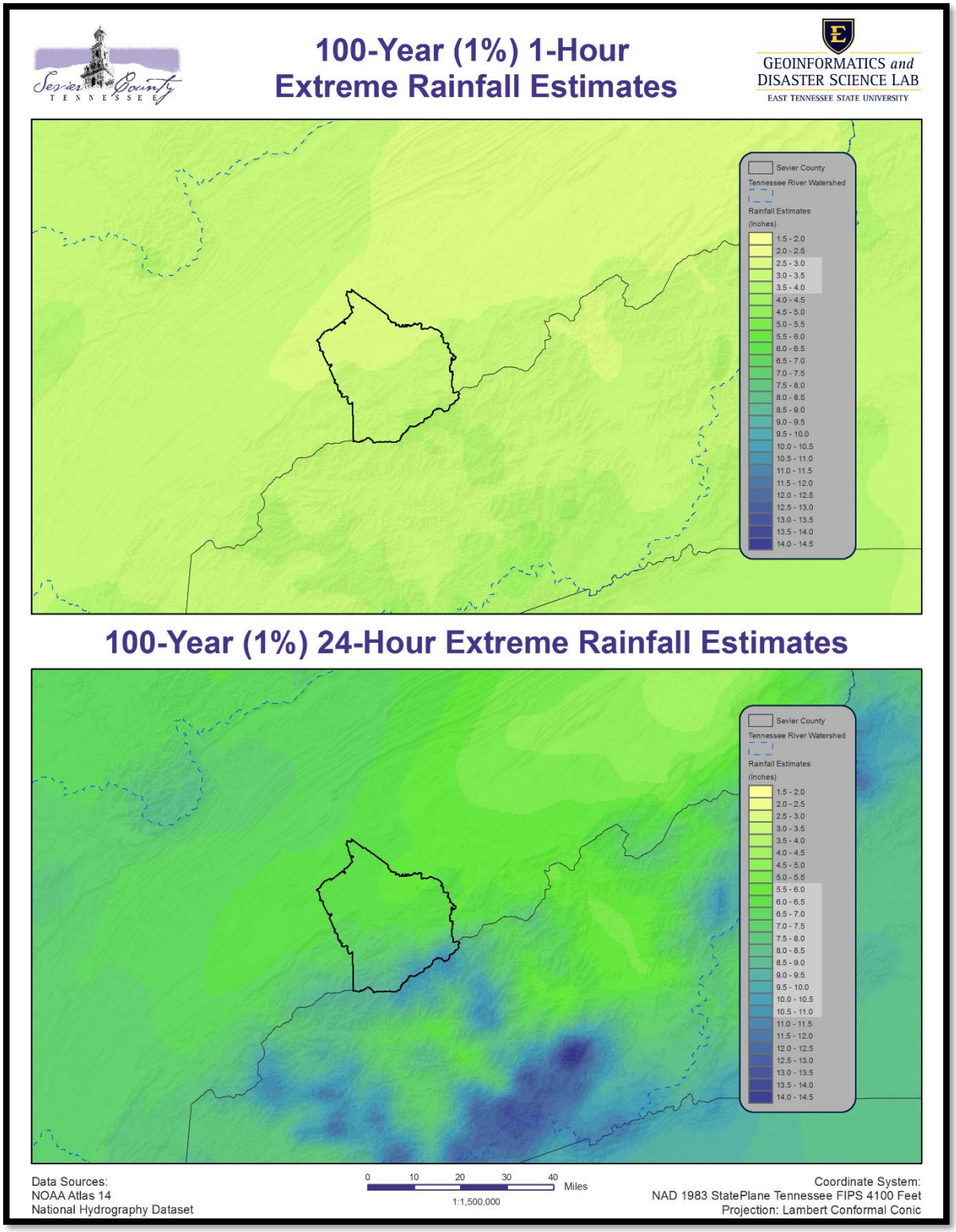

Figure 4-8: 100-year Rainfall Estimates for Two Return Periods.

Property Damage

The depth and velocity of flood waters are the major variables in determining property damage. Flood velocity is important because the faster water moves, the more pressure it puts on a structure and the more it will erode stream banks and scour the earth around a building's foundation. In some situations, deep and fast-moving waters can push a building off its foundation. Structural damage can also be caused by the weight of standing water (hydrostatic pressure).

Another threat to property from a flood is called "soaking." When soaked, many materials change their composition or shape. Wet wood will swell, and if dried too quickly, will crack, split, or warp. Plywood can come apart and gypsum wallboard can deteriorate if it is bumped before it has time to completely dry. The longer these materials are saturated, the more moisture, sediment, and pollutants they absorb.

Soaking can also cause extensive damage to building contents. Wooden furniture may become warped, making it unusable, while other furnishings such as books, carpeting, mattresses, and upholstery are usually not salvageable. Electrical appliances and gasoline engines will flood, making them indefinitely unusable or at a minimum unusable until they are professionally dried and cleaned. Contents are also susceptible to mold damage. Microscopic organisms are found everywhere and develop easily into mold in the presence of water or dampness. Mold discoloration comes in a variety of colors from white to orange and from green to brown or black.

According to FEMA, infants, children, pregnant women, individuals with existing respiratory conditions (allergies, multiple chemical sensitivity, and asthma), and the elderly appear to be at higher risks for adverse health effects from mold. Symptoms include nose and throat irritation, wheezing, coughing, asthma attacks in individuals who have asthma, and lower respiratory tract infections (in children).

Many buildings that have succumbed to flood waters may look sound and unharmed after a flood, but water has the potential to cause severe property damage. Any structure that experiences a flood should be stripped, cleaned, and allowed to dry before being reconstructed. This can be an extremely expensive and time-consuming effort.

Repetitive Loss Properties

Repetitive loss structures are structures covered by a contract for flood insurance made available under the NFIP that:

- Have incurred flood-related damage on two occasions, in which the cost of the repair, on average, equaled or exceeded 25 percent of the market value of the structure at the time of each such flood occurrence; and
- At the time of the second incidence of flood-related damage, the contract for flood insurance contains increased cost of compliance coverage.

Severe repetitive loss (SRL) is defined by the Flood Insurance Reform Act of 2004 and updated in the Biggert-Waters Flood Insurance Reform Act of 2012. For a property to be designated SRL, the following criteria must be met:

- It is covered under contract for flood insurance made available under the NFIP; and
- It has incurred flood related damage-

- For which four or more separate claims payments have been made under the flood insurance coverage with the amount of each claim exceeding $5,000 and with the cumulative amount of such claims payments exceeding $20,000; or
- For which at least two separate claims payments have been made under such coverage, with the cumulative amount of such claims exceeding the market value of the insured structure.

Repetitive loss properties for Sevier County are provided below:

Table 4-8: Repetitive Loss Structures for Sevier County.

Jurisdiction	Number of Structures	Residential	Commercial	Government	Total Claims	Total Claims Paid	Average Claim Paid
Sevier County (Unincorporated	0	0	0	0	0	0	0
Gatlinburg	4	2	2	0	10	$254,101	$25,410
Pigeon Forge	18	17	1	0	58	$753,603	$12,993
Pittman Center	0	0	0	0	0	0	0
Sevierville	1	1	0	0	3	$15,294	$509,810
Total	**23**	**20**	**3**	**0**	**71**	**$1,022,998**	**$14,408**

The following figure provides an overview of where the repetitive loss structures are located throughout the county and where the highest concentration of repetitive loss structures are located within the county.

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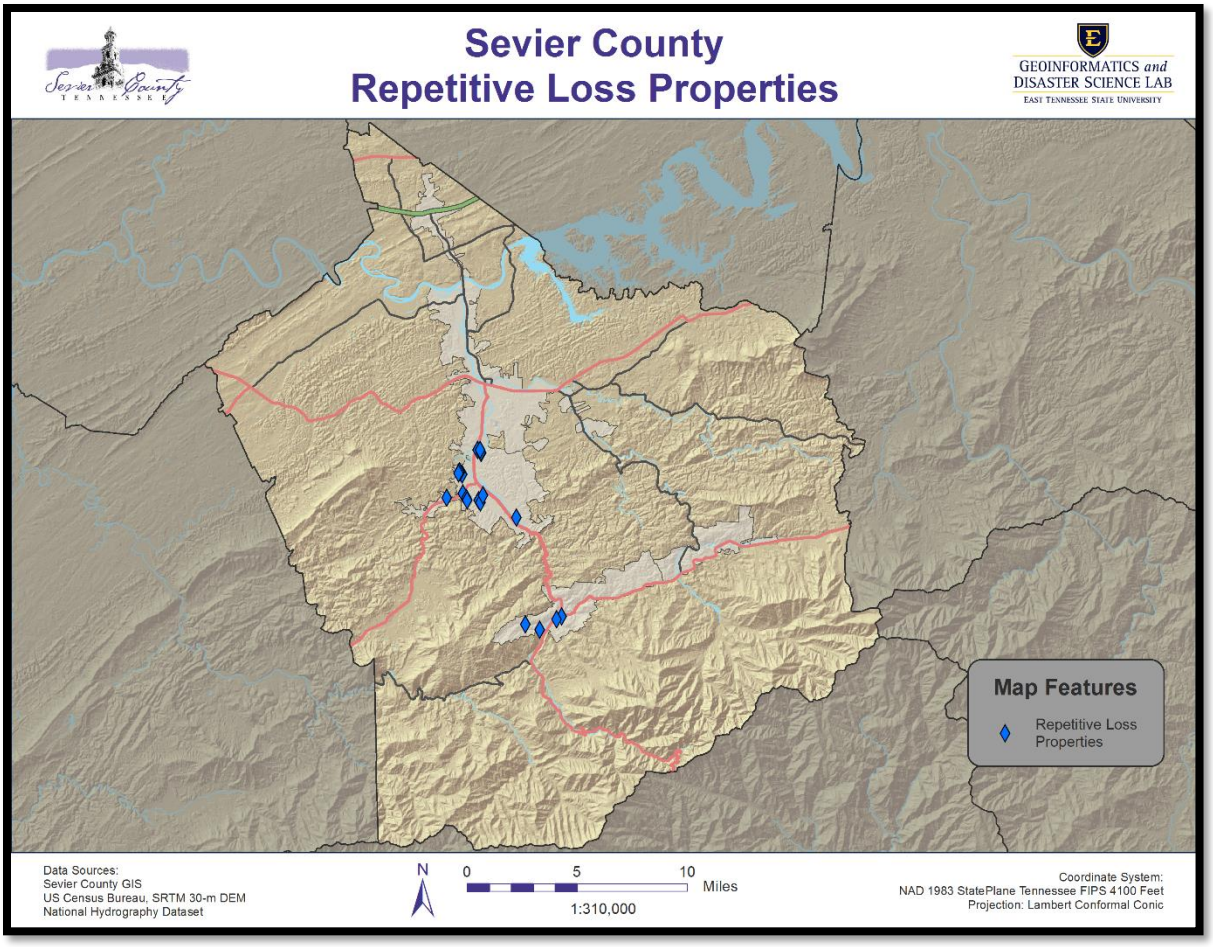

Figure 4-9: Repetitive Loss Properties in Sevier County.

National Flood Insurance Program

Flood insurance statistics indicate that Sevier County has 1,343 flood insurance policies with the NFIP with total annual premiums in excess of $1 million. Sevier County, Gatlinburg, Pigeon Forge, Pittman Center, and Sevierville all participate in the NFIP. Flood insurance statistics and additional NFIP participation details for the unincorporated part of Sevier County and incorporated jurisdictions are provided in the tables to follow.

Table 4-9: Summary of NFIP Policies for Sevier County.

Jurisdiction	Number of Insured Structures	Total Insurance Coverage Value	Annual Premiums Paid	Number of Insurance Claims Filed Since 1979	Total Loss Payments
Sevier County (Unincorporated	111	$25,227,200	$107,699	1	$1,500
Gatlinburg	382	$84,823,500	$285,745	76	$700,275
Pigeon Forge	442	$122,510,200	$435,520	203	$1,695,429
Pittman Center	10	$3,706,800	$33,789	0	$0
Sevierville	398	$88,813,300	$404,000	15	$101,544
Total	**1,343**	**$325,081,000**	**$1,266,753**	**295**	**$2,498,748**

Table 4-10: Summary of NFIP Policies for Sevier County.

CID	Community Name	Initial FHBM Identified	Initial FIRM Identified	Current Effective Map Date	Date Joined the NFIP	Tribal
470236	Sevier County	11/25/1977	6/15/1984	5/18/2009	8/19/2010	No
475426	Gatlinburg	10/30/1970	10/30/1970	5/18/2009	10/30/1970	No
475442	Pigeon Forge	11/12/1971	6/15/1984	5/18/2009	9/1/1972	No
470378	Pittman Center	12/7/1979	3/1/1995	5/18/09 (M)	3/1/1995	No
475444	Sevierville	-	3/27/1971	5/18/2009	3/27/1971	No

Community Rating System

According to the Community Rating System (CRS) list of eligible communities dated October 2016, the city of Gatlinburg is the only community within Sevier County, which participates in the CRS. See the below table for information on the City of Gatlinburg CRS information.

Table 4-11: Community Rating System for the City of Gatlinburg.

Community Number	Name	CRS Entry Date	Current Effective Date	Current Class	% Discount for SFHA	% Discount for Non-SFHA	Status
45426	Gatlinburg	10/1/193	10/1/2009	8	10%	5%	C

Threat to People

Just as with property damage, depth and velocity are major factors in determining the threat posed to people by flooding. It takes very little depth or velocity for flood waters to become dangerous. A car will float in less than two feet of moving water, and can be swept downstream into deeper waters, trapping passengers within the vehicle. Victims of flooding have often put themselves in perilous situations by entering flood waters that they believe to be safe, or by ignoring travel advisories.

Major health concerns are also associated with floods. Flood waters can transport materials such as dirt, oil, animal waste, and chemicals (e.g., farm, lawn, and industrial) that may cause illnesses of various degrees when coming in contact with humans. Flood waters can also infiltrate sewer lines and inundate wastewater treatment plants, causing sewage to back up and creating a breeding ground for dangerous bacteria. This infiltration may also cause water supplies to become contaminated and undrinkable.

4.1.6 Mass Wasting

A mass wasting event, such as a landslide, is the movement of rock, earth, or debris down a slope resulting from the failure of materials which make up the hill slope. Landslides are driven by the force of gravity and can be triggered by natural causes or human activity. Natural causes include rain, earthquakes, erosion, geology (the composition of the material itself), and morphology (the structure of the land). Human activity includes agriculture, construction, irrigation, deforestation, and excavation. Landslides can range from a single boulder to tens of millions of cubic meters of material. The movement of material can be very abrupt or slow and gradual. Sudden/rapid events tend to be the most dangerous due to a lack of warning and the combined speed and impact of material travelling down a slope. However, slow/gradual events can still cause considerable damage to property. Mass wasting events can occur in a number of ways including falls, topples, transitional slides, block slides, lateral spreads, and debris flows.

Table 4-12: Mass Wasting Movement Types.

Type	Description
Topple	The forward rotation of matter about a pivotal point under the force of gravity.
Fall	A rapid movement/decent of material characterized by a freefall period.
Debris Flow	A landslide with high water content which is channeled by the landscape. Water combines with loose soil, rock, and organic material to form slurry which flows downslope. Flows are often triggered by heavy precipitation or rapid snowmelt which erodes and mobilizes loose soil or rock.
Transitional Slide	A slide wherein the surface material is separated from the stable underlying layer of a slope.
Block Slide	A transitional slide in which the moving mass consists of a single unit or small number of units which move in a single mass.
Lateral Spread	The movement of material sideways (laterally). Failure is caused by liquefaction triggered by rapid ground motion (associated with earthquakes). This type of landslide is unique because it can occur on gentle slopes or flat land.

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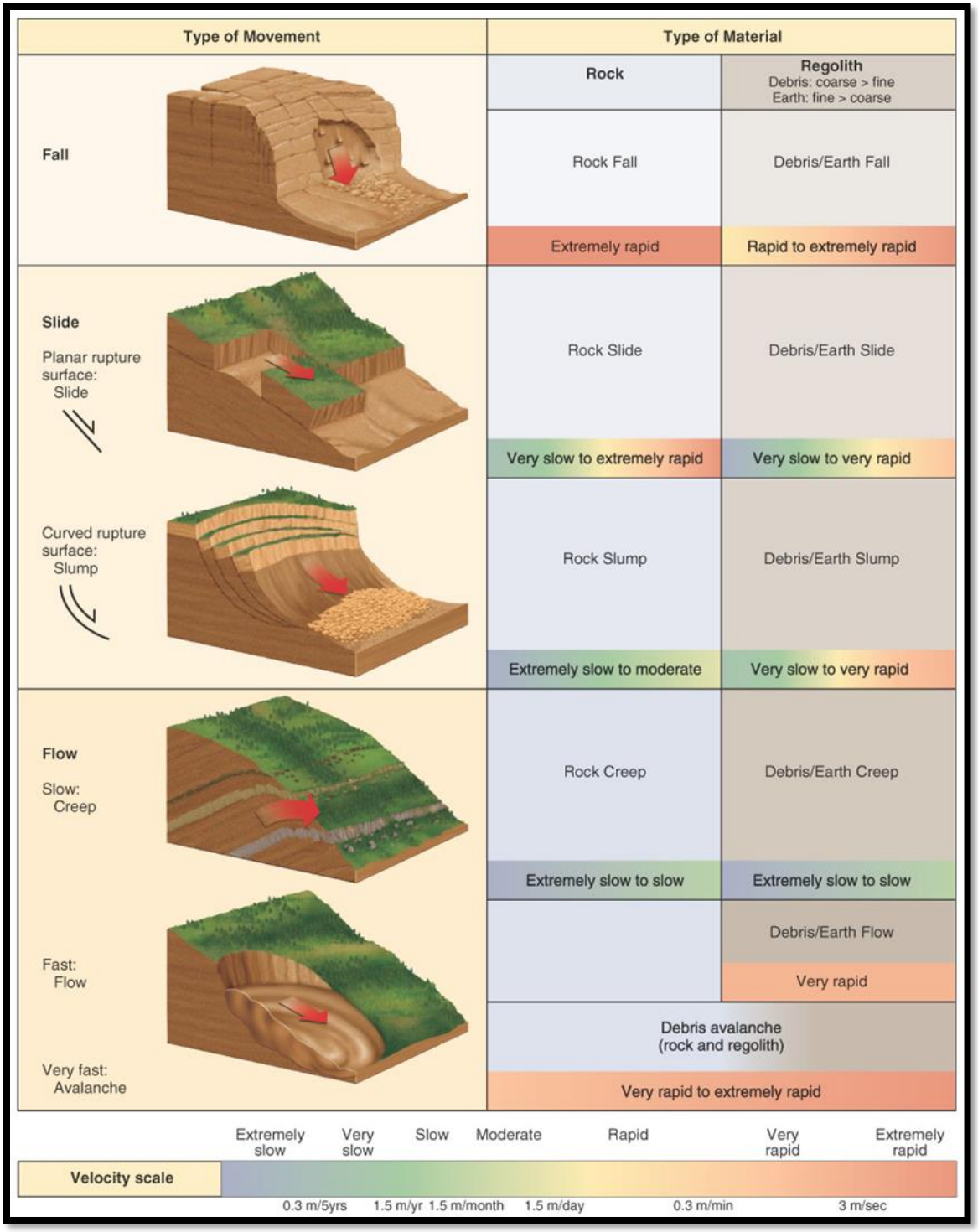


Figure 4-10: Illustrations of Mass Wasting Movement Types.
(Source: McGraw Hill)

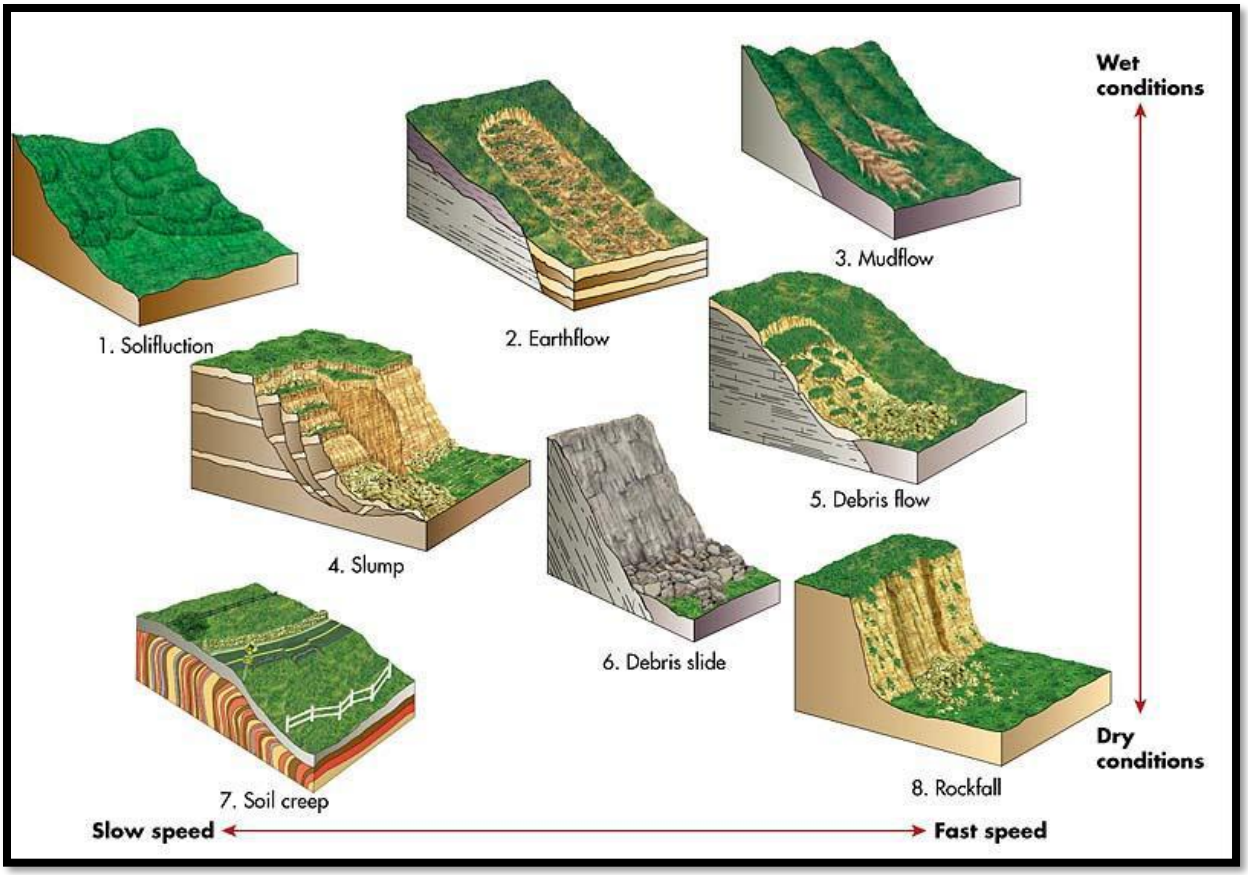


Figure 4-11: Conditions Influencing and Speed of Movement Types.
(Source: McGraw Hill)

Slope instability can be caused by various factors that act together on a slope and eventually causes landslide. Causes of landslide include geological factors, morphological factors, and anthropogenic activity. However, it is important to understand the subtle difference between landslide causes and triggering factor. Landslide causes may be considered to be the factor or combination of factors which make the slope unstable and the reason for which landslide has taken place in a particular location and at that time. On the other hand, trigger the event that initiates landslide. Rainfall and seismic activity are the two main triggering factors for landslides. Therefore, combination of different causes make a slope vulnerable and triggering factor finally initiates landslide. Following are some of the causes of landslide:

- Geological Causes:
    - Weak and weathered material
    - Adverse orientation of discontinuities
    - Contrast in porosity and permeability
    - Groundwater condition
- Morphological Causes:
    - Slope gradient and aspect
    - Curvature of the slope

  - Land Use
  - Poor drainage system.
  - Change in vegetation cover (by fire or drought)
  - Freeze and thaw
  - Erosion of slope toe (by fluvial, glacial and glacial)
  - Tectonic or volcanic uplift
  - Glacial rebound
- Anthropogenic Causes:
  - Deforestation
  - Slope modification
  - Mining
  - Loading of slope
  - Water leakage from utilities

4.1.7 Severe Wind

Mountain waves are typically observed near large mountain ranges around the world when the large-scale winds are perpendicular to the mountain ranges. These mountain waves can produce very strong wind gusts in a narrow area along the foothills, and can also create strong turbulence which adversely affects aviation. The formation of mountain waves is similar to when fast-moving water flows over a large boulder in a river. As the river current flows over the stationary boulder, waves are formed downstream of the boulder. The atmosphere behaves in a similar fashion when the wind flow encounters a large mountain range (a stationary object) with a stable air mass in place. In a stable air mass, air wants to either remain at its same altitude or descend (much like water always wanting to flow downhill). So, when a strong southeast wind flow is perpendicular to the southwest-to-northeast oriented southern Appalachians, it will be forced to rise over the mountains. With a stable air mass also in place, the wind will behave like water and immediately descend on the other side of the mountains in the form of wave. Mountain waves generally occur during the cooler months of the year from late fall through early spring (mid October to mid April), when large low pressure systems and stable air masses are more common. The peak month for mountain wave activity in the western foothills of the southern Appalachians is December. These events generally do not occur during the summer months.

Strong wind gusts from mountain waves generally only affect a narrow zone in the foothills where the bottom of the wave intersects the ground. Those people who live in the narrow corridor along the foothills where these waves intersect the ground can sometimes experience hurricane-force wind gusts. Wind gusts around 100 mph have been routinely measured at Cove Mountain in the Great Smoky Mountains National Park during strong mountain wave events when strong southeast winds occurred within a stable air mass. Wind gusts in excess of 80 mph have also been measured at Camp Creek in southeast Greene County during mountain wave events. While high winds due to mountain waves occur all along the foothills, the Cove Mountain and Camp Creek observation sites are places that routinely experience strong winds due to their favorable terrain location. A favorable terrain profile for mountain waves is one where steep slopes are found on the leeward side (side facing opposite the direction the wind comes from) with more gently-rising slopes on the windward side (side facing the direction the wind comes from). Mountain waves also can occur along the eastern foothills of the southern Appalachian Mountains when the wind flow is from the northwest. While mountain wave events occur more

frequently on the eastern side of the mountains (due to the more frequent occurrence of northwest winds versus southeast winds), it is likely that high winds due to mountain waves are stronger on the western side, because of the steeper slopes that quickly descend into the Great Tennessee Valley. However, due to the lack of observations near the mountains, this theoretical claim cannot be fully verified.

Formation of mountain waves can occur in the following conditions:

- Wind direction within 30 degrees of perpendicular to the ridge of high ground and no change in direction over a significant height band.
- Wind speeds at the crest of the ridge in excess of 15 knots, increasing with height.
- Stable air above the crest of the ridge with less stable air above and a stable layer below the ridge.

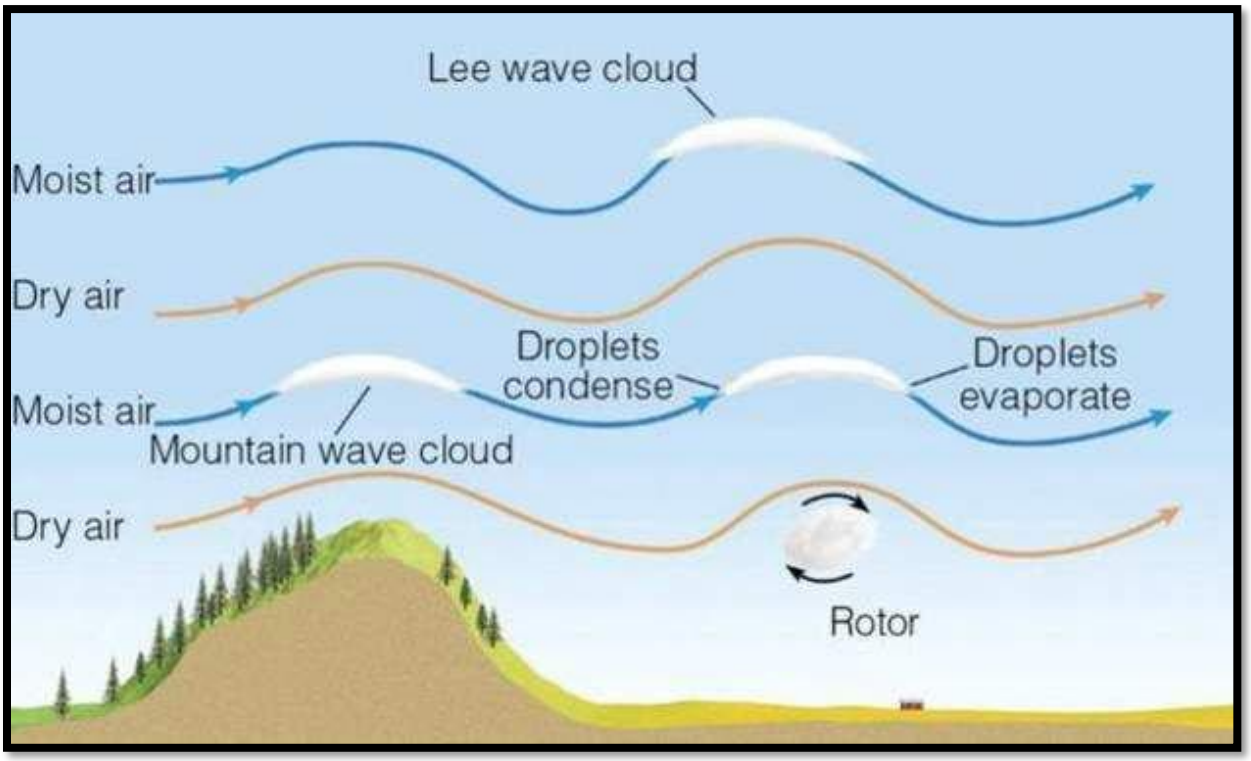
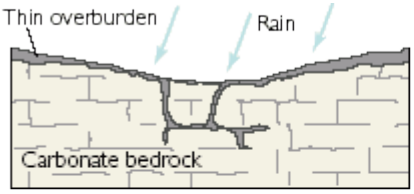


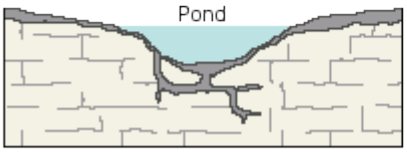
Figure 4-12: Mountain Wave Formation.

4.1.8 Sinkholes

Certain rock types, such as limestone, dolomite, and carbonate rock are water soluble. When a region is composed of this geologically distinctive topography it is known as karst terrain. Karst terrain is common in East Tennessee and results in ground fissures, sinkholes, underground streams, and caverns. The main concern regarding karst in East Tennessee is the formation of sinkholes. Leaching of karst bedrock by groundwater results in underground voids. When these voids collapse, they form sinkholes. The collapse can be very slow and gradual or sudden. Sinkhole depth can be one foot or over 100 feet, and the area can be a few square feet to hundreds of acres. Types of sinkholes include dissolution sinkholes, cover-subsidence sinkholes, and cover-collapse sinkholes.



Rainfall and surface water percolate through joints in the limestone. Dissolved carbonate rock is carried away from the surface and a small depression gradually forms.



On exposed carbonate surfaces, a depression may focus surface drainage, accelerating the dissolution process. Debris carried into the developing sinkhole may plug the outflow, ponding water and creating wetlands.

Figure 4-13: Dissolution Processes in Limestone.
(Source: USGS)

Granular sediments spall into secondary openings in the underlying carbonate rocks.

A column of overlying sediments settles into the vacated spaces (a process termed "piping").

Dissolution and infilling continue, forming a noticable depression in the land surface.

The slow downward erosion eventually forms small surface depressions 1 inch to several feet in depth and diameter.

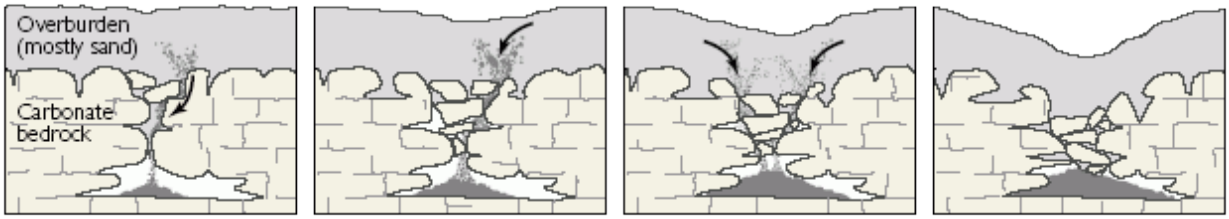


Figure 4-14: Cover-Subsidence in Karst Topography.
(Source: USGS)

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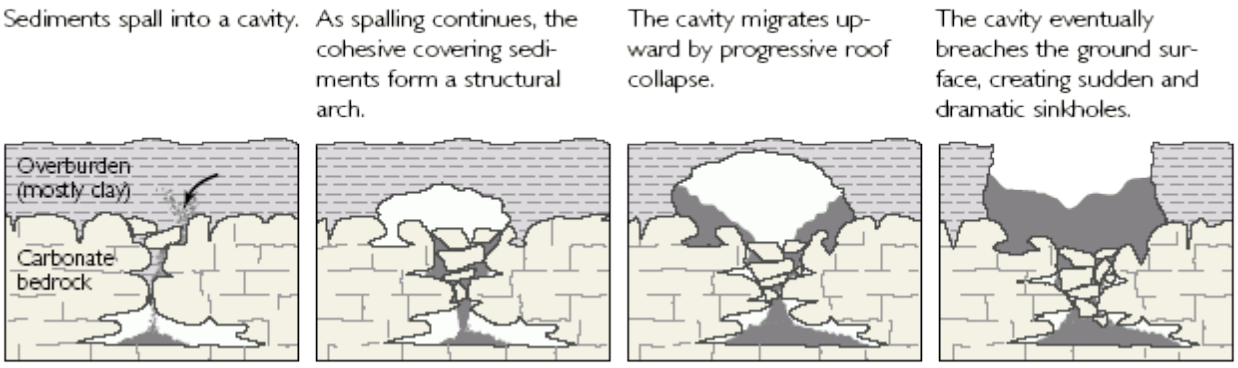

Figure 4-15: Cover-Collapse Process in Karst Topography.
(Source: USGS)

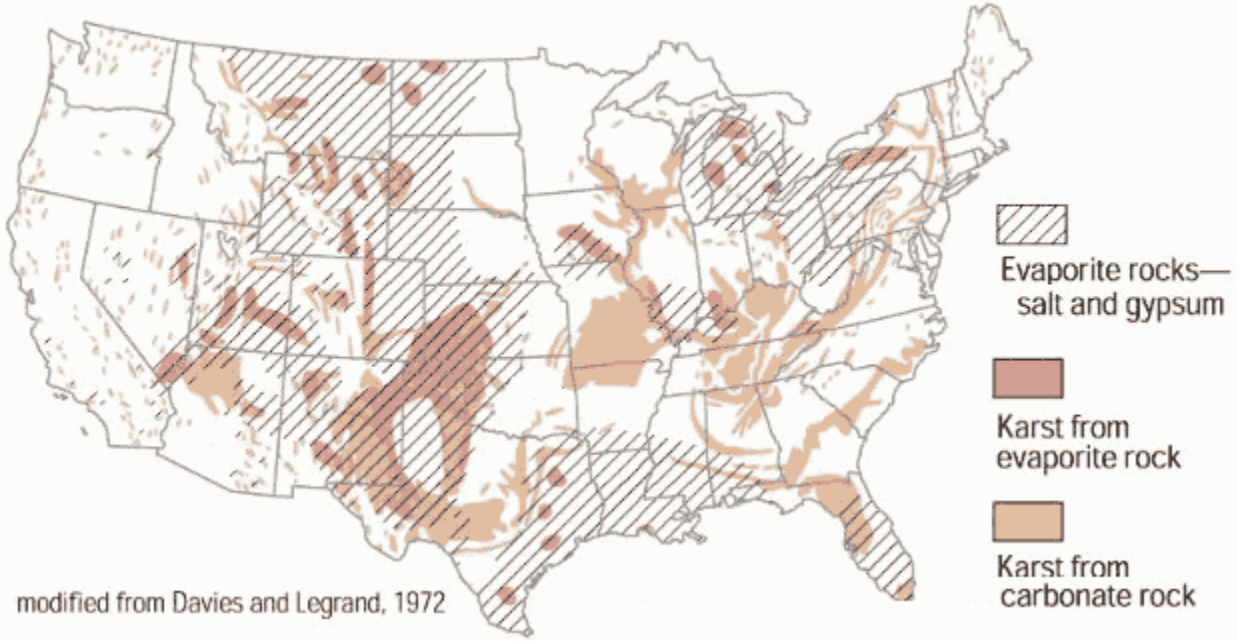

Figure 4-16: Karst Topography throughout the United States.
(Source: USGS)

Sinkholes can form naturally (through groundwater seepage) or through anthropogenic influence such as mining, sewers, hydraulic fracture drilling, groundwater pumping, irrigation, or storage ponds. Like naturally caused sinkholes, the collapse is due to a lack of support for surface soils.

In non-developed areas, sinkhole collapse does not cause much damage beyond the local ecosystem. However, in developed areas, sinkholes can cause significant structural and infrastructure damage including building or roadway collapse and damage to utilities. Death and injury can occur if collapses are sudden or if vehicles are driven into collapsed roadways.

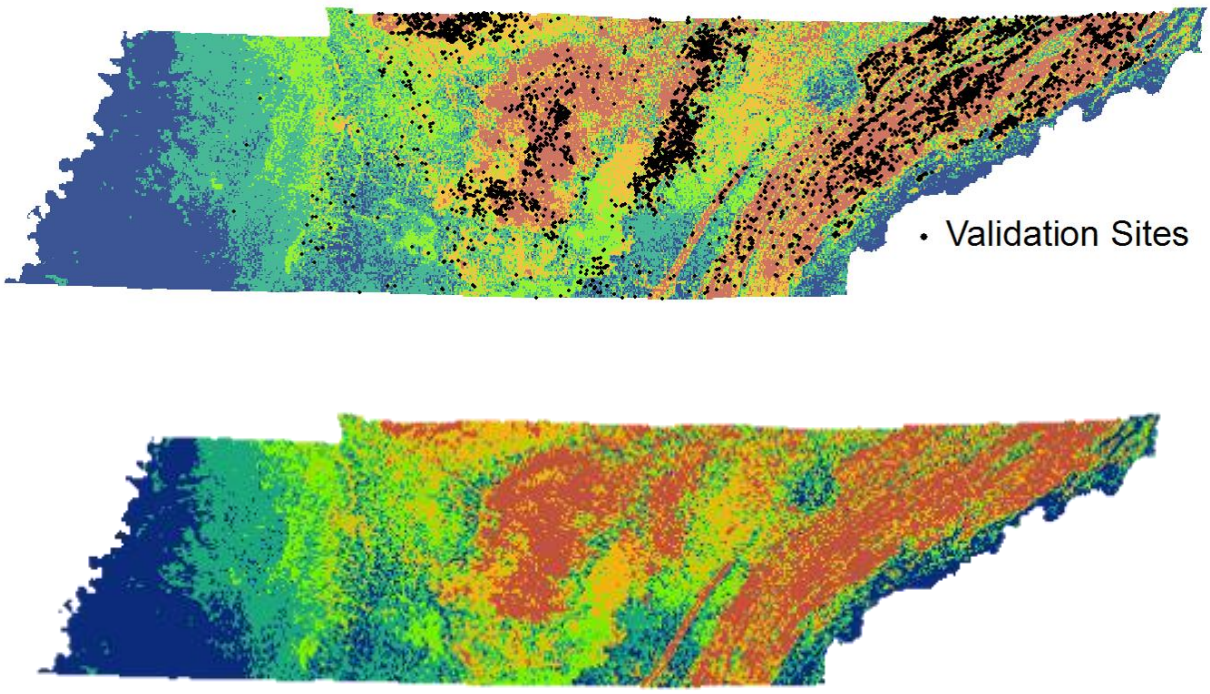

Figure 4-17: Sinkhole Locations (Validation Sites) and Predictive Model (Logistic Regression) of Sinkhole Probability Across Tennessee (Developed by ETSU Department of Geosciences Graduate Student Kimberly Blazzard).

4.1.9 Thunderstorms (Hail, Lightning, and Wind)

The term "thunderstorm" is usually used as a catch-all term for several kinds of storms. Here, "thunderstorm" is defined to include any precipitation occurrence in which thunder is heard or lightning is seen. Thunderstorms are often accompanied by heavy rain and strong winds, and occasionally, depending on conditions, by hail or snow. A thunderstorm is formed due to an atmospheric imbalance of warm, unstable air rising rapidly. As the warm air rises, the air masses' water vapor condenses into liquid water and/or deposits directly into ice when they rise sufficiently to cool to the dew-point temperature, forming cumulonimbus clouds—or thunderheads. Typically, thunderstorms last an average of 30 minutes and are 15 miles in diameter.

Thunderstorms are classified into four main types (single-cell, multi-cell, squall line, and supercell), depending on the degree of atmospheric instability, the change in wind speed with height (called wind shear), and the degree to which the storm's internal dynamics are coordinated with those of adjacent storms. There is no such interaction for single-cell thunderstorms, but there is significant interaction with clusters of adjacent thunderstorms in multi-cell thunderstorms, and with a linear "chain" of adjacent storms in squall line thunderstorms. Though supercell storms have no significant interactions with other storms, they have very well-organized and self-sustaining internal dynamics, which allows them to be the longest-lived and most severe of all thunderstorms.

The life of a thunderstorm proceeds through three stages: the developing (or cumulus) stage, the mature stage, and the dissipation stage (Figure 4-18). During the developing stage, the unstable air mass is lifted as an updraft into the atmosphere. This sudden lift rapidly cools the moisture in the air mass, releasing latent heat as condensation and/or deposition occurs, which warms the surrounding environment, thus making it less dense than the surrounding air. This process intensifies the updraft and creates a localized lateral rush of air from all directions into the area beneath the thunderstorm to feed continued updrafts. At the mature stage, the rising air is accompanied by downdrafts caused by the shear of falling rain (if melted completely), or hail, freezing rain, sleet, or snow (if not melted completely). The dissipation stage is characterized by the dominating presence of the downdraft as the hot surface that gave the updrafts their buoyancy is cooled by precipitation. During the dissipation stage, the moisture in the air mass largely empties out.

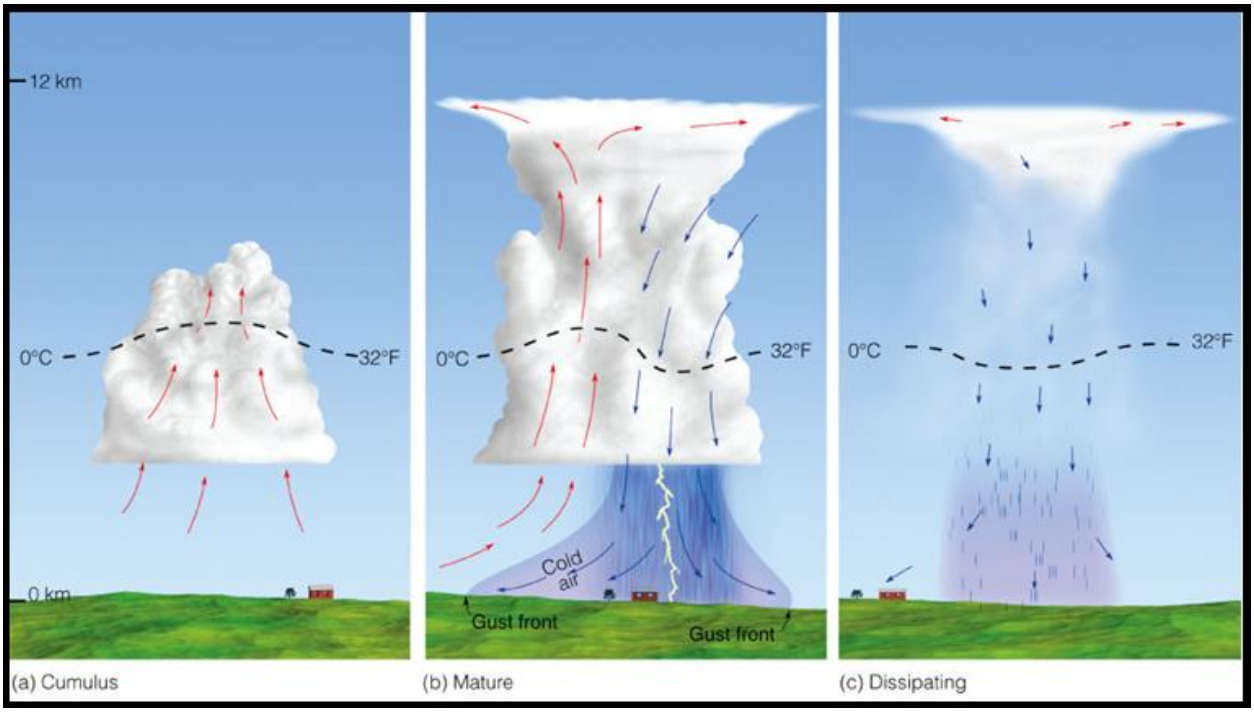

Figure 4-18: Life Cycle of a Thunderstorm.

The Storm Prediction Center, in conjunction with local National Weather Service (NWS) offices, have the ability to issue advisory messages based on forecasts and observations. The following are the advisory messages that may be issued, along with definitions of each:

- Severe Thunderstorm Watch: Issued by the Storm Prediction Center to alert people to the possibility of a severe thunderstorm developing in the area. Expected time frame for these storms is three to six hours.

- Severe Thunderstorm Warning: Issued by local National Weather Service Office when severe thunderstorms are imminent. This warning is highly localized and covers parts of one to several counties.

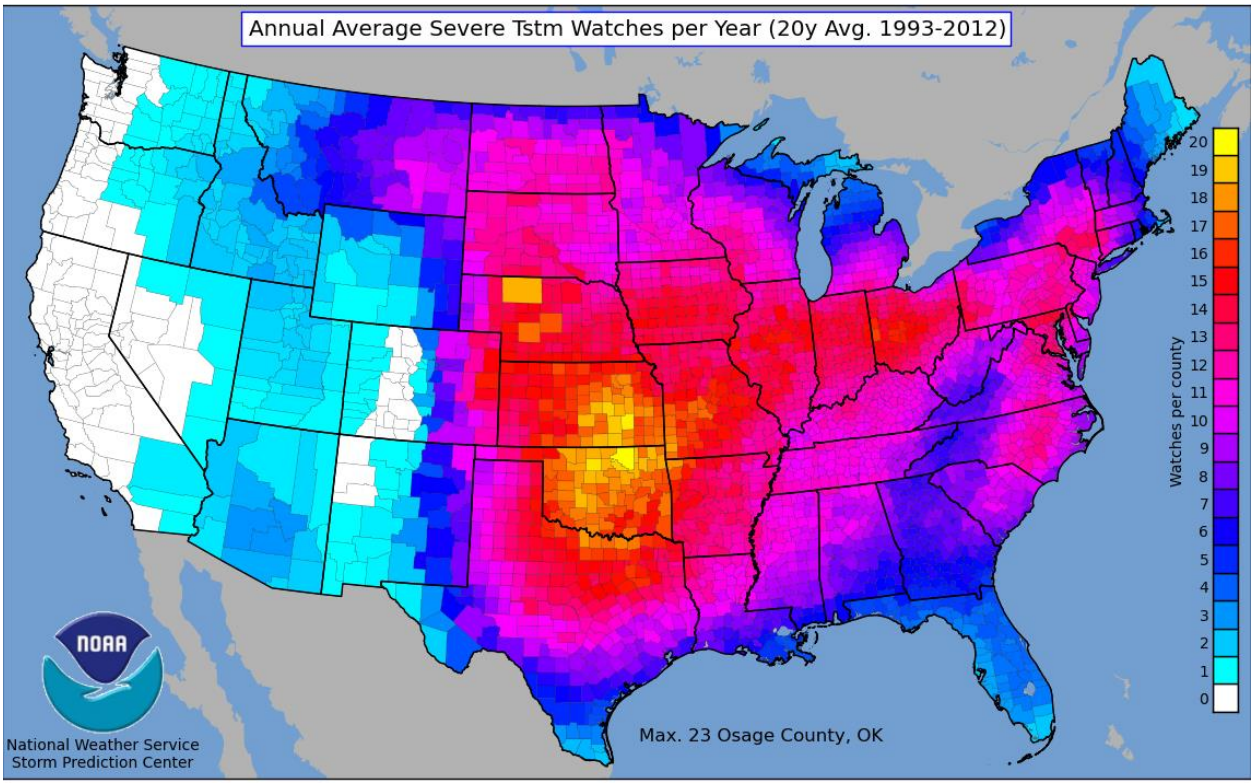

Figure 4-19: County-Level Severe Thunderstorm Watches Issued Per Year on Average.

A variety of hazards might be produced by thunderstorms, including lightning, hail, tornadoes or waterspouts, flash flooding, and high-speed winds called downbursts. Nevertheless, given the criteria, the National Oceanic and Atmospheric Administration (NOAA) characterizes a thunderstorm as severe when it produces one or more of the following:

- Hail of one inch in diameter or larger
- Wind gusts to 58 mph or greater
- One or more tornadoes

Tornadoes and flooding hazards have been profiled individually within this report; therefore, for the purpose of thunderstorms, the sub-hazards of hail, high winds, and lightning will be profiled.

Thunderstorms occur throughout the United States at all times of the year, although the types and severity of these storms vary greatly depending on a wide variety of atmospheric conditions. Severe thunderstorms occur more frequently during the late spring and early summer and late summer and early fall when extreme variations exist between ground surface temperatures and upper atmospheric temperatures.

Hail Profile

Hail is defined as falling ice more than 5 mm in diameter. Hail initially develops in the upper atmosphere as ice crystals that are bounced about by high-velocity updraft winds. The ice crystals grow through deposition of water vapor onto their surface. They then fall partially to a level in the cloud where the temperature exceeds the freezing point, melt partially, and then get caught in another updraft whereupon re-freezing and deposition grows another concentric layer of ice. After several trips up and down the cloud, they develop enough weight to fall. The size of hailstones varies depending on the severity and size of the thunderstorm. Higher surface temperatures generally mean stronger updrafts, which allow more massive hailstones to be supported by updrafts, leaving them suspended longer. This longer suspension time results in larger hailstone sizes. The tables on the next page display the TORRO Hailstorm Intensity Scale, along with a spectrum of hailstone diameters and their everyday equivalents.

Table 4-13: TORRO Hailstorm Intensity Scale.

Intensity Category		Hail Diameter (mm)	Typical Damage Impacts
H0	Hard Hail	5	No damage
H1	Potentially Damaging	5 -15	Slight general damage to plant, crops
H2	Significant	10 – 20	Significant damage to fruit, crops, vegetation
H3	Severe	20 – 30	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
H4	Severe	25 – 40	Widespread glass damage, vehicle body work
H5	Destructive	30 – 50	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
H6	Destructive	40 – 60	Bodywork of grounded aircraft dented, brick walls pitted
H7	Destructive	50 – 75	Severe roof damage, risk of serious injuries
H8	Destructive	60 – 90	Severe damage to aircraft bodywork
H9	Super Hailstorms	75 – 100	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
H10	Super Hailstorms	>100	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

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Table 4-14: Spectrum of Hailstone Diameters and Their Everyday Equivalent. (Source: National Weather Service)

Hail Diameter Size	Description
1/4”	Pea
1/2”	Plain M&M
3/4”	Penny
7/8”	Nickle
1” (severe)	Quarter
1 ¼”	Half Dollar
1 ½”	Ping Pong Ball/Walnut
1 ¾”	Golf ball
2”	Hen Egg/Lime
2 ½”	Tennis ball
2 ¾”	Baseball
3”	Teacup/Large Apple
4”	Softball
4 ½”	Grapefruit
4 ¾” – 5”	Computer CD-DVD

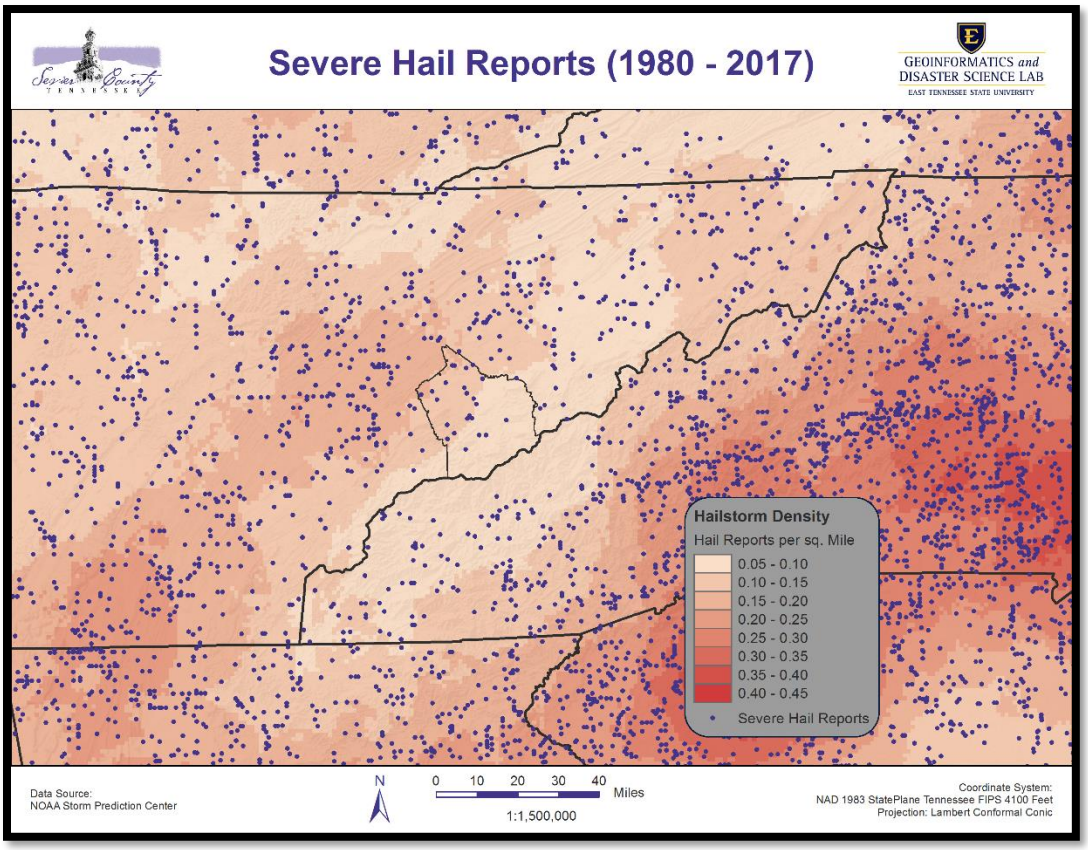

Figure 4-20: Severe Hail Reports for Northeast Tennessee and Surrounding States.

Lightning Profile

Lightning is present during all thunderstorms and can strike anywhere. Lightning is an electrical discharge which results from the buildup of positive and negative charges within a thunderstorm, or locations under or near the thunderstorm cloud. Lightning may occur between clouds, between a cloud and the ground, between the ground and a cloud, or between clouds and the air. Thunder is an acoustic wave derived from lightning. Lightning rapidly heats the air surrounding it to 50,000°F and a supersonic shock occurs as the air compresses. The decay of the supersonic shock results in the sound known as thunder.

Intra-cloud lightning is the most common type of discharge. This occurs between oppositely charged centers within the same cloud. Usually it transpires inside the cloud and looks from the outside of the cloud like a diffuse brightening that flickers. However, the flash may exit the boundary of the cloud, and a bright channel, similar to a cloud-to-ground flash, can be visible for many miles.

Cloud-to-ground lightning is the most damaging and dangerous type of lightning, though it is also less common. Cloud-to-ground lightning can kill or injure people by direct or indirect means. Objects can be struck directly, which may result in an explosion, burn, or total destruction. Damage may also be indirect which occurs when the current passes through or near an object. Most flashes of cloud-to-ground lightning originate near the lower-negative charged center and deliver negative charge to the earth. However, a large minority of flashes carry a positive charge to earth. These positive flashes often occur during the dissipating stage of a thunderstorm. Positive flashes are also more common as a percentage of total ground strikes during the winter months. This type of lightning is particularly dangerous for several reasons. It frequently strikes away from the rain core, either ahead or behind the thunderstorm. It can strike five to ten miles from the storm in areas that most people do not consider a threat. Positive lightning also has a longer duration, so fires are more easily ignited. When positive lightning strikes, it usually carries a high peak electrical current, which can potentially result in greater damage.

According to the NWS Storm Prediction Center data, over the last 29 years (1989-2018), an average of 47 lightning fatalities are reported per year. According to FEMA, lightning continues to be one of the top three storm-related causes of death in the United States; however only about 10% of people who are struck by lightning are killed. If not fatal, being struck by lightning has the ability to cause negative long-term health effects to the individual that is struck. The following table outlines the lightning activity level and intensity scale.

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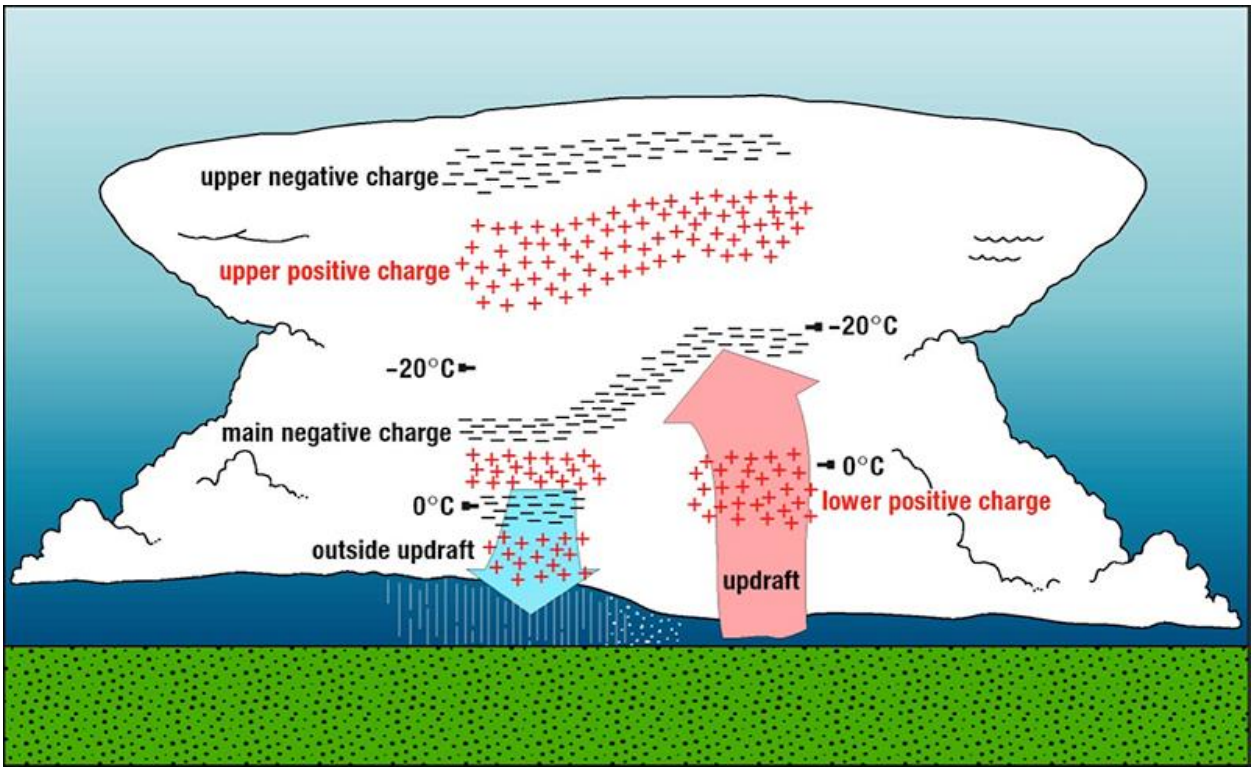

Figure 4-21: Charge Distribution in a Typical Storm Cloud.
(Source: The National Severe Storms Laboratory)

Table 4-15: Lightning Activity Level (LAL) Grids.

LAL	Cloud and Storm Development	Lightning Strikes/ 15 Minutes
1	No thunderstorms.	-
2	Cumulus clouds are common, but only a few reach the towering cumulus stage. A single thunderstorm must be confirmed in the observation area. The clouds produce mainly virga, but light rain will occasionally reach the ground. Lightning is very infrequent.	1 – 8
3	Towering cumulus covers less than two-tenths of the sky. Thunderstorms are few, but two to three must occur within the observation. Light to moderate rain will reach the ground, and lightning is infrequent.	9 – 15
4	Towering cumulus covers two to three-tenths of the sky. Thunderstorms are scattered and more than three must occur within the observation area. Moderate rain is common and lightning is frequent.	16 – 25
5	Towering cumulus and thunderstorms are numerous. They cover more than three-tenths and occasionally obscure the sky. Rain is moderate to heavy and lightning is frequent.	>25
6	Similar to LAL 3 except thunderstorms are dry	

Thunderstorm Winds Profile

In general, high winds occur in a number of different ways, with and without thunderstorms. Similar to hailstorms (and often associated with the same storm), high wind damage densities and reports resulting from severe thunderstorms vary spatially across Tennessee. Thunderstorm winds are often defined as strong or high winds accompanying a thunderstorm with sustained wind speeds of ≥40 mph lasting for at least 1 hour, or winds ≥58 mph for any duration. Thunderstorm winds are often referred to as straight line winds to differentiate from rotating or tornado associated wind. Straight line winds can exceed 100 miles per hour and are typically responsible for the most thunderstorm damage. Downbursts can also occur during a severe thunderstorm and are characterized as sudden wind blowing down due to downdraft in a thunderstorm that spreads out horizontally at the ground.

Major damage directly caused by thunderstorm winds is relatively rare, while minor damage is common and pervasive, and most noticeable when it contributes to power outages. These power outages can have major negative impacts such as increased tendency for traffic accidents, increased vulnerability to fire, food spoilage, and other losses that might be sustained by a loss of power. These high winds can also cause trees and limbs to fall, damaging cars and structures. Flying debris can also present danger to those caught unsheltered during a storm. Table 4-16 presents the Beaufort Wind Scale, first developed in 1805 by Sir Francis Beaufort, which aids in determining relative force and wind speed based on the appearance of wind effects.

Table 4-16: Beaufort Wind Scale.
(Source: NOAA's SPC)

Force	Wind (mph)	WMO Classification	Appearance of Wind Effects on Land
			Calm, smoke rises vertically
1	1 – 3	Light Air	Smoke drift indicates wind direction, still wind vanes
2	4 – 7	Light Breeze	Wind felt on face, leaves rustle, vanes begin to move
3	8 – 12	Gentle Breeze	Leaves and small twig constantly moving, light flags extended
4	13 – 17	Moderate Breeze	Dust, leaves, and loose paper lifted, small tree branches move
5	18 – 24	Fresh Breeze	Small trees in leaf begin to sway
6	25 – 30	Strong Breeze	Larger tree branches moving, whistling in wires
7	31 – 38	Near Gale	Whole trees moving, resistance felt walking against wind
8	39 – 46	Gale	Twigs breaking off trees, generally impedes progress
9	47 – 54	Strong Gale	Slight structural damage occurs, slate blows off roofs
10	55 – 63	Storm	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"
11	54 – 73	Violent Storm	N/A
12	74+	Hurricane	N/A

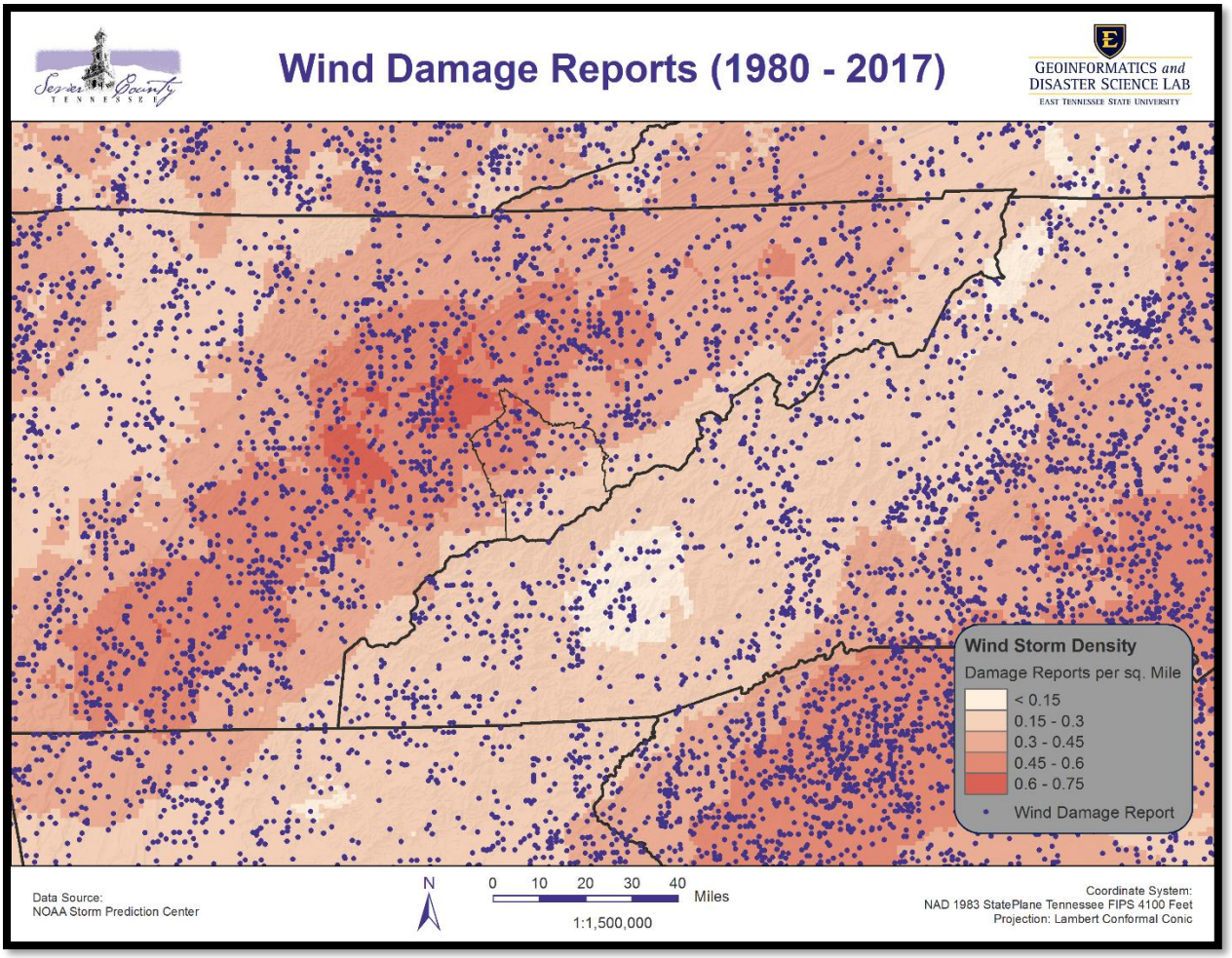

Figure 4-22: Wind Damage Reports for Northeast Tennessee and Surrounding States.

4.1.10 Tornadoes

Tornadoes (also called twisters or cyclones) are rapidly rotating funnels of wind extending between storm clouds and the ground. For their size, tornadoes are the most severe storms, and 70% of the world's reported tornadoes occur within the continental United States, making them one of the most significant hazards Americans face. Tornadoes and waterspouts form during severe weather occurrences, such as thunderstorms and hurricanes, when cold air overrides a layer of warm air, causing the warm air to rise rapidly. This usually results in a counterclockwise rotation in the northern hemisphere. The updraft of air in tornadoes always rotates because of wind shear (differing speeds of moving air at various heights), and it can rotate in either a clockwise or counterclockwise direction; clockwise rotations (in the northern hemisphere) will sustain the system, at least until other forces cause it to die seconds to minutes later.

Since February 1, 2007, the Enhanced Fujita (EF) Scale has been used to classify tornado intensity. The EF Scale classifies tornadoes based on their damage pattern rather than wind speed; wind speed is then derived and estimated. This contrasts with the Saffir-Simpson scale used for hurricane classification, which is based on measured wind speed. Table 4-17 shows the EF scale in comparison with the original Fujita (F) Scale, which was used prior to February 1, 2007. When discussing past tornadoes, the scale used

at the time of the hazard is used. Damage and adjustment between scales can be made using the following tables.

Table 4-17: Comparison of the Enhanced Fujita (EF) Scale to the Fujita (F) Scale.

Wind Speed (mph)	**Enhanced Fujita Scale**					
	EF0	**EF1**	**EF2**	**EF3**	**EF4**	**EF5**
	65 – 85	86 – 110	111 – 135	136 – 165	166 – 200	>200
	Fujita Scale					
	F0	**F1**	**F2**	**F3**	**F4**	**F5**
	<73	73 – 112	113 – 157	158 – 206	207 – 260	>261

Table 4-18: Fujita and Enhanced Fujita Tornado Damage Scale.

Scale	Typical Damage
F0/EF0	Light damage. Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; sign boards damaged.
F1/EF1	Moderate damage. Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.
F2/EF2	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars overturned; light-object missiles generated; cars lifted off ground.
F3/EF3	Severe damage. Roofs and some walls torn of well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.
F4/EF4	Devastating damage. Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown and large missiles generated.
F5/EF5	Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yards); trees debarked; incredible phenomena will occur.

The National Weather Service (NWS) has the ability to issue advisory messages based on forecasts and observations. The following are the advisory messages that may be issued, along with definitions of each:

Advisory	Description
Tornado Watch	Issued to alert people to the possibility of a tornado developing in the area. A tornado has not been spotted but the conditions are favorable for tornadoes to occur.
Tornado Warning	Issued when a tornado has been spotted or when radar identifies a distinctive “hook-shaped” area within a thunderstorm line.

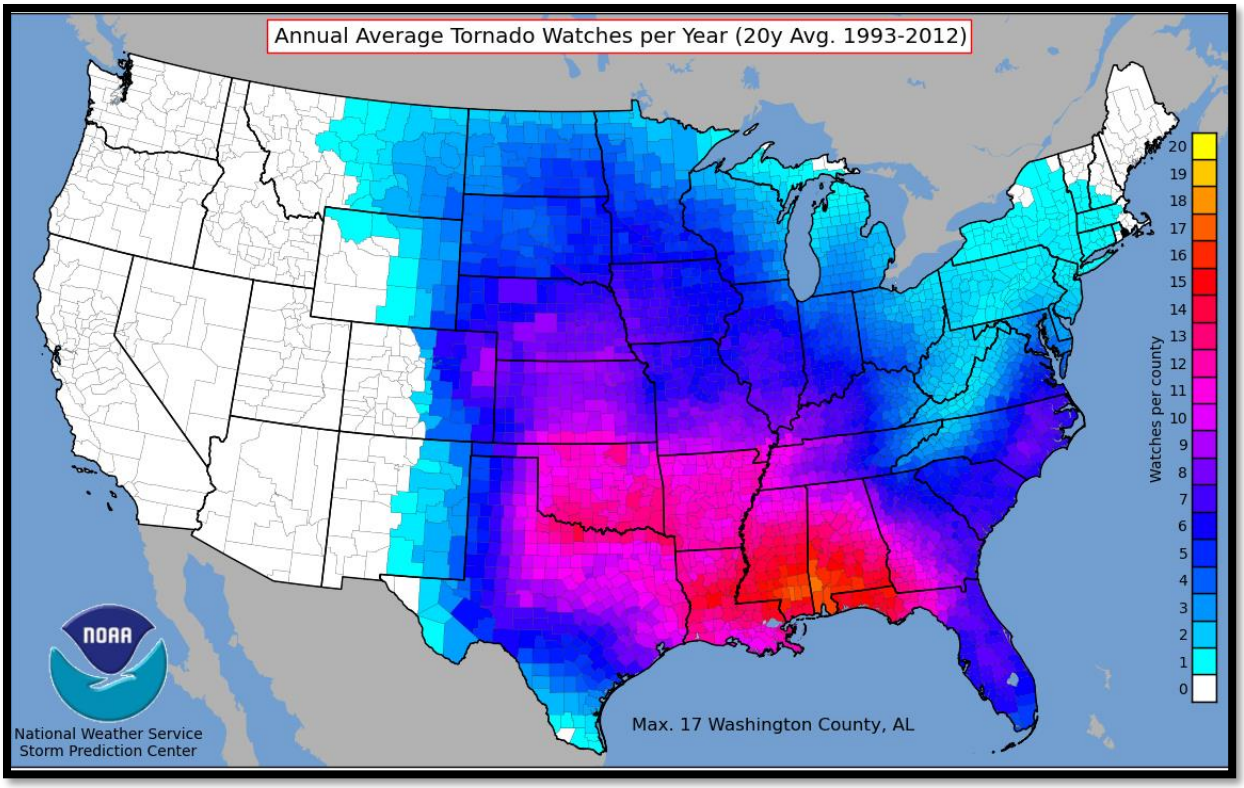

Figure 4-23: County-Level Tornado Watches Issued Per Year on Average. (Source: NOAA SPC)

Structures within the direct path of a tornado vortex are often reduced to rubble. Structures adjacent to the tornado's path are often severely damaged by high winds flowing into the tornado vortex, known as inflow winds. It is here, adjacent to the tornado's path, that the building type and construction techniques are critical to the structure's survival. Although tornadoes strike at random, making all buildings vulnerable, mobile homes, homes with crawlspaces, and buildings with large spans are more likely to suffer damage.

The major health hazard from tornadoes is physical injury from flying debris, or being in a collapsed building or mobile home. Within a building, flying debris or projectiles are generally stopped by interior walls. However, if a building has no partitions, any glass, brick, or other debris blown into the interior is life-threatening. Following a tornado, damaged buildings are a potential health hazard due to instability, electrical system damage, and gas leaks. Sewage and water lines may also be damaged. Tornadoes have historically impacted all areas of Tennessee (Figure 4-24).

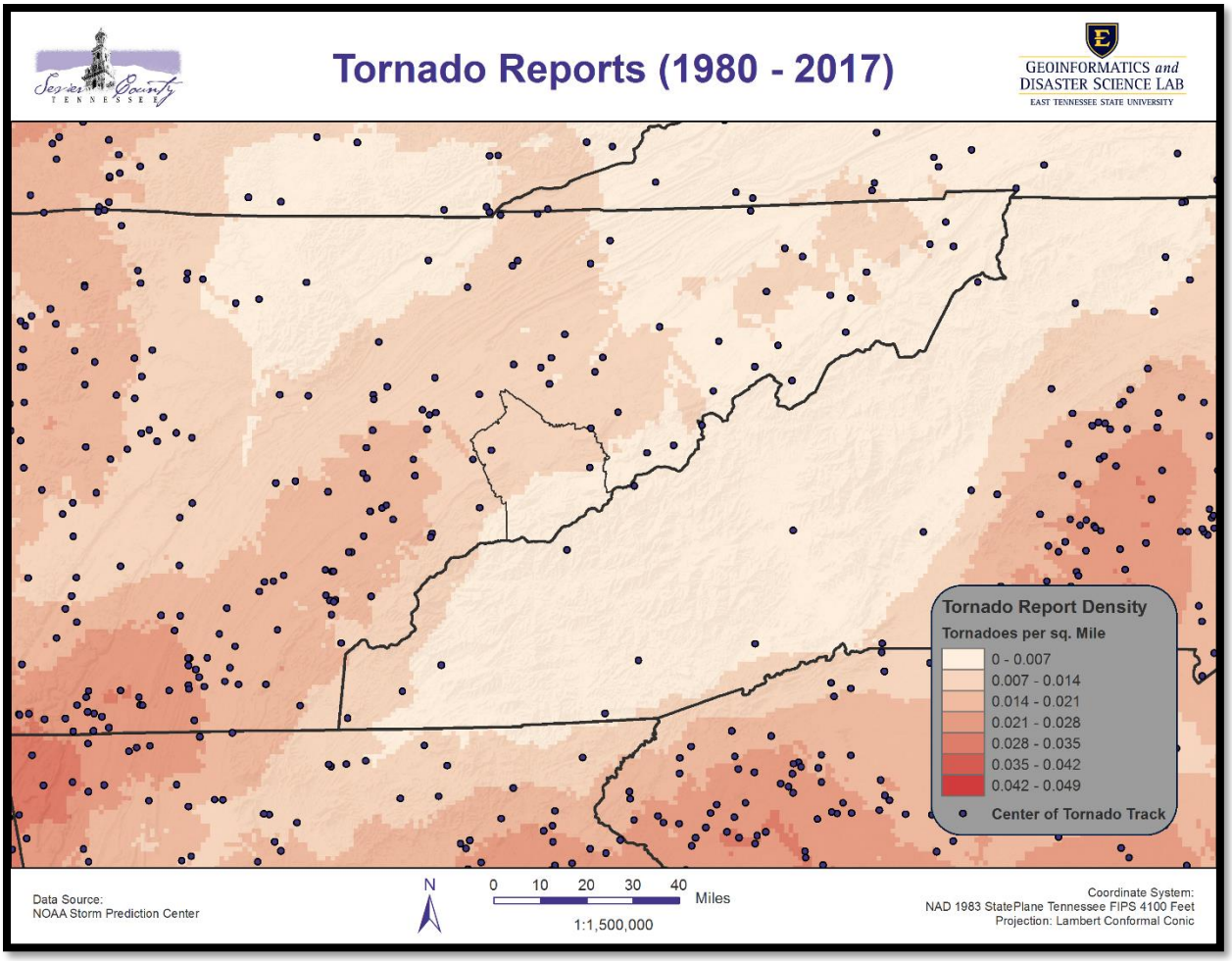

Figure 4-24: Tornado Report Density in Northeast Tennessee from 1980 to 2017.

4.1.11 Tropical Cyclones

The term tropical cyclone refers to "a warm-core non-frontal synoptic-scale cyclone, originating over tropical or subtropical waters, with organized deep convection and a closed surface wind circulation about a well-defined center." Tropical cyclones are caused by atmospheric instability associated with convergence in tropical wind patterns and the large amount of latent heat provided by warm sea surface temperatures. These events are characterized by thunderstorms and spiraling wind patterns around a calm low pressure "eye." The term tropical cyclone is the generic term for these systems which are also called hurricanes, typhoons, tropical storms, tropical depressions, etc. depending on location and strength of the cyclone.

The key energy source for a tropical cyclone is the release of latent heat energy from condensation. This energy is found where there is a deep layer of warm water to fuel the system. Conditions for hurricane formation include warm waters, rotational force from the earth's spin (Coriolis effect), and the absence of vertical wind shear (stability in the lower atmosphere). Tropical disturbances that affect North America typically originate off the west coast of Africa. If the tropical disturbance lowers in pressure and starts to rotate around a low-pressure center, it may turn into a tropical depression. Barometric pressure

(measured in millibars or inches of mercury) continues to fall in the center as these storm systems develop in intensity. When sustained wind speeds reach 39 mph, the system becomes a tropical storm and is given a name by the National Hurricane Center. When sustained wind speeds reach 74 mph, it becomes a hurricane. Hurricanes are much larger and powerful storms with an average diameter of 350 miles. The start of the official Atlantic hurricane season is June 1st and it ends November 30th, although cyclones can form outside of this window. Tropical cyclone formation and typical cyclone paths in the Atlantic basin vary by month throughout the season (Figure 4-25). Peak hurricane season is August and September in the Northern Hemisphere, when water temperatures and evaporation rates are greatest.

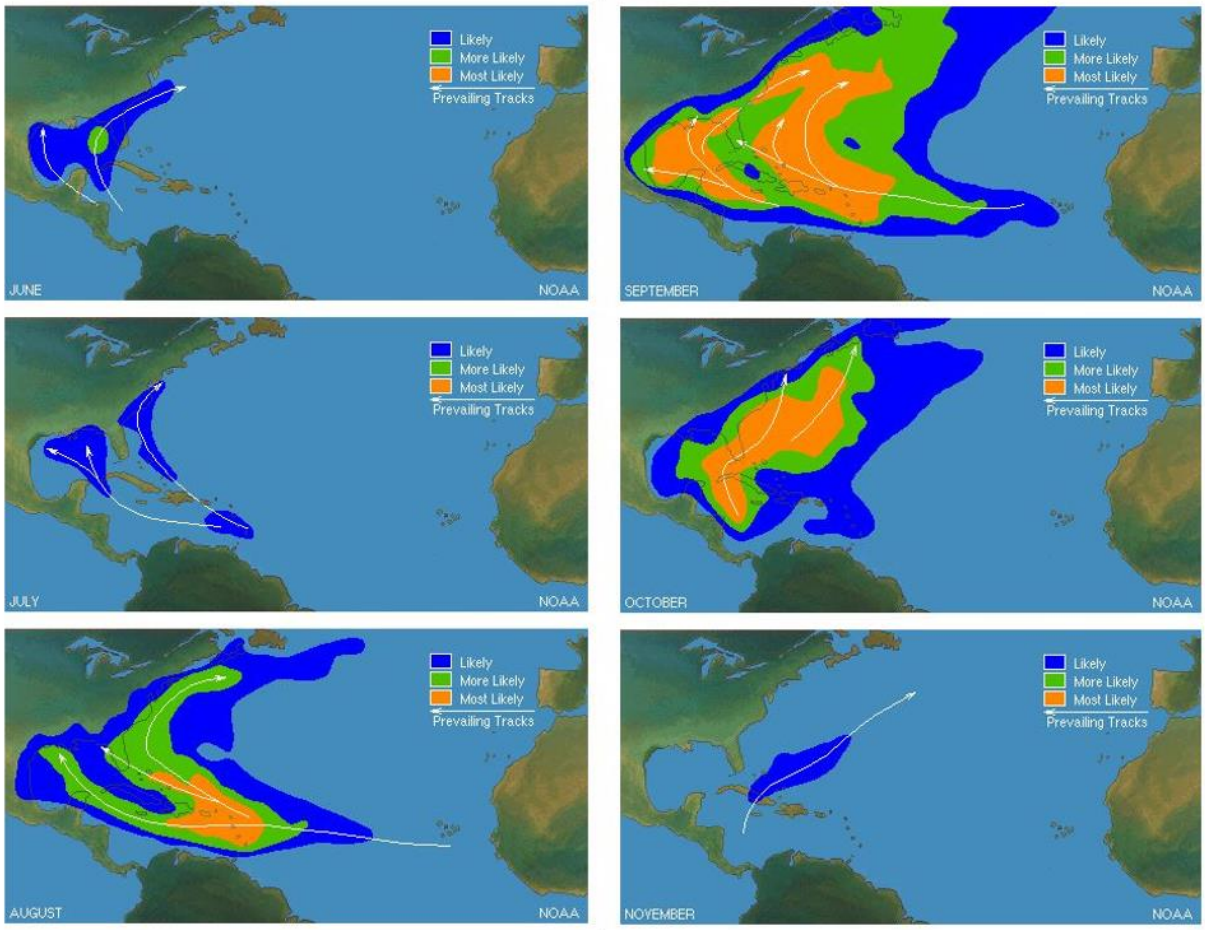

Figure 4-25: Areas of Likely Tropical Cyclone Formation and Tracking.
(Source: NOAA NHC)

Hurricane intensity is classified by the Saffir-Simpson Scale, which categorizes hurricane intensity based upon maximum sustained wind speeds on a scale of one to five, with five being the most intense. Typically, higher category hurricanes have lower pressure and greater storm surge. Categories three, four, and five are classified as "major" hurricanes, and while hurricanes within this range comprise only 20 percent of total landfalls, they account for over 70 percent of the damage incurred in the United States. Associated with these storms are damaging winds, heavy precipitation, and tornadoes, which can occur

in coastal areas as well as well inland. Coastal areas are also vulnerable to storm surge, wind-driven waves, and tidal flooding, which can cause more destruction than cyclone winds.

Because it is located several hundred miles from any coastline, Sevier County would not suffer direct impacts from a tropical cyclone. However, hurricanes are capable of travelling far inland while maintaining tropical cyclone-force winds, and producing heavy rainfall. Therefore, remnants of hurricanes as they weaken over land could impact Sevier County, bringing the risk of significant rainfall and strong winds. Extreme rainfall events spawned by tropical cyclones have the potential to cause major flooding. For more detail regarding possible flooding effects, refer to the "Flooding" section of this report.

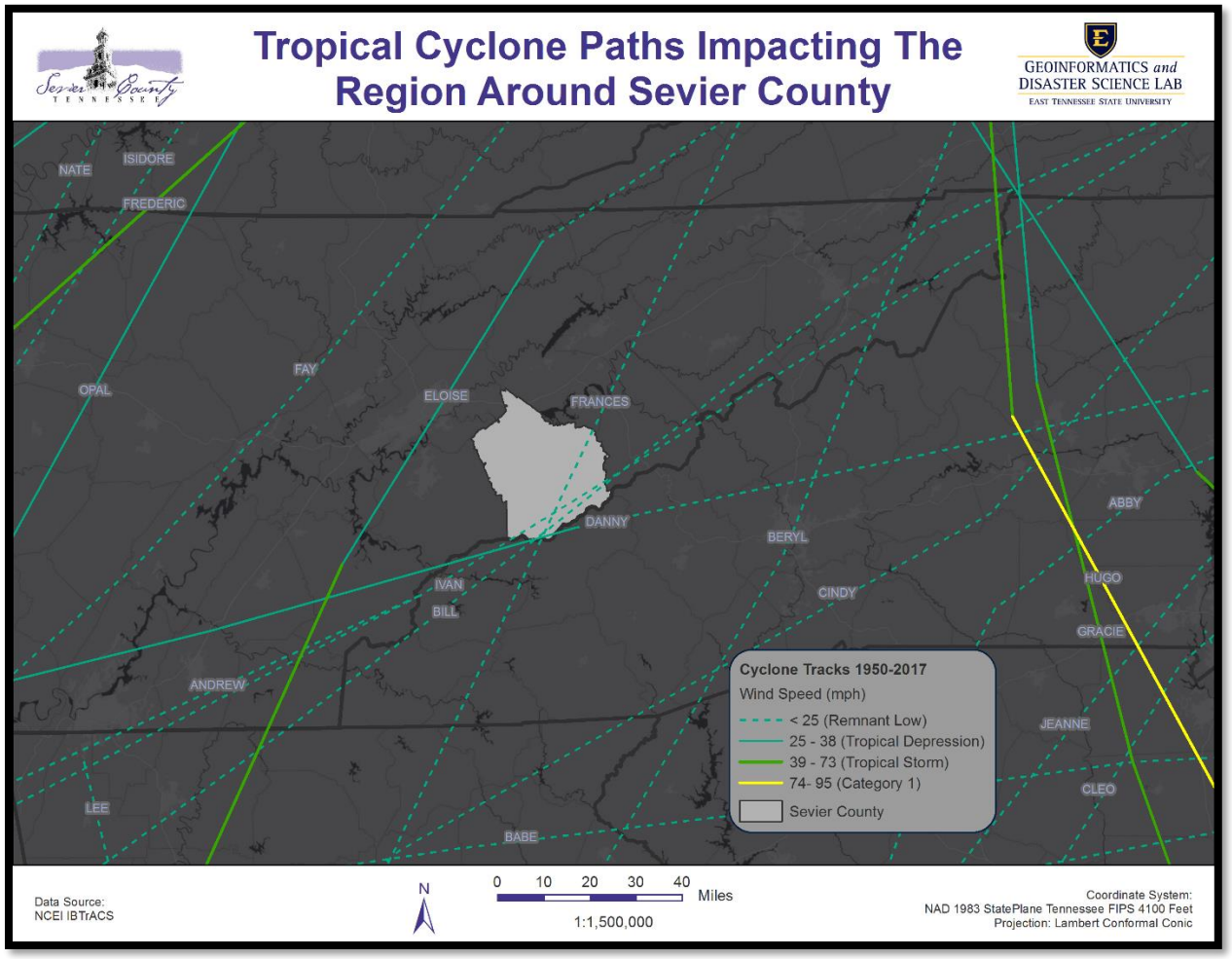

Figure 4-26: Tropical Cyclones Traversing the State of Tennessee (1950 – 2017).

Table 4-19: Saffir-Simpson Hurricane Wind Scale.

Category	Sustained Winds	Pressure	Types of Damage Due to Winds
Tropical Depression	< 39 mph	N/A	N/A
Tropical Storm	39 – 73 mph	N/A	N/A
1	74 – 95 mph	>14.2 psi	Very dangerous winds will produce some damage. Well-constructed frame homes could have damage to roof, shingles, vinyl siding, and gutters. Large branches of trees will snap and shallow-rooted trees may be toppled, especially after the soil becomes waterlogged. Extensive damage to power lines and poles will likely result in power outages that could last several days.
2	96 – 110 mph	14 – 14.2 psi	Extremely dangerous winds will cause extensive damage. Well-constructed frame homes could sustain major roof and siding damage. Many shallow-rooted trees will be snapped or uprooted, especially after the soil becomes waterlogged, and block numerous roads. Near total power loss is expected, with outages that could last from several days to weeks.
3	111 – 129 mph	13.7 – 14 psi	Devastating damage will occur. Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, especially after the soil becomes waterlogged, blocking numerous roads. Electricity and water may be unavailable for several days to weeks after the storm passes.
4	130 – 156 mph	13.3 – 13.7 psi	Catastrophic damage will occur. Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted, especially after the soil becomes waterlogged, and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5	>157 mph	<13.7 psi	Catastrophic damage will occur. A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks to months.

Storm surge is elevated water level that is pushed towards the shore by the force of strong winds that result in the piling up of water. The advancing surge combines with the normal tides, which in extreme cases can increase the normal water height over 20 feet. The storm surge arrives ahead of the storm's actual landfall and the more intense the hurricane is, the sooner the surge arrives. Water rise can be very rapid and can move far inland, posing a serious threat to those who have not yet evacuated flood-prone areas. Debris carried by the waves can also contribute to the devastation. As the storm approaches shore, the greatest storm surge will be to the north of the hurricane eye, in the right-front quadrant of the direction in which the hurricane is moving. Such a surge of high water topped by waves driven by hurricane force winds can be devastating to coastal regions, causing severe beach erosion and property damage along the immediate coast. Storm sure heights, and associated waves, are dependent upon the shape of the continental shelf (narrow or wide) and the depth of the ocean bottom (bathymetry). A narrow shelf, or one that drops steeply from the shoreline and subsequently produces deep water close to the shoreline, tends to produce a lower surge but higher and more powerful storm waves. While disassociated with the Saffir-Simpson Scale, storm surge remains the leading killer of residents along immediate coastal areas. Researchers at the Southern Regional Climate Center have indicated that hurricane strength at approximately 12-18 hours prior to landfall is a better indicator of storm surge strength (compared to wind speeds at landfall). Since Sevier County is not located in a coastal environment, the storm surge component of tropical cyclones does not impact the county.

4.1.12 Wildfires/Conflagration

A wildfire is combustion in a natural setting, marked by flames or intense heat. Most frequently, wildfires are ignited by lightning or (un)intentionally by humans. Fires set purposefully (but lawfully) are referred to as controlled fires or burns. There are three different types of wildfires: (1) *Ground fires* burn primarily in the thick layers of organic matter directly on the forest floor and even within the soil. Ground fires destroy root networks, peat, and compact litter. These fires spread extremely slowly and can smolder for months. (2) *Surface fires* burn litter (e.g., leaves, small sticks) and vegetative matter in the underbrush of a forest. (3) *Crown fires* spread rapidly by wind and move quickly by jumping along the tops of trees. There are two types of crown fires: (a) passive (or dependent) crown fires rely on heat transfer from surface fire, whereas (b) active (or independent) crown fires do not require any heat transfer from below. Active crown fires tend to occur with greater tree density and drier conditions. A firestorm is a mass crown fire (also called a running crown fire, area fire, or conflagration). They are large, continuous, intense fires that lead to violent convection. They are characterized by destructively violent surface in-drafts near and beyond their perimeter. Crown fires are the most damaging and most difficult to contain. The intensity of crown fires enables the fire to produce its own wind gusts. These so-called fire whirls can move embers ahead of the fire front and ignite new fires. Fire whirls are spinning vortex columns of ascending hot air and gases rising from the fire. Large fire whirls have the intensity of a small tornado.

The conditions conducive to the occurrence of wildfires are not distributed equally across the United States. Wildfires have a much greater likelihood of occurring in the western part of the country. Although less frequent than western fires, wildfires do occur in Tennessee – especially in areas within and adjacent to National Forests, Wildlife Management Areas, and the Great Smoky Mountains National Park. Wildfire danger can vary greatly season to season, and is exacerbated by dry weather conditions. Factors that increase susceptibility to wildfires are the availability of fuel (e.g., litter and debris), topography (i.e., slope and elevation affect various factors like precipitation, fuel amount, and wind exposure), and specific meteorological conditions (e.g., low rainfall, high temperatures, low relative humidity, and winds). The

potential for wildfire is often measured by the Keetch–Byram Drought Index (KBDI), which represents the net effect of evapotranspiration and precipitation in producing cumulative moisture deficiency in the soil. The KBDI aims to measure the amount of precipitation needed to return soil to its full field capacity, with KBDI values ranging from 0 (moist soil) to 800 (severe drought).

The wildland-urban interface and intermix land cover surface, developed by the SILVIS Lab at the University of Wisconsin in Madison, can be used to determine areas at risk (Figure 4-27). Wildland-urban interface is defined as the zone of transition between unoccupied land and human development. This usually includes communities or areas of human development that are within 0.5 miles of the zone. Wildland-urban intermix is defined as areas in which human development is intermixed with wildland fuels. Intermix and interface areas are at risk of wildfires.

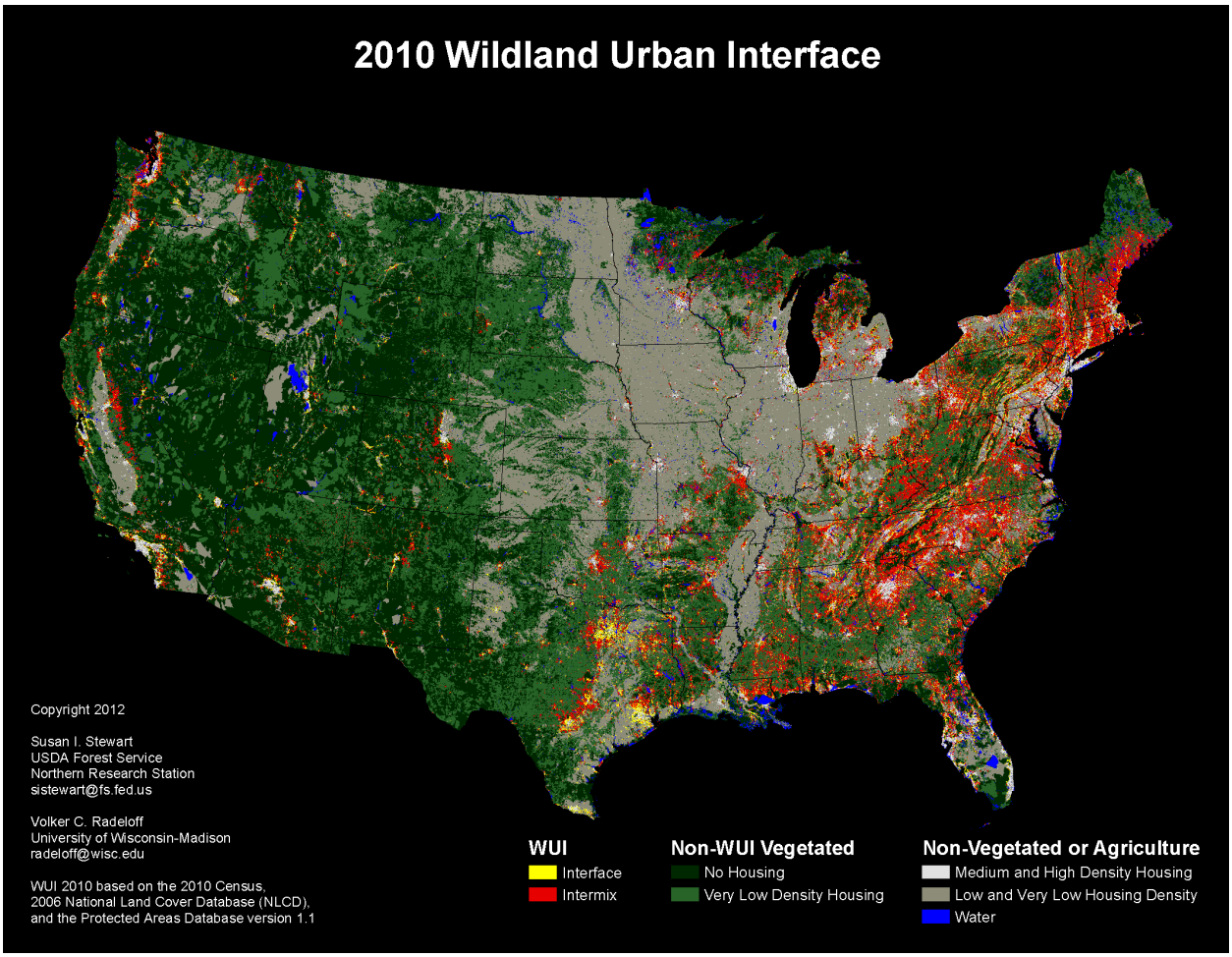

Figure 4-27: Contiguous USA Wildland Urban Interface Map.

While it is nearly impossible to pinpoint a wildfire outbreak, it is easier to predict the conditions in which fires are likely to start. Shifting climactic conditions, such as increased atmospheric temperature and decreased humidity, has increase fuel aridity, which in turn has nearly doubled fire activity across the United States (particularly the western US) over the past 30 years. Increases in fire activity are seen

through changes in area burned, number of large fires, and fire season length[3]. Fire danger in a particular area is rated using the fire danger rating below.

Table 4-20: Fire Danger Rating System and Description.

Fire Danger Rating	Description
Low	Fuels do not ignite readily from small firebrands although a more intense heat source, such as lightning, may start fires in duff or punky wood. Fires in open cured grasslands may bum freely a few hours after rain, but woods fires spread slowly by creeping or smoldering, and burn in irregular fingers. There is little danger of spotting.
Moderate	Fires can start from most accidental causes, but with the exception of lightning fires in some areas, the number of starts is generally low. Fires in open cured grasslands will burn briskly and spread rapidly on windy days. Timber fires spread slowly to moderately fast. The average fire is of moderate intensity, although heavy concentrations of fuel, especially draped fuel, may burn hot. Short-distance spotting may occur, but is not persistent. Fires are not likely to become serious and control is relatively easy.
High	All fine dead fuels ignite readily and fires start easily from most causes. Unattended brush and campfires are likely to escape. Fires spread rapidly and short-distance spotting is common. High-intensity burning may develop on slopes or in concentrations of fine fuels. Fires may become serious and their control difficult unless they are attacked successfully while small.
Very High	Fires start easily from all causes and, immediately after ignition, spread rapidly and increase quickly in intensity. Spot fires are a constant danger. Fires burning in light fuels may quickly develop high intensity characteristics such as long-distance spotting and fire whirlwinds when they burn into heavier fuels.
Extreme	Fires start quickly, spread furiously, and burn intensely. All fires are potentially serious. Development into high intensity burning will usually be faster and occur from smaller fires than in the very high fire danger class. Direct attack is rarely possible and may be dangerous except immediately after ignition. Fires that develop headway in heavy slash or in conifer stands may be unmanageable while the extreme burning condition lasts. Under these conditions the only effective and safe control action is on the flanks until the weather changes or the fuel supply lessens.

Wildfires occur when natural materials combust, forming and spreading flames over a potentially large area. This can come about through both natural and artificial means. Natural wildfires occur where vegetation is dry and usually as the result of a lightning strike. Artificial wildfires are typically the result of negligence or arson. A common classification used for wildfires separates fires into three categories: ground, surface, and crown. *Ground fires* burn and spread slowly, destroying litter, peat, and root networks over months. *Surface fires* occur in a forest's underbrush, burning litter and vegetation. *Crown fires* are quick-spreading fires that jump between trees through the forest canopy. Crown fires are categorized into passive (dependent) and active (independent) crown fires. Passive crown fires depend

[3] Abatzoglou, J.T. and Williams, A.P. 2006. Impact of anthropogenic climate change on wildfire across western US forests. *Proceedings of the National Academy of Sciences*, 113(42), 11770-11775.

on the heat transfer of surface fires. Active crown fires occur where tree density is high and conditions are dry without requiring any heat transfer. Firestorms (or running crown fire, area fire, or conflagration) can occur when a continuous crown fire becomes massive in scope, its intensity leading to violent convection and surface in-drafts that go beyond their perimeter. From intense crown fires, spinning columns of hot air and gas called “fire whirls” can form with the intensity of larger whirls being comparable to tornadoes. Out of the wildfire categories, crown fires are the most damaging to the environment and most difficult to contain. Prescribed burns, small fires purposefully set for mitigation purposes, are not a type of wildfire for their planned, and beneficial, nature.

The hazard of wildfire occurrence is not uniform throughout the United States. The western half of the U.S. has a higher likelihood of developing wildfires, but that is not to say that the east or Sevier County may not see wildfires at any given time. Seasonal climate plays a major role in wildfire hazard, with drier seasons presenting a greater risk of sparking potential disaster. Other conditions that factor into wildfire susceptibility include the presence of vegetation (e.g. litter, debris, and tree canopy), meteorological variables (precipitation, temperature, and wind), and topography (e.g. elevation and slope, which affects meteorological conditions).

The Keetch-Byram Drought Index (KBDI) measures the potential for wildfire by measuring moisture deficiency in soil through local rates of evapotranspiration and precipitation with values ranging from no deficiency at 0 to an absolutely dry 800 (Figure 4-28).

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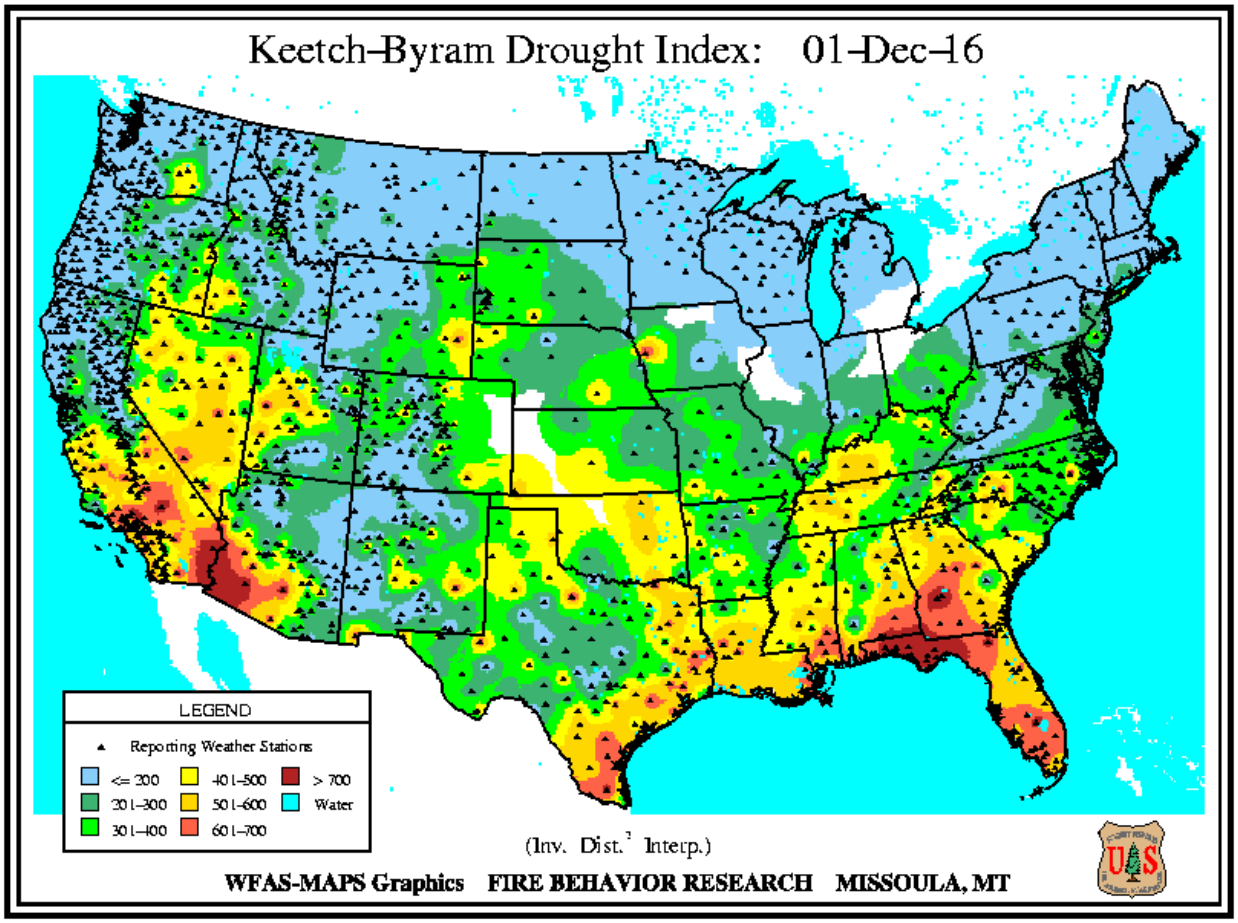

Figure 4-28: Sample Keetch-Byram Drought Index. Sevier County is near the 401-50 class, which is typical of late summer conditions.

The Wildland-Urban Interface (WUI) is where human development closely interacts with undeveloped wild vegetation. The WUI is where the highest risk exists for wildfires, as both types of environment produce fuel to generate and spread hazardous blazes. As an area becomes more densely settled, the greater the risk people and property are in should an event occur. Figure 4-27 displays areas where wild and urban areas interface or mix.

To increase awareness of the hazard of wildfires, the Southern Group of State Foresters developed the Wildfire Risk Assessment Portal (WRAP), allowing users to identify areas prone to wildfire activity. WRAP uses the "Fire Intensity Scale" (FIS) to identify areas with significant fuel and other dangers associated with fire behavior. Table 4-21 identifies and briefly summarizes the classes of the FIS.

Table 4-21: Southern Group of State Foresters Wildfire Risk Assessment Fire Intensity Scale Classifications.

Class	Definition
1 (Very Low)	Discontinuous or flames of up to 1 foot long, spreads slowly. Responders easily suppress fires.
2 (Low)	Less than 2 feet long. Embers transported very short distance from fire. Trained responders with equipment easily suppress fires.
3 (Moderate)	Up to 8 feet long with short-range ember transportation. Trained responders with equipment may have difficulty suppressing fires. Aircraft or fire engines may be necessary. These fires start to become potentially damaging to life and property.
4 (High)	Flames up to 30 feet long. Direct attacks ineffective even by trained firefighters with substantial equipment, indirect attacks can be effective. Significant potential for damage to life and property.
5 (Very High)	Flames up to 150 feet long, strong fire-induced winds. Embers constantly transported by fire-produced winds. Indirect attacks of the fire are only marginally effective. High potential for damage to life and property.

4.1.13 Winter Storms

Winter storms include heavy snowfall, freezing rain/ice, sleet, and/or blizzards. These storms can vary in intensity and size and can be costly to life when accompanied by extremely cold temperatures and strong winds. Roofs and powerlines may cave due to heavy snowfall or ice cover, leaving many without electricity for extended periods of time. Decreased visibility and road conditions can be extremely hazardous to drivers and first responders. Those without shelter in such storms may experience frostbite, hypothermia, or death.

Table 4-22: Warning and Advisory Thresholds for Winter Weather from NWS Morristown.

Warning/Advisory Type	Description
Winter Storm Warning	**Snow** ▪ 4 inches or more in 12 hours ▪ 6 inches or more in 24 hours **Freezing Rain & Sleet** ▪ Ice accumulation of 0.25 inches or more
Blizzard Warning	Sustained winds or frequent gusts ≥ 35 mph AND considerable falling and/or blowing snow frequently reducing visibility < ¼ for ≥ 3 hours. Blizzard conditions are predominant over a 3-hour period.
Ice Storm Warning	0.25 inches or greater of ice accumulation in 12 hours.
Winter Weather Advisory	**Snow** ▪ 1 - 3 inches in 12 hours **Freezing Rain & Sleet** ▪ Ice accumulation of less than 0.25 inches **Forecaster's Discretion** A NWS forecaster can issue a winter weather advisory at their discretion even if criteria are not met, but a forecasted event may impact the region.

Heavy Snow

According to the National Weather Service (NWS), heavy snow is generally snowfall accumulating to 4 inches or more in depth in 12 hours or less; or snowfall accumulating to six inches or more in depth in 24 hours or less. A snow squall is an intense, but limited duration, period of moderate to heavy snowfall, also known as a snowstorm, accompanied by strong, gusty surface winds and possibly lightning (generally moderate to heavy snow showers). Snowstorms are complex phenomena involving heavy snow and winds, whose impact can be affected by a great many factors, including a region's climatological susceptibility to snowstorms, snowfall amounts, snowfall rates, wind speeds, temperatures, visibility, storm duration, topography, and occurrence during the course of the day, weekday versus weekend, and time of season. Major heavy snow occurrences result in widespread economic, transportation, and infrastructure impacts, among other impacts.

Blizzard

Blizzards are characterized by low temperatures, wind gusts of 35 miles per hour (mph) or more, and falling and/or blowing snow that reduces visibility to ¼-mile or less for an extended period of time (three or more hours).

Sleet or Freezing Rain Storm

Sleet is defined as pellets of ice composed of frozen or mostly frozen raindrops or refrozen partially melted snowflakes. These pellets of ice usually bounce after hitting the ground or other hard surfaces. Freezing rain is rain that falls as a liquid but freezes into glaze upon contact with the ground or other surface that is below 32°F. Both types of precipitation, even in small accumulations, can cause significant hazards to a community. An ice storm is used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. Significant accumulations of ice pull down trees and utility lines resulting in loss of power and communication. These accumulations of ice make walking and driving extremely dangerous, and can create extreme hazards to motorists and pedestrians.

The extent of severe winter weather can be classified by meteorological measurements and by evaluating its societal impacts. Unlike the Fujita Scale (tornado) and Saffir-Simpson Scale (hurricanes), there is no widely used scale to classify snowstorms. The Northeast Snowfall Impact Scale (NESIS), categorizes snowstorms, including Nor'easter occurrences, in this manner. NESIS was developed by Paul Kocin of The Weather Channel and Louis Uccellini of the NWS to characterize and rank high-impact, northeast snowstorms. NESIS has five ranking categories: Notable (1), Significant (2), Major (3), Crippling (4), and Extreme (5) (Table 4-23). NOAA's National Centers for Environmental Information (NCEI) is now producing a Regional Snowfall Index based on the NESIS, but with certain regional-specific parameters and thresholds based on NCEI climate regions (Figure 4-29). The index differs from other meteorological indices in that it uses population information in addition to meteorological measurements. Thus, RSI gives an indication of a storm's societal impacts.

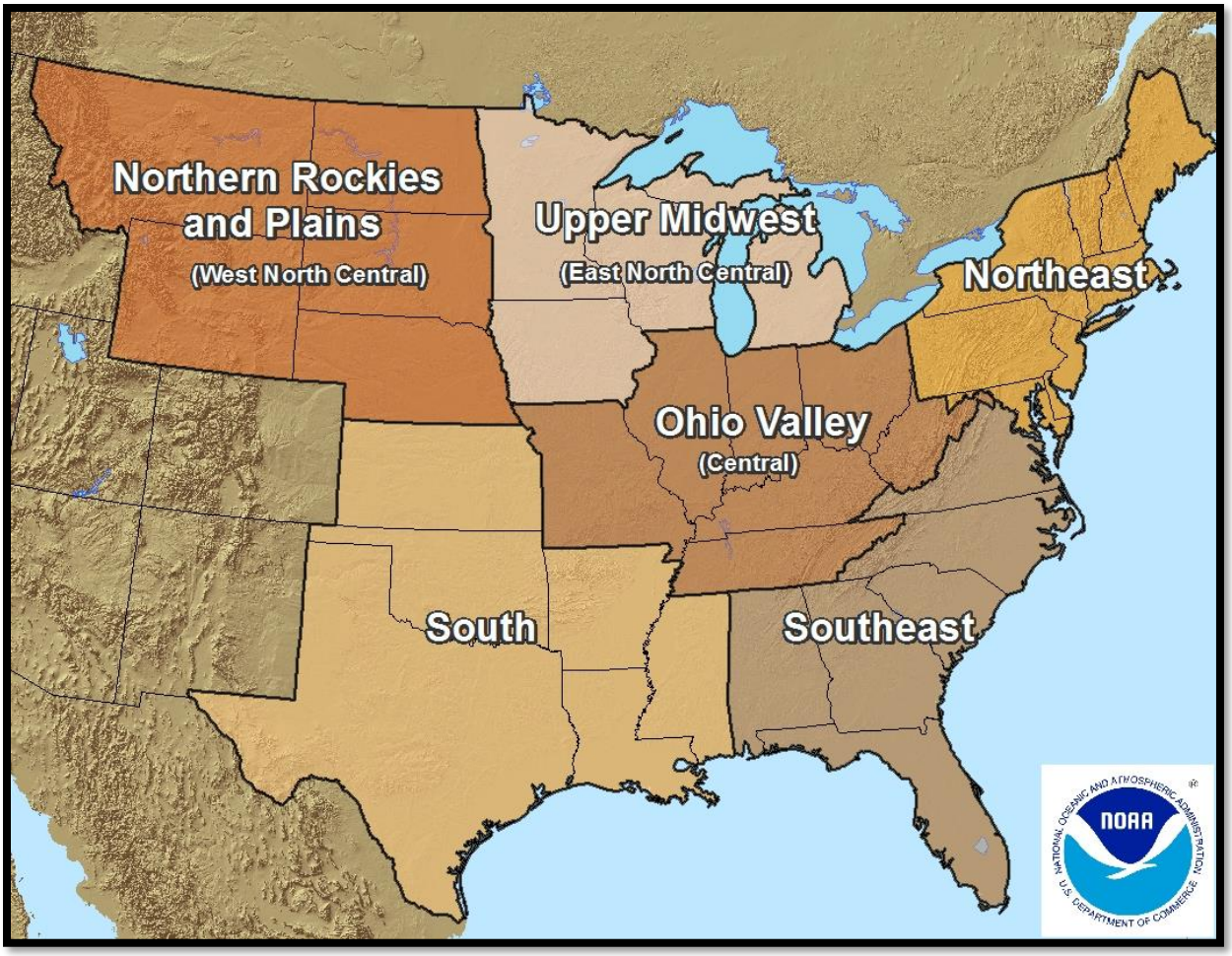

Figure 4-29: NCEI Climate Divisions/RSI regions

Table 4-23: Ohio-Valley RSI Ranking Categories.

Category	Description	RSI Value	Definition
1	Notable	1 - 3	These storms are notable for their large areas of 3-inch accumulations
2	Significant	3 – 6	Includes storms that produce significant areas of 6- inch accumulations
3	Major	6 – 10	This category encompasses the typical major snowstorm producing 12-inch accumulations
4	Crippling	10 – 18	These storms consist of some of the most widespread, heavy snows of the sample and can be best described as crippling to the Ohio Valley region, with the impact to transportation and the economy felt throughout the United States. These storms encompass over 2,900 mi^2 with 18+ inch accumulations
5	Extreme	18 +	These storms represent those with the most extreme snowfall distributions, blanketing large areas and populations with snowfalls greater than 18 inches. Category 5 storms make up about 1% of all snow storms.

4.2 Technological Hazards

Technological hazards result from accidents or the failures of systems and structures. Usually, little or no warning precedes incidents involving technological hazards.

4.2.1 Dam Failure

A dam is defined as an artificial barrier with the ability to impound water, wastewater, or any liquid-borne material, for the purpose of storage or control of water. A dam failure is a catastrophic type of failure characterized by the sudden, rapid, and uncontrolled release of impounded water or the likelihood of such an uncontrolled release. It is recognized that there are lesser degrees of failure, and that any malfunction or abnormality outside the design assumptions and parameters that adversely affects a dam's primary function of impounding water is properly considered a failure. These lesser degrees of failure can progressively lead to or heighten the risk of a catastrophic failure. Dam failures are usually a secondary effect of massive rainfall and flooding, and occur when too much water enters the spillway system. This will occur with little or no warning. Spring thaws, severe thunderstorms, and heavy rainfall are also contributory factors. Additionally, poor engineering or poor maintenance may also cause dam failures. According to the Federal Emergency Management Agency, dams can fail for one or a combination of the following reasons:

- overtopping caused by floods that exceed the capacity of the dam;
- deliberate acts of sabotage;
- structural failure of materials used in dam construction;
- movement and/or failure of the foundation supporting the dam;
- settlement and cracking of concrete or embankment dams;
- piping and internal erosion of soil in embankment dams; and
- inadequate maintenance

The National Inventory of Dams is a registry that captures information about structures that are greater than or equal to 25 feet in height or impounding 50-acre-feet or more of water (an acre-foot is equal to 325,851 gallons of water), and also includes structures above six feet in height, where failure would potentially cause damage downstream. The dams are classified in terms of hazard potential as "high," "significant," or "low" (Table 4-24).

Table 4-24: Classification of Dams.

Classification	Definition
Low	No probable loss of human life and low economic and/or environmental losses are expected. Losses are principally limited to the owner's property.
Significant	Loss of human life is not probable, but economic loss, environmental damage, and/or disruption of lifeline facilities can be expected.
High	Failure or misoperation will probably cause loss of human life.

4.2.2 Infrastructure Failure

Infrastructure disasters are complex scenarios which can be difficult to respond to, prepare for, and mitigate since the infrastructure itself is often a mechanism in responding to, preparing for, and mitigating

hazards. Further, infrastructure is often owned by a variety of public and private interests, and in some cases both, making the delegation of responsibilities and assessment of liability difficult.

Infrastructure is defined as any permanent or semi-permanent asset that facilitates the transport of goods, services, human resources, or information. This can include but is not limited to roadways, rail, airports, telephone, cellular, and data communications mediums, hospitals, waste water treatment facilities, municipal water reservoirs, and community support facilities (i.e., shelters, libraries, and historic registrar sites).

Physical infrastructure is critical for everyday operations and is essential following a disaster. Lack or poor condition of infrastructure can negatively affect a community's ability to cope with, respond to, and recover from a hazard event. Diversity, redundancy, and consistent maintenance of infrastructure systems help create system resiliency.

4.3 Human-Caused Hazards

Human-caused hazards are intentional acts of an adversary. These hazards involve an element of human intent, negligence or error, or threats.

4.3.1 Civil Disobedience/Terrorism

Civil disobedience or civil disorder is a term that generally refers to groups of people purposely choosing not to observe a law, regulation, or rule, usually in order to bring attention to their cause, concern, or agenda. Civil disobedience can take the form of small gatherings or large groups blocking or impeding access to a building or disrupting normal activities by generating noise and intimidating people. They can range from a peaceful sit-in to a full-scale riot in which a mob burns or otherwise destroys property and terrorizes individuals. Even in its more passive forms, a group that blocks roadways, sidewalks, or buildings interferes with public order.

Throughout this country's history, incidents that disrupted the public peace have figured prominently. The constitutional guarantees allow for ample expression of protest and dissent, and in many cases collide with the preamble's requirement of the government "to ensure domestic tranquility". Typical example of such conflicting ideology include the protest movements for civil rights in the late 1960s and the Vietnam War protest demonstrations in the early 1970s. The balance between an individual's and group's legitimate expression of dissent and the right of the populace to live in domestic tranquility requires the diligent efforts of everyone to avoid such confrontations in the future.

In modern society, laws have evolved that govern the interaction of its members to peacefully resolve conflict. In the United States, a crowd itself is constitutionally protected under "the right of the people to peacefully assemble". However, assemblies that are not peaceable are not protected, and this is generally the dividing line between crowds and mobs. The laws that deal with disruptive conduct are generally grouped into offenses that disturb the public peace. They range from misdemeanors, such as blocking sidewalks or challenging another to fight, to felonies, such as looting and rioting.

Terrorism

Terrorism is defined by the Federal Bureau of Investigation (FBI) as "the unlawful use of force or violence against persons or property to intimidate or coerce a government, the civilian population, or any segment

thereof, in furtherance of political or social objectives". The effects of terrorism can vary significantly, including loss of life, injuries to people and properties, and disruptions in services (e.g., water supplies, public transportation, and communications).

According to the FBI, there are two primary types of terrorism:

- **Domestic Terrorism:** Involves groups or individuals whose terrorist activities are directed at elements of the US local, state, or federal government or populations without foreign direction.
- **International Terrorism:** Involves terrorist activity committed by nations, groups, or individuals who are foreign-based and/or directed by countries or groups outside the United States or whose activities transcend national boundaries.

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5. Sevier County (Unincorporated Area)

5.1 Risk Assessment

This section assesses the various hazard risks that Sevier County (Unincorporated Area) faces in order to identify a strategy for mitigation. Having identified the categories of hazards, emergencies, disasters, and catastrophes, this section details the major natural, technological, and human-caused hazards by (1) describing their geographic extent, (2) surveying their previous occurrences, and (3) evaluating their future likelihood of occurrences. To review news stories and other media related to previous occurrences, see Appendix D.

5.1.1 Communicable Diseases

Location & Extent

Tennessee maintains an extensive array of communicable disease personnel both inside and ancillary to the Communicable and Environmental Diseases and Emergency Preparedness (CEDEP) division. Communicable and Environmental Disease and Emergency Preparedness is a program area of the Tennessee Department of Health; it is assigned the responsibility of detecting, preventing, educating, and controlling infectious and environmentally-related illnesses of public health significance. Emergency management personnel are more frequently including pandemic and communicable disease drills in their exercise dockets at locations across the nation. The Centers for Disease Control and Prevention (CDC) has created a pandemic flu toolkit which is aligned with the pandemic phases outlined by the 2013 World Health Organization guidelines.

A biologic or communicable disease threat can occur anywhere, or anytime. Concentrated efforts must be made at surveillance in the following arenas:

Healthcare: Tennessee health care institutions serve as the front lines to communicable disease response and also as potential disease reservoir populations and points of cross contamination. Tennessee maintains excellent hospital and in-patient coverage in all 3 of its primary regions, with Level I trauma facilities. All Tennessee hospitals and healthcare facilities are required to report specific Healthcare Acquired Infections to the NHSN, the National Healthcare Safety Network. The NHSN is a web-based data reporting and submission program, which includes validation routines for many data elements, thus reducing common data entry errors. Hospitals can view, edit, and analyze their data at any time.

Education Facilities and Dormitories: The State of Tennessee mandates a vaccination series for all incoming resident students at educational facilities, consisting of measles, mumps, rubella, meningococcal meningitis, and varicella vaccines. In spite of these vaccine series, dormitory housing at colleges and universities have historically been susceptible to outbreaks of viral meningitis. Vaccination, along with immediate quarantine procedures should be adhered to with particular care in the academic setting where institutional controls are the primary mitigation technique with proven effectiveness

Previous Occurrences

Influenza

In 2012, Tennessee was listed by the CDC as one of the highest influenza burdened states in the nation. On average, 20% of the nation's population will contract the seasonal influenza every year. Tennessee

carries a higher than average mortality and morbidity rate for influenza and associated pneumonia, with 20.9 per 100,000 compared with the national average of 16.2 per 100,000.

HIV/AIDS

The incidence of HIV/AIDS and their associated comorbidities (including tuberculosis) increased in Tennessee from 2006 to 2012 across almost all ages, sexes, and races, with the exception of diagnosed AIDS cases in 2011, which decreased markedly. The 2 are categorized separately by both state and federal agencies due to differing mortalities and comorbidities for each. Currently in Tennessee, 18 community-based organizations are funded to implement a wide-range of science-based HIV prevention programs.

Tertiary Events

Hepatitis C

In 2012, the CDC revised its recommendations to include prophylactic screening for Hepatitis C for anyone born between the years 1945 and 1965. This screening is seen as paramount to reducing potential contamination in the blood supply as Hepatitis C is spread primarily through contaminated needles and drug use. Prior to 1992, blood supply screening techniques were not used resulting in Hep C being transmitted through blood transfusions and organ transplants. The most common mode of transmission for Hep A is person-to-person, resulting from fecal contamination and oral ingestion, and contaminated shellfish. In 1995, a major outbreak of Hepatitis A occurred in Tennessee with Shelby County documenting over 80% of the diagnosed cases. In the fall of 2003, approximately 80 cases were attributed to a Hepatitis A outbreak resulting from ingestion of contaminated green onions at a restaurant in East Tennessee.

Hepatitis B

Hepatitis B is transmitted through blood or body fluids, semen, cervical secretions, and saliva. People with chronic HBV infection are the primary reservoirs for infection. With the exception of the year 2001, from 1995 to 2002, Hepatitis B acute cases steadily decreased. The prevalence of HBV infection among adolescents and adults is 3 to 4 times greater for black individuals than white individuals. Children born to Hepatitis B Surface Antigen positive women are at high risk of becoming chronic carriers of hepatitis B. If these children are administered Hepatitis B Immune Globulin and hepatitis B vaccine at birth, their chances of being protected from the illness are greatly increased. The result is the endorsement of this mitigation procedure by the TDH and the CDC.

Incidents/Probability

The communicable disease events categorized by the CDC and the US Department of Labor as the most likely to adversely affect human performance are any and all strains of influenza. In a typical flu season, between 5% and 20% of the public contract influenza resulting in an average of 36,000 deaths. Pandemic flu viruses may cause illness in 20% to 40% of the population and cause more severe illness and deaths than ordinary seasonal influenza. A pandemic virus vaccine could take 6 to 8 months to produce in conjunction with CDC labs in Atlanta, limiting mitigation success in initial months of an outbreak. Because of this potential, the TDH and CDC consider influenza monitoring and reporting of critical importance.

Based on previous occurrences, there is a 100% annual chance of occurrence for communicable disease occurrence in Sevier County and its jurisdictions.

5.1.2 Drought

Location & Extent

Drought typically impacts a region and not one specific county or jurisdiction. While the entire planning area can experience drought, the major impact of a drought event in Sevier County is on the agricultural community. There is no set speed of onset or warning period. A drought may begin in as short of period as a week or it may take months to reach an official declared drought. Additionally, the drought can last for as little as a week to up to the entire season.

While different parts of the county have experienced varying levels of drought severity, the location of drought conditions are more related to Sevier County's geographical location and the effects of climate on the region in general. Below is a map of the drought conditions in Sevier County in October 2019.

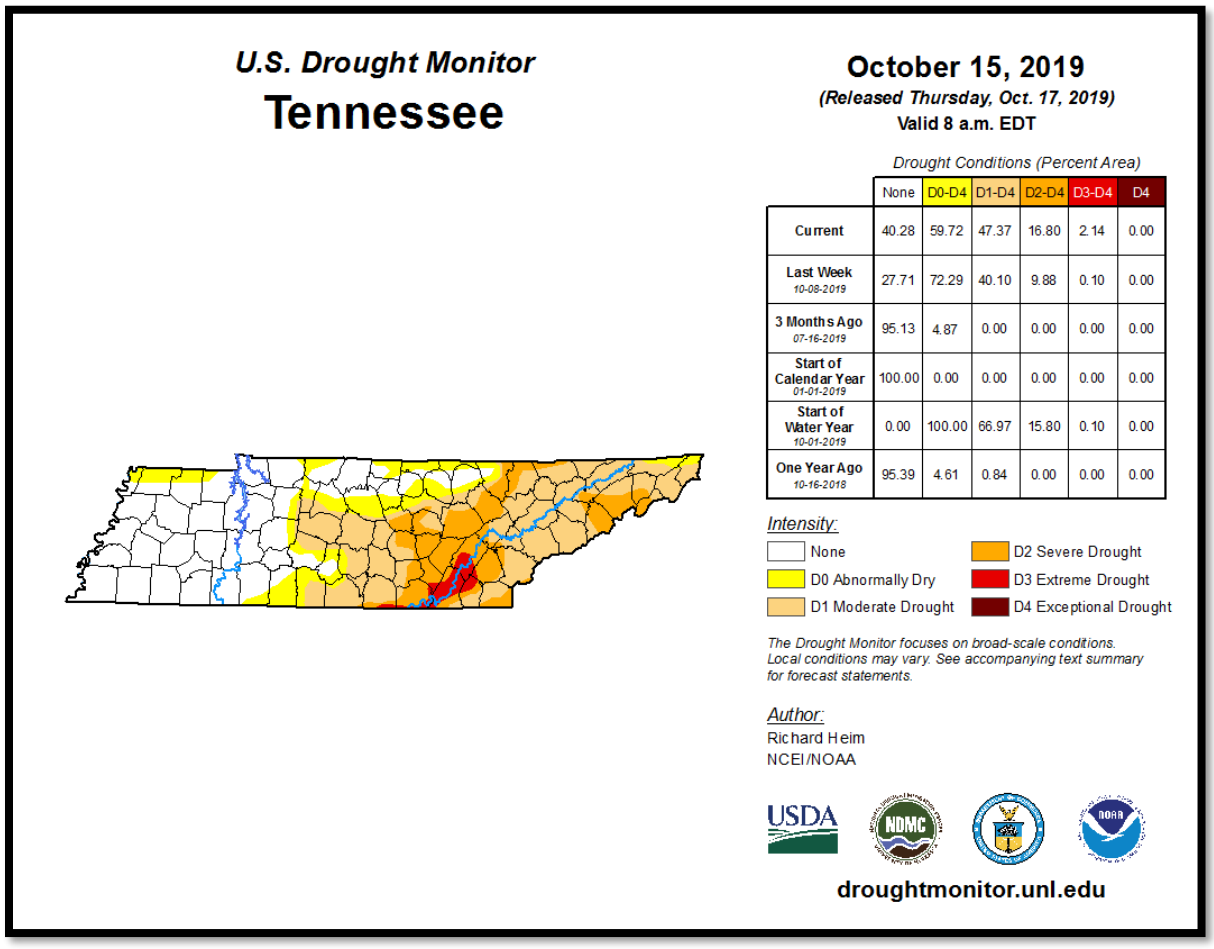

Figure 5-1: Drought Monitor for the State of Tennessee for the Week of October 15, 2019. (Source: U.S. Drought Monitor)

Previous Occurrences

The NCEI database reports a total of one drought event occurring within the boundaries of Sevier County between the years 1996 to 2017. The following table identifies the date of occurrence, estimated crop damage, and severity of the events that have occurred in Sevier County. Based on previous occurrences,

and in accordance with the Palmer Drought Index and United States Drought Monitor, the worst-case scenario for drought in Sevier County would be D4 (Exceptional Drought).

Table 5-1: Previous Occurrences of Drought Events in Sevier County.

Date	Details	Crop Damage	Property Damage	Severity
September 1998	An extremely dry month throughout all of East Tennessee caused drought conditions in the county. Rainfall was approximately 2" inches below normal for the area.	$2,000	$0	D3

Since the last plan update, there have been no new drought events which have caused damage to property or crops. However, drought events have occurred periodically during the period of record (January 1, 2000 to January 1, 2019).

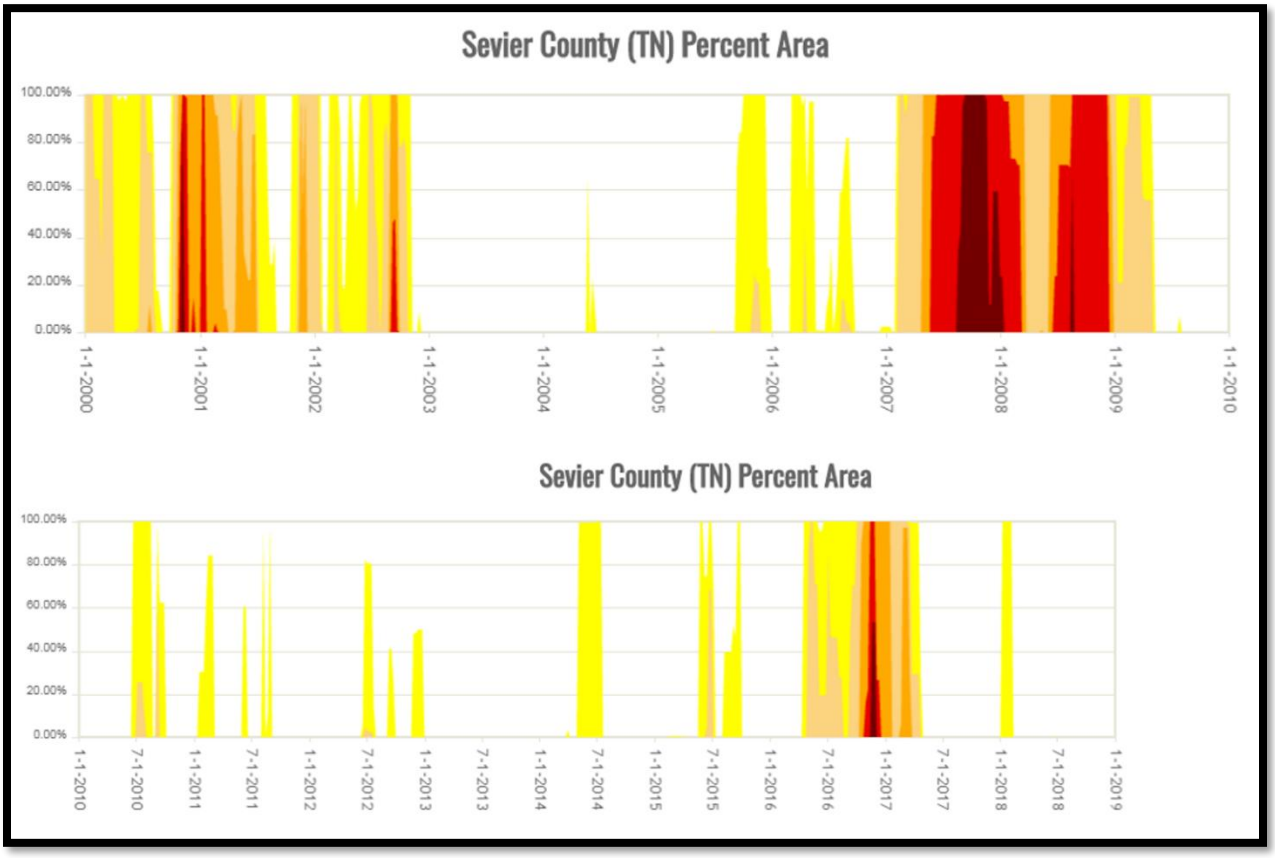

Figure 5-2: Timeline of drought conditions in Sevier County from January 1, 2000 to January 1, 2019. (Source: U.S. Drought Monitor)

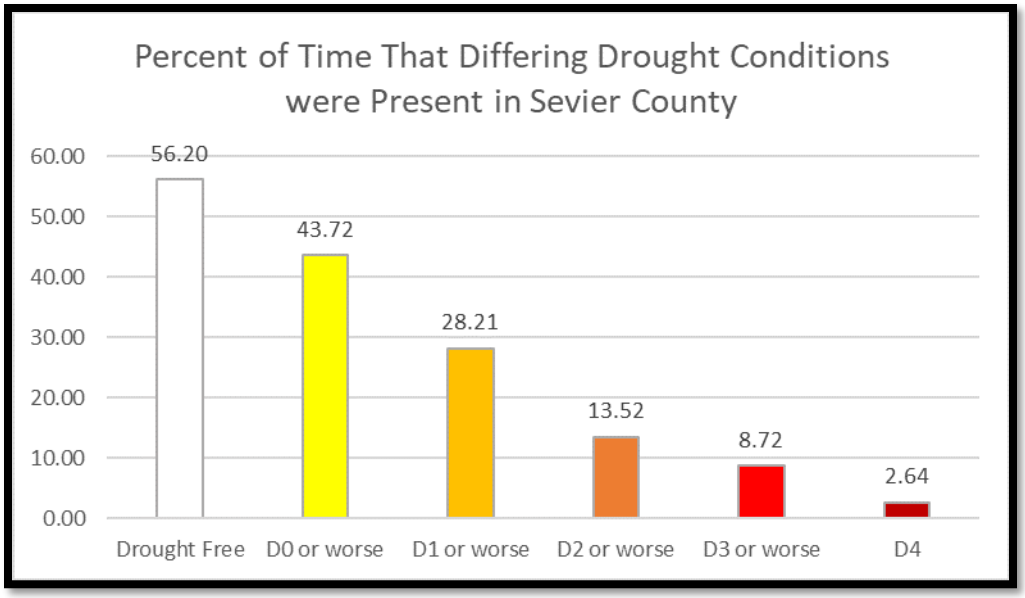

Figure 5-3: Sevier County experienced drought conditions (D0 or worse) during ~43% of the weeks between January 1, 2000 and January 1, 2019. (Source: U.S. Drought Monitor)

Incidents/Probability

Drought conditions can exist which are not recorded in the NCEI database if the event does not cause any direct damage to property or crops and injuries or loss of life. Based on previous occurrences, there is a 4.3% annual chance of occurrence for direct-impact drought events in Sevier County and its jurisdictions. While the chance of a drought that causes damage is approximately 4% annually, Sevier County experienced D2 or worse drought conditions approximately 35% over the past 20-years.

5.1.3 Earthquakes

Location & Extent

Earthquakes strike suddenly and without warning, occur at any time of the year, and at any time of the day. A damaging earthquake occurs without definitive signals and massive earthquakes are accompanied by aftershocks. The duration of shaking can last anywhere from a second to a period of minutes. There are numerous characteristics measured when observing earthquake activity; however, its force, depth, peak ground acceleration, and the distance to the epicenter are the most influential in determining damage.

Earthquakes of magnitude 5.5 or greater are considered potentially threatening to Sevier County and its jurisdictions, as this is the point at which structures can become damaged. Any earthquake felt at this magnitude or greater would result in cessation of operations until sight inspections can take place.

The Southern Appalachian Seismic Zone (East Tennessee Seismic Zone) is a geographic band stretching from northeastern Alabama through eastern Tennessee into southwestern Virginia which is subject to frequent small earthquakes. This seismic zone is one of the most active earthquake zones in the eastern United States. Most earthquakes in the Southern Appalachian Zone are small and are detected only with instruments. A few damaging earthquakes have occurred with the largest historic earthquakes measuring 4.6 magnitude on the Richter Scale, occurring in 1973 near Knoxville and April 29, 2003 near Fort Payne,

Alabama. Earthquakes large enough to be felt occur approximately once a year in this zone. The USGS estimates that earthquakes as large as magnitude 7.5 are possible in the Southern Appalachian Zone which would be as devastating to the region as a major quake along the New Madrid fault. The worst-case scenario for an earthquake in Sevier County would be an MMI of IV, which would be quite noticeable by persons indoors, especially during the daytime.

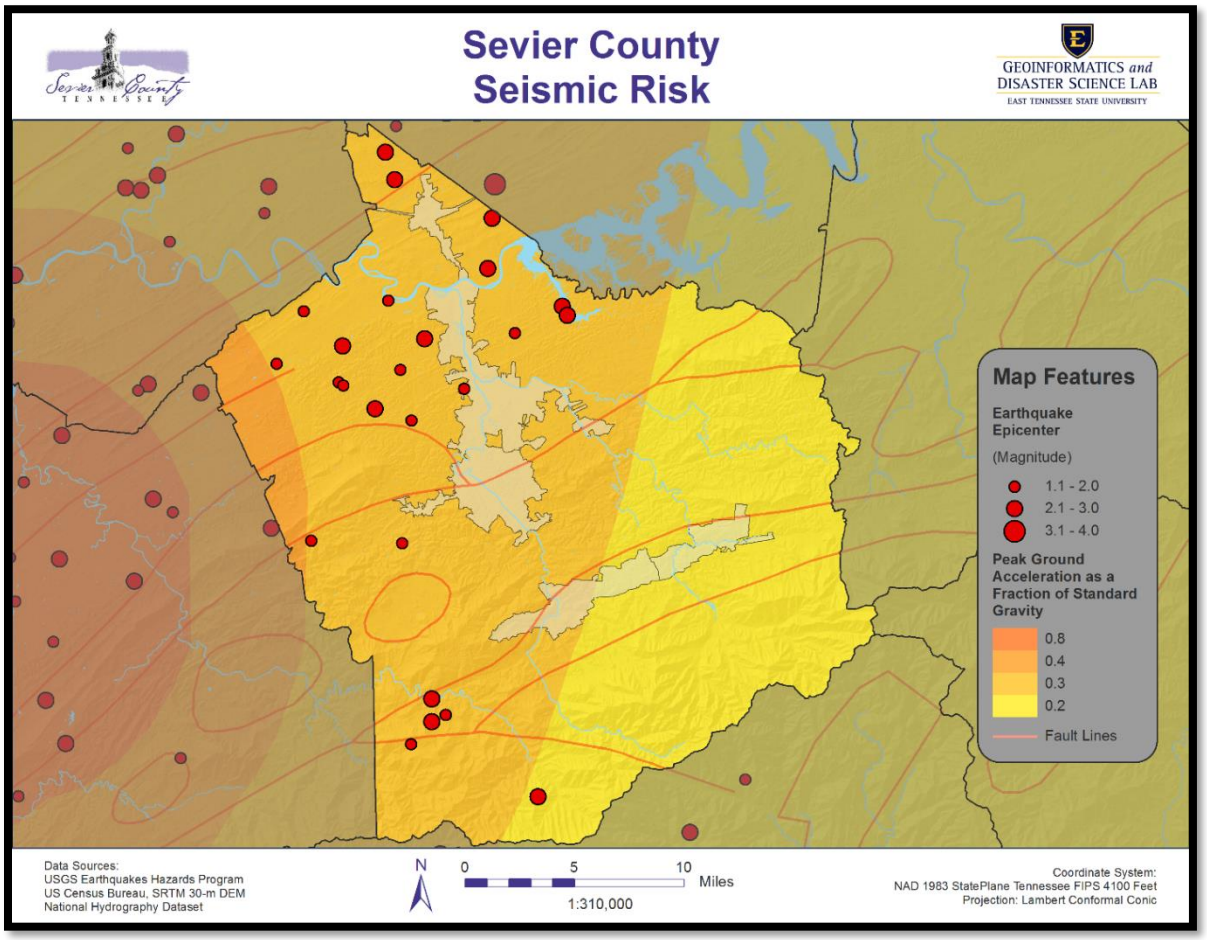

Figure 5-4: Earthquake Epicenters and Fault Lines in Sevier County.

Previous Occurrences

NOAA reports a total of four earthquake events over a magnitude of 2.0 occurring within the boundaries of Sevier County between the years 1996 to 2017. The following table identifies the date of occurrence, magnitude, and focal depth.

Table 5-2: Previous Occurrences of Earthquake Events in Sevier County.

Date	Magnitude	Focal Depth
7/26/2001	3.2	5 kilometers
11/24/2012	3.0	7.1 kilometers
11/24/2012	2.5	8.9 Kilometers
8/3/2017	2.7	7.4 kilometers

Since the last plan update, three earthquake events occurred within the boundaries of Sevier County. Below is a brief synopsis of the events.

November 24, 2012
An earthquake of magnitude 3.0 and depth of 7.1 kilometers occurred approximately five miles northeast of Sevierville at 11:03 AM. No damages, injuries, or fatalities were associated with the event.

November 24, 2012
An earthquake of magnitude 2.5 and depth of 8.9 kilometers occurred approximately five miles northeast of Sevierville at 2:56 PM. No damages, injuries, or fatalities were associated with the event.

August 3, 2017
An earthquake of magnitude 2.7 and depth of 7.4 kilometers occurred approximately four miles north of Sevierville at 5:40 PM. No damages, injuries, or fatalities were associated with the event.

Incidents/Probability
Historically, there have been four earthquake events in Sevier County and its jurisdictions from 1996 to 2018. With a total of four earthquake events, the annual return rate (frequency) for Sevier County and its jurisdictions is one event every five to six years. This equates to an annual probability of approximately 16%.

5.1.4 Extreme Temperatures

Location & Extent
Extreme heat and cold can occur in all of Sevier County. Extreme heat is not a hazard that responds to the traditional mitigation measures of building codes or land use restrictions. Heat is the number one weather related killer in the United States, resulting in roughly 175 fatalities each year. In fact, on average, excessive heat claims more lives each year than floods, lightning, tornadoes, and hurricanes combined.

What constitutes extreme cold varies in different parts of the country. In the southern United States, near freezing temperatures are considered extreme cold. Freezing temperatures can cause severe damage to citrus fruit crops and other vegetation. Pipes may freeze and burst in homes that are poorly insulated or without heat. Most people judge extreme cold by the problems it causes rather than just by a temperature or a wind chill factor. In the northern areas of the country, extreme cold means temperatures well below zero.

The speed of onset of extreme temperatures, both hot and cold, is fairly slow and predictable from short and long-term weather forecasts. The scale of measurement for this hazard is temperature and departure from normal temperature.

Previous Occurrences
In winter, the average temperature in Sevier County is approximately 38^{O}F with an average daily minimum temperature of approximately 26^{O}F. The lowest temperatures recorded in Sevier County were -18^{O}F in Gatlinburg and -24^{O}F in Sevierville with both occurring on January 21, 1985.

In summer, the average temperature in Sevier County is approximately 71^{o}F with an average daily maximum temperature of approximately 83^{o}F. The highest temperatures ever recorded in Sevier County were 106^{o}F in Gatlinburg on June 30, 1936 and 102^{o}F in Sevierville on August 21, 1983.

Incidents/Probability

The NCEI Storm Events Database reports no extreme temperature (extreme heat or extreme cold) occurrences within the boundaries of Sevier County between the years 1996 and 2018. However, based on the State of Tennessee Hazard Mitigation Plan, Sevier County and its jurisdictions have an annual probability of 64% for extreme cold events and 100% for extreme heat events.

5.1.5 Floods Including Extreme Precipitation

Location & Extent

A variety of factors affects the type and severity of flooding in Sevier County including topography, urban development and infrastructure, and geology. Serious flooding in the mountainous or elevated areas is unusual because streams tend to be faster flowing and flood waters drain quickly.

Intense flooding will cause havoc on the jurisdictions affected. Floods can cause minimal damage in the form of just inches of water to complete submersion of houses and critical facilities. Any amount of damage can render a structure unusable for as long as recovery operations would take depending on the level of damage. Intense and widespread flooding can trap people and entire communities without basic goods or services.

Areas of Sevier County outside of municipal and township jurisdictions have experienced flooding in the past. In northern parts of the county, flood depths of 2-5' have occurred along Boyds Creek with some roads (eg. Von Cannon Ln, Loposser Hollow Rd) experiencing flood conditions. Areas adjacent to Happy Creek and Knob Creek also experience similar flood depths with Zion Hill Church Rd impacted occasionally. Areas around the French Broad River can also flood with depths of 13'+. Western parts of Douglas Lake have also flooded with depths of 6-10'. Cove Creek in the Wears Valley area has experienced several feet of flooding. The East Fork of the Little Pigeon River has also flooded, with depths of 10'+ affecting some roads (e.g., Jones Cove Rd and Henry Town Rd). Areas around Flat Creek in eastern Sevier County have also flooded with depths of 3-5'. Pittman Center Rd along the Little Pigeon River has also experienced flooding with depths varying by location and 5-7' not being uncommon. The Tuckahoe Creek in northern Sevier County has also flooded, with depths of 6-8'.

The following figure displays the location of the 100- and 500-year floodplains in Sevier County.

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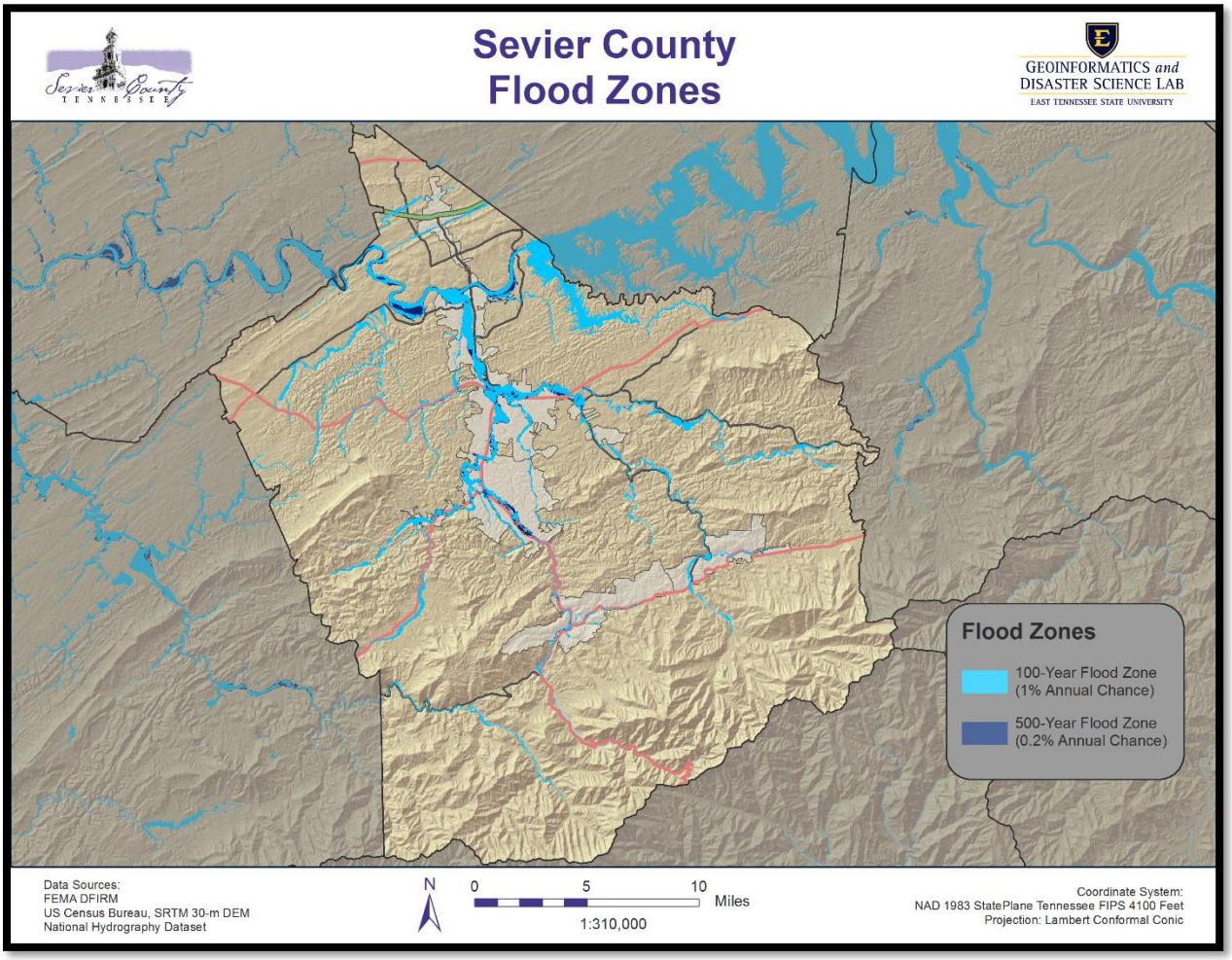

Figure 5-5: 100- and 500-Year Floodplains in Sevier County.

Previous Occurrences

Historically, there have been 19 flood and extreme precipitation events in Sevier County from 1996 to 2018. According to NCEI, there have been no injuries or fatalities due to flood and extreme precipitation events in the unincorporated area of Sevier County.

Table 5-3: Flood Events and Extreme Precipitation from 1996 to 2018 with Total Losses. (Source: NCEI Storm Events Database)

Date	Location	Event	Injuries	Fatalities	Property Damage
1/19/1996	COUNTYWIDE	Flash Flood	0	0	$0
6/21/1997	COUNTYWIDE	Flash Flood	0	0	$0
1/7/1998	COUNTYWIDE	Flash Flood	0	0	$0

Date	Location	Event	Injuries	Fatalities	Property Damage
6/1/1998	SEYMOUR	Flood	0	0	$0
7/11/1999	COUNTYWIDE	Flash Flood	0	0	$0
3/17/2002	NORTH SEVIER	Flood	0	0	$0
3/17/2002	SMOKY MT	Flood	0	0	$0
3/17/2002	COUNTYWIDE	Flash Flood	0	0	$0
2/14/2003	SMOKY MT	Flood	0	0	$8,000
2/14/2003	SMOKY MT	Flood	0	0	$8,000
2/16/2003	COUNTYWIDE	Flash Flood	0	0	$0
2/21/2003	SMOKY MT	Flood	0	0	$0
2/21/2003	NORTH SEVIER	Flood	0	0	$0
4/10/2003	NORTH SEVIER	Flood	0	0	$0
4/10/2003	SMOKY MT	Flood	0	0	$0
1/30/2013	KODAK	Flood	0	0	$0
5/21/2013	KODAK	Flash Flood	0	0	$5,000
6/22/2015	GREENBRIER	Flash Flood	0	0	$0
6/28/2018	ELKMONT	Flash Flood	0	0	$0

Since the last plan update (through the end of 2018), there have been four new flooding events in the unincorporated Sevier County area. Below is a brief synopsis of those events.

January 30, 2013 – Kodak

Heavy rain impacted the region days after severe storms saturated the soils. The saturated soils enabled the event to produce widespread flooding throughout the unincorporated area of Sevier County. This included minor street flooding in and around the unincorporated area of Kodak.

May 21, 2013 – Kodak

An outflow boundary from complex thunderstorms across the region interacted with moderate to strongly unstable air across Eastern Tennessee mainly north of Interstate 40. The slow moving storms produced wind damage with some hail and flash flooding. Several cars were stranded on Black Oak Ridge Road near the southwest end of Douglas Lake.

June 22, 2015 – Greenbrier

Slow moving thunderstorms produced localized heavy rainfall amounts near the mountain tops along the Tennessee/North Carolina state line, upstream from Cosby and Pittman Center. Flash flooding occurred in the Great Smoky Mountains Park, endangering hikers and campers. The Middle Prong Little Pigeon River was out of its banks in the area of the Great Smoky Mountains Park.

June 28, 2018 – Elkmont

Repeat convection along a slow moving frontal boundary over a lengthy period generated wind damage and flash flooding across Southeast Tennessee from the evening hours into the following morning. Flooding occurred in the Great Smoky Mountains National Park near the Elkmont area.

While this risk assessment did not include 2019 data for flooding, it should be noted that the early part of 2019 broke many rainfall records, including the wettest month on record (February 2019) according to the Tennessee Climate Office. Extensive flooding occurred in February and April of 2019, possibly exceeding $7 million in damage in Sevier County (Knox News).

Incidents/Probability

With a total of 19 events, the annual return rate (frequency) for flooding and extreme precipitation for the unincorporated area of Sevier County is one event every one to two years. This equates to an annual probability of approximately 76%.

5.1.6 Mass Wasting

Location & Extent

Most mass wasting events within Sevier County are located along road networks. Rockfalls or rock sliding along road cuts is a very common phenomenon. These are mainly due to improper slope management which causes instability within the slope face. Additionally, adverse orientation of geological discontinuities (joints, fractures, and faults) with the slope gradient and aspect play an important role in slope stability. Probability of future failure of a slope depends on various factors including lithology, land cover, drainage condition, and soil cover of the area.

The southern part of Sevier County located within the Great Smoky Mountains National Park near the state boundary between Tennessee and North Carolina has a high concentration of areas which could produce mass wasting events. High rain coupled with fragile lithology and adverse orientation of geological discontinuities have increased the probably of a mass wasting event. Below is a susceptibility map, high concentration map, and prior occurrences of mass wasting events within Sevier County.

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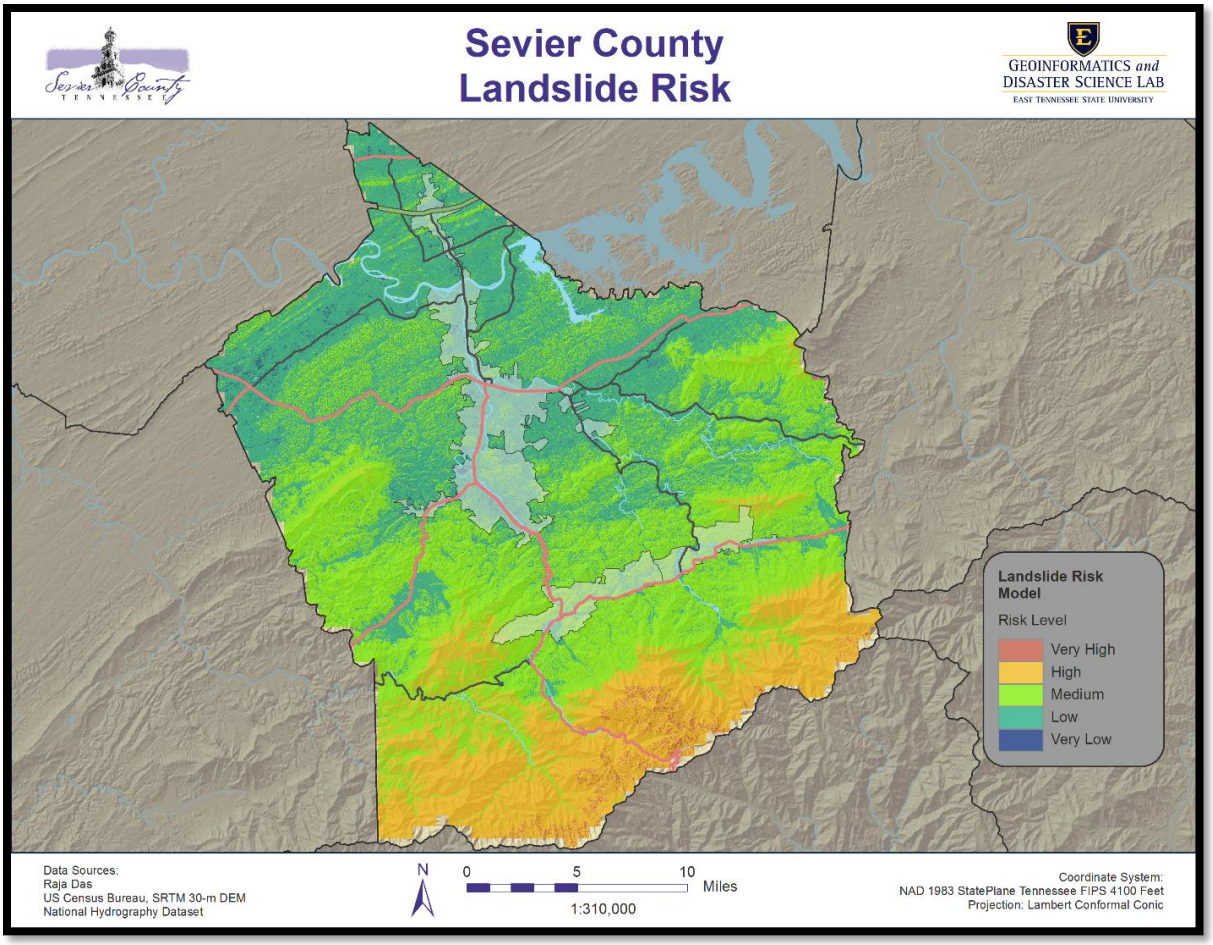

Figure 5-6: Landslide Susceptibility Map in Sevier County.

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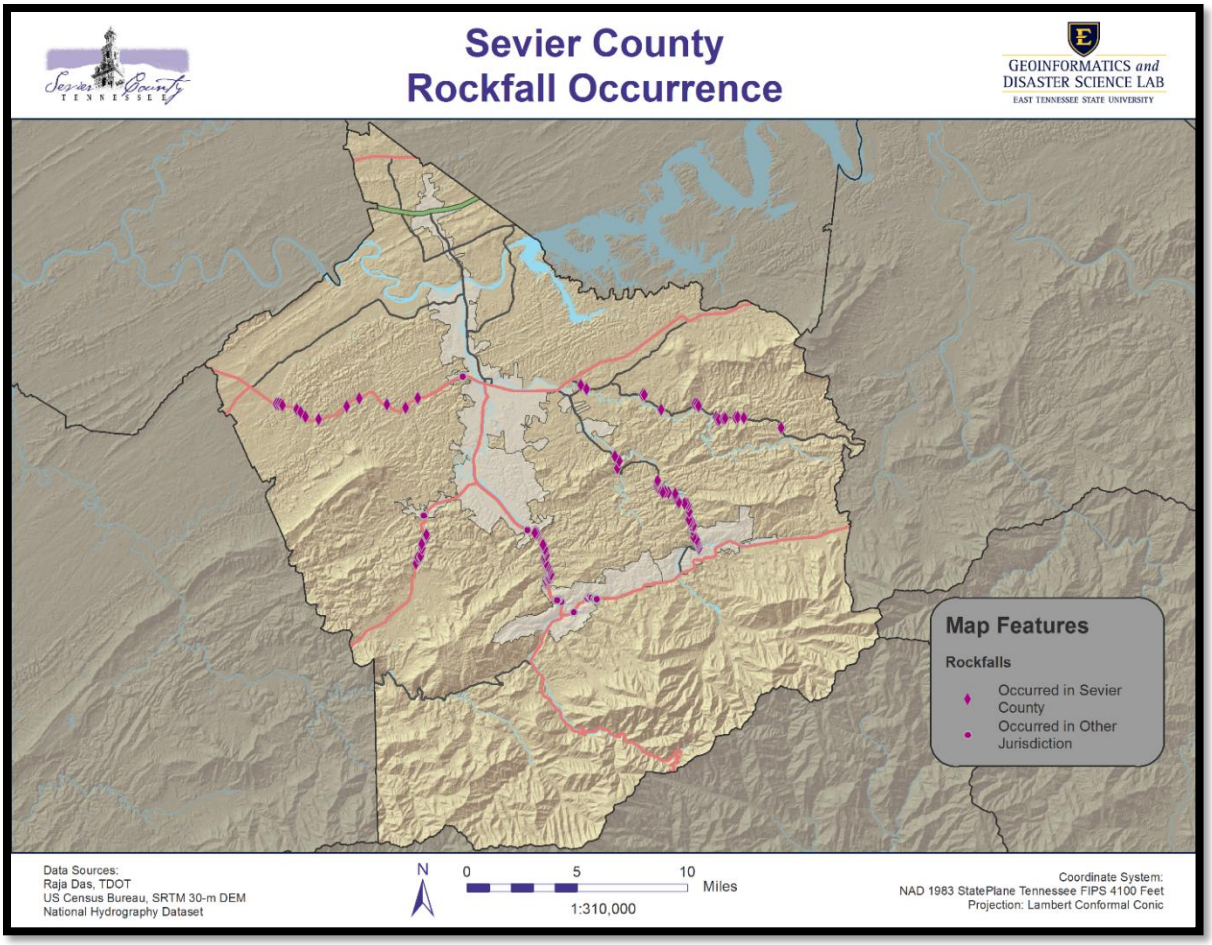

Figure 5-7: Rockfall Occurrences along major roads in Sevier County.

Previous Occurrences

Some rockfall locations are available from the Tennessee Department of Transportation (TDOT). The following table outlines major debris flow events related to storms in Sevier County.

Table 5-4: Major Debris Flow Events Related to Storm Events.
(Source: Tennessee Department of Transportation)

Date	Type of Storm	Location
7/10/1942	Thunderstorm	Newfound Gap
9/1/1951	Cloudburst	Mt. LeConte
6/15/1971		Mt. LeConte
3/1975 – 3/1983	Multiple Storms	Anakeesta Ridge
8/3/1978	Thunderstorm	Mt. LeConte
7/1984	Thunderstorm	Anakeesta Ridge
8/10/1984	Thunderstorm	Anakeesta Ridge
8/10/1984	Thunderstorm	Anakeesta Ridge
3/1985	Thunderstorm	Anakeesta Ridge
6/28/1993	Cloudburst	Mt. LeConte

Date	Type of Storm	Location
10/4/1995	Hurricane Opal	Mt. LeConte/Anakeesta Ridge
9/17/2004	Hurricane Ivan	Mt. LeConte/Anakeesta Ridge
8/5/2012	Thunderstorm	Anakeesta Ridge
9/10/2017	Hurricane Irma	Anakeesta Ridge
8/1/2019	Thunderstorm	Gatlinburg

Since the last plan update, there have been three mass wasting events in Sevier County and its jurisdictions. Below is a brief synopsis of those events.

August 5, 2012 – Anakeesta Ridge
No synopsis available for the event.

September 10, 2017 – Anakeesta Ridge
No synopsis available for the event.

August 1, 2019 - Gatlinburg
A 73-year old man was fatally injured when a tree fell from a slope and hit his Honda sedan. Both the northbound and southbound lanes of the Spur were closed until heavy equipment could complete slope repairs and assessments. Multiple rock slides were also reported.

Incidents/Probability
With a total of four recorded events from 1996 to 2018, the annual return rate (frequency) for mass wasting events for Sevier County and its jurisdictions is one event every five to six years. This equates to an annual probability of a mass wasting event occurrence of approximately 17%.

5.1.7 Severe Wind

Location & Extent
Mountain waves develop on the lee, or downwind, side of mountains. These waves are generated when strong winds flowing toward mountains in a generally perpendicular fashion are raised up over the mountains. Given the geographical location of Sevier County, the unincorporated areas and all of its jurisdictions are susceptible to severe wind events. The following figures provide the extent of severe winds within Sevier County and its jurisdictions.

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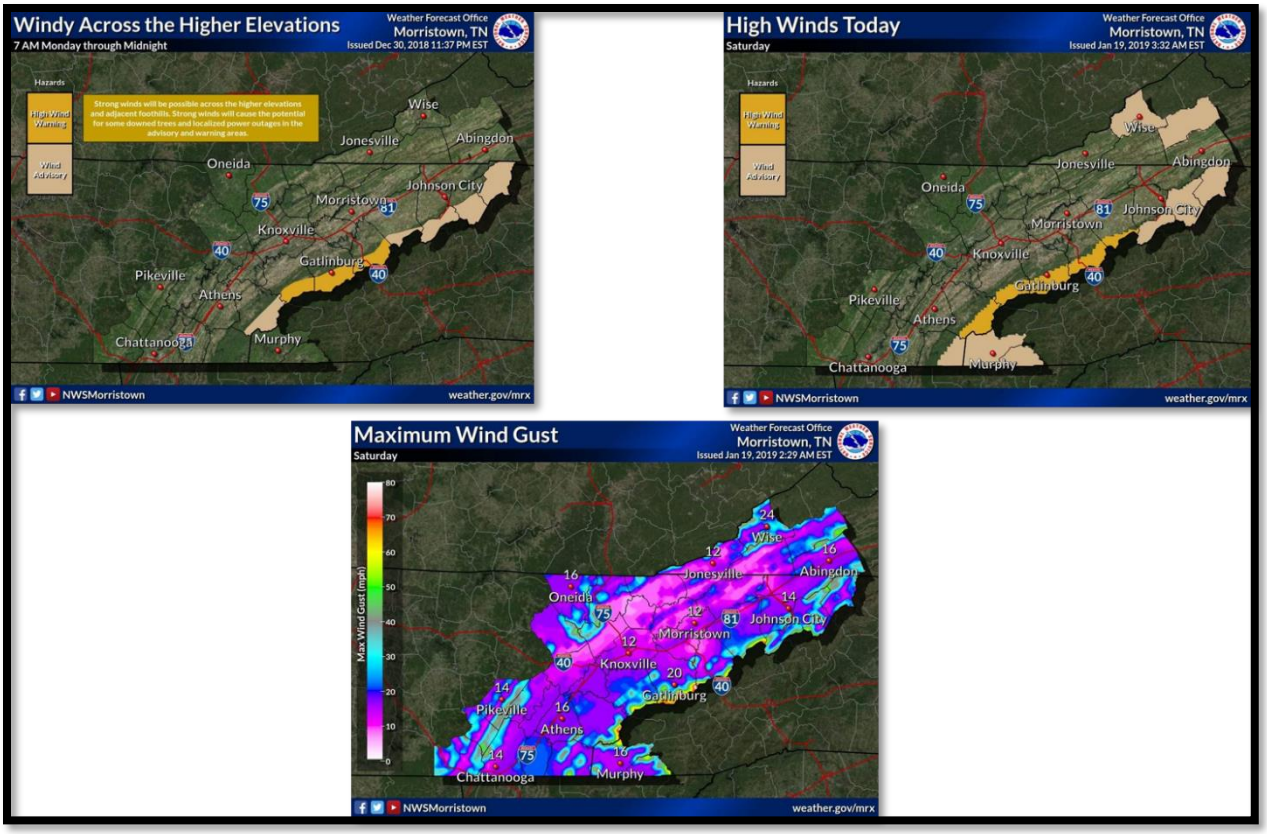

Figure 5-8: Severe Wind Extent and Location within Sevier County and Surrounding Areas, based on standard patterns (these occurring during the 2018-2019 winter months).

Previous Occurrences

Historically, there have been two severe wind events in Sevier County and its jurisdictions from 1996 to 2018. There have been no injuries or fatalities due to severe wind events in the unincorporated area of Sevier County and its jurisdictions.

Table 5-5: Severe Wind Events from 1996 to 2018 with Total Losses. (Source: NCEI Storm Events Database)

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage
2/3/2003	COUNTYWIDE	40	0	0	$2,000
6/21/1997	COUNTYWIDE	45	0	0	$20,000

Since the last plan update, there have been no new severe wind events reported from NCEI, which have caused damage to property or crops and/or loss of life or injuries.

Incidents/Probability

The NCEI Storm Events Database reports two severe wind event occurrences within the boundaries of Sevier County between the years 1996 and 2018. With a total of two events, the annual return rate

(frequency) for severe winds for Sevier County and its jurisdictions is one event every 11 to 12 years. This equates to an annual probability of approximately 8%.

5.1.8 Sinkholes

Location & Extent

Subsidence can occur slowly and continuously over time or abruptly for various reasons. Subsidence and sinkholes can occur due to either natural processes (karst sinkholes in areas underlain by soluble bedrock or as a result of human activities. The entire Sevier County planning area is susceptible to subsidence and sinkholes based on the karst topography of the region.

Previous Occurrences

Per the State of Tennessee Hazard Mitigation Plan, there are 586 sinkhole locations within Sevier County. The following figure displays all known sinkhole locations within Sevier County and its jurisdictions.

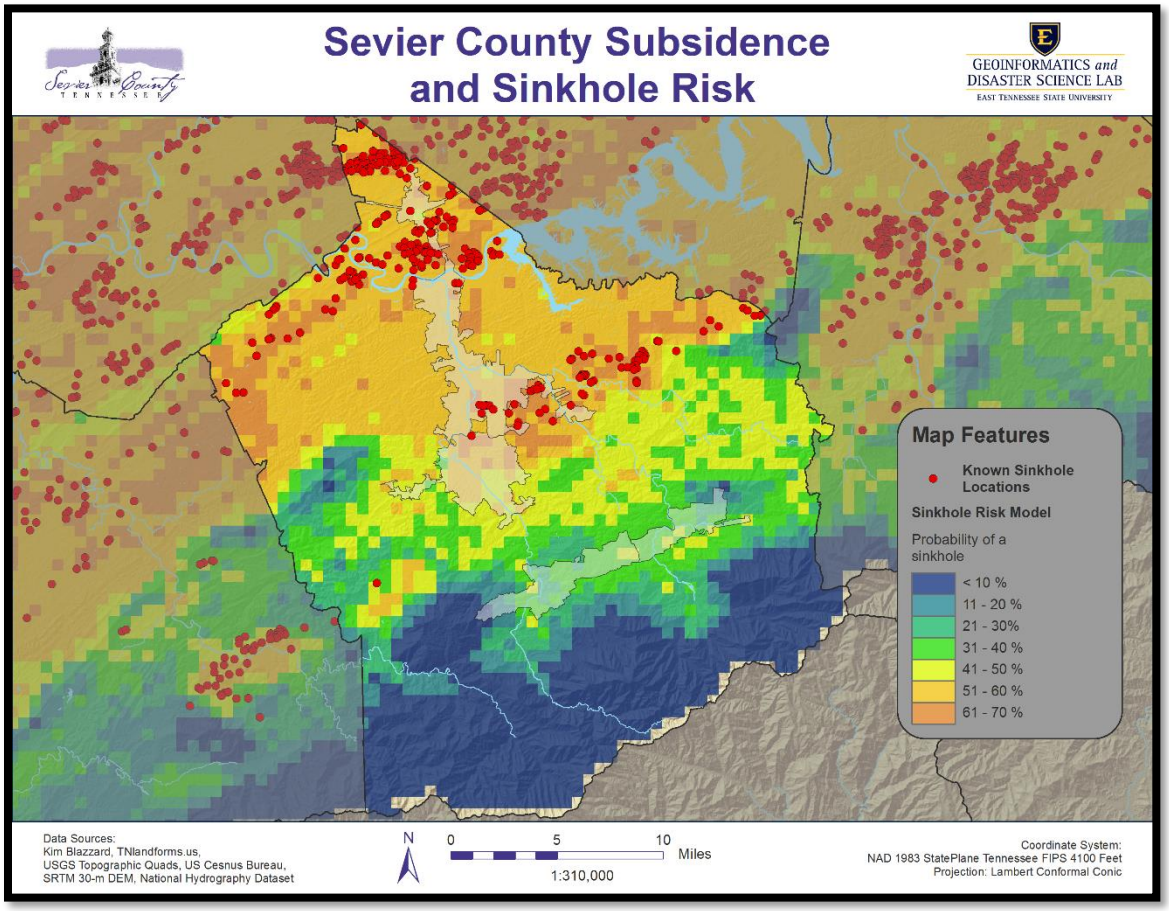

Figure 5-9: Sevier County Subsidence and Sinkhole Locations and Risk Probability.

May 2019

A sinkhole opened on the Dolly Parton Parkway in Sevierville, shutting down an eastbound lane for several hours

Incidents/Probability

Based on the total number of sinkholes within Sevier County and its jurisdictions, the annual probability of a sinkhole occurrence is calculated at 100%.

5.1.9 Thunderstorms (Hail, Lightning, and Wind)

Hail

Location & Extent

Because hailstorms are a meteorological phenomenon that can occur anywhere, the entire Sevier County planning area is equally at risk from hailstorms. The worst-case scenario for hailstorms is hail up to 3" in diameter.

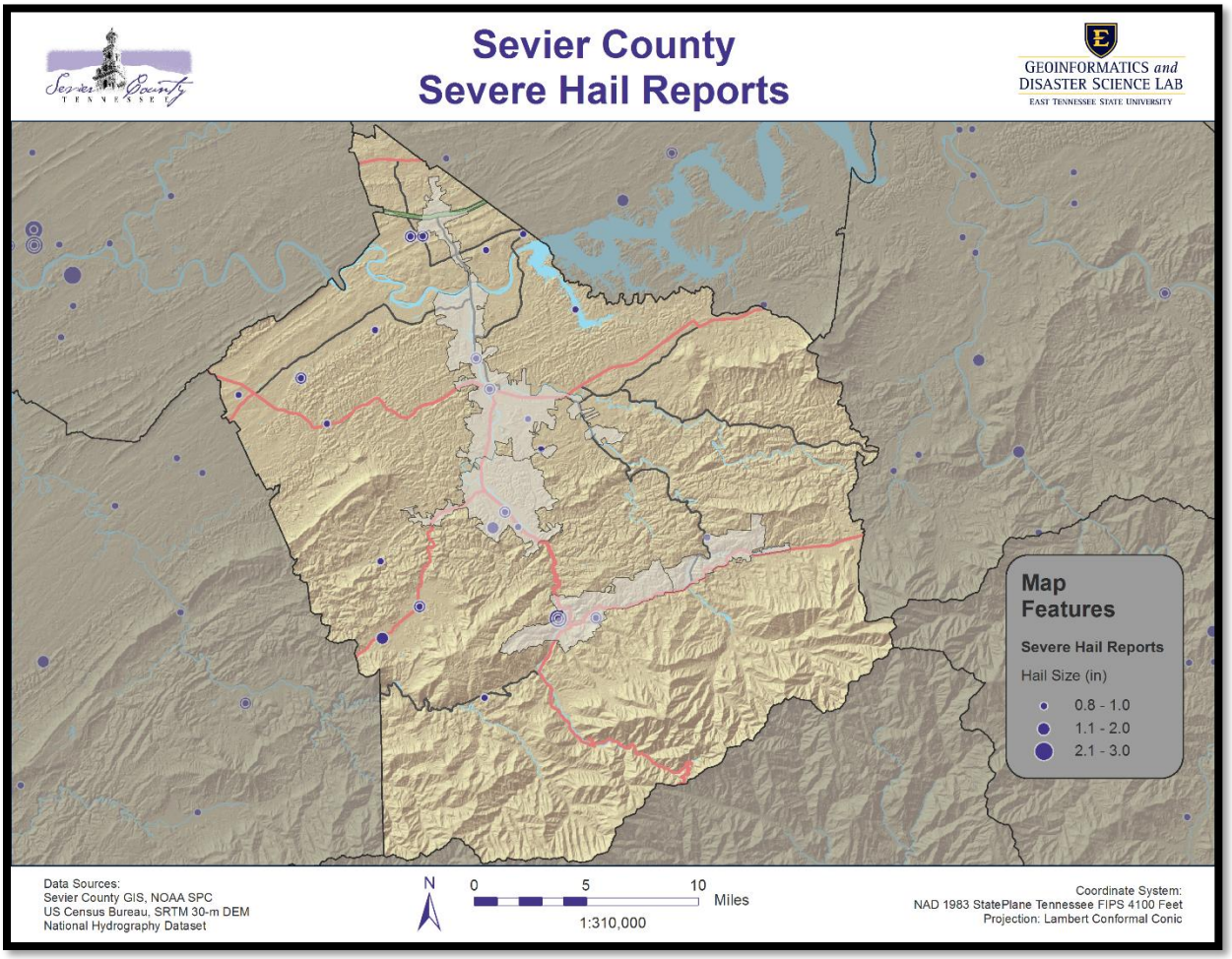

Figure 5-10: Severe Hail Reports and Density in Relation to Sevier County.

Previous Occurrences

Historically, there have been 25 hail events in the unincorporated area of Sevier County and its jurisdictions from 1996 to 2018. There have been no injuries or fatalities due to hail events in the Sevier County planning area. The following table briefly outlines the hail events that have occurred in the unincorporated area of Sevier County and its jurisdictions.

Table 5-6: Hail Incidents from 1996 to 2018 with Total Losses.
(Source: NCEI Storm Events Database)

Date	Location	Diameter (inches)	Injuries	Fatalities	Property Damage
4/10/1992	COUNTYWIDE	1.75	0	0	$0
8/26/1993	COUNTYWIDE	2.75	0	0	$0
5/26/1998	COUNTYWIDE	1	0	0	$0
1/18/1999	CUSICK	0.75	0	0	$0
5/13/1999	SEYMOUR	1.75	0	0	$0
4/5/2003	KODAK	1.75	0	0	$0
5/15/2003	COUNTYWIDE	0.75	0	0	$0
12/10/2004	KODAK	0.88	0	0	$0
4/3/2006	SEYMOUR	1.75	0	0	$0
5/20/2006	WALDEN CREEK	0.75	0	0	$0
5/20/2006	KODAK	0.75	0	0	$0
6/2/2006	PIGEON FORGE	0.75	0	0	$0
6/24/2007	KODAK	1	0	0	$0
5/9/2008	SEVIERVILLE	0.88	0	0	$0
7/21/2008	BOYDS CREEK	0.75	0	0	$0
6/17/2009	PITTMAN CTR	1	0	0	$0
5/26/2011	CATES XRDS	0.75	0	0	$0
5/26/2011	MILLICAN	0.88	0	0	$0
8/14/2011	PITNER	1	0	0	$0
2/29/2012	KODAK	1.25	0	0	$0
4/26/2012	KODAK	1	0	0	$0
6/14/2012	HATCHERTOWN	1.5	0	0	$0
7/27/2014	PITNER	1	0	0	$0
6/2/2015	COVE CREEK	1	0	0	$0
4/22/2016	SEVIERVILLE	1.5	0	0	$0

Since the last plan update, there have been six hail events which have occurred within the unincorporated areas of Sevier County and its jurisdictions. Below is a brief synopsis of these events.

February 29, 2012 – Kodak

A boundary across the area triggered thunderstorms over east Tennessee toward the end of the month. The boundary aided in the development of an EF-0 tornado as well as golfball-size hail and several reports of wind damage.

April 26, 2012 – Kodak

A cold front tracked across east Tennessee during the overnight hours triggering scattered thunderstorms over the area. A few of the storms produced damaging thunderstorm wind and hail as large as quarters.

June 14, 2012 – Hatchertown

Elevated moisture and instability permitted routine afternoon thunderstorms to produce severe weather including hail, wind damage, and flooding. Law enforcement personnel reported thunderstorms produced golfball-size hail 2 miles northeast of Wears Valley in Hatchertown.

July 27, 2014 – Pitner

A potent upper-level storm system impacted the region on Sunday, July 27th, bringing several rounds of severe weather along with locally heavy rainfall. Three tornadoes were observed across east Tennessee; one classified as a strong, EF-3 tornado with winds of 140 mph. Additionally, there were several reports of straight-line wind damage and large hail up 2 to 3 inches in diameter. A storm system of this magnitude is highly unusual for this time of year due to the strength of the front and the record cool temperatures it produced in the middle of the summer season.

June 2, 2015 – Cove Creek

Sufficient instability developed in a moist low level environment underneath an upper level low pressure system parked over the Cumberland Plateau for the development of localized severe convection in the foothills of the Smoky Mountains. Impacts from the storms included wind damage along with the formation of large hail. Quarter sized hail fell three miles north of Wears Valley.

April 22, 2016 – Sevierville

A few severe thunderstorms developed during the afternoon across the region in an environment that could be characterized as weakly unstable. The convection formed in response to a weak upper level impulse riding a few hundred miles east of a cold front.

Incidents/Probability

The NCEI Storm Events Database reports 25 hail events within the boundaries of Sevier County between the years 1996 and 2018. With a total of 25 events, the annual return rate (frequency) for hail events in the unincorporated area of Sevier County and its jurisdictions is one to two events every year. This equates to an annual probability of approximately 100%.

Lightning

Location & Extent

Lightning is a meteorological phenomenon that can occur anywhere and has the same probability of occurring throughout the entire Sevier County planning area. Based on historical lightning events, the Sevier County planning area can expect a lightning density of 11-12 flashes per square mile per year.

Previous Occurrences

Historically, there have been two lightning events that impacted the unincorporated area of Sevier County and its jurisdictions from 1996 to 2018. There have been no injuries and one fatality due to lightning events in the Sevier County planning area. The following table briefly outlines the lightning events that have occurred in the unincorporated area of Sevier County and its jurisdictions.

Table 5-7: Lightning Incidents from 1996 to 2018 with Total Losses.
(Source: NCEI Storm Events Database)

Date	Location	Injuries	Fatalities	Property Damage
5/7/1996	PIGEON FORGE	0	0	$0
7/10/2004	KODAK	0	1	$0

Since the last plan update, there have been no lightning events that have caused property damage and/or loss of life or injuries in Sevier County and its jurisdictions.

Incidents/Probability

The NCEI Storm Events Database reports two lightning events within the boundaries of Sevier County between the years 1996 and 2018. With a total of two 'impact' events, the annual return rate (frequency) for lightning events in the unincorporated area of Sevier County and its jurisdictions is one event every 11 to 12 years. This equates to an annual probability of approximately 8%.

Wind

Location & Extent

Thunderstorm wind is a meteorological phenomenon that can occur anywhere and has the same probability of occurring throughout the entire Sevier County planning area. Based on historical thunderstorm wind events, the Sevier County planning area can expect thunderstorm wind speeds of approximately 60 knots. The following figure displays the damages caused by thunderstorm winds from 1980 to 2017.

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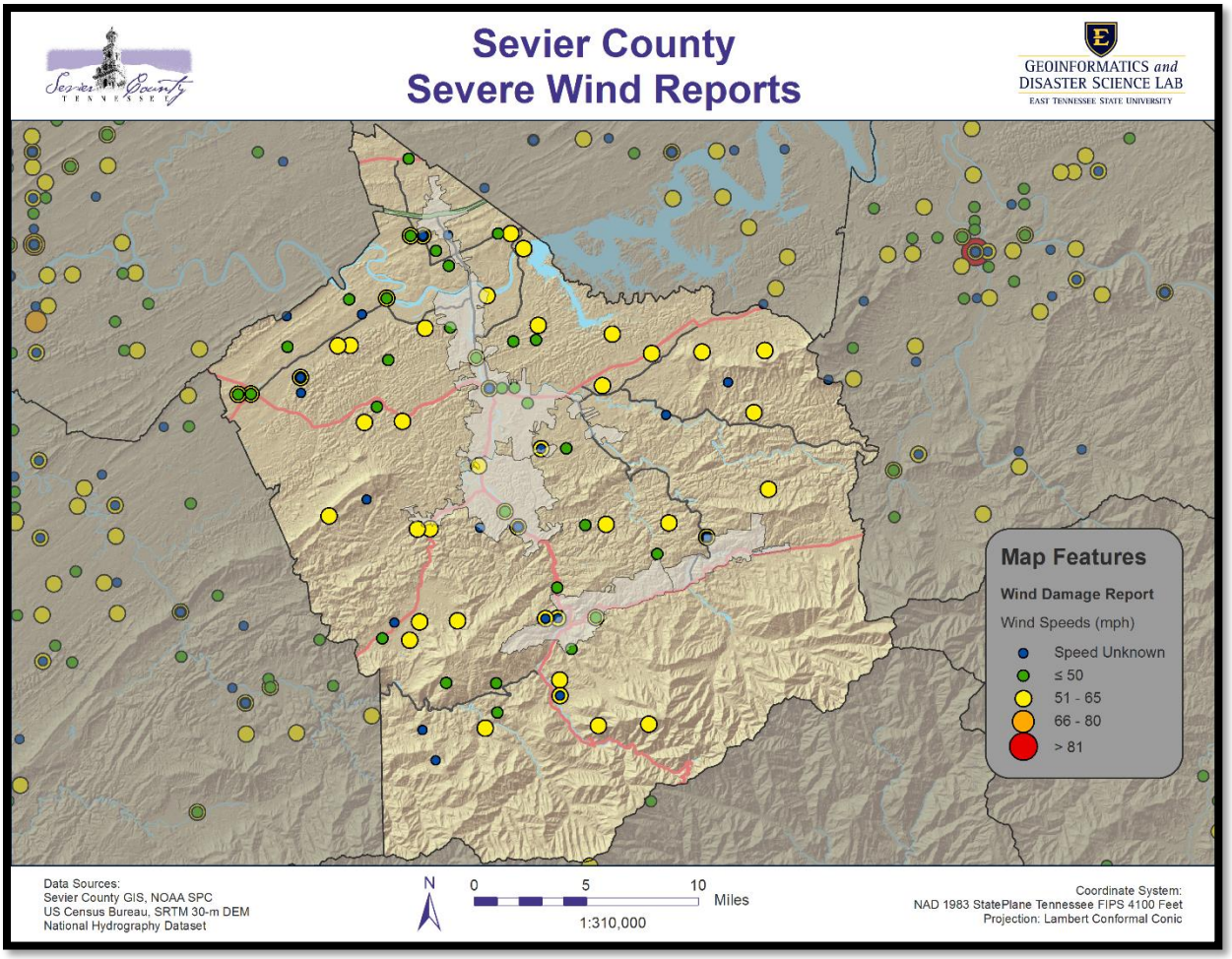

Figure 5-11: Severe Thunderstorm Wind Reports in Relation to Sevier County.

Previous Occurrences

Historically, there have been 189 thunderstorm wind events in the unincorporated area of Sevier County and its jurisdictions from 1996 to 2018. There have been no injuries or fatalities due to thunderstorm wind events in the Sevier County planning area. The following table briefly outlines the thunderstorm wind events that have occurred in the unincorporated area of Sevier County and its jurisdictions.

Table 5-8: Thunderstorm Wind Incidents from 1996 to 2018 with Total Losses.
(Source: NCEI Storm Events Database)

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage	Crop Damage
4/20/1996	GATLINBURG	60	0	0	$0	$0
5/27/1996	SOUTHWEST PART		0	0	$10,000	$0
8/8/1996	SEVIERVILLE		0	0	$0	$2,000
1/5/1997	GATLINBURG		0	0	$0	$4,000
3/5/1997	EXTREME N PART OF CO		0	0	$0	$3,000
6/13/1997	SEVIERVILLE		0	0	$0	$10,000

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage	Crop Damage
6/14/1997	SEYMOUR		0	0	$0	$7,000
7/4/1997	COUNTYWIDE		0	0	$25,000	$20,000
8/4/1997	COUNTYWIDE	55	0	0	$0	$20,000
2/17/1998	SEVIERVILLE		0	0	$0	$0
4/3/1998	COUNTYWIDE		0	0	$17,000	$15,000
6/2/1998	PIGEON FORGE		0	0	$0	$20,000
6/2/1998	GATLINBURG		0	0	$0	$15,000
6/5/1998	KODAK		0	0	$5,000	$14,000
6/15/1998	GATLINBURG		0	0	$15,000	$0
6/22/1998	SEVIERVILLE		0	0	$0	$20,000
6/24/1998	SEVIERVILLE		0	0	$0	$20,000
7/19/1998	SEVIERVILLE		0	0	$0	$5,000
11/25/1998	PIGEON FORGE		0	0	$0	$15,000
4/23/1999	SEVIERVILLE		0	0	$0	$7,000
5/6/1999	KODAK		0	0	$0	$2,000
5/7/1999	KODAK		0	0	$0	$5,000
7/24/1999	BEECH SPGS		0	0	$6,000	$0
7/29/1999	KODAK		0	0	$12,000	$0
7/29/1999	PIGEON FORGE		0	0	$10,000	$0
8/23/1999	SEYMOUR		0	0	$4,000	$0
2/13/2000	PIGEON FORGE		0	0	$0	$11,000
5/23/2000	PIGEON FORGE		0	0	$0	$11,000
5/27/2000	COUNTYWIDE		0	0	$0	$6,000
5/27/2000	COUNTYWIDE		0	0	$0	$2,000
7/28/2000	GATLINBURG		0	0	$0	$15,000
7/28/2000	GATLINBURG		0	0	$14,000	$0
7/29/2000	SEVIERVILLE		0	0	$0	$4,000
7/30/2000	KODAK		0	0	$0	$12,000
8/10/2000	HATCHERTOWN		0	0	$0	$15,000
8/18/2000	SEVIERVILLE		0	0	$0	$23,000
11/9/2000	KODAK		0	0	$0	$4,000
11/9/2000	SEYMOUR		0	0	$0	$5,000
5/21/2001	CEDAR BLUFF		0	0	$0	$5,000
7/4/2001	PIGEON FORGE		0	0	$0	$24,000
7/8/2001	PITTMAN CENTER		0	0	$0	$21,000
10/25/2001	COUNTYWIDE		0	0	$16,000	$20,000
1/24/2002	COUNTYWIDE		0	0	$8,000	$0
5/2/2002	SEVIERVILLE		0	0	$15,000	$0
5/2/2002	SEYMOUR		0	0	$12,000	$0
5/13/2002	COUNTYWIDE		0	0	$15,000	$0

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage	Crop Damage
6/4/2002	GATLINBURG		0	0	$15,000	$0
7/2/2002	COUNTYWIDE		0	0	$25,000	$0
7/30/2002	GATLINBURG		0	0	$0	$5,000
8/1/2002	GATLINBURG		0	0	$5,000	$0
9/4/2002	BOYDS CREEK		0	0	$10,000	$0
9/4/2002	WALDEN CREEK		0	0	$15,000	$0
11/10/2002	KODAK	60	0	0	$15,000	$0
2/16/2003	GATLINBURG	60	0	0	$5,000	$0
5/2/2003	SEVIERVILLE	55	0	0	$12,000	$0
5/11/2003	KODAK	55	0	0	$8,000	$0
6/11/2003	KODAK	60	0	0	$12,000	$0
7/6/2003	COUNTYWIDE	60	0	0	$0	$0
7/10/2003	SEYMOUR	60	0	0	$0	$0
8/11/2003	COUNTYWIDE	60	0	0	$0	$0
8/29/2003	PIGEON FORGE	60	0	0	$0	$0
8/31/2003	PIGEON FORGE	60	0	0	$0	$0
11/18/2003	COUNTYWIDE	55	0	0	$10,000	$0
5/26/2004	KODAK	65	0	0	$10,000	$0
5/31/2004	SEVIERVILLE	65	0	0	$20,000	$0
6/2/2004	SEYMOUR	65	0	0	$5,000	$0
6/12/2004	SEVIERVILLE	60	0	0	$10,000	$0
7/5/2004	SEYMOUR	60	0	0	$12,000	$0
7/5/2004	KODAK	60	0	0	$10,000	$0
7/5/2004	PIGEON FORGE	60	0	0	$12,000	$0
7/10/2004	KODAK	60	0	0	$8,000	$0
7/13/2004	SEVIERVILLE	65	0	0	$15,000	$0
7/17/2004	SEVIERVILLE	65	0	0	$30,000	$0
5/20/2005	COUNTYWIDE	65	0	0	$30,000	$0
6/6/2005	SEVIERVILLE	65	0	0	$15,000	$0
6/27/2005	SEVIERVILLE	65	0	0	$18,000	$0
6/30/2005	COUNTYWIDE	55	0	0	$20,000	$0
7/27/2005	GATLINBURG	55	0	0	$10,000	$0
7/31/2005	SEVIERVILLE	55	0	0	$3,000	$0
7/31/2005	SEVIERVILLE	60	0	0	$3,000	$0
4/2/2006	KODAK	60	0	0	$12,000	$0
4/21/2006	SEYMOUR	60	0	0	$12,000	$0
5/20/2006	SEVIERVILLE	60	0	0	$20,000	$0
5/20/2006	SEVIERVILLE	60	0	0	$12,000	$0
5/30/2006	PITTMAN CENTER	60	0	0	$3,000	$0
5/30/2006	GATLINBURG	60	0	0	$20,000	$0

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage	Crop Damage
5/30/2006	GATLINBURG	60	0	0	$15,000	$0
5/31/2006	KODAK	60	0	0	$10,000	$0
6/23/2006	COUNTYWIDE	60	0	0	$6,000	$0
7/28/2006	GATLINBURG	60	0	0	$15,000	$0
8/4/2006	COUNTYWIDE	55	0	0	$6,000	$0
8/5/2006	WALDEN CREEK	60	0	0	$10,000	$0
10/5/2006	KODAK	55	0	0	$0	$0
4/3/2007	CATLETTSBURG	55	0	0	$30,000	$0
6/14/2007	PITTMAN CENTER	50	0	0	$10,000	$0
6/24/2007	SEVIERVILLE	55	0	0	$5,000	$0
6/25/2007	SEVIERVILLE	55	0	0	$20,000	$0
6/28/2007	PIGEON FORGE	55	0	0	$10,000	$0
6/28/2007	GATLINBURG	55	0	0	$15,000	$0
6/28/2007	SEVIERVILLE	50	0	0	$2,000	$0
1/10/2008	BOYDS CREEK	55	0	0	$0	$0
3/19/2008	CATLETTSBURG	50	0	0	$0	$0
6/9/2008	BANNER	55	0	0	$10,000	$0
6/11/2008	BIRD XRD	50	0	0	$10,000	$0
6/12/2008	GATLINBURG	50	0	0	$5,000	$0
6/12/2008	LINE SPG	52	0	0	$2,000	$0
6/12/2008	PITNER	55	0	0	$5,000	$0
6/28/2008	KODAK	55	0	0	$8,000	$0
6/28/2008	PINE GROVE	55	0	0	$8,000	$0
6/28/2008	GLADES	55	0	0	$8,000	$0
7/22/2008	ELKMONT	55	0	0	$0	$0
7/22/2008	GLADES	60	0	0	$0	$0
2/11/2009	CATLETTSBURG	55	0	0	$15,000	$0
4/2/2009	PITNER	55	0	0	$8,000	$0
4/6/2009	KODAK	52	0	0	$8,000	$0
4/6/2009	OAK CITY	50	0	0	$2,000	$0
4/6/2009	KODAK	50	0	0	$2,000	$0
5/28/2009	CUSICK	52	0	0	$0	$0
6/4/2009	MC MAHAN	52	0	0	$2,000	$0
6/4/2009	FAIR GARDEN	52	0	0	$2,000	$0
6/10/2009	KODAK	62	0	0	$5,000	$0
6/17/2009	SEVIERVILLE	50	0	0	$30,000	$0
8/16/2009	SEVIERVILLE	52	0	0	$2,000	$0
8/16/2009	SEVIERVILLE	58	0	0	$15,000	$0
8/22/2009	PITTMAN CENTER	60	0	0	$15,000	$0
8/22/2009	PITTMAN CENTER	50	0	0	$20,000	$0

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage	Crop Damage
7/26/2010	SHADY GROVE	55	0	0	$0	$0
10/26/2010	SEVIERVILLE	55	0	0	$5,000	$0
2/25/2011	SEVIERVILLE	50	0	0	$15,000	$0
2/28/2011	PITTMAN CENTER	60	0	0	$12,000	$0
3/23/2011	CATLETTSBURG	60	0	0	$0	$0
3/23/2011	GLADES	55	0	0	$0	$0
5/22/2011	MILLICAN	50	0	0	$0	$0
5/26/2011	HENRY XRDS	50	0	0	$0	$0
5/26/2011	ALDER BRANCH	50	0	0	$0	$0
6/24/2011	SEVIERVILLE	50	0	0	$5,000	$0
8/8/2011	SEVIERVILLE	52	0	0	$3,000	$0
8/18/2011	SEVIERVILLE	52	0	0	$10,000	$0
2/29/2012	PIGEON FORGE	60	0	0	$5,000	$0
3/2/2012	DU PONT	50	0	0	$0	$0
3/30/2012	CATLETTSBURG	50	0	0	$0	$0
7/1/2012	ELKMONT	60	0	0	$0	$0
7/5/2012	CATLETTSBURG	60	0	0	$1,000,000	$0
7/5/2012	FRENCH BROAD	60	0	0	$1,000,000	$0
7/5/2012	PIGEON FORGE	50	0	0	$0	$0
7/9/2012	BOYDS CREEK	50	0	0	$0	$0
7/10/2012	LINE SPG	50	0	0	$0	$0
7/10/2012	SEVIERVILLE	50	0	0	$0	$0
7/31/2012	MIDDLE CREEK	50	0	0	$0	$0
7/31/2012	PITNER	50	0	0	$0	$0
5/21/2013	CATLETTSBURG	50	0	0	$0	$0
5/22/2013	CATLETTSBURG	50	0	0	$0	$0
6/5/2013	PIGEON FORGE	50	0	0	$2,000	$0
6/5/2013	PIGEON FORGE	50	0	0	$5,000	$0
6/13/2013	PITTMAN CENTER	50	0	0	$8,000	$0
6/13/2013	SEYMOUR	55	0	0	$8,000	$0
6/10/2014	SEVIERVILLE	50	0	0	$10,000	$0
6/23/2014	PIGEON FORGE	50	0	0	$5,000	$0
6/23/2014	SEVIERVILLE	50	0	0	$8,000	$0
6/27/2014	SEYMOUR	50	0	0	$8,000	$0
7/8/2014	PITNER	50	0	0	$0	$0
7/8/2014	LINE SPG	60	0	0	$0	$0
7/27/2014	CATLETTSBURG	50	0	0	$0	$0
9/16/2014	CATLETTSBURG	52	0	0	$0	$0
10/14/2014	PIGEON FORGE	50	0	0	$5,000	$0
4/25/2015	KODAK	50	0	0	$5,000	$0

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage	Crop Damage
4/25/2015	GATLINBURG	50	0	0	$8,000	$0
6/2/2015	GLADES	50	0	0	$0	$0
6/30/2015	KODAK	50	0	0	$0	$0
8/10/2015	PITNER	50	0	0	$0	$0
8/10/2015	LINE SPG	50	0	0	$0	$0
4/22/2016	PITNER	50	0	0	$0	$0
6/2/2016	PIGEON FORGE	50	0	0	$0	$0
6/14/2016	HICKS CROSSING	50	0	0	$0	$0
7/7/2016	LINE SPG	50	0	0	$0	$0
7/7/2016	LINE SPG	50	0	0	$0	$0
7/7/2016	CATLETTSBURG	55	0	0	$0	$0
7/8/2016	ELKMONT	60	0	0	$0	$0
7/8/2016	PITNER	50	0	0	$0	$0
7/12/2016	BEECH SPGS	50	0	0	$0	$0
3/1/2017	CATLETTSBURG	50	0	0	$0	$0
3/1/2017	CATLETTSBURG	50	0	0	$0	$0
3/27/2017	CATES XRDS	50	0	0	$0	$0
5/24/2017	GLADES	50	0	0	$0	$0
5/24/2017	SEVIERVILLE ARPT	50	0	0	$0	$0
6/25/2018	BIRD XRD	50	0	0	$0	$0
6/26/2018	CATLETTSBURG	50	0	0	$0	$0
6/28/2018	GLADES	50	0	0	$0	$0
11/6/2018	PITNER	50	0	0	$0	$0

Since the last plan update, there have been 51 thunderstorm wind events which have occurred within the unincorporated areas of Sevier County and its jurisdictions.

Incidents/Probability

The NCEI Storm Events Database reports 189 thunderstorm wind events within the boundaries of Sevier County between the years 1996 and 2018. With a total of 189 events, the annual return rate (frequency) for thunderstorm wind events in the unincorporated area of Sevier County and its jurisdictions is eight to nine events every year. This equates to an annual probability of approximately 100%.

5.1.10 Tornadoes

Location & Extent

While there is a significant tornado record for Sevier County with actual locations, tornadoes in general are a meteorological phenomenon that can occur anywhere and have the same approximate probability of occurring anywhere in the Sevier County planning area. Because a tornado has a similar probability of striking anywhere within the planning area, all of Sevier County and its jurisdictions are equally at risk for tornadoes. The tornadoes experienced in Sevier County range from EF0 to EF1 on the EF scale. Based on

historical county-level data, the worst-case scenario for Sevier County and its jurisdictions is an EF1 tornado; however, an EF4 tornado did impact Blount County in 2011 in an area adjacent to Sevier County.

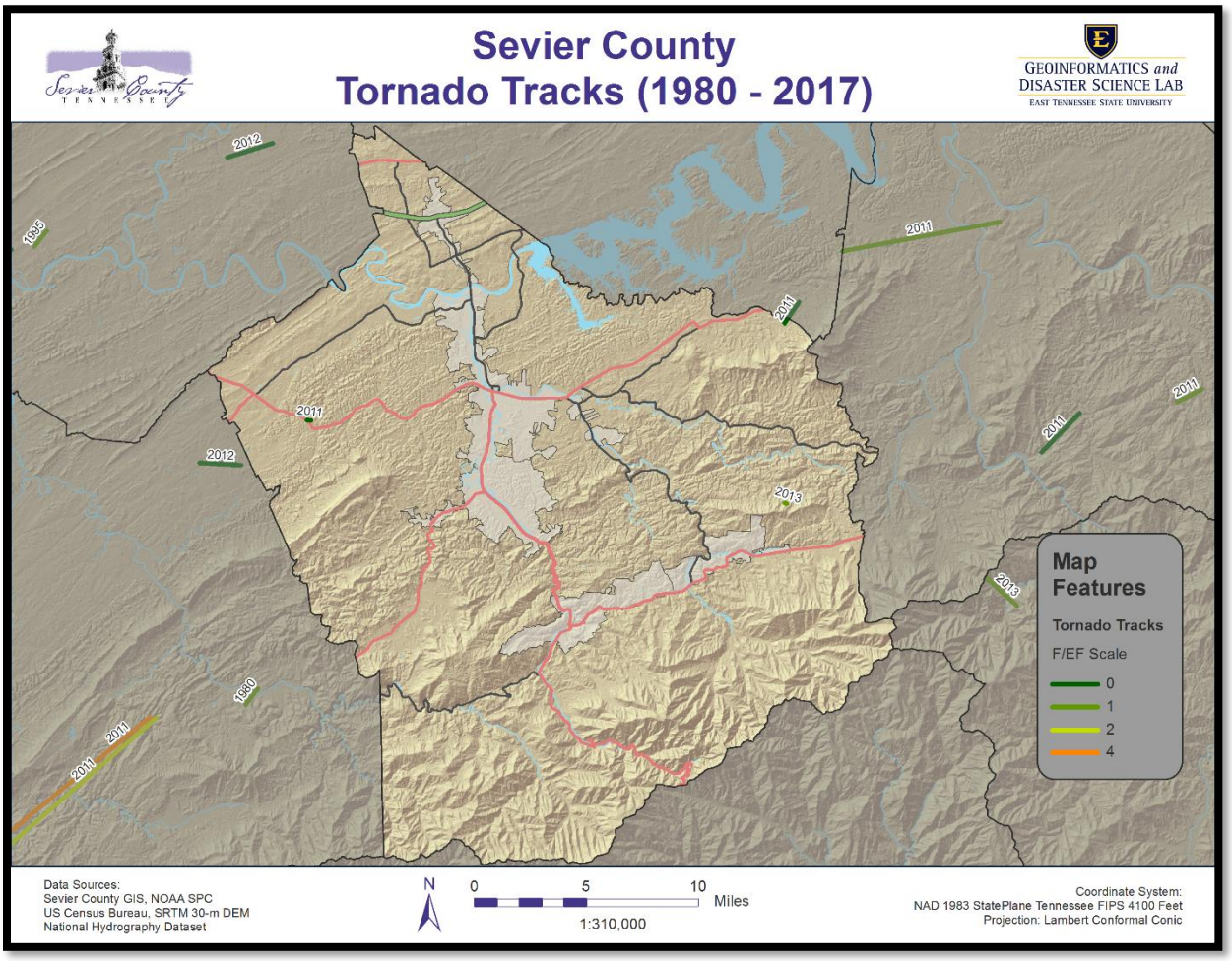

Figure 5-12: Tornado Tracks in Relation to Sevier County.

Previous Occurrences

The NCEI Storm Events Database reports three tornadoes occurring within the boundaries of Sevier County. There have been no injuries due to tornadoes in Sevier County and its jurisdictions. The following table is a list of all events that have occurred between 1996 and 2018.

Table 5-9: Tornado Incidents from 1996 to 2018 with Total Losses.
(Source: NCEI Storm Events Database)

Date	Location	Magnitude	Injuries	Fatalities	Property Damage
4/27/2011	CUSICK	EF0	0	0	$5,000
4/27/2011	BIRD XRD	EF0	0	0	$3,000
6/13/2013	SEVIERVILLE	EF1	0	0	$50,000

Since the last plan update, there have been no tornado events that have caused property damage and/or loss of life or injuries in Sevier County and its jurisdictions.

Incidents/Probability

The NCEI Storm Events Database reports three tornado events within the boundaries of Sevier County between the years 1996 and 2018. With a total of three events, the annual return rate (frequency) for tornado events in the unincorporated area of Sevier County and its jurisdictions is one event every 7 to 8 years. This equates to an annual probability of approximately 12%.

5.1.11 Tropical Cyclones (Hurricanes)

Location & Extent

Tropical cyclones typically impact multiple regions and not one specific jurisdiction. Based on historical data, the Sevier County planning area can expect to experience tropical cyclones at the tropical depression level. Additionally, no portions of Sevier County will be impacted by storm surge based on its geographical location.

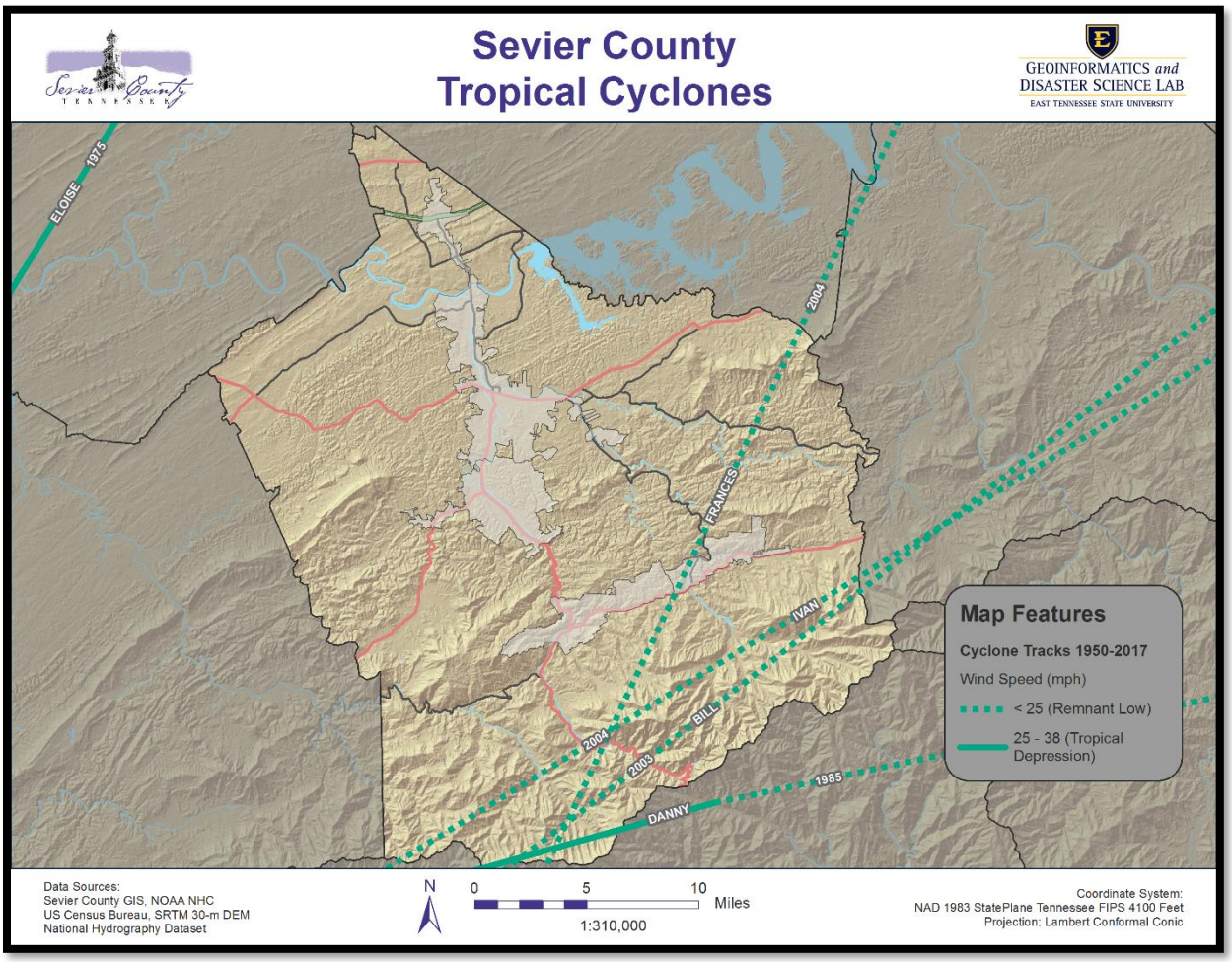

Figure 5-13: Tropical Cyclone Tracks in Relation to Sevier County and Its Jurisdictions.

Previous Occurrences

The NCEI Storm Events Database reports no tropical cyclone (tropical depressions, tropical storms, and hurricanes) occurrences within the boundaries of Sevier County and its jurisdictions between the years 1996 and 2018.

Incidents/Probability

Based on historical record, the annual probability of tropical cyclones for Sevier County and its jurisdictions is less than 1%.

5.1.12 Wildfires/Conflagration

Location & Extent

Wildfires impact areas that are populated with forests and grasslands. On the fire danger rating system, Sevier County and its jurisdictions can expect a moderate to high rating based on current land use/land cover in the area. The following figure displays the areas of wildland-urban interface and intermix for Sevier County and its jurisdictions, as well as the underlying land cover (aerial imagery). The aerial imagery helps to identify possible wildfire fuel sources such as small wooded and shrub areas that may not be identified by the WUI dataset.

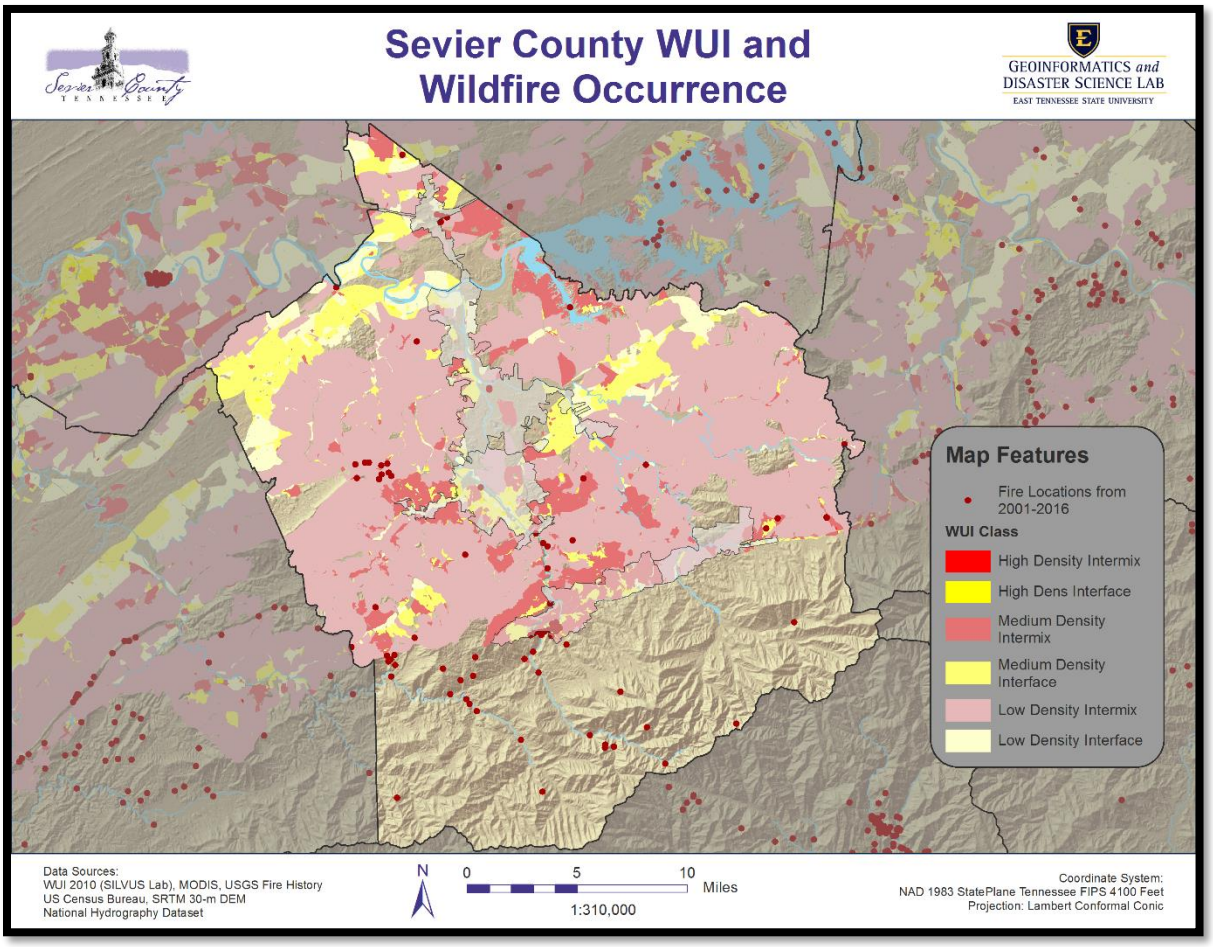

Figure 5-14: Wildland-Urban Interaction for Sevier County and its Jurisdictions.

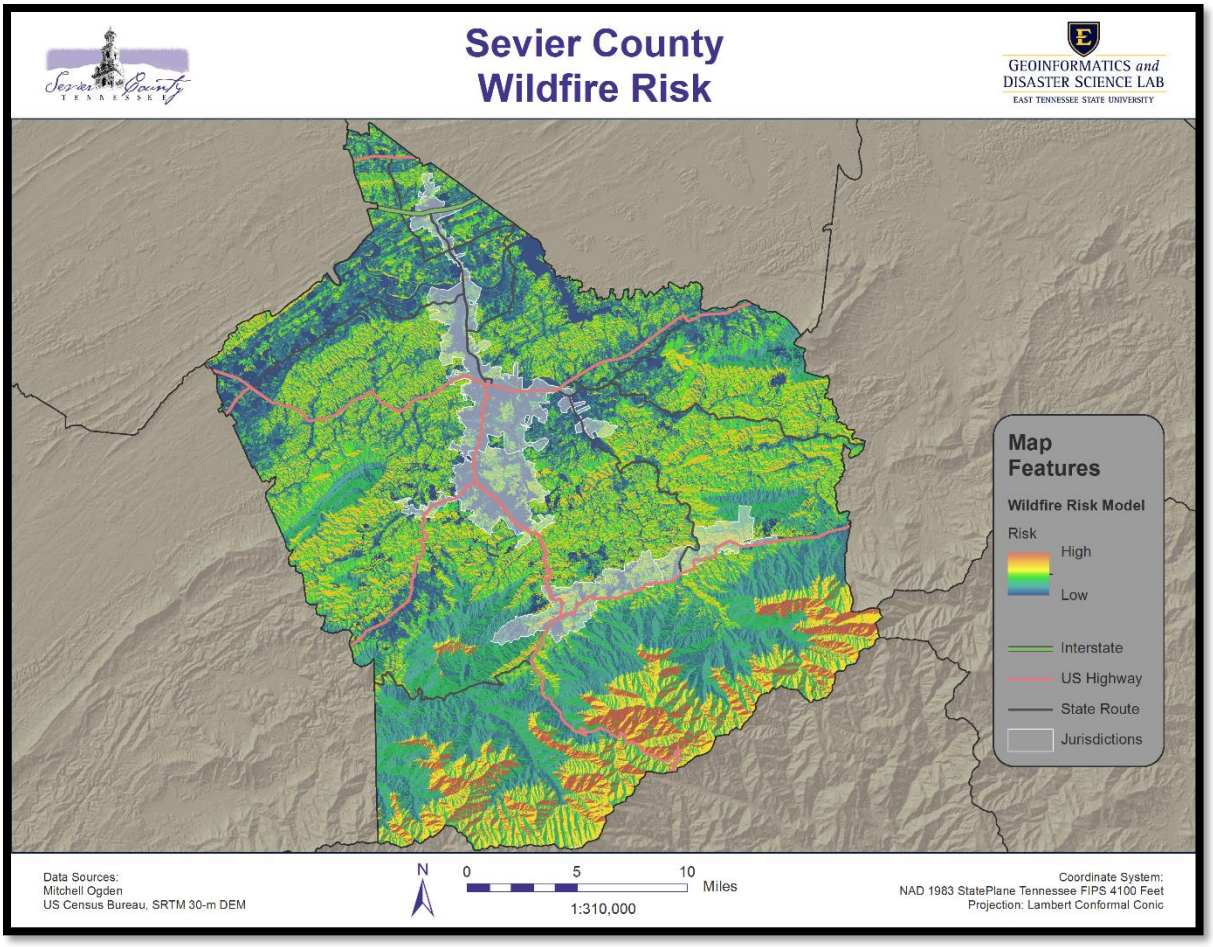

Figure 5-15: Wildfire Risk Model for Sevier County.

Using the record of wildfires in Sevier County, how much of an effect each variable has on wildfire development can be determined through spatial logistic regression and GIS modeling. Calculating wildfire risk through these methods requires data on previous wildfire occurrences and variables related to fire development. Wildfire occurrence data comes from two sources: the United States Forest Service (USFS) and the Geological Survey (USGS). The USGS data recorded only those wildfires that occurred on federal land, primarily the Great Smoky Mountains National Park, for which the USFS dataset includes.

The duration of a wildfire depends on the weather conditions, how dry it is, the availability of fuel to spread, and the ability of responders to contain and extinguish the fire. Historically, some wildfires have lasted only hours while other fires have continued to spread and grow for an entire season. They spread quickly and often begin unnoticed until they have grown large enough to produce dense smoke. If fuel is available, and high wind speeds occur, a wildfire can spread over a large area in a very short amount of time. These factors make the difference between small upstart fires easily controlled by local fire services and fires destroying thousands of acres requiring multiple state and federal assets for containment and suppression.

Previous Occurrences

The USGS and USFS report 168 wildfire/conflagration occurrences within the boundaries of Sevier County and its jurisdictions from 2001 to 2016. A historic drought in the fall of 2016 preceded historic wildfires. By November 22, all 95 counties in Tennessee were classified in "Severe Drought" (D2) or higher. Tennessee experienced numerous wildfires across the state, including several that required federal assistance. On November 28, 2016, hurricane-force winds rapidly expanded a small wildfire in Sevier County into the largest interface fire to impact the state of Tennessee in 100 years, resulting in an estimated $911 million in property and contents loss. There were 14 fatalities and 221 people treated with fire-related injuries. The fire area was reported at 17,140 acres.

Figure 5-16: Photos showing the 2016 wildfire entering the developed area of Gatlinburg (upper left, The Atlantic), drastically reducing visibility with intense smoke (upper right, WV Metro News), devastating large areas (lower left, CNN), and destroying many homes (lower right, NPR).

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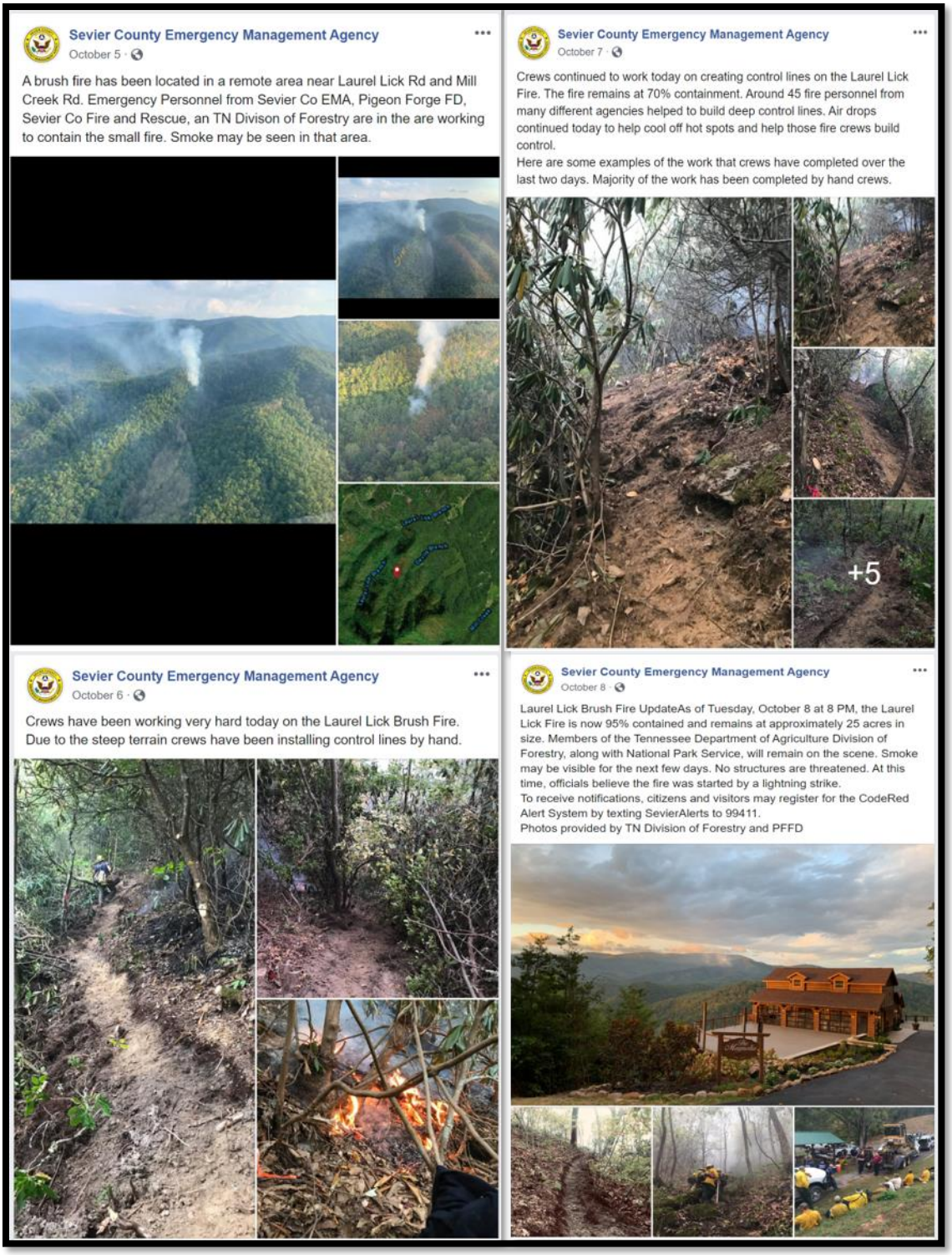

Figure 5-17: Social media documentation and community awareness of recent wildfires (October 2019) impacting Sevier County (Sevier County EMA).

Incidents/Probability

The USGS and USFS Database reports 168 wildfire/conflagration events within the boundaries of Sevier County between the years 2001 and 2016. With a total of 168 events, the annual return rate (frequency) for wildfire/conflagration events in the unincorporated area of Sevier County and its jurisdictions is eight to nine events every year. This equates to an annual probability of approximately 100%.

5.1.13 Winter Storms

Location & Extent

Because winter weather is a climatological hazard and has the same probability of occurring in any area in Sevier County, the entire planning area is equally at risk for winter weather. Based on historic data, Sevier County and its jurisdictions can expect a category 5 on the Ohio Valley Regional Snowfall Index scale.

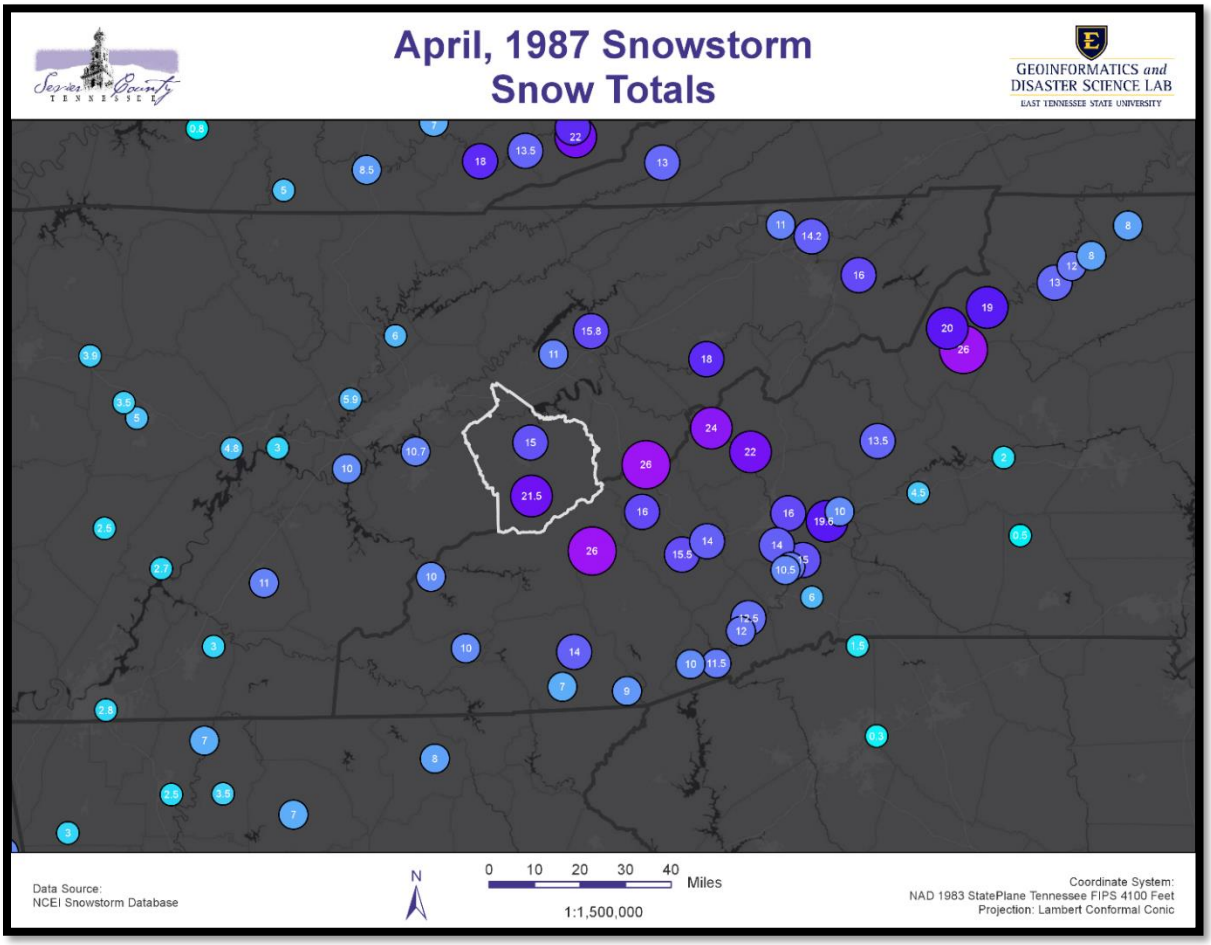

Figure 5-18: Station reported snowfall totals from the April 1987 snowstorm. This event resulted in the highest single day snowfall total for Sevierville, TN.

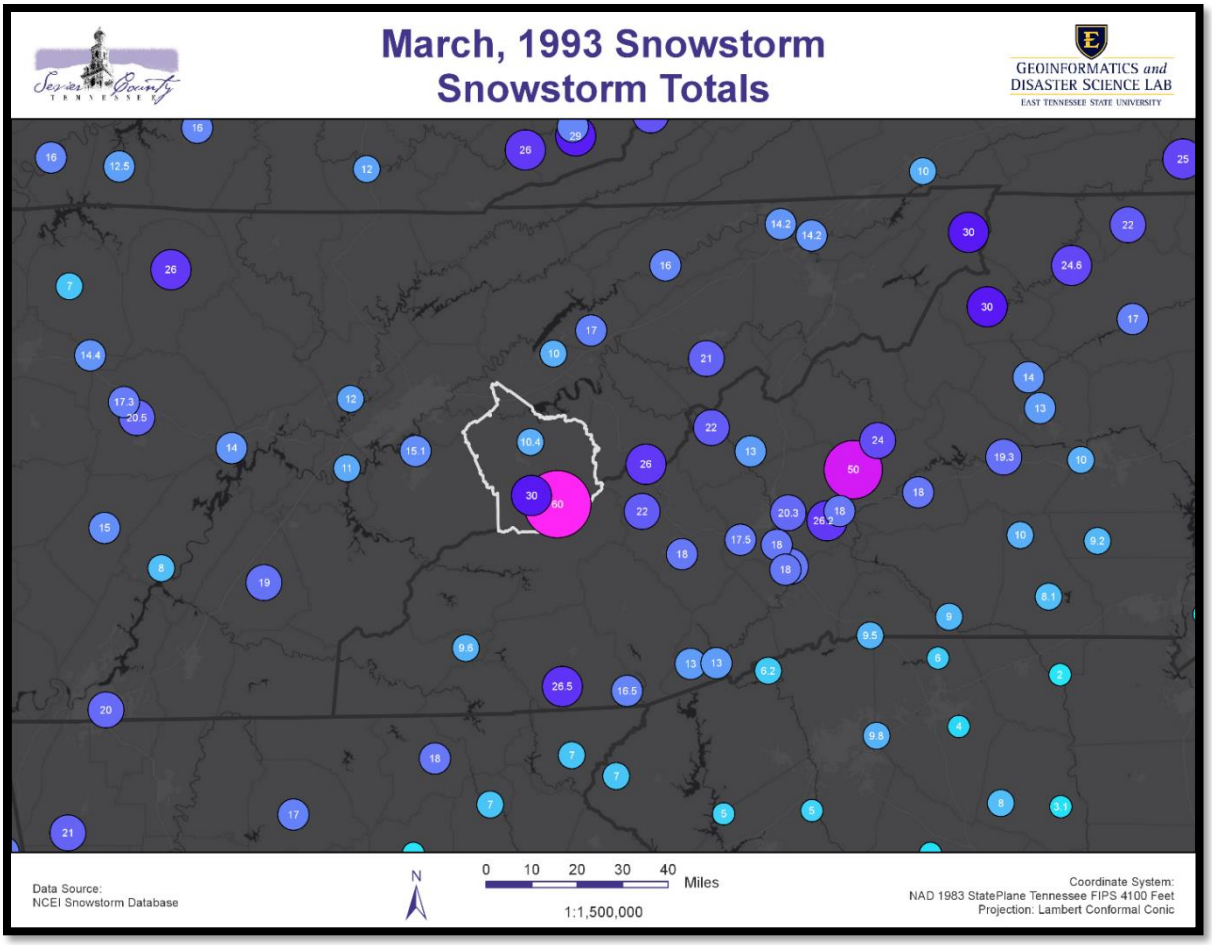

Figure 5-19: Station reported snowfall totals from the March 1993 snowstorm. This event resulted in the highest single day snowfall total for Gatlinburg, TN.

Previous Occurrences

Historically, there have been 102 winter storm events in the unincorporated area of Sevier County and its jurisdictions from 1996 to 2018. There have been no injuries or fatalities due to winter storm events in the Sevier County planning area. The following table briefly outlines the winter storm events that have occurred in the unincorporated area of Sevier County and its jurisdictions.

Table 5-10: Winter Storm Incidents from 1996 to 2018 with Total Losses.
(Source: NCEI Storm Events Database)

Date	Location	Injuries	Fatalities	Property Damage	Crop Damage
1/6/1996	GATLINBURG	0	0	$0	$0
1/6/1996	SOUTHWEST PART	0	0	$0	$0
1/11/1996	SEVIERVILLE	0	0	$0	$0
1/11/1996	GATLINBURG	0	0	$0	$0
2/2/1996	EXTREME N PART OF CO	0	0	$0	$0
2/2/1996	SEVIERVILLE	0	0	$0	$0
3/19/1996	SEYMOUR	0	0	$5,000	$0

Date	Location	Injuries	Fatalities	Property Damage	Crop Damage
3/19/1996	COUNTYWIDE	0	0	$0	$0
12/18/1996	COUNTYWIDE	0	0	$0	$0
12/18/1996	SEVIERVILLE	0	0	$0	$0
1/10/1997	COUNTYWIDE	0	0	$0	$0
1/10/1997	PIGEON FORGE	0	0	$0	$0
12/30/1997	GATLINBURG	0	0	$0	$0
12/30/1997	KODAK	0	0	$0	$0
1/27/1998	GATLINBURG	0	0	$0	$0
1/27/1998	SEVIERVILLE	0	0	$0	$0
1/6/1999	SEVIERVILLE	0	0	$0	$0
1/6/1999	SEVIERVILLE	0	0	$0	$0
3/3/1999	PIGEON FORGE	0	0	$0	$0
3/3/1999	SEVIERVILLE	0	0	$0	$0
3/13/1999	KODAK	0	0	$0	$0
3/13/1999	KODAK	0	0	$0	$0
3/26/1999	BEECH SPGS	0	0	$0	$0
3/26/1999	KODAK	0	0	$0	$0
1/22/2000	PIGEON FORGE	0	0	$0	$0
1/22/2000	SEYMOUR	0	0	$0	$0
12/2/2000	PIGEON FORGE	0	0	$0	$0
12/2/2000	PIGEON FORGE	0	0	$0	$0
12/18/2000	COUNTYWIDE	0	0	$0	$0
12/18/2000	COUNTYWIDE	0	0	$5,000	$0
1/1/2001	GATLINBURG	0	0	$0	$0
1/1/2001	GATLINBURG	0	0	$0	$0
1/20/2001	SEVIERVILLE	0	0	$0	$0
1/20/2001	KODAK	0	0	$0	$0
3/20/2001	HATCHERTOWN	0	0	$0	$0
3/20/2001	SEVIERVILLE	0	0	$0	$0
1/5/2002	KODAK	0	0	$2,000	$0
1/5/2002	SEYMOUR	0	0	$0	$0
12/4/2002	CEDAR BLUFF	0	0	$0	$0
1/5/2003	PIGEON FORGE	0	0	$0	$0
1/16/2003	PITTMAN CENTER	0	0	$0	$0
1/16/2003	COUNTYWIDE	0	0	$0	$0
1/22/2003	COUNTYWIDE	0	0	$0	$0
1/22/2003	SEVIERVILLE	0	0	$0	$0
2/7/2003	SEYMOUR	0	0	$0	$0
2/9/2003	COUNTYWIDE	0	0	$0	$0
4/10/2003	GATLINBURG	0	0	$0	$0
12/18/2003	COUNTYWIDE	0	0	$0	$0

Date	Location	Injuries	Fatalities	Property Damage	Crop Damage
12/19/2003	GATLINBURG	0	0	$0	$0
1/9/2004	GATLINBURG	0	0	$0	$0
1/9/2004	BOYDS CREEK	0	0	$0	$0
2/7/2004	WALDEN CREEK	0	0	$0	$0
12/11/2004	KODAK	0	0	$0	$0
12/19/2004	GATLINBURG	0	0	$0	$0
2/10/2005	SEVIERVILLE	0	0	$0	$0
2/28/2005	KODAK	0	0	$0	$0
11/21/2005	KODAK	0	0	$0	$0
1/14/2006	COUNTYWIDE	0	0	$0	$0
2/11/2006	SEYMOUR	0	0	$0	$0
2/18/2007	COUNTYWIDE	0	0	$0	$0
1/16/2008	PIGEON FORGE	0	0	$0	$0
2/27/2008	PIGEON FORGE	0	0	$0	$0
2/3/2009	COUNTYWIDE	0	0	$0	$0
4/7/2009	KODAK	0	0	$0	$0
12/18/2009	SEVIERVILLE	0	0	$0	$0
1/29/2010	SEYMOUR	0	0	$0	$0
1/29/2010	SEVIERVILLE	0	0	$0	$0
2/9/2010	SEYMOUR	0	0	$0	$0
2/24/2010	KODAK	0	0	$0	$0
12/6/2010	PIGEON FORGE	0	0	$0	$0
12/6/2010	KODAK	0	0	$0	$0
12/12/2010	SEVIERVILLE	0	0	$0	$0
12/12/2010	SEVIERVILLE	0	0	$0	$0
12/12/2010	COUNTYWIDE	0	0	$0	$0
12/12/2010	SEVIERVILLE	0	0	$0	$0
12/25/2010	SEVIERVILLE	0	0	$0	$0
12/26/2010	COUNTYWIDE	0	0	$0	$0
12/26/2010	GATLINBURG	0	0	$0	$0
12/26/2010	SEVIERVILLE	0	0	$0	$0
10/28/2012	SEVIERVILLE	0	0	$0	$0
10/28/2012	KODAK	0	0	$0	$0
10/28/2012	SEYMOUR	0	0	$0	$0
10/28/2012	SEVIERVILLE	0	0	$0	$0
1/17/2013	SEVIERVILLE	0	0	$0	$0
3/5/2013	PITTMAN CENTER	0	0	$0	$0
3/25/2013	GATLINBURG	0	0	$0	$0
11/26/2013	GATLINBURG	0	0	$0	$0
2/12/2014	KODAK	0	0	$0	$0
2/13/2014	COUNTYWIDE	0	0	$0	$0

Date	Location	Injuries	Fatalities	Property Damage	Crop Damage
3/29/2014	GATLINBURG	0	0	$0	$0
11/1/2014	COUNTYWIDE	0	0	$0	$0
2/17/2015	WALDEN CREEK	0	0	$1,000	$0
2/25/2015	KODAK	0	0	$0	$0
2/26/2015	CATLETTSBURG	0	0	$0	$0
1/20/2016	PITTMAN CENTER	0	0	$0	$0
1/22/2016	SEVIERVILLE	0	0	$0	$0
2/8/2016	SEVIERVILLE	0	0	$0	$0
1/6/2017	PIGEON FORGE	0	0	$0	$0
12/8/2017	GATLINBURG	0	0	$0	$0
1/29/2018	SEVIERVILLE	0	0	$0	$0
12/9/2018	BOYDS CREEK	0	0	$0	$0
12/21/2018	CATLETTSBURG	0	0	$0	$0

Since the last plan update, there have been 23 winter storm events which have occurred within the unincorporated areas of Sevier County and its jurisdictions.

Incidents/Probability

The NCEI Storm Events Database reports 102 winter storm events within the boundaries of Sevier County between the years 1996 and 2018. With a total of 102 events, the annual return rate (frequency) for winter storm events in the unincorporated area of Sevier County and its jurisdictions is eight to nine events every year. This equates to an annual probability of approximately 100%.

5.1.14 Dam Failure

Location & Extent

Dams have been an important part of Sevier County's water infrastructure. In addition to the historic economic benefits provided by dams, they are used for flood control, water supply, power generation, recreation, and for mitigating the impact of increased runoff typically caused by land use changes associated with property development. The United Sates Army Corps of Engineers maintains a national inventory of dams in Sevier County.

In addition to proximity, the level of failure and meteorological conditions during a dam failure will greatly contribute to the extent of an incident. A minor failure will have lesser impacts than a total dam failure. Weather conditions also impact extent, as a dam failure without rainy conditions will have lesser extent, but the population will likely receive less warning. Conversely, rainy conditions exacerbate impacts, but allow for more warning due to expected failure.

According to the Federal Guidelines for Dam Safety, two (2) factors influence the severity of a dam failure: the amount of water impounded and the density, type, and value of development and infrastructure located downstream. Most dam failures are described by their potential point of inundation; the hazard potential levels of low, significant and high are further defined in the table below, while the figure on the following page provides a map of the locations of significant- and high-hazard dams. The magnitude and

severity of dam failures may also be assessed in terms of damage, including loss of life and injury, damage to infrastructure, loss of services or utilities, debris, and economic damage. The following figure shows dams in Sevier County and their hazard level.

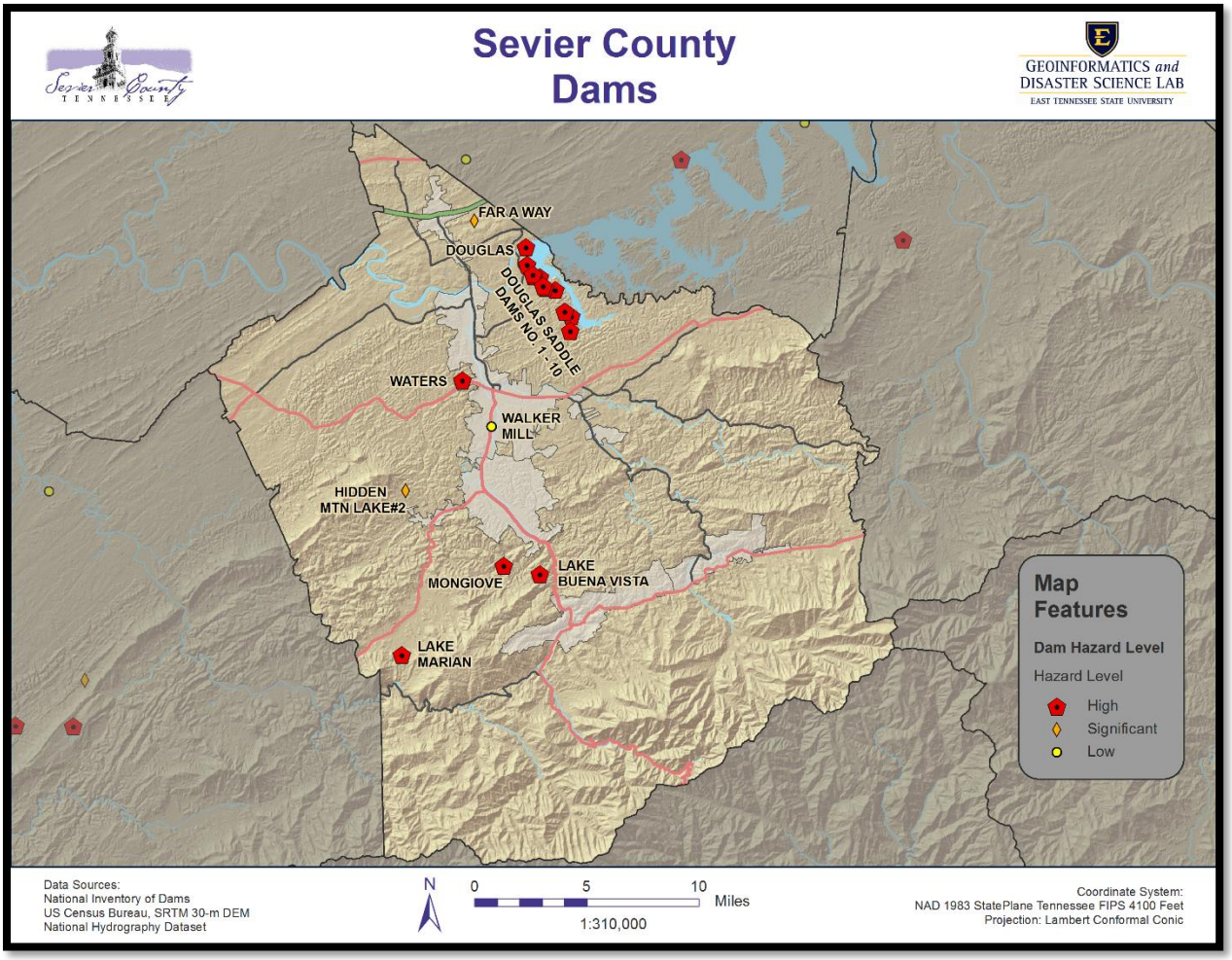

Figure 5-20: Dam Locations with Hazard Level in Sevier County.

Previous Occurrences

Sevier County and its jurisdictions have experienced no dam failures from 1989 to 2018 nor since the last update of the county hazard mitigation plan.

Incidents/Probability

Based on historical records, the annual chance of occurrence for a dam failure is calculated at less than 1%.

5.1.15 Infrastructure Failure

Location & Extent

Critical infrastructure is located throughout the county. Predicting the precise location of the next infrastructure failure is often difficult and generally dependent on the quality, upkeep, and maintenance

of each piece of infrastructure as well as any protective actions that can mitigate or prevent sources of failure.

The failure of these structures could have potentially devastating impacts, including significant disruption to essential facilities, economic and financial impacts, and physical damage to infrastructure. The reliance of virtually all industries on transportation networks is of key importance. A significant event could have cascading effects on other infrastructure.

Previous Occurrences

Oftentimes, smaller scale infrastructure failures occur as a secondary impact from a natural disaster, such as a temporary closure of a road due to a mass wasting event. Sevier County and its jurisdictions experience these disruptions occasionally and manages them through coordination across agencies. When infrastructure does fail, the county responds quickly to repair the infrastructure.

Incidents/Probability

In general, the county has not experienced any direct, prolonged catastrophic infrastructure failures. However, a significant failure of infrastructure could result in severe disruptions to public life and overall response efforts. Overall, Sevier County and its jurisdictions are vulnerable to infrastructure failure; however, the probability of occurrence is calculated at less than 1% based on previous occurrences.

5.1.16 Civil Disobedience/Terrorism

Location & Extent

Because of their often-spontaneous nature, it is difficult to pinpoint a location for the occurrence of a civil disturbance or terrorism event. However, monitoring social trends and social media can often inform responders about where potential demonstrations or acts of violence may take place. In addition, information gathered in advance may warn officials and provide locations of sites of potential future disturbances or acts of terrorism. Oftentimes, demonstrations and large, crowded gatherings begin peacefully and escalate to instances of sometimes-violent civil disturbance.

Instances of civil disobedience may originate from a number of different public gatherings, including political rallies, sporting events, and peaceful protests. Civil disturbance and acts of terrorism are typically seen in larger urban areas rather than rural unincorporated areas.

The severity of a civil disturbance incident depends on the nature of the disturbance. Significant disturbances can result in mass arrests, civilian curfews, intensive response efforts, property damage, injuries, and deaths. In general, civil disturbance impacts can range from low to high depending on the severity of the incident.

Police dispatched to control traffic corridors or intrusion on private property is considered a low severity civil disturbance. Disruption of businesses and potential property damage are assessed as a moderate civil disturbance. In these cases, police intervention would be required to restore order without employing chemical agents or physical force. A severe civil disturbance incident would involve rioting, arson, looting, assault, and death, where aggressive police action (tear gas, curfews, and mass arrests) may be required.

Civil disturbances may take on different characteristics depending on the severity of an incident. Each level of severity—low, medium, or high—poses risk to property. A low severity rating may be given to a

localized event that results in minimal to no property damage, minimal police action, and no physical harm to the participants, bystanders, or police. While low severity disturbances may simply disrupt usual business activity due to large crowds and inability to access businesses and possibly residences, they have the potential to become incidents of medium or even high severity due to the amount of people involved and the sometimes emotionally-charged atmosphere that can result. A localized event that results in damage to property, police action, and physical harm to people involved, such as police or protestors, may be considered moderately severe. A moderately severe event may cause some damage to businesses and residences but overall the damage is limited.

Civil disturbances involving emotionally-charged and highly contentious business, police, or political action, or unrest based on the outrage of a segment of the population, could be considered high severity. The results and extent of severe civil disturbances are expected to range from financially burdensome on businesses facing considerable damage and possibly looting to potential destruction of public and private property as well as fire and subsequent smoke damage.

Previous Occurrences

Sevier County and its jurisdictions recently experienced what could be considered an act of terrorism – the only such event of note from 1996 to 2019, and since the last plan update

Tanger Outlet Shooting

A gunman opened fire at the Tanger Outlet Mall in Sevierville on April 16, 2019, killing one person and wounded another before killing himself. The shooting appeared to be random, confirming that such events could happen anywhere and anytime, but most often in event areas or high population areas.

Incidents/Probability

Civil disturbances and acts of terrorism have a low probability of occurring in the unincorporated areas of Sevier County. Based on previous occurrences and location, there is less than a 5% annual chance of occurrence for civil disturbances and acts of terrorism in the unincorporated areas of Sevier County and its jurisdictions.

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5.2 Vulnerability Assessment

5.2.1 Communicable Diseases Vulnerability

Estimated Impact and Potential Loss

Communicable disease does not have the potential to impact property and crops; however, livestock operations throughout Sevier County and its jurisdictions are subject to disease outbreaks.

Vulnerable Population

Many communicable diseases are transmitted by vectors, such as mosquitoes, ticks, and fleas. Vectors can transmit an array of pathogens, such as viruses, bacteria, and protozoa, which can cause illness in humans (or humans and animals). While everyone in Sevier County and its jurisdictions are susceptible to communicable disease, special attention should be paid to highly vulnerable populations such as those who are socioeconomically disadvantaged, young children, and the elderly.

Vulnerability Score

Table 5-11: Communicable Disease Vulnerability Score.

	Communicable Diseases Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	4	2	3	4	2	1.7	**2.6**

5.2.2 Drought Vulnerability

Estimated Impact and Potential Loss

According to the NCEI database, there has been one drought event that has caused some level of crop damage. The total agricultural damage from this event was $2,000. When annualizing the total cost over the 23-year record, total annual losses based on drought is estimated to be $83. The following table presents an analysis of agricultural exposure that is susceptible to drought by major crop type for Sevier County.

Table 5-12: Agricultural Exposure by Crop Type for Drought in Sevier County.
(Source: United States Department of Agriculture 2017 Census)

Agricultural Exposure by Crop Type for Drought				
Nursery Plants	Hay	Corn	Dry Peas	Soybeans
$428,000	$1,384,000	$98,000	$135,000	$31,000

Vulnerable Population

Drought typically has a larger impact on the agricultural community, and does not directly affect human life or health. However, drought can exacerbate other hazardous conditions, especially wildfires. There have been no reported injuries or loss of life due to drought in Sevier County and its jurisdictions.

Vulnerability Score

Table 5-13: Drought Vulnerability Score.

	Drought Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	3	2	4	1	4	2	**2.6**

5.2.3 Earthquake Vulnerability

Estimated Impact and Potential Loss

Sevier County and its jurisdictions are vulnerable to earthquake hazards; however, the impact is largely unknown since there has yet to be an earthquake that has caused any property or crop damage. The USGS database shows that there is a 6.34% chance of a major earthquake (5.0 or greater) within 50 miles of Sevier County and its jurisdictions within the next 50 years.

Vulnerable Population

There has been no recorded earthquake event that has caused loss of life or injuries in the state of Tennessee per the Tennessee Hazard Mitigation Plan, so the impact on population is largely unknown in Sevier County and its jurisdictions.

Vulnerability Score

Table 5-14: Earthquake Vulnerability Score.

	Earthquake Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	1	1	4	4	1	1.3	**1.8**

5.2.4 Extreme Temperature Vulnerability

Estimated Impact and Potential Loss

All of Sevier County is vulnerable to extreme temperature occurrences. Extreme heat occurrences often transpire in conjunction with drought occurrences, which leaves soil susceptible to desiccation. Extreme cold occurrences impact all utilities in the area such as exposed pipes that can freeze and burst. Based on historical data, there has been no property damage as a result of extreme temperatures; however, an extreme temperature incident has the potential to cause thousands of dollars in property damage.

Vulnerable Population

Residents of Sevier County and its jurisdictions who are elderly or in poor health are at acute risk along with residents who work outside in the extreme conditions.

Vulnerability Score

Table 5-15: Extreme Temperatures Vulnerability Score.

	Extreme Temperatures Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	4	3	4	1	3	2	**3.0**

5.2.5 Flood Including Extreme Precipitation Vulnerability

Estimated Impact and Potential Loss

Using the Hazus 4.2 Flood Model, along with Sevier County and its jurisdiction's Digital Flood Insurance Rate Maps, the 100-year flood scenario was analyzed to determine losses for the scenario. The following table displays the total economic losses that would result from a 100-year flood scenario.

Table 5-16: Estimated Losses for 100-Year Flood Scenario in Sevier County and its Jurisdictions.

Jurisdiction	Estimated Total Losses
Sevier County (Unincorporated)	$634,000
Gatlinburg	$784,000
Pigeon Forge	$880,000
Pittman Center	$51,000
Sevierville	$960,000
Total	**$3,309,000**

The Hazus 4.2 Flood Model also provided a breakdown by jurisdiction for seven primary sectors throughout Sevier County. The losses for Sevier County (Unincorporated) are listed in the following table.

Table 5-17: Estimated Losses for 100-Year Flood Scenario in Sevier County by Sector.

Sevier County (Unincorporated)	Estimated Total Losses
Agricultural	$44,000
Commercial	$176,000
Government	$1,000
Industrial	$99,000
Religious/Non-Profit	$5,000
Residential	$301,000
Education	$8,000
Total	**$634,000**

Vulnerable Population

The total population within the county that is susceptible to a flood hazard is shown in the table below:

Table 5-18: Vulnerable Populations Susceptible to a 100-Year Flood Event for Sevier County and its Jurisdictions.

Number of People Exposed to Flood Hazards			
Jurisdiction	**# in Community**	**# in Hazard Area**	**% in Hazard Area**
Sevier County (Unincorporated)	64,761	6,848	10.6%
Gatlinburg	3,944	977	24.8%
Pigeon Forge	5,875	1,433	24.4%
Pittman Center	502	74	14.7%
Sevierville	14,807	3,144	21.2%
Total	**89,889**	**12,476**	**13.9%**

The Hazus 4.2 Flood Model was also extrapolated to provide an overview of vulnerable populations throughout Sevier County and its jurisdictions. The following table identifies the vulnerable population to floods in unincorporated Sevier County.

Table 5-19: Vulnerable Populates Susceptible to a 100-Year Flood Event in Unincorporated Sevier County.

Sevier County (Unincorporated Area)		
Category	**Total Numbers**	**% of People in Hazard Area**
Number in Hazard Area	6,848	10.6%
Persons Under 5 Years	401	5.9%
Persons Under 18 Years	1,515	22.1%
Persons 65 Year and Over	1,060	15.5%
Caucasian	6,416	93.7%
Minority	432	6.3%

Vulnerability Score

Table 5-20: Flooding including Extreme Precipitation Vulnerability Score.

	Flooding including Extreme Precipitation Vulnerability Score						
	Probability	**Impact**	**Spatial Extent**	**Warning Time**	**Duration**	**Vulnerability**	**Risk Factor**
Risk Level	3	2	3	3	2	3	**2.7**

5.2.6 Mass Wasting

Estimated Impact and Potential Loss

The entire planning area within Sevier County is susceptible to the effects of mass wasting events. Mass wasting events can cause serious damage to highways, buildings, homes, and other structures that support a wide range of economies and activities. Mass wasting events commonly coincide with other natural disasters such as extreme precipitation events. Expansion of urban development contributes to greater risk of damage by mass wasting.

The USGS recognizes six major impacts caused by mass wasting events:

1. Causes damage in all 50 states, Puerto Rico, and the U.S. Virgin Islands
2. Costs $3.5 billion per year in damage repair
3. Causes between 25 and 50 deaths in the United States annually
4. Reduces real estate values and tourist revenue
5. Leads to lost human, industrial, agricultural, and forest productivity
6. Causes damage to the natural environment

Vulnerable Population

Mass wasting events typically impact motorists and those living in the vicinity of a vulnerable area. This is demonstrated in a mass wasting event which occurred on August 1, 2019 in Gatlinburg when a tree fell from a slope and fatally injured a 73-year old man. The lack of a detailed mass wasting inventory makes research on the vulnerability of people to mass wasting events highly limited.

Vulnerability Score

Table 5-21: Mass Wasting Vulnerability Score.

	Mass Wasting Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	3	2	2	4	4	2.3	**2.6**

5.2.7 Severe Wind Vulnerability

Estimated Impact and Potential Loss

Since 1996, there have been two reported severe wind events that have occurred within the boundaries of Sevier County and its jurisdictions. The total property damages associated with these events have totaled $22,000. To estimate the potential losses of a severe wind event on an annual basis, the total damage recorded for severe wind events was divided by the total number of years of available severe wind data (1996 - 2018). This provides an annual estimated potential loss of $957. To assess potential losses to the participating jurisdictions, the 2010 Census population was used to assign the estimated potential losses proportionally across the jurisdictions. The following table provides an estimate of potential property losses for Sevier County and its jurisdictions based on the 2010 Census data:

Table 5-22: Estimated Annual Losses for Severe Wind Events in Sevier County and its Jurisdictions.

Unincorporated Sevier County (72.0% of Population)	Gatlinburg (4.4 % of Population)	Pigeon Forge (6.5% of Population)	Pittman Center (0.6% of Population)	Sevierville (16.5% of Population)
$689	$42	$63	$5	$158

Vulnerable Population

There have been no recorded severe wind event that has caused loss of life or injuries in Sevier County and its jurisdictions; however, these events have the potential to significantly impact the aviation community in these areas.

Vulnerability Score

Table 5-23: Severe Wind Vulnerability Score.

	Severe Wind Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	2	2	2	4	1	2	**2.1**

5.2.8 Sinkhole Vulnerability

Estimated Impact and Potential Loss

The entire Sevier County planning area is susceptible to subsidence and sinkholes based on the karst topography of the region. While sinkholes have a higher risk of forming in the northern portions of the county, the southern portion is also susceptible to sinkholes.

Vulnerable Population

There are no reported fatalities or injuries associated with sinkhole events.

Vulnerability Score

Table 5-24: Sinkhole Vulnerability Score.

	Sinkhole Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	4	2	1	4	1	1.15	**2.1**

5.2.9 Thunderstorm Vulnerability

Hail

Estimated Impact and Potential Loss

Since 1996, there have been 25 reported hail events that have occurred within the boundaries of Sevier County and its jurisdictions. The total property damages associated with these events have totaled $13,700. To estimate the potential losses of a hail event on an annual basis, the total damage recorded for hail events was divided by the total number of years of available hail data (1996 - 2018). This provides an annual estimated potential loss of $596. To assess potential losses to the participating jurisdictions, the 2010 Census population was used to assign the estimated potential losses proportionally across the jurisdictions. The following table provides an estimate of potential property losses for Sevier County and its jurisdictions based on the 2010 Census data:

Table 5-25: Estimated Annual Losses for Hail Events in Sevier County and its Jurisdictions.

Unincorporated Sevier County (72.0% of Population)	Gatlinburg (4.4 % of Population)	Pigeon Forge (6.5% of Population)	Pittman Center (0.6% of Population)	Sevierville (16.5% of Population)
$429	$26	$39	$3	$98

Vulnerable Population

There have been no reported injuries or fatalities associated with hail events in Sevier County and its jurisdictions.

Hail Vulnerability Score

Table 5-26: Hail Vulnerability Score.

	Hail Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	4	2	4	3	1	2	**2.7**

Lightning

Estimated Impact and Potential Loss

Since 1996, there have been two reported lightning events that have occurred within the boundaries of Sevier County and its jurisdictions. There has been no reported property or crop damage associated with lightning within the boundaries of Sevier County.

Vulnerable Population

There has been one reported fatality from lightning that has occurred within the boundaries of Sevier County and its jurisdictions. On July 10, 2004, a man was struck by lightning while he was fishing on Douglas Lake. The boat was several hundred yards from Douglas Dam when the incident occurred. He was rendered unconscious and fell into the water.

Lightning Vulnerability Score

Table 5-27: Lightning Vulnerability Score.

	Lightning Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	2	1	2	3	1	2	**1.8**

Wind

Estimated Impact and Potential Loss

Since 1996, there have been 189 reported thunderstorm wind events that have occurred within the boundaries of Sevier County and its jurisdictions. The total property damages associated with these events have totaled $3,089,000. To estimate the potential losses of a thunderstorm wind event on an annual basis, the total damage recorded for thunderstorm wind events was divided by the total number of years of available thunderstorm wind data (1996 - 2018). This provides an annual estimated potential loss of $134,304. To assess potential losses to the participating jurisdictions, the 2010 Census population was used to assign the estimated potential losses proportionally across the jurisdictions. The following table provides an estimate of potential property losses for Sevier County and its jurisdictions based on the 2010 Census data:

Table 5-28: Estimated Annual Losses for Thunderstorm Wind Events in Sevier County and its Jurisdictions.

Unincorporated Sevier County (72.0% of Population)	Gatlinburg (4.4 % of Population)	Pigeon Forge (6.5% of Population)	Pittman Center (0.6% of Population)	Sevierville (16.5% of Population)
$96,760	$5,893	$8,778	$750	$22,123

Vulnerable Population

There have been no reported injuries or fatalities associated with thunderstorm wind events in Sevier County and its jurisdictions.

Wind Vulnerability Score

Table 5-29: Wind Vulnerability Score.

	Wind Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	4	2	4	3	1	2	**2.7**

5.2.10 Tornado Vulnerability

Estimated Impact and Potential Loss

Since 1996, there have been three reported tornadoes that have occurred within the boundaries of Sevier County and its jurisdictions. The total property damages associated with these tornadoes have totaled $58,000. To estimate the potential losses of a tornado on an annual basis, the total damage recorded for thunderstorm wind events was divided by the total number of years of available thunderstorm wind data (1996 - 2018). This provides an annual estimated potential loss of $2,522. To assess potential losses to the participating jurisdictions, the 2010 Census population was used to assign the estimated potential losses proportionally across the jurisdictions. The following table provides an estimate of potential property losses for Sevier County and its jurisdictions based on the 2010 Census data:

Table 5-30: Estimated Annual Losses for Tornado Events in Sevier County and its Jurisdictions.

Unincorporated Sevier County (72.0% of Population)	Gatlinburg (4.4 % of Population)	Pigeon Forge (6.5% of Population)	Pittman Center (0.6% of Population)	Sevierville (16.5% of Population)
$1,817	$111	$165	$14	$415

Vulnerable Population

There have been no reported injuries or fatalities associated with tornadoes; however, residents living in manufactured housing are more vulnerable to tornadoes and are more likely to sustain higher damage totals due to the construction materials. Approximately 22% of all buildings in Sevier County and its jurisdictions are manufactured housing. The following table presents an analysis of building exposure that is susceptible to tornadoes by general occupancy type for Sevier County, along with the percentage of building stock that are manufactured homes.

Table 5-31: Building Exposure by General Occupancy Type for Tornadoes in Sevier County ($1,000).

Residential	Commercial	Industrial	Agricultural	Religion	Government	Education	Manufactured Homes
9,332,162	1,574,531	333,255	31,641	201,848	47,906	95,279	22%

Vulnerability Score

Table 5-32: Tornado Vulnerability Score.

	Tornado Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	3	2	2	4	3	1.15	**2.2**

5.2.11 Tropical Cyclone (Hurricane) Vulnerability

Estimated Impact and Potential Loss

There has been no reported property or crop damage associated with tropical cyclones within the boundaries of Sevier County and its jurisdictions.

Vulnerable Population

There have been no reported injuries or deaths associated with tropical cyclone within the boundaries of Sevier County and its jurisdictions.

Vulnerability Score

Table 5-33: Tropical Cyclone Vulnerability Score.

	Tropical Cyclone Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	1	1	4	1	2	1	**1.5**

5.2.12 Wildfires/Conflagration Vulnerability

Estimated Impact and Potential Loss

The entire Sevier County planning area is located near areas of wildland-urban interface and intermix or other susceptible land use/land cover types, which makes them vulnerable to wildfires. Southern areas of Sevier County are particularly vulnerable since they are located within the Great Smoky Mountain National Park. In November of 2016, a wildfire in Sevier County turned into the largest interface fire to impact the state of Tennessee in 100 years, resulting in $911 million in property and content loss.

Vulnerable Population

Sevier County and its jurisdiction residents near areas of wildland-urban interface and intermix and other wooded land cover types are vulnerable to the effects of wildfire. Fourteen fatalities and 221 people were treated for fire-related injuries in November 2016 when the largest interface fire to impact the state of Tennessee in 100 years occurred in Sevier County.

Vulnerability Score

Table 5-34: Wildfires/Conflagration Vulnerability Score.

	Wildfires/Conflagration Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	4	4	4	2	4	3	**3.6**

5.2.13 Winter Storm Vulnerability

Estimated Impact and Potential Loss

Since 1996, there have been 102 reported winter storm events that have occurred within the boundaries of Sevier County and its jurisdictions. The total property damages associated with these storms have totaled $13,000. To estimate the potential losses of a winter weather event on an annual basis, the total damage recorded for winter storm events was divided by the total number of years of available winter storm data (1996 - 2018). This provides an annual estimated potential loss of $565. To assess potential losses to the participating jurisdictions, the 2010 Census population was used to assign the estimated potential losses proportionally across the jurisdictions. The following table provides an estimate of potential property losses for Sevier County and its jurisdictions based on the 2010 Census data:

Table 5-35: Estimated Annual Losses for Winter Storm Events in Sevier County and its Jurisdictions.

Unincorporated Sevier County (72.0% of Population)	Gatlinburg (4.4 % of Population)	Pigeon Forge (6.5% of Population)	Pittman Center (0.6% of Population)	Sevierville (16.5% of Population)
$407	$25	$37	$3	$93

There have been no injuries or fatalities due to winter storm events in the Sevier County planning area.

Vulnerable Population

All of Sevier County and its jurisdiction residents are vulnerable to the effects of winter weather.

Vulnerability Score

Table 5-36: Winter Storm Vulnerability Score.

	Winter Storm Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	4	3	4	2	4	2	**3.1**

5.2.14 Dam Failure Vulnerability

Estimated Impact and Potential Loss

Sevier County and its jurisdictions are vulnerable to dam failures; however, the impact is largely unknown since there has yet to be a dam failure in the planning area.

Vulnerable Population

There have been no fatalities or injuries associated with dam failure in Sevier County and its jurisdictions; however, homes and businesses in immediate vicinity downstream of a dam location are vulnerable to the impacts of a dam failure.

Vulnerability Score

Table 5-37: Dam Failure Vulnerability Score.

	Dam Failure Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	1	3	2	4	4	2	**2.4**

5.2.15 Infrastructure Failure Vulnerability

Estimated Impact and Potential Loss

In general, the county has not experienced any direct, prolonged catastrophic infrastructure failures. However, a significant failure of infrastructure could result in severe disruptions to public life and overall response efforts.

Vulnerable Population

There are no recorded fatalities or injuries associated with infrastructure failure in Sevier County and its surrounding areas.

Vulnerability Score

Table 5-38: Infrastructure Failure Vulnerability Score.

	Infrastructure Failure Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	1	3	2	4	3	2	**2.3**

5.2.16 Civil Disobedience/Terrorism Vulnerability

Estimated Impact and Potential Loss

The Sevier County planning area experienced one civil disobedience/terrorism event since 1996 (Tanger Outlet Shooting in April 2019).

Vulnerable Population

There were two fatalities and one injury associated with civil disobedience/terrorism events.

Vulnerability Score

Table 5-39: Civil Disobedience/Terrorism Vulnerability Score.

	Civil Disobedience Terrorism Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	1	4	4	4	1	2.7	**2.9**

5.3 Capability Assessment

This section summarizes the results of the Sevier County Hazard Mitigation Planning Committee and other agency efforts to develop policies, programs, and activities that directly or indirectly support hazard mitigation. It also provides information on resources and gaps in the county's infrastructure, as well as relevant changes in its laws since the last Plan Update, in order to suggest a mitigation strategy. Through this assessment, Sevier County is able to identify strengths that could be used to reduce losses and reduce risk throughout the community. It also identifies areas where mitigation actions might be used to supplement current capabilities and create a more resilient community before, during, and after a hazard event.

Policies, Plans, and Programs

Sevier County and its jurisdictions capabilities are unique to the county as a whole, including planning, regulatory, administrative, technical, financial, education, and outreach resources. There are a number of mitigation-specific acts, plans, executive orders, and policies that address specific goals, objectives, and policy statements which already support or could support pre- and post-disaster hazard mitigation. Many of the ongoing plans and policies hold significant promise for hazard mitigation, and take an integrated and strategic look holistically at hazard mitigation in all jurisdictions to continually propose ways to improve it. These tools are valuable instruments in pre- and post-disaster mitigation as they facilitate the implementation of mitigation activities through the current legal and regulatory framework. Some examples of these types of planning and regulatory efforts for Sevier County and each jurisdiction are the following:

- Comprehensive/Master Plan
- Transportation Plan
- Local Emergency Operations Plan
- Community Wildfire Protection Plan
- Building Codes
- Flood Insurance Rate Maps
- Zoning Ordinance

Some programs and policies, such as the ones just described, might use complementary tools to achieve a common end, but fail to coordinate with or support each other. Thus, coordination among local mitigation policies and programs is essential to hazard mitigation.

Administration, Technical, and Financial

As a community, Sevier County and its jurisdictions have administrative and technical capabilities in place that may be utilized in reducing hazard impacts or implementing hazard mitigation activities. Such capabilities include staff, skillset, and tools available in the community that may be accessed to implement mitigation activities and to effectively coordinate resources. The following are resources in place for Sevier County and its incorporated jurisdictions:

- Maintenance programs to reduce risk (tree trimming, clearing drainage systems)
- Mutual Aid Agreements
- Emergency Manager
- Community Planner

- GIS Data
- Warning Systems/Services (Reverse 911, outdoor warning systems)
- Hazard Data & Information

Financial capabilities are the resources that Sevier County and its incorporated jurisdictions have access to or are eligible to use to fund mitigation actions. The following resources are available to fund mitigation actions in Sevier County and its incorporated jurisdictions:

- Capital Improvements Project Funding
- Authority to levy taxes for specific purposes
- Fees for water, sewer, gas, or electric services

Sevier County and its incorporated jurisdictions have existing programs to implement mitigation activities as well as communicate risk. The existing programs are as follows:

- Local citizen groups or non-profits focused on environmental protection, emergency preparedness, access and functional needs populations, etc.
- Ongoing public education or information programs (responsible water use, fire safety, household preparedness, wildfire preparedness)
- Storm Ready certification
- Firewise Communities certification

The following jurisdictions and entities are recognized by Sevier County under the Hazard Mitigation Plan allowing them to apply for available hazard mitigation funding for as long as these jurisdictions notify the county of their intentions and the county concurs:

- City of Gatlinburg
- City of Pigeon Forge
- Town of Pittman Center
- City of Sevierville
- Unincorporated Areas of Sevier County

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5.4 Summary

Table 5-40: Risk Assessment for Unincorporated Sevier County (Unincorporated Area).

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Overall Risk
Wildfires/ Conflagration	4	4	4	2	4	3.0	**3.6**
Winter Storms	4	3	4	2	4	2.0	**3.1**
Extreme Temperatures	4	3	4	1	3	2.0	**3.0**
Civil Disobedience/ Terrorism	1	4	4	4	1	2.7	**2.9**
Thunderstorms (Hail)	4	2	4	3	1	2.0	**2.7**
Thunderstorms (Wind)	4	2	4	3	1	2.0	**2.7**
Floods Including Extreme Precipitation	3	2	3	3	2	3.0	**2.7**
Communicable Disease	4	2	3	4	2	1.7	**2.6**
Drought	3	2	4	1	4	2.0	**2.6**
Mass Wasting	3	2	2	4	4	2.3	**2.6**
Dam Failure	1	3	2	4	4	2.0	**2.4**
Infrastructure	1	3	2	4	3	2.0	**2.3**
Tornadoes	3	2	2	4	3	1.2	**2.2**
Sinkholes	4	2	1	4	1	1.2	**2.1**
Severe Wind	2	2	2	4	1	2.0	**2.1**
Earthquakes	1	1	4	4	1	1.3	**1.8**
Thunderstorms (Lightning)	2	1	2	3	1	2.0	**1.8**
Tropical Cyclones	1	1	4	1	2	1.0	**1.5**

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6. City of Gatlinburg

6.1 Risk Assessment

This section assesses the various hazard risks that city of Gatlinburg faces in order to identify a strategy for mitigation. Having identified the categories of hazards, emergencies, disasters, and catastrophes, this section details the major natural, technological, and human-caused hazards by (1) describing their geographic extent, (2) surveying their previous occurrences, and (3) evaluating their future likelihood of occurrences. To review news stories and other media related to previous occurrences, see Appendix D.

6.1.1 Communicable Diseases

Location & Extent

Tennessee maintains an extensive array of communicable disease personnel both inside and ancillary to the Communicable and Environmental Diseases and Emergency Preparedness (CEDEP) division. Communicable and Environmental Disease and Emergency Preparedness is a program area of the Tennessee Department of Health; it is assigned the responsibility of detecting, preventing, educating, and controlling infectious and environmentally-related illnesses of public health significance. Emergency management personnel are more frequently including pandemic and communicable disease drills in their exercise dockets at locations across the nation. The Centers for Disease Control and Prevention (CDC) has created a pandemic flu toolkit which is aligned with the pandemic phases outlined by the 2013 World Health Organization guidelines.

A biologic or communicable disease threat can occur anywhere, or anytime. Concentrated efforts must be made at surveillance in the following arenas:

Healthcare: Tennessee health care institutions serve as the front lines to communicable disease response and also as potential disease reservoir populations and points of cross contamination. Tennessee maintains excellent hospital and in-patient coverage in all 3 of its primary regions, with Level I trauma facilities. All Tennessee hospitals and healthcare facilities are required to report specific Healthcare Acquired Infections to the NHSN, the National Healthcare Safety Network. The NHSN is a web-based data reporting and submission program, which includes validation routines for many data elements, thus reducing common data entry errors. Hospitals can view, edit, and analyze their data at any time.

Education Facilities and Dormitories: The State of Tennessee mandates a vaccination series for all incoming resident students at educational facilities, consisting of measles, mumps, rubella, meningococcal meningitis, and varicella vaccines. In spite of these vaccine series, dormitory housing at colleges and universities have historically been susceptible to outbreaks of viral meningitis. Vaccination, along with immediate quarantine procedures should be adhered to with particular care in the academic setting where institutional controls are the primary mitigation technique with proven effectiveness

Previous Occurrences

Influenza

In 2012, Tennessee was listed by the CDC as one of the highest influenza burdened states in the nation. On average, 20% of the nation's population will contract the seasonal influenza every year. Tennessee

carries a higher than average mortality and morbidity rate for influenza and associated pneumonia, with 20.9 per 100,000 compared with the national average of 16.2 per 100,000.

HIV/AIDS

The incidence of HIV/AIDS and their associated comorbidities (including tuberculosis) increased in Tennessee from 2006 to 2012 across almost all ages, sexes, and races, with the exception of diagnosed AIDS cases in 2011, which decreased markedly. The 2 are categorized separately by both state and federal agencies due to differing mortalities and comorbidities for each. Currently in Tennessee, 18 community-based organizations are funded to implement a wide-range of science-based HIV prevention programs.

Tertiary Events

Hepatitis C

In 2012, the CDC revised its recommendations to include prophylactic screening for Hepatitis C for anyone born between the years 1945 and 1965. This screening is seen as paramount to reducing potential contamination in the blood supply as Hepatitis C is spread primarily through contaminated needles and drug use. Prior to 1992, blood supply screening techniques were not used resulting in Hep C being transmitted through blood transfusions and organ transplants. The most common mode of transmission for Hep A is person-to-person, resulting from fecal contamination and oral ingestion, and contaminated shellfish. In 1995, a major outbreak of Hepatitis A occurred in Tennessee with Shelby County documenting over 80% of the diagnosed cases. In the fall of 2003, approximately 80 cases were attributed to a Hepatitis A outbreak resulting from ingestion of contaminated green onions at a restaurant in East Tennessee.

Hepatitis B

Hepatitis B is transmitted through blood or body fluids, semen, cervical secretions, and saliva. People with chronic HBV infection are the primary reservoirs for infection. With the exception of the year 2001, from 1995 to 2002, Hepatitis B acute cases steadily decreased. The prevalence of HBV infection among adolescents and adults is 3 to 4 times greater for black individuals than white individuals. Children born to Hepatitis B Surface Antigen positive women are at high risk of becoming chronic carriers of hepatitis B. If these children are administered Hepatitis B Immune Globulin and hepatitis B vaccine at birth, their chances of being protected from the illness are greatly increased. The result is the endorsement of this mitigation procedure by the TDH and the CDC.

Incidents/Probability

The communicable disease events categorized by the CDC and the US Department of Labor as the most likely to adversely affect human performance are any and all strains of influenza. In a typical flu season, between 5% and 20% of the public contract influenza resulting in an average of 36,000 deaths. Pandemic flu viruses may cause illness in 20% to 40% of the population and cause more severe illness and deaths than ordinary seasonal influenza. A pandemic virus vaccine could take 6 to 8 months to produce in conjunction with CDC labs in Atlanta, limiting mitigation success in initial months of an outbreak. Because of this potential, the TDH and CDC consider influenza monitoring and reporting of critical importance.

Based on previous occurrences, there is a 100% annual chance of occurrence for communicable disease occurrence in Gatlinburg.

6.1.2 Drought

Location & Extent

Drought typically impacts a region and not one specific county or jurisdiction. While the entire planning area can experience drought, the major impact of a drought event in Gatlinburg is on the agricultural community. There is no set speed of onset or warning period. A drought may begin in as short of period as a week or it may take months to reach an official declared drought. Additionally, the drought can last for as little as a week to up to the entire season.

While different parts of the county have experienced varying levels of drought severity, the location of drought conditions are more related to Gatlinburg's geographical location and the effects of climate on the region in general. Below is a map of the drought conditions in Gatlinburg in October 2019.

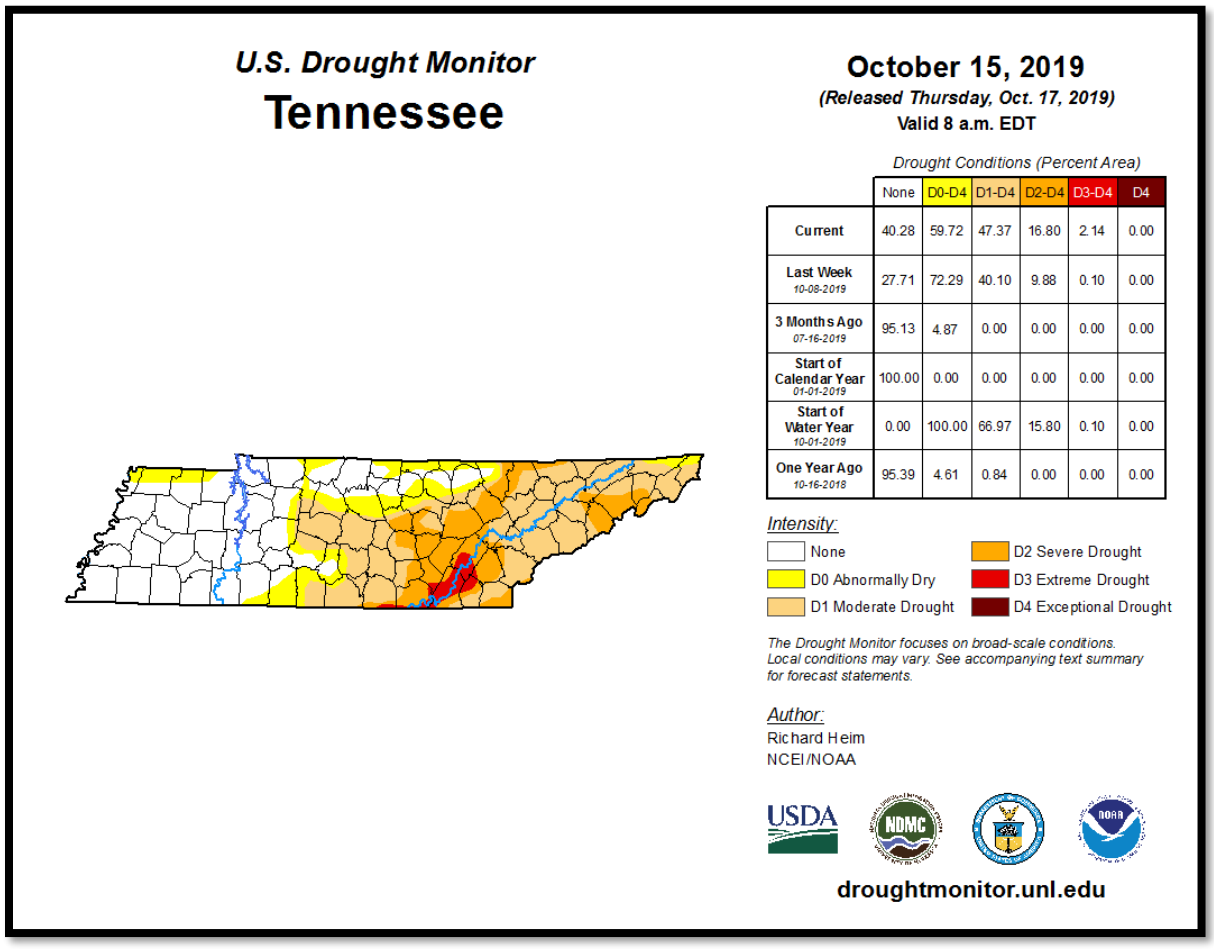

Figure 6-1: Drought Monitor for the State of Tennessee for the Week of October 15, 2019. (Source: U.S. Drought Monitor)

Previous Occurrences

The NCEI database reports a total of one drought event occurring within the boundaries of Gatlinburg between the years 1996 to 2017. The following table identifies the date of occurrence, estimated crop damage, and severity of the events that have occurred in Gatlinburg. Based on previous occurrences, and

in accordance with the Palmer Drought Index and United States Drought Monitor, the worst-case scenario for drought in Gatlinburg would be D4 (Exceptional Drought).

Table 6-1: Previous Occurrences of Drought Events in Gatlinburg.

Date	Details	Crop Damage	Property Damage	Severity
September 1998	An extremely dry month throughout all of East Tennessee caused drought conditions in the county. Rainfall was approximately 2" inches below normal for the area.	$2,000	$0	D3

Since the last plan update, there have been no new drought events which have caused damage to property or crops. However, drought events have occurred periodically during the period of record (January 1, 2000 to January 1, 2019).

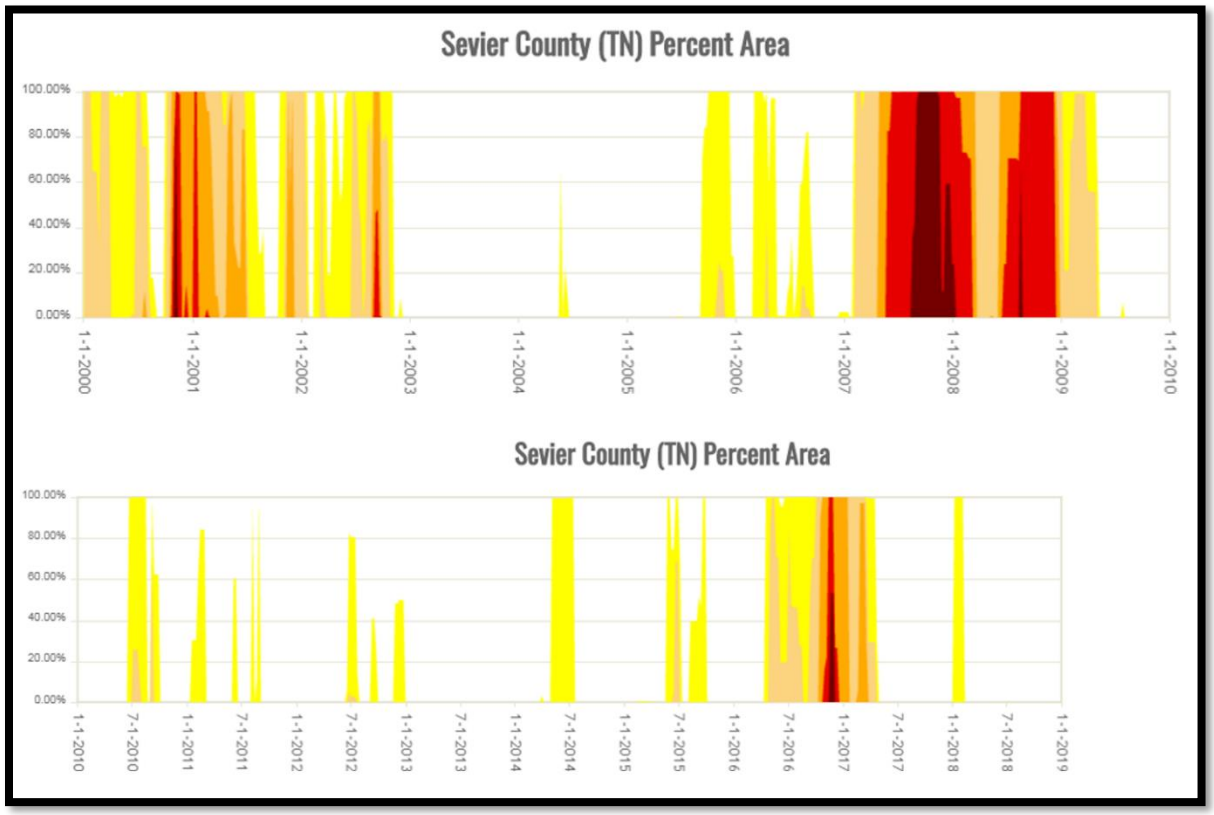

Figure 6-2: Timeline of drought conditions in Sevier County from January 1, 2000 to January 1, 2019. (Source: U.S. Drought Monitor)

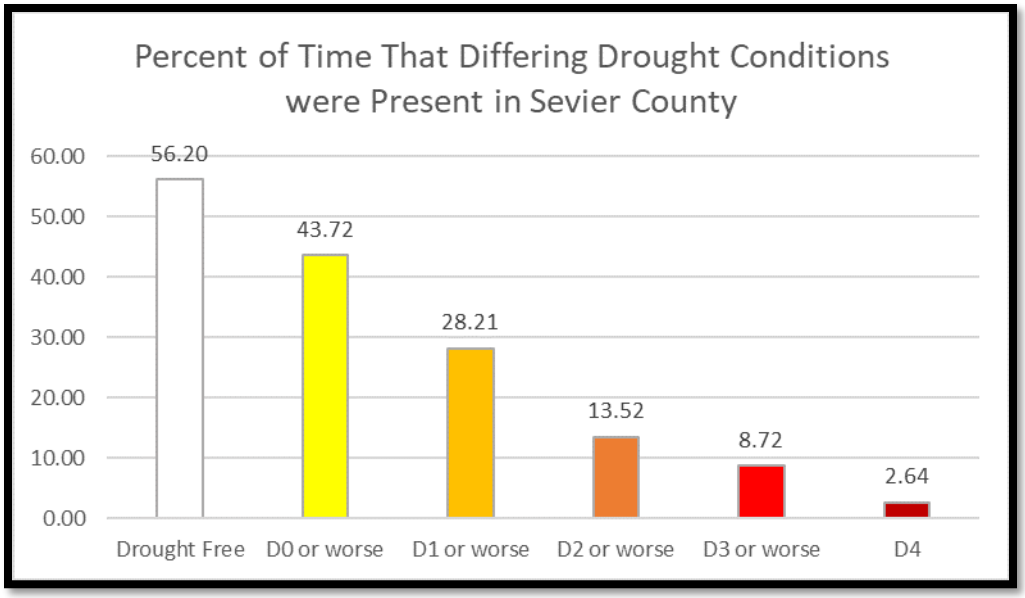

Figure 6-3: Sevier County experienced drought conditions (D0 or worse) during ~43% of the weeks between January 1, 2000 and January 1, 2019. (Source: U.S. Drought Monitor)

Incidents/Probability

Drought conditions can exist which are not recorded in the NCEI database if the event does not cause any direct damage to property or crops and injuries or loss of life. Based on previous occurrences, there is a 4.3% annual chance of occurrence for direct-impact drought events in Gatlinburg. While the chance of a drought that causes damage is approximately 4% annually, Gatlinburg experienced D2 or worse drought conditions approximately 35% over the past 20-years.

6.1.3 Earthquakes

Location & Extent

Earthquakes strike suddenly and without warning, occur at any time of the year, and at any time of the day. A damaging earthquake occurs without definitive signals and massive earthquakes are accompanied by aftershocks. The duration of shaking can last anywhere from a second to a period of minutes. There are numerous characteristics measured when observing earthquake activity; however, its force, depth, peak ground acceleration, and the distance to the epicenter are the most influential in determining damage.

Earthquakes of magnitude 5.5 or greater are considered potentially threatening to Gatlinburg, as this is the point at which structures can become damaged. Any earthquake felt at this magnitude or greater would result in cessation of operations until sight inspections can take place.

The Southern Appalachian Seismic Zone (East Tennessee Seismic Zone) is a geographic band stretching from northeastern Alabama through eastern Tennessee into southwestern Virginia, which is subject to frequent small earthquakes. This seismic zone is one of the most active earthquake zones in the eastern United States. Most earthquakes in the Southern Appalachian Zone are small and are detected only with instruments. A few damaging earthquakes have occurred with the largest historic earthquakes measuring 4.6 magnitude on the Richter Scale, occurring in 1973 near Knoxville and April 29, 2003 near Fort Payne,

Alabama. Earthquakes large enough to be felt occur approximately once a year in this zone. The USGS estimates that earthquakes as large as magnitude 7.5 are possible in the Southern Appalachian Zone, which would be as devastating to the region as a major quake along the New Madrid fault. The worst-case scenario for an earthquake in Gatlinburg would be an MMI of IV, which would be quite noticeable by persons indoors, especially during the daytime.

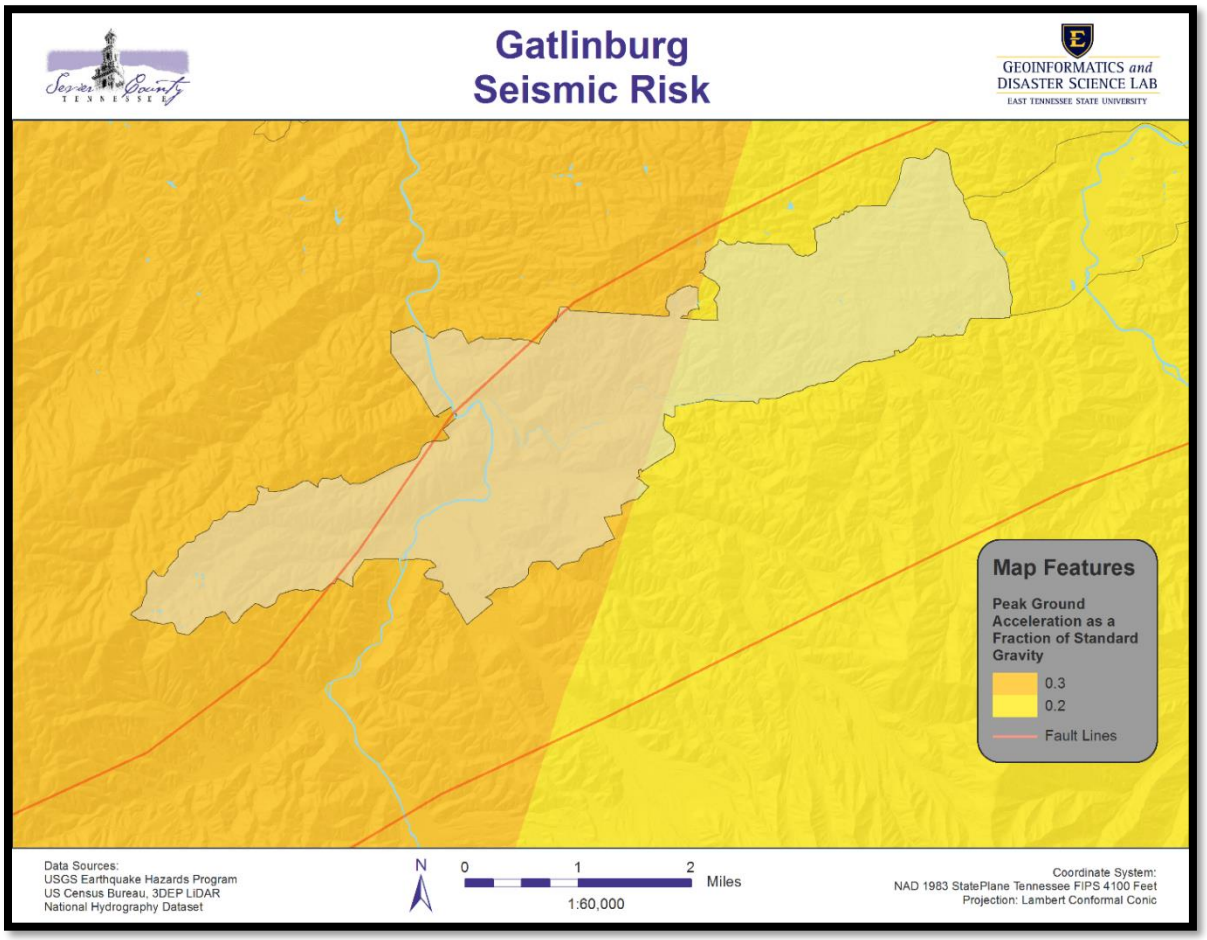

Figure 6-4: Earthquake Epicenters and Fault Lines in Gatlinburg.

Previous Occurrences

NOAA reports a total of four earthquake events over a magnitude of 2.0 occurring within the boundaries of Sevier County between the years 1996 to 2017. The following table identifies the date of occurrence, magnitude, and focal depth.

Table 6-2: Previous Occurrences of Earthquake Events in Sevier County.

Date	Magnitude	Focal Depth
7/26/2001	3.2	5 kilometers
11/24/2012	3.0	7.1 kilometers
11/24/2012	2.5	8.9 Kilometers
8/3/2017	2.7	7.4 kilometers

Since the last plan update, three earthquake events occurred within the boundaries of Sevier County, although none have occurred in Gatlinburg. Below is a brief synopsis of the Sevier County events.

November 24, 2012
An earthquake of magnitude 3.0 and depth of 7.1 kilometers occurred approximately five miles northeast of Sevierville at 11:03 AM. No damages, injuries, or fatalities were associated with the event.

November 24, 2012
An earthquake of magnitude 2.5 and depth of 8.9 kilometers occurred approximately five miles northeast of Sevierville at 2:56 PM. No damages, injuries, or fatalities were associated with the event.

August 3, 2017
An earthquake of magnitude 2.7 and depth of 7.4 kilometers occurred approximately four miles north of Sevierville at 5:40 PM. No damages, injuries, or fatalities were associated with the event.

Incidents/Probability
Historically, there have been four earthquake events in Sevier County and its jurisdictions from 1996 to 2018. With a total of four earthquake events, the annual return rate (frequency) for Sevier County and its jurisdictions is one event every five to six years. This equates to an annual probability of approximately 16%.

6.1.4 Extreme Temperatures

Location & Extent
Extreme heat and cold can occur in all of Sevier County. Extreme heat is not a hazard that responds to the traditional mitigation measures of building codes or land use restrictions. Heat is the number one weather related killer in the United States, resulting in roughly 175 fatalities each year. In fact, on average, excessive heat claims more lives each year than floods, lightning, tornadoes, and hurricanes combined.

What constitutes extreme cold varies in different parts of the country. In the southern United States, near freezing temperatures are considered extreme cold. Freezing temperatures can cause severe damage to citrus fruit crops and other vegetation. Pipes may freeze and burst in homes that are poorly insulated or without heat. Most people judge extreme cold by the problems it causes rather than just by a temperature or a wind chill factor. In the northern areas of the country, extreme cold means temperatures well below zero.

The speed of onset of extreme temperatures, both hot and cold, is fairly slow and predictable from short and long-term weather forecasts. The scale of measurement for this hazard is temperature and departure from normal temperature.

Previous Occurrences
In winter, the average temperature in Gatlinburg is approximately 38^{O}F with an average daily minimum temperature of approximately 26^{O}F. The lowest temperature recorded in Gatlinburg was -18^{O}F, occurring on January 21, 1985.

In summer, the average temperature in Gatlinburg is approximately 71°F with an average daily maximum temperature of approximately 83°F. The highest temperatures ever recorded in Gatlinburg was 106°F on June 30, 1936.

Incidents/Probability

The NCEI Storm Events Database reports no extreme temperature (extreme heat or extreme cold) occurrences within the boundaries of Sevier County between the years 1996 and 2018. However, based on the State of Tennessee Hazard Mitigation Plan, Sevier County and its jurisdictions have an annual probability of 64% for extreme cold events and 100% for extreme heat events.

6.1.5 Floods Including Extreme Precipitation

Location & Extent

A variety of factors affects the type and severity of flooding in Gatlinburg including topography, urban development and infrastructure, and geology. Serious flooding in the mountainous or elevated areas is unusual because streams tend to be faster flowing and flood waters drain quickly.

Intense flooding will cause havoc on the jurisdictions affected. Floods can cause minimal damage in the form of just inches of water to complete submersion of houses and critical facilities. Any amount of damage can render a structure unusable for as long as recovery operations would take depending on the level of damage. Intense and widespread flooding can trap people and entire communities without basic goods or services.

Specifically, depths from previous flood events have commonly ranged from 10-11'+ when the Cliff Branch River overflows its boundaries along the Parkway in downtown Gatlinburg, especially in areas around and near Ripley's Aquarium of the Smokies. Additionally, flood depths of 4-6' are common along the LeConte Creek (sometimes affecting LeConte Creek Rd) and Baskins Creek (sometimes affecting Cherokee Orchard Rd). Flood depths of approximately 7' have occurred near the southwest area of Gatlinburg around the intersection of Ski Mountain Rd and River Rd. Flood depths of 6-8' have occurred in areas adjacent to Roaring Fork and Dudley Creek in eastern parts of Gatlinburg. Flood depths of 15'+ have been observed in areas adjacent to the West Prong of the Little Pigeon River in the northern areas of Gatlinburg towards Pigeon Forge.

The following figure displays the location of the 100- and 500-year floodplains in Gatlinburg.

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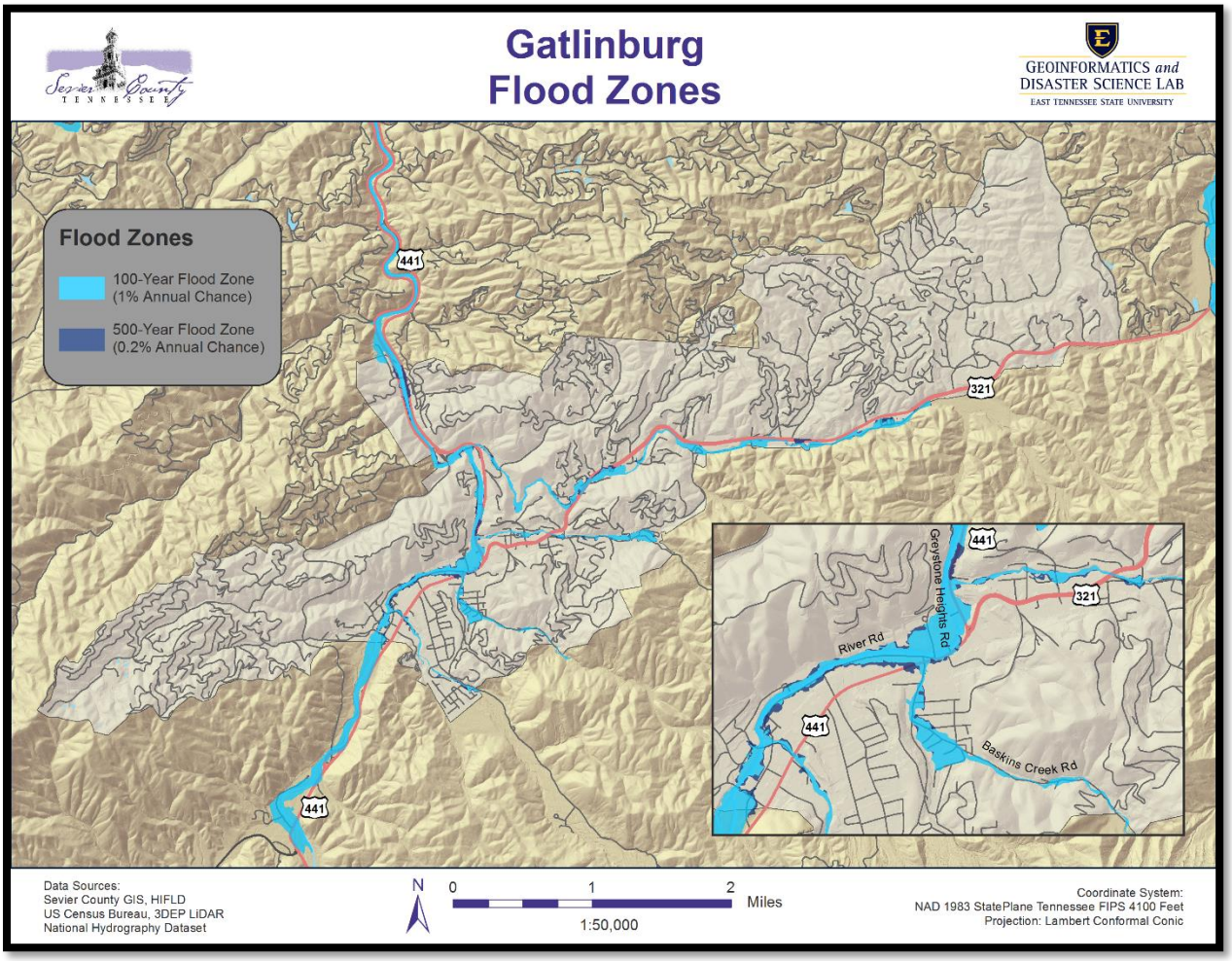

Figure 6-5: 100- and 500-Year Floodplains in Gatlinburg.

Previous Occurrences

Historically, there have been 11 flood and extreme precipitation events in Gatlinburg from 1996 to 2018. According to NCEI, there have been no injuries or fatalities due to flood and extreme precipitation events in Gatlinburg.

Table 6-3: Flood Events and Extreme Precipitation from 1996 to 2018 with Total Losses. (Source: NCEI Storm Events Database)

Date	Location	Event	Injuries	Fatalities	Property Damage
1/19/1996	COUNTYWIDE	Flash Flood	0	0	$0
6/21/1997	COUNTYWIDE	Flash Flood	0	0	$0
1/7/1998	COUNTYWIDE	Flash Flood	0	0	$0
7/11/1999	COUNTYWIDE	Flash Flood	0	0	$0
3/17/2002	COUNTYWIDE	Flash Flood	0	0	$0

Date	Location	Event	Injuries	Fatalities	Property Damage
2/16/2003	COUNTYWIDE	Flash Flood	0	0	$0
1/16/2013	GATLINBURG	Flood	0	0	$0
1/30/2013	GATLINBURG	Flood	0	0	$2,000
1/11/2014	GATLINBURG	Flood	0	0	$2,000
10/14/2014	GATLINBURG	Flash Flood	0	0	$10,000
12/28/2018	GATLINBURG	Flood	0	0	$0

Since the last plan update (through the end of 2018), there have been five new flooding events in the Gatlinburg area. Below is a brief synopsis of those events.

January 16, 2013 – Gatlinburg

Significant synoptic scale event produced several inches of rain over much of the area. Stone Fence Lane closed at Forest Springs Drive.

January 30, 2013 – Gatlinburg

Heavy rain returned to the region. Though not as heavy as the event of the 15th-16th, the very wet soils enabled this event to produce widespread flooding.

January 11, 2014 - Gatlinburg

A strong cold front tapping Gulf moisture moved across the southeastern U.S. with a band of moderate to locally heavy rain across east Tennessee. Heavy rain falling upon previous snow cover produced localized stream flooding that required evacuation of a known flood-prone apartment in Gatlinburg called Medlin Addition Apartments. Other minor flooding noted around town.

October 14, 2014 - Gatlinburg

A strong front tracked across east Tennessee during the morning hours. Most damage was across higher elevations where numerous tress were downed. Flooding was also seen. Park service personnel reported water topped and closed Aquarium Bridge at Greystone Heights Road in Gatlinburg.

December 28, 2018 - Gatlinburg

An unseasonably humid regime featured moisture intrusion from the Gulf of Mexico ahead of an approaching cold front, and a southwesterly flow aloft. Localized heavy rainfall mainly south of the I-40 corridor produced flooding.

While this risk assessment did not include 2019 data for flooding, it should be noted that the early part of 2019 broke many rainfall records, including the wettest month on record (February 2019) according to the Tennessee Climate Office. Extensive flooding occurred in February and April of 2019, possibly exceeding $7 million in damage in Sevier County (Knox News).

Incidents/Probability

With 11 events, the annual return rate (frequency) for flooding and extreme precipitation for Gatlinburg is one event every two to three years. This equates to an annual probability of approximately 44%.

6.1.6 Mass Wasting

Location & Extent

Most mass wasting events within Gatlinburg are located along road networks. Rockfalls or rock sliding along road cuts is a very common phenomenon. These are mainly due to improper slope management that causes instability within the slope face. Additionally, adverse orientation of geological discontinuities (joints, fractures, and faults) with the slope gradient and aspect play an important role in slope stability. Probability of future failure of a slope depends on various factors including lithology, land cover, drainage condition, and soil cover of the area.

The southern part of Sevier County located within the Great Smoky Mountains National Park near the state boundary between Tennessee and North Carolina has a high concentration of areas that could produce mass wasting events. High rain coupled with fragile lithology and adverse orientation of geological discontinuities have increased the probably of a mass wasting event. Below is a susceptibility map, high concentration map, and prior occurrences of mass wasting events within Gatlinburg.

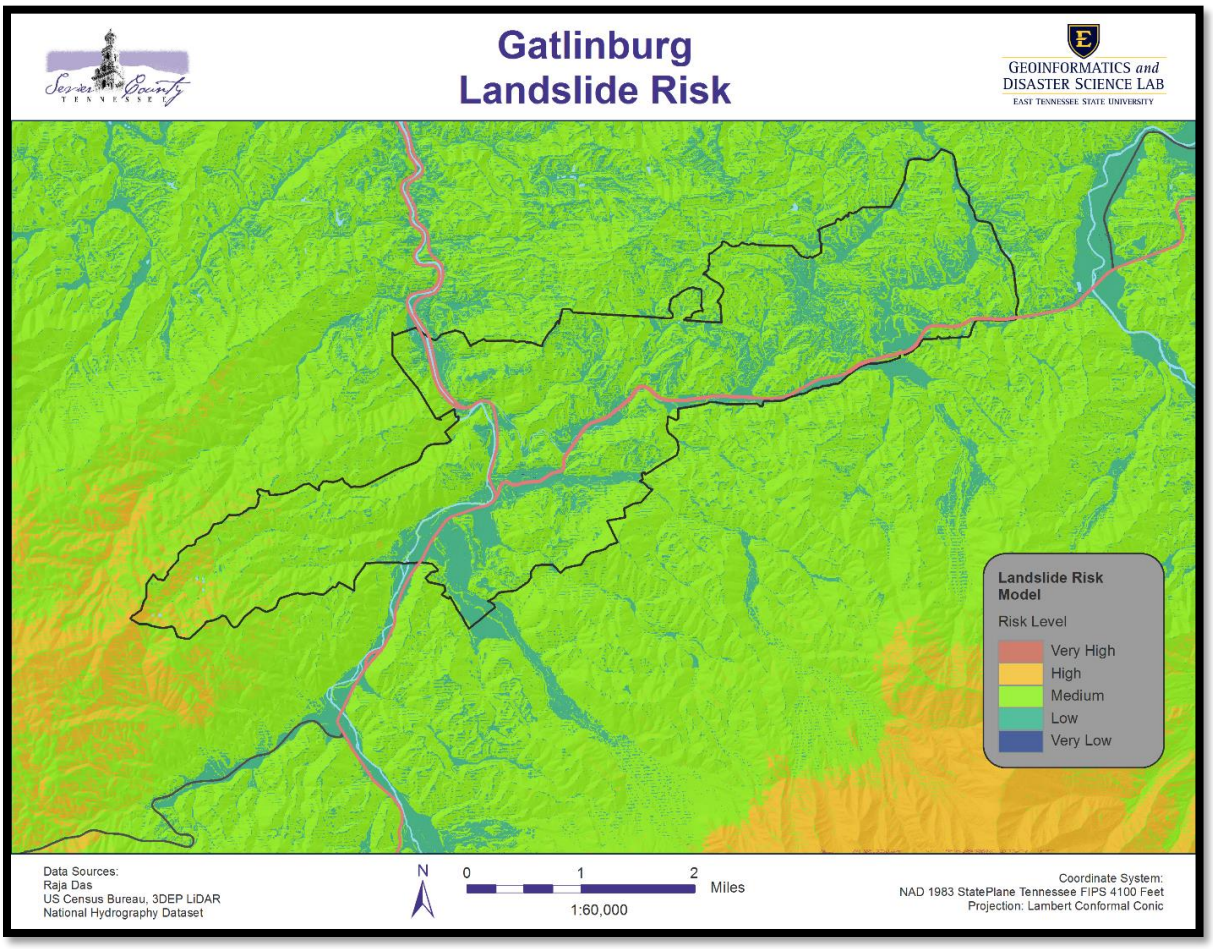

Figure 6-6: Landslide Susceptibility Map in Gatlinburg.

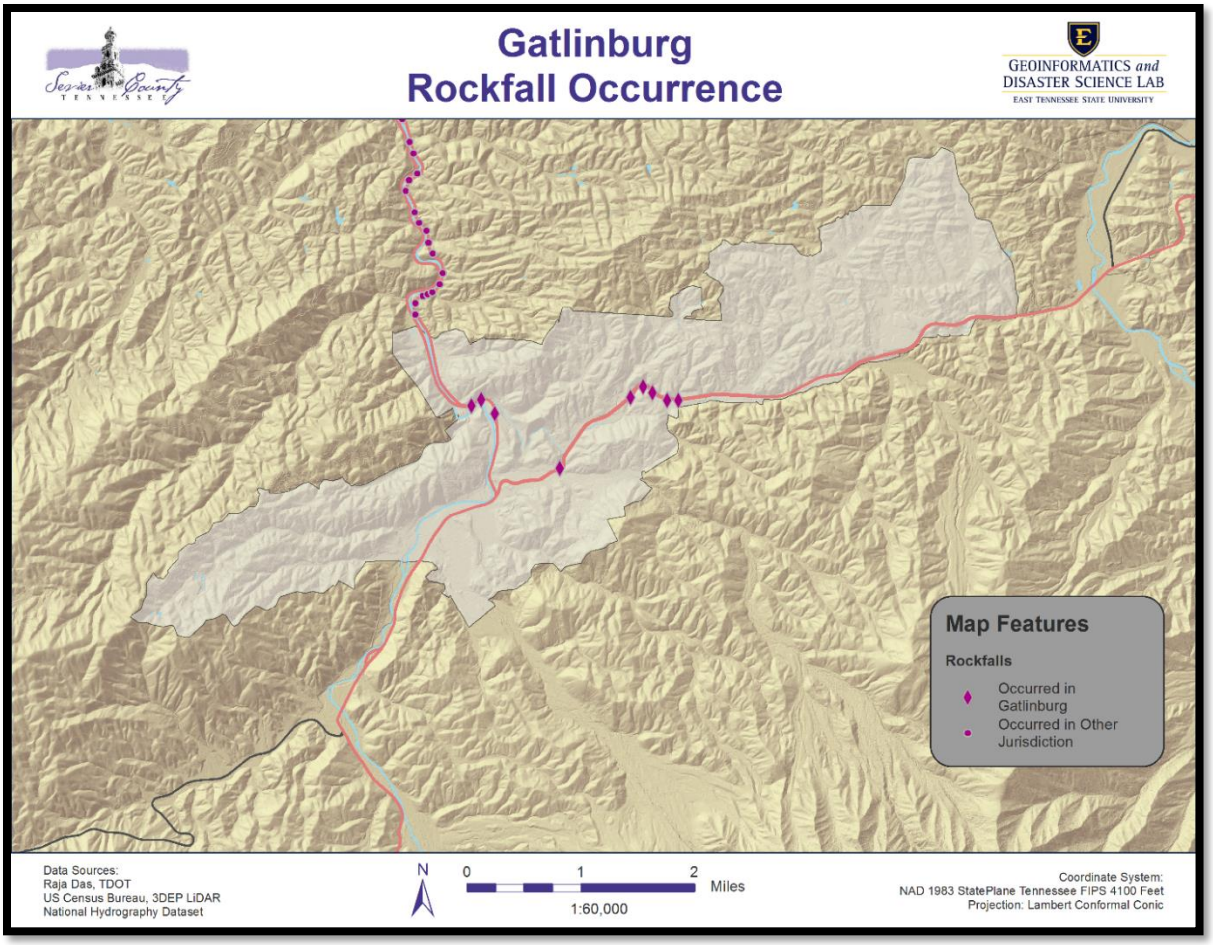

Figure 6-7: Previous Rockfall Events in Gatlinburg.

Previous Occurrences

Some rockfall locations are available from the Tennessee Department of Transportation (TDOT). The following table outlines major debris flow events related to storms in Sevier County.

Table 6-4: Major Debris Flow Events Related to Storm Events.
(Source: Tennessee Department of Transportation)

Date	Type of Storm	Location
7/10/1942	Thunderstorm	Newfound Gap
9/1/1951	Cloudburst	Mt. LeConte
6/15/1971		Mt. LeConte
3/1975 – 3/1983	Multiple Storms	Anakeesta Ridge
8/3/1978	Thunderstorm	Mt. LeConte
7/1984	Thunderstorm	Anakeesta Ridge
8/10/1984	Thunderstorm	Anakeesta Ridge
8/10/1984	Thunderstorm	Anakeesta Ridge
3/1985	Thunderstorm	Anakeesta Ridge
6/28/1993	Cloudburst	Mt. LeConte

Date	Type of Storm	Location
10/4/1995	Hurricane Opal	Mt. LeConte/Anakeesta Ridge
9/17/2004	Hurricane Ivan	Mt. LeConte/Anakeesta Ridge
8/5/2012	Thunderstorm	Anakeesta Ridge
9/10/2017	Hurricane Irma	Anakeesta Ridge
8/1/2019	Thunderstorm	Gatlinburg

Since the last plan update, there have been three mass wasting events in Sevier County with each of them occurring near or in the Gatlinburg area. Below is a brief synopsis of those events.

August 5, 2012 – Anakeesta Ridge
No synopsis available for the event.

September 10, 2017 – Anakeesta Ridge
No synopsis available for the event.

August 1, 2019 - Gatlinburg
A 73-year old man was fatally injured when a tree fell from a slope and hit his Honda sedan. Both the northbound and southbound lanes of the Spur were closed until heavy equipment could complete slope repairs and assessments. Multiple rock slides were also reported.

Incidents/Probability
With four recorded events from 1996 to 2018, the annual return rate (frequency) for mass wasting events for Gatlinburg is one event every five to six years. This equates to an annual probability of a mass wasting event occurrence of approximately 17%.

6.1.7 Severe Wind

Location & Extent
Mountain waves develop on the lee, or downwind, side of mountains. These waves are generated when strong winds flowing toward mountains in a generally perpendicular fashion are raised up over the mountains. Given the geographical location of Sevier County, the unincorporated areas and all of its jurisdictions are susceptible to severe wind events. The following figures provide the extent of severe winds within Gatlinburg and its jurisdictions.

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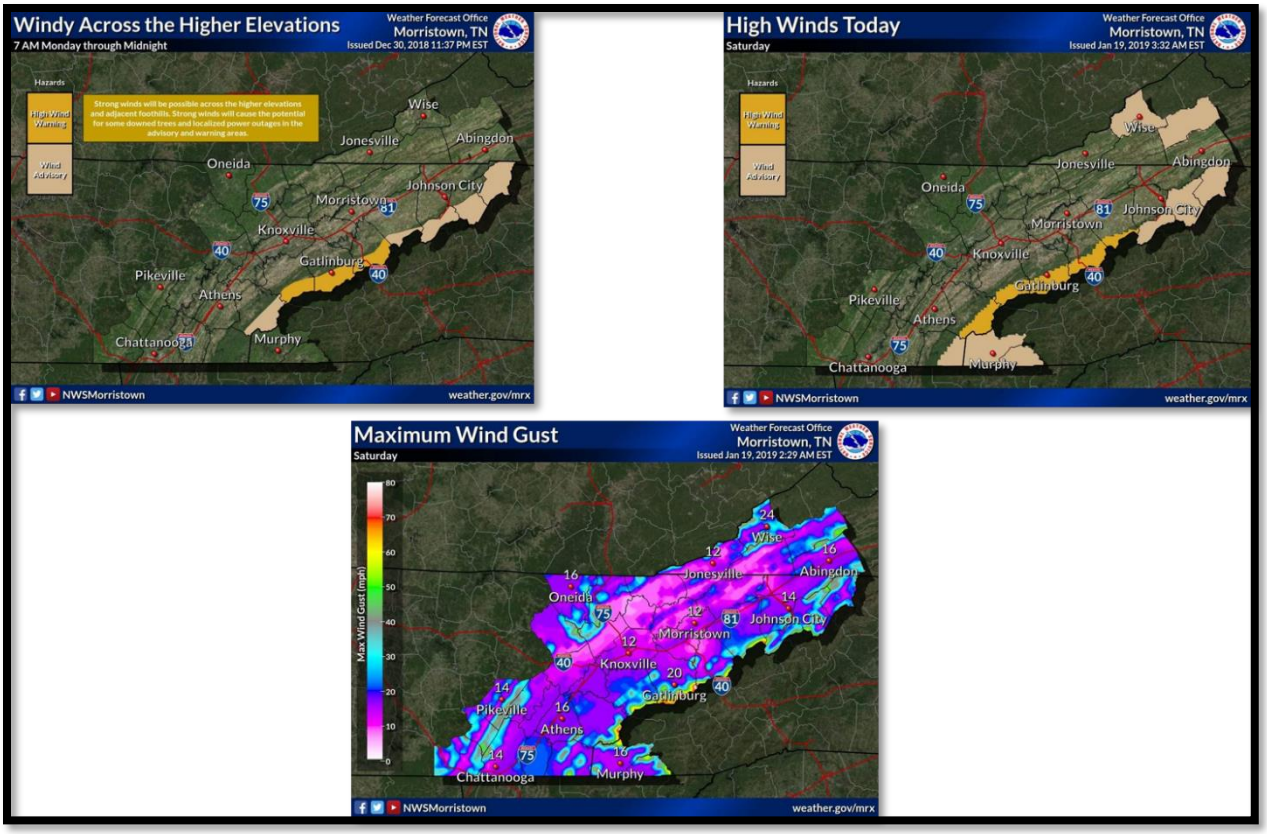

Figure 6-8: Severe Wind Extent and Location within Sevier County and Surrounding Areas, based on standard patterns (these occurring during the 2018-2019 winter months).

Previous Occurrences

Historically, there have been two severe wind events in Gatlinburg from 1996 to 2018. There have been no injuries or fatalities due to severe wind events in Gatlinburg.

Table 6-5: Severe Wind Events from 1996 to 2018 with Total Losses.
(Source: NCEI Storm Events Database)

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage
2/3/2003	COUNTYWIDE	40	0	0	$2,000
6/21/1997	COUNTYWIDE	45	0	0	$20,000

Since the last plan update, there have been no new severe wind events reported from NCEI, which have caused damage to property or crops and/or loss of life or injuries.

Incidents/Probability

The NCEI Storm Events Database reports two severe wind event occurrences within the boundaries of Gatlinburg between the years 1996 and 2018. With a total of two events, the annual return rate

(frequency) for severe winds for Gatlinburg is one event every 11 to 12 years. This equates to an annual probability of approximately 8%.

6.1.8 Sinkholes

Location & Extent

Subsidence can occur slowly and continuously over time or abruptly for various reasons. Subsidence and sinkholes can occur due to either natural processes (karst sinkholes in areas underlain by soluble bedrock or because of human activities. The entire Gatlinburg planning area is susceptible to subsidence and sinkholes based on the karst topography of the region, although less susceptible than northern parts of Sevier County.

Previous Occurrences

Per the State of Tennessee Hazard Mitigation Plan, there are 586 sinkhole locations within Sevier County. The following figure displays all known sinkhole locations within Gatlinburg and underlying risk.

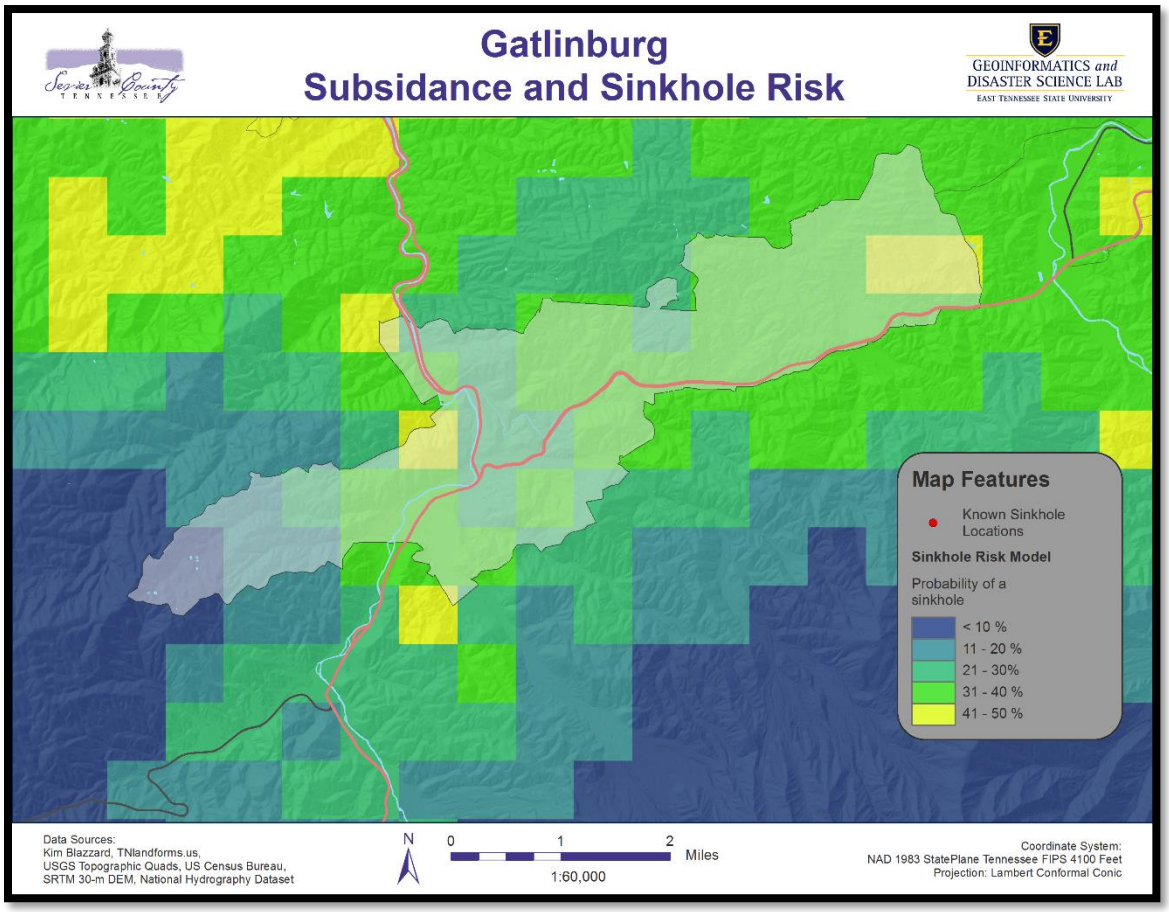

Figure 6-9: Gatlinburg Subsidence and Sinkhole Locations and Risk Probability.

Incidents/Probability

Based on the underlying risk factors within Gatlinburg, the annual probability of a sinkhole occurrence is calculated at less than 5%.

6.1.9 Thunderstorms (Hail, Lightning, and Wind)

Hail

Location & Extent

Because hailstorms are a meteorological phenomenon that can occur anywhere, the entire Gatlinburg planning area is equally at risk from hailstorms. The worst-case scenario for hailstorms is hail up to 3" in diameter.

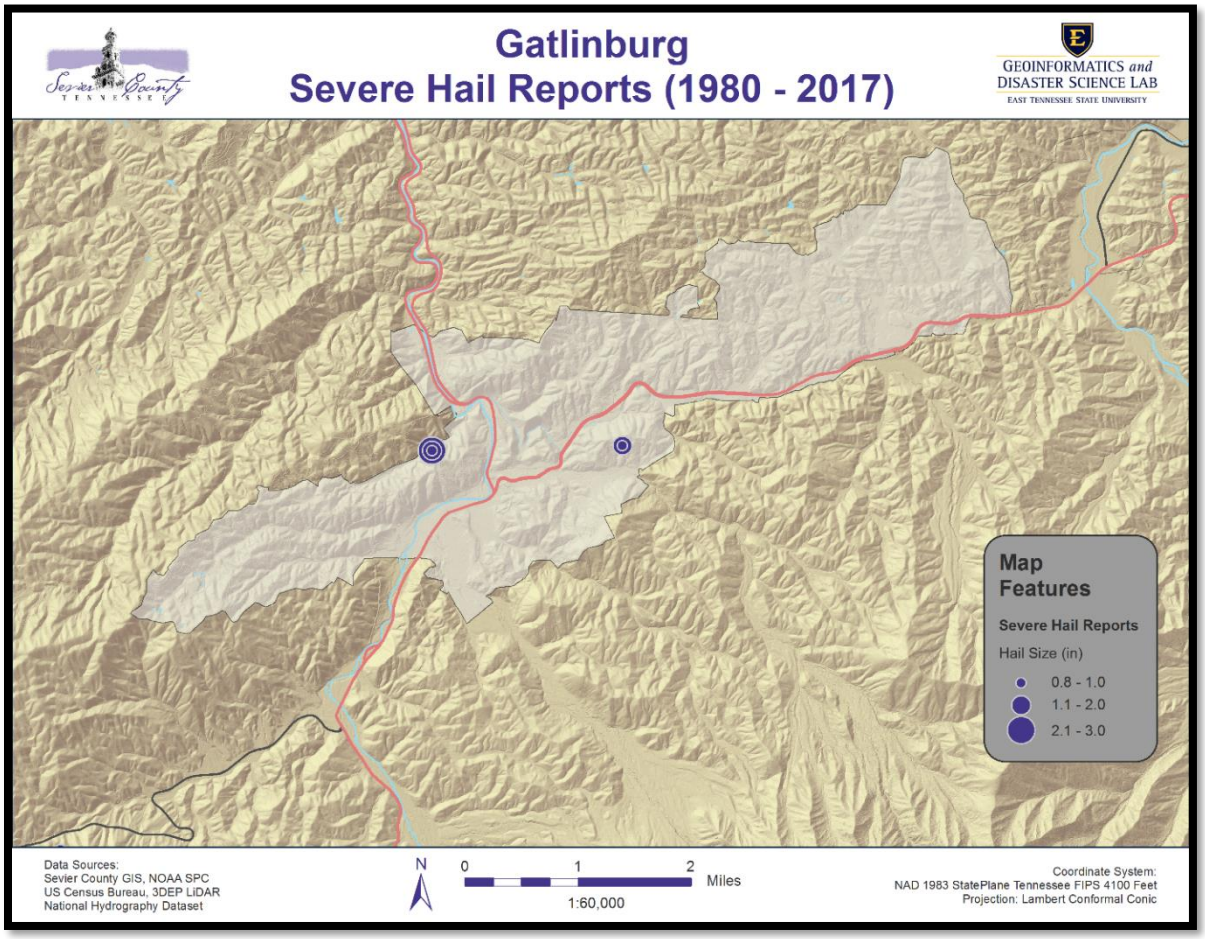

Figure 6-10: Severe Hail Reports and Density in Relation to Gatlinburg.

Previous Occurrences

Historically, there have been 25 hail events in Sevier County from 1996 to 2018, with several of those occurring with Gatlinburg. There have been no injuries or fatalities due to hail events in the Gatlinburg planning area. The following table briefly outlines the hail events that have occurred in Sevier County.

Table 6-6: Hail Incidents from 1996 to 2018 with Total Losses.
(Source: NCEI Storm Events Database)

Date	Location	Diameter (inches)	Injuries	Fatalities	Property Damage
4/10/1992	COUNTYWIDE	1.75	0	0	$0
8/26/1993	COUNTYWIDE	2.75	0	0	$0

Date	Location	Diameter (inches)	Injuries	Fatalities	Property Damage
5/26/1998	COUNTYWIDE	1	0	0	$0
1/18/1999	CUSICK	0.75	0	0	$0
5/13/1999	SEYMOUR	1.75	0	0	$0
4/5/2003	KODAK	1.75	0	0	$0
5/15/2003	COUNTYWIDE	0.75	0	0	$0
12/10/2004	KODAK	0.88	0	0	$0
4/3/2006	SEYMOUR	1.75	0	0	$0
5/20/2006	WALDEN CREEK	0.75	0	0	$0
5/20/2006	KODAK	0.75	0	0	$0
6/2/2006	PIGEON FORGE	0.75	0	0	$0
6/24/2007	KODAK	1	0	0	$0
5/9/2008	SEVIERVILLE	0.88	0	0	$0
7/21/2008	BOYDS CREEK	0.75	0	0	$0
6/17/2009	PITTMAN CTR	1	0	0	$0
5/26/2011	CATES XRDS	0.75	0	0	$0
5/26/2011	MILLICAN	0.88	0	0	$0
8/14/2011	PITNER	1	0	0	$0
2/29/2012	KODAK	1.25	0	0	$0
4/26/2012	KODAK	1	0	0	$0
6/14/2012	HATCHERTOWN	1.5	0	0	$0
7/27/2014	PITNER	1	0	0	$0
6/2/2015	COVE CREEK	1	0	0	$0
4/22/2016	SEVIERVILLE	1.5	0	0	$0

Since the last plan update, there have been six hail events which have occurred within the unincorporated areas of Sevier County and its jurisdictions. Below is a brief synopsis of these events.

February 29, 2012 – Kodak

A boundary across the area triggered thunderstorms over east Tennessee toward the end of the month. The boundary aided in the development of an EF-0 tornado as well as golfball-size hail and several reports of wind damage.

April 26, 2012 – Kodak

A cold front tracked across east Tennessee during the overnight hours triggering scattered thunderstorms over the area. A few of the storms produced damaging thunderstorm wind and hail as large as quarters.

June 14, 2012 – Hatchertown

Elevated moisture and instability permitted routine afternoon thunderstorms to produce severe weather including hail, wind damage, and flooding. Law enforcement personnel reported thunderstorms produced golfball-size hail 2 miles northeast of Wears Valley in Hatchertown.

July 27, 2014 – Pitner

A potent upper-level storm system impacted the region on Sunday, July 27th, bringing several rounds of severe weather along with locally heavy rainfall. Three tornadoes were observed across east Tennessee; one classified as a strong, EF-3 tornado with winds of 140 mph. Additionally, there were several reports of straight-line wind damage and large hail up 2 to 3 inches in diameter. A storm system of this magnitude is highly unusual for this time of year due to the strength of the front and the record cool temperatures it produced in the middle of the summer season.

June 2, 2015 – Cove Creek

Sufficient instability developed in a moist low level environment underneath an upper level low pressure system parked over the Cumberland Plateau for the development of localized severe convection in the foothills of the Smoky Mountains. Impacts from the storms included wind damage along with the formation of large hail. Quarter sized hail fell three miles north of Wears Valley.

April 22, 2016 – Sevierville

A few severe thunderstorms developed during the afternoon across the region in an environment that could be characterized as weakly unstable. The convection formed in response to a weak upper level impulse riding a few hundred miles east of a cold front.

Incidents/Probability

The NCEI Storm Events Database reports 25 hail events within the boundaries of Sevier County between the years 1996 and 2018. With 25 events, the annual return rate (frequency) for hail events in the Gatlinburg area is one to two events every year. This equates to an annual probability of approximately 100%.

Lightning

Location & Extent

Lightning is a meteorological phenomenon that can occur anywhere and has the same probability of occurring throughout the entire Gatlinburg planning area. Based on historical lightning events, the Gatlinburg planning area can expect a lightning density of 11-12 flashes per square mile per year.

Previous Occurrences

Historically, there have been two lightning events in Sevier County from 1996 to 2018. There have been no injuries and one fatality due to lightning events in the Gatlinburg planning area. The following table briefly outlines the lightning events that have occurred in Sevier County.

Table 6-7: Lightning Incidents from 1996 to 2018 with Total Losses.
(Source: NCEI Storm Events Database)

Date	Location	Injuries	Fatalities	Property Damage
5/7/1996	PIGEON FORGE	0	0	$0
7/10/2004	KODAK	0	1	$0

Since the last plan update, there have been no lightning events that have caused property damage and/or loss of life or injuries in Gatlinburg.

Incidents/Probability

The NCEI Storm Events Database reports two lightning events within the boundaries of Sevier County between the years 1996 and 2018. With two events, the annual return rate (frequency) for lightning events in the area of Gatlinburg is one event every 11 to 12 years. This equates to an annual probability of approximately 8%.

Wind

Location & Extent

Thunderstorm wind is a meteorological phenomenon that can occur anywhere and has the same probability of occurring throughout the entire Gatlinburg planning area. Based on historical thunderstorm wind events, the Gatlinburg planning area can expect thunderstorm wind speeds of approximately 60 knots. The following figure displays the damages caused by thunderstorm winds from 1980 to 2017.

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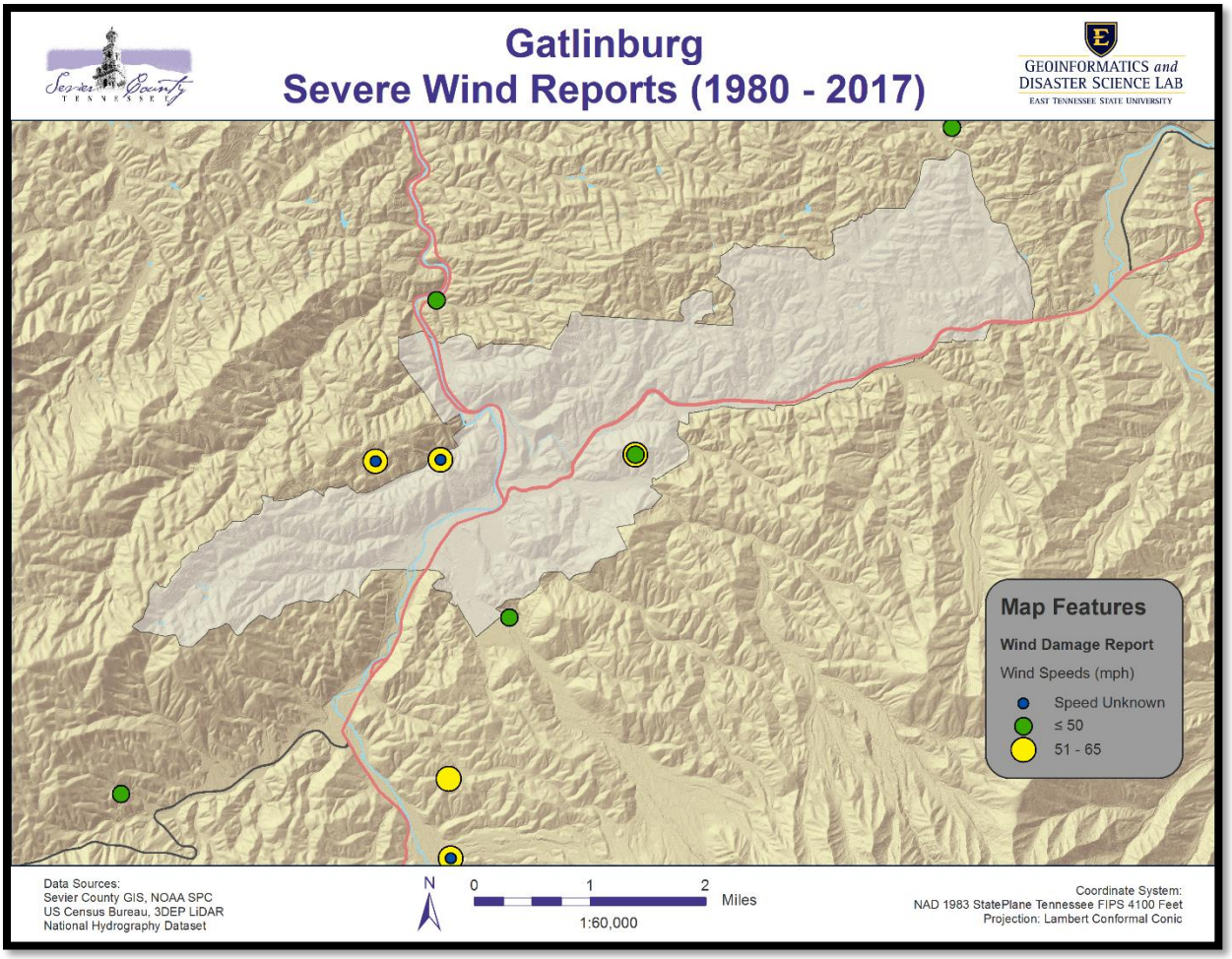

Figure 6-11: Severe Thunderstorm Wind Reports and Density in Relation to Gatlinburg.

Previous Occurrences

Historically, there have been 189 thunderstorm wind events in the unincorporated area of Sevier County and its jurisdictions from 1996 to 2018. There have been no injuries or fatalities due to thunderstorm wind events in the Gatlinburg planning area. The following table briefly outlines the thunderstorm wind events that have occurred in the unincorporated area of Sevier County and its jurisdictions.

Table 6-8: Thunderstorm Wind Incidents from 1996 to 2018 with Total Losses.
(Source: NCEI Storm Events Database)

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage	Crop Damage
4/20/1996	GATLINBURG	60	0	0	$0	$0
5/27/1996	SOUTHWEST PART		0	0	$10,000	$0
8/8/1996	SEVIERVILLE		0	0	$0	$2,000
1/5/1997	GATLINBURG		0	0	$0	$4,000
3/5/1997	EXTREME N PART OF CO		0	0	$0	$3,000
6/13/1997	SEVIERVILLE		0	0	$0	$10,000

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage	Crop Damage
6/14/1997	SEYMOUR		0	0	$0	$7,000
7/4/1997	COUNTYWIDE		0	0	$25,000	$20,000
8/4/1997	COUNTYWIDE	55	0	0	$0	$20,000
2/17/1998	SEVIERVILLE		0	0	$0	$0
4/3/1998	COUNTYWIDE		0	0	$17,000	$15,000
6/2/1998	PIGEON FORGE		0	0	$0	$20,000
6/2/1998	GATLINBURG		0	0	$0	$15,000
6/5/1998	KODAK		0	0	$5,000	$14,000
6/15/1998	GATLINBURG		0	0	$15,000	$0
6/22/1998	SEVIERVILLE		0	0	$0	$20,000
6/24/1998	SEVIERVILLE		0	0	$0	$20,000
7/19/1998	SEVIERVILLE		0	0	$0	$5,000
11/25/1998	PIGEON FORGE		0	0	$0	$15,000
4/23/1999	SEVIERVILLE		0	0	$0	$7,000
5/6/1999	KODAK		0	0	$0	$2,000
5/7/1999	KODAK		0	0	$0	$5,000
7/24/1999	BEECH SPGS		0	0	$6,000	$0
7/29/1999	KODAK		0	0	$12,000	$0
7/29/1999	PIGEON FORGE		0	0	$10,000	$0
8/23/1999	SEYMOUR		0	0	$4,000	$0
2/13/2000	PIGEON FORGE		0	0	$0	$11,000
5/23/2000	PIGEON FORGE		0	0	$0	$11,000
5/27/2000	COUNTYWIDE		0	0	$0	$6,000
5/27/2000	COUNTYWIDE		0	0	$0	$2,000
7/28/2000	GATLINBURG		0	0	$0	$15,000
7/28/2000	GATLINBURG		0	0	$14,000	$0
7/29/2000	SEVIERVILLE		0	0	$0	$4,000
7/30/2000	KODAK		0	0	$0	$12,000
8/10/2000	HATCHERTOWN		0	0	$0	$15,000
8/18/2000	SEVIERVILLE		0	0	$0	$23,000
11/9/2000	KODAK		0	0	$0	$4,000
11/9/2000	SEYMOUR		0	0	$0	$5,000
5/21/2001	CEDAR BLUFF		0	0	$0	$5,000
7/4/2001	PIGEON FORGE		0	0	$0	$24,000
7/8/2001	PITTMAN CENTER		0	0	$0	$21,000
10/25/2001	COUNTYWIDE		0	0	$16,000	$20,000
1/24/2002	COUNTYWIDE		0	0	$8,000	$0
5/2/2002	SEVIERVILLE		0	0	$15,000	$0
5/2/2002	SEYMOUR		0	0	$12,000	$0
5/13/2002	COUNTYWIDE		0	0	$15,000	$0

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage	Crop Damage
6/4/2002	GATLINBURG		0	0	$15,000	$0
7/2/2002	COUNTYWIDE		0	0	$25,000	$0
7/30/2002	GATLINBURG		0	0	$0	$5,000
8/1/2002	GATLINBURG		0	0	$5,000	$0
9/4/2002	BOYDS CREEK		0	0	$10,000	$0
9/4/2002	WALDEN CREEK		0	0	$15,000	$0
11/10/2002	KODAK	60	0	0	$15,000	$0
2/16/2003	GATLINBURG	60	0	0	$5,000	$0
5/2/2003	SEVIERVILLE	55	0	0	$12,000	$0
5/11/2003	KODAK	55	0	0	$8,000	$0
6/11/2003	KODAK	60	0	0	$12,000	$0
7/6/2003	COUNTYWIDE	60	0	0	$0	$0
7/10/2003	SEYMOUR	60	0	0	$0	$0
8/11/2003	COUNTYWIDE	60	0	0	$0	$0
8/29/2003	PIGEON FORGE	60	0	0	$0	$0
8/31/2003	PIGEON FORGE	60	0	0	$0	$0
11/18/2003	COUNTYWIDE	55	0	0	$10,000	$0
5/26/2004	KODAK	65	0	0	$10,000	$0
5/31/2004	SEVIERVILLE	65	0	0	$20,000	$0
6/2/2004	SEYMOUR	65	0	0	$5,000	$0
6/12/2004	SEVIERVILLE	60	0	0	$10,000	$0
7/5/2004	SEYMOUR	60	0	0	$12,000	$0
7/5/2004	KODAK	60	0	0	$10,000	$0
7/5/2004	PIGEON FORGE	60	0	0	$12,000	$0
7/10/2004	KODAK	60	0	0	$8,000	$0
7/13/2004	SEVIERVILLE	65	0	0	$15,000	$0
7/17/2004	SEVIERVILLE	65	0	0	$30,000	$0
5/20/2005	COUNTYWIDE	65	0	0	$30,000	$0
6/6/2005	SEVIERVILLE	65	0	0	$15,000	$0
6/27/2005	SEVIERVILLE	65	0	0	$18,000	$0
6/30/2005	COUNTYWIDE	55	0	0	$20,000	$0
7/27/2005	GATLINBURG	55	0	0	$10,000	$0
7/31/2005	SEVIERVILLE	55	0	0	$3,000	$0
7/31/2005	SEVIERVILLE	60	0	0	$3,000	$0
4/2/2006	KODAK	60	0	0	$12,000	$0
4/21/2006	SEYMOUR	60	0	0	$12,000	$0
5/20/2006	SEVIERVILLE	60	0	0	$20,000	$0
5/20/2006	SEVIERVILLE	60	0	0	$12,000	$0
5/30/2006	PITTMAN CENTER	60	0	0	$3,000	$0
5/30/2006	GATLINBURG	60	0	0	$20,000	$0

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage	Crop Damage
5/30/2006	GATLINBURG	60	0	0	$15,000	$0
5/31/2006	KODAK	60	0	0	$10,000	$0
6/23/2006	COUNTYWIDE	60	0	0	$6,000	$0
7/28/2006	GATLINBURG	60	0	0	$15,000	$0
8/4/2006	COUNTYWIDE	55	0	0	$6,000	$0
8/5/2006	WALDEN CREEK	60	0	0	$10,000	$0
10/5/2006	KODAK	55	0	0	$0	$0
4/3/2007	CATLETTSBURG	55	0	0	$30,000	$0
6/14/2007	PITTMAN CENTER	50	0	0	$10,000	$0
6/24/2007	SEVIERVILLE	55	0	0	$5,000	$0
6/25/2007	SEVIERVILLE	55	0	0	$20,000	$0
6/28/2007	PIGEON FORGE	55	0	0	$10,000	$0
6/28/2007	GATLINBURG	55	0	0	$15,000	$0
6/28/2007	SEVIERVILLE	50	0	0	$2,000	$0
1/10/2008	BOYDS CREEK	55	0	0	$0	$0
3/19/2008	CATLETTSBURG	50	0	0	$0	$0
6/9/2008	BANNER	55	0	0	$10,000	$0
6/11/2008	BIRD XRD	50	0	0	$10,000	$0
6/12/2008	GATLINBURG	50	0	0	$5,000	$0
6/12/2008	LINE SPG	52	0	0	$2,000	$0
6/12/2008	PITNER	55	0	0	$5,000	$0
6/28/2008	KODAK	55	0	0	$8,000	$0
6/28/2008	PINE GROVE	55	0	0	$8,000	$0
6/28/2008	GLADES	55	0	0	$8,000	$0
7/22/2008	ELKMONT	55	0	0	$0	$0
7/22/2008	GLADES	60	0	0	$0	$0
2/11/2009	CATLETTSBURG	55	0	0	$15,000	$0
4/2/2009	PITNER	55	0	0	$8,000	$0
4/6/2009	KODAK	52	0	0	$8,000	$0
4/6/2009	OAK CITY	50	0	0	$2,000	$0
4/6/2009	KODAK	50	0	0	$2,000	$0
5/28/2009	CUSICK	52	0	0	$0	$0
6/4/2009	MC MAHAN	52	0	0	$2,000	$0
6/4/2009	FAIR GARDEN	52	0	0	$2,000	$0
6/10/2009	KODAK	62	0	0	$5,000	$0
6/17/2009	SEVIERVILLE	50	0	0	$30,000	$0
8/16/2009	SEVIERVILLE	52	0	0	$2,000	$0
8/16/2009	SEVIERVILLE	58	0	0	$15,000	$0
8/22/2009	PITTMAN CENTER	60	0	0	$15,000	$0
8/22/2009	PITTMAN CENTER	50	0	0	$20,000	$0

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage	Crop Damage
7/26/2010	SHADY GROVE	55	0	0	$0	$0
10/26/2010	SEVIERVILLE	55	0	0	$5,000	$0
2/25/2011	SEVIERVILLE	50	0	0	$15,000	$0
2/28/2011	PITTMAN CENTER	60	0	0	$12,000	$0
3/23/2011	CATLETTSBURG	60	0	0	$0	$0
3/23/2011	GLADES	55	0	0	$0	$0
5/22/2011	MILLICAN	50	0	0	$0	$0
5/26/2011	HENRY XRDS	50	0	0	$0	$0
5/26/2011	ALDER BRANCH	50	0	0	$0	$0
6/24/2011	SEVIERVILLE	50	0	0	$5,000	$0
8/8/2011	SEVIERVILLE	52	0	0	$3,000	$0
8/18/2011	SEVIERVILLE	52	0	0	$10,000	$0
2/29/2012	PIGEON FORGE	60	0	0	$5,000	$0
3/2/2012	DU PONT	50	0	0	$0	$0
3/30/2012	CATLETTSBURG	50	0	0	$0	$0
7/1/2012	ELKMONT	60	0	0	$0	$0
7/5/2012	CATLETTSBURG	60	0	0	$1,000,000	$0
7/5/2012	FRENCH BROAD	60	0	0	$1,000,000	$0
7/5/2012	PIGEON FORGE	50	0	0	$0	$0
7/9/2012	BOYDS CREEK	50	0	0	$0	$0
7/10/2012	LINE SPG	50	0	0	$0	$0
7/10/2012	SEVIERVILLE	50	0	0	$0	$0
7/31/2012	MIDDLE CREEK	50	0	0	$0	$0
7/31/2012	PITNER	50	0	0	$0	$0
5/21/2013	CATLETTSBURG	50	0	0	$0	$0
5/22/2013	CATLETTSBURG	50	0	0	$0	$0
6/5/2013	PIGEON FORGE	50	0	0	$2,000	$0
6/5/2013	PIGEON FORGE	50	0	0	$5,000	$0
6/13/2013	PITTMAN CENTER	50	0	0	$8,000	$0
6/13/2013	SEYMOUR	55	0	0	$8,000	$0
6/10/2014	SEVIERVILLE	50	0	0	$10,000	$0
6/23/2014	PIGEON FORGE	50	0	0	$5,000	$0
6/23/2014	SEVIERVILLE	50	0	0	$8,000	$0
6/27/2014	SEYMOUR	50	0	0	$8,000	$0
7/8/2014	PITNER	50	0	0	$0	$0
7/8/2014	LINE SPG	60	0	0	$0	$0
7/27/2014	CATLETTSBURG	50	0	0	$0	$0
9/16/2014	CATLETTSBURG	52	0	0	$0	$0
10/14/2014	PIGEON FORGE	50	0	0	$5,000	$0
4/25/2015	KODAK	50	0	0	$5,000	$0

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage	Crop Damage
4/25/2015	GATLINBURG	50	0	0	$8,000	$0
6/2/2015	GLADES	50	0	0	$0	$0
6/30/2015	KODAK	50	0	0	$0	$0
8/10/2015	PITNER	50	0	0	$0	$0
8/10/2015	LINE SPG	50	0	0	$0	$0
4/22/2016	PITNER	50	0	0	$0	$0
6/2/2016	PIGEON FORGE	50	0	0	$0	$0
6/14/2016	HICKS CROSSING	50	0	0	$0	$0
7/7/2016	LINE SPG	50	0	0	$0	$0
7/7/2016	LINE SPG	50	0	0	$0	$0
7/7/2016	CATLETTSBURG	55	0	0	$0	$0
7/8/2016	ELKMONT	60	0	0	$0	$0
7/8/2016	PITNER	50	0	0	$0	$0
7/12/2016	BEECH SPGS	50	0	0	$0	$0
3/1/2017	CATLETTSBURG	50	0	0	$0	$0
3/1/2017	CATLETTSBURG	50	0	0	$0	$0
3/27/2017	CATES XRDS	50	0	0	$0	$0
5/24/2017	GLADES	50	0	0	$0	$0
5/24/2017	SEVIERVILLE ARPT	50	0	0	$0	$0
6/25/2018	BIRD XRD	50	0	0	$0	$0
6/26/2018	CATLETTSBURG	50	0	0	$0	$0
6/28/2018	GLADES	50	0	0	$0	$0
11/6/2018	PITNER	50	0	0	$0	$0

Since the last plan update, there have been 51 thunderstorm wind events that have occurred within the unincorporated areas of Sevier County and its jurisdictions.

Incidents/Probability

The NCEI Storm Events Database reports 189 thunderstorm wind events within the boundaries of Sevier County between the years 1996 and 2018. With 189 events, the annual return rate (frequency) for thunderstorm wind events in the unincorporated area of Sevier County and Gatlinburg is eight to nine events every year. This equates to an annual probability of approximately 100%.

6.1.10 Tornadoes

Location & Extent

While there is a significant tornado record for Gatlinburg with actual locations, tornadoes in general are a meteorological phenomenon that can occur anywhere and have the same approximate probability of occurring anywhere in the Gatlinburg planning area. Because a tornado has a similar probability of striking anywhere within the planning area, all of Sevier County and Gatlinburg are equally at risk for tornadoes. The tornadoes experienced in Sevier County range from EF0 to EF1 on the EF scale. Based on historical

county-level data, the worst-case scenario for Sevier County and Gatlinburg is an EF1 tornado; however, an EF4 tornado did impact Blount County in 2011 in an area adjacent to Sevier County.

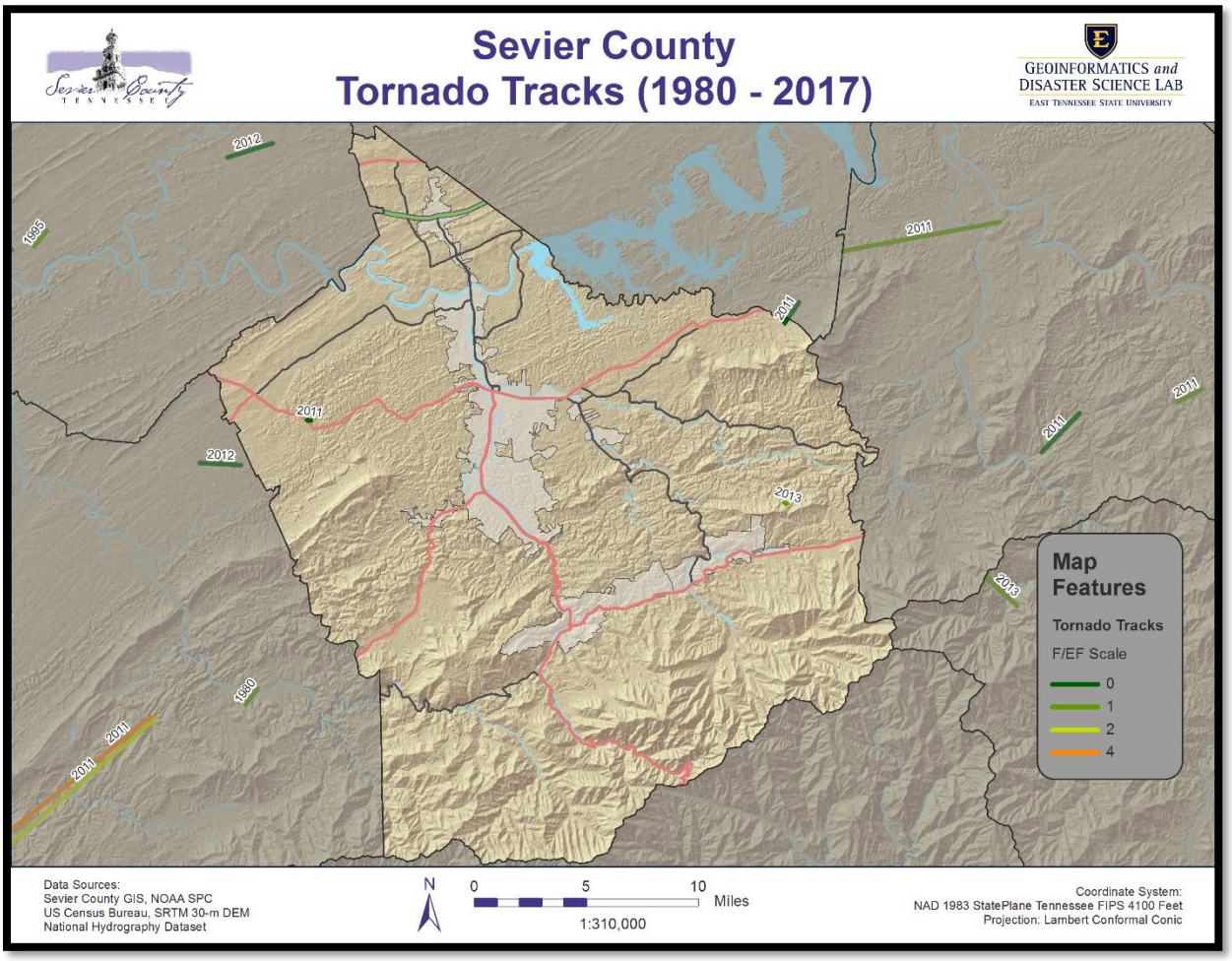

Figure 6-12: Tornado Density and Tracks in Relation to Sevier County.

Previous Occurrences

The NCEI Storm Events Database reports three tornadoes occurring within the boundaries of Sevier County. There have been no injuries due to tornadoes in Sevier County and Gatlinburg. The following table is a list of all events that have occurred between 1996 and 2018.

Table 6-9: Tornado Incidents from 1996 to 2018 with Total Losses.
(Source: NCEI Storm Events Database)

Date	Location	Magnitude	Injuries	Fatalities	Property Damage
4/27/2011	CUSICK	EF0	0	0	$5,000
4/27/2011	BIRD XRD	EF0	0	0	$3,000
6/13/2013	SEVIERVILLE	EF1	0	0	$50,000

Since the last plan update, there have been no tornado events that have caused property damage and/or loss of life or injuries in Sevier County and Gatlinburg.

Incidents/Probability

The NCEI Storm Events Database reports three tornado events within the boundaries of Sevier County between the years 1996 and 2018. With three events, the annual return rate (frequency) for tornado events in the unincorporated area of Sevier County and Gatlinburg is one event every 7 to 8 years. This equates to an annual probability of approximately 12%.

6.1.11 Tropical Cyclones (Hurricanes)

Location & Extent

Tropical cyclones typically impact multiple regions and not one specific jurisdiction. Based on historical data, the Sevier County planning area can expect to experience tropical cyclones at the tropical depression level. Additionally, no portions of Sevier County will be impacted by storm surge based on its geographical location.

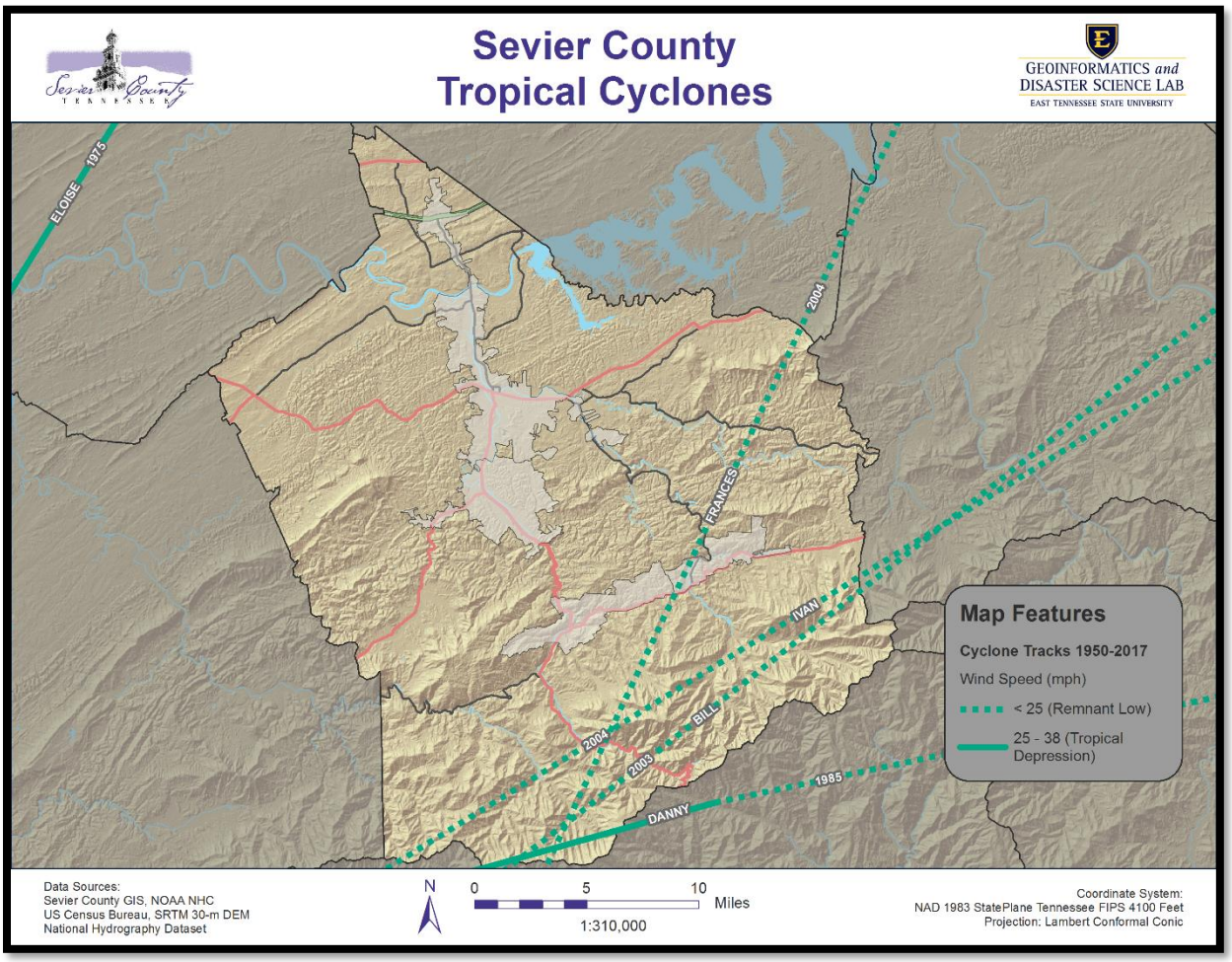

Figure 6-13: Tropical Cyclone Tracks in Relation to Sevier County and Gatlinburg.

Previous Occurrences

The NCEI Storm Events Database reports no tropical cyclone (tropical depressions, tropical storms, and hurricanes) occurrences within the boundaries of Sevier County and Gatlinburg between the years 1996 and 2018.

Incidents/Probability

Based on historical record, the annual probability of tropical cyclones for Sevier County and Gatlinburg is less than 1%.

6.1.12 Wildfires/Conflagration

Location & Extent

Wildfires affect areas that are populated with forests and grasslands. On the fire danger rating system, Sevier County and Gatlinburg can expect a moderate to high rating based on current land use/land cover in the area. The following figure displays the areas of wildland-urban interface and intermix for Sevier County and Gatlinburg, as well as the underlying land cover (aerial imagery). The aerial imagery helps to identify possible wildfire fuel sources such as small wooded and shrub areas that may not be identified by the WUI dataset.

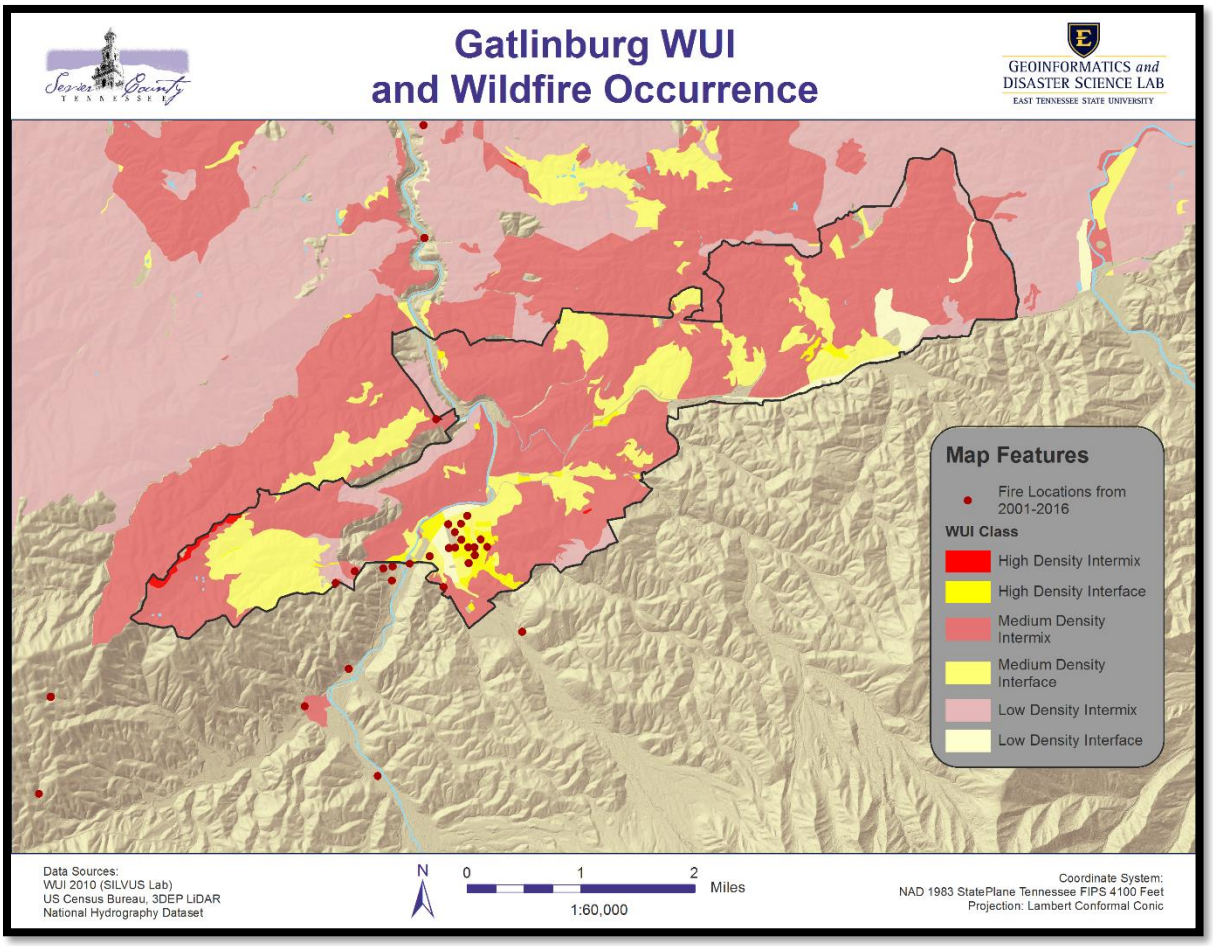

Figure 6-14: Wildland-Urban Interaction for Gatlinburg.

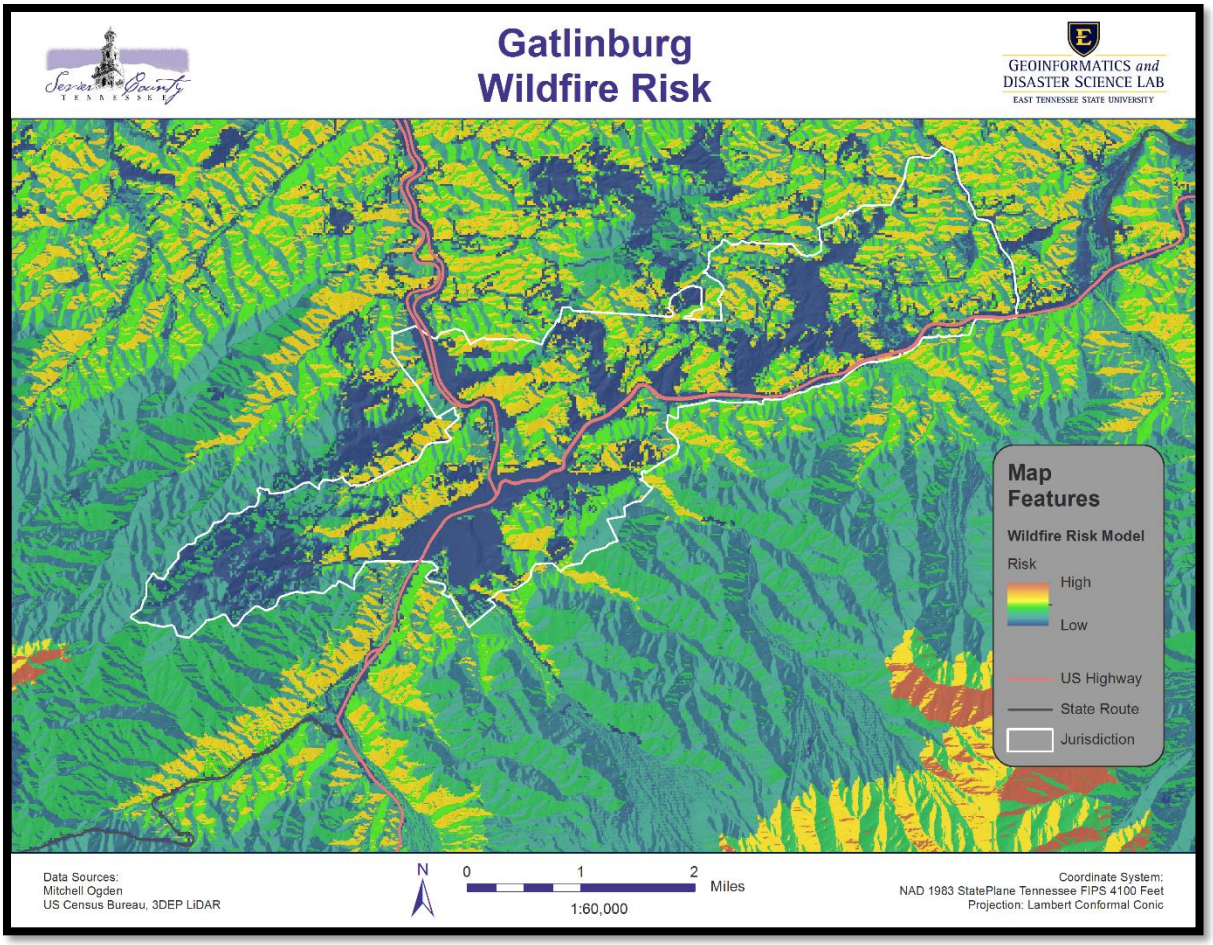

Figure 6-15: Wildfire Risk Model for Gatlinburg.

Using the record of wildfires in Sevier County, how much of an effect each variable has on wildfire development can be determined through spatial logistic regression and GIS modeling. Calculating wildfire risk through these methods requires data on previous wildfire occurrences and variables related to fire development. Wildfire occurrence data comes from two sources: the United States Forest Service (USFS) and the Geological Survey (USGS). The USGS data recorded only those wildfires that occurred on federal land, primarily the Great Smoky Mountains National Park, for which the USFS dataset includes.

The duration of a wildfire depends on the weather conditions, how dry it is, the availability of fuel to spread, and the ability of responders to contain and extinguish the fire. Historically, some wildfires have lasted only hours while other fires have continued to spread and grow for an entire season. They spread quickly and often begin unnoticed until they have grown large enough to produce dense smoke. If fuel is available, and high wind speeds occur, a wildfire can spread over a large area in a very short amount of time. These factors make the difference between small upstart fires easily controlled by local fire services and fires destroying thousands of acres requiring multiple state and federal assets for containment and suppression.

Previous Occurrences

The USGS and USFS report 168 wildfire/conflagration occurrences within the boundaries of Sevier County and Gatlinburg from 2001 to 2016. A historic drought in the fall of 2016 preceded historic wildfires. By November 22, all 95 counties in Tennessee were classified in "Severe Drought" (D2) or higher. Tennessee experienced numerous wildfires across the state, including several that required federal assistance. On November 28, 2016, hurricane-force winds rapidly expanded a small wildfire in Sevier County into the largest interface fire to affect the state of Tennessee in 100 years, resulting in an estimated $911 million in property and contents loss. There were 14 fatalities and 221 people treated with fire-related injuries. The fire area was reported at 17,140 acres.

Figure 6-16: Photos showing the 2016 wildfire entering the developed area of Gatlinburg (upper left, The Atlantic), drastically reducing visibility with intense smoke (upper right, WV Metro News), devastating large areas (lower left, CNN), and destroying many homes (lower right, NPR).

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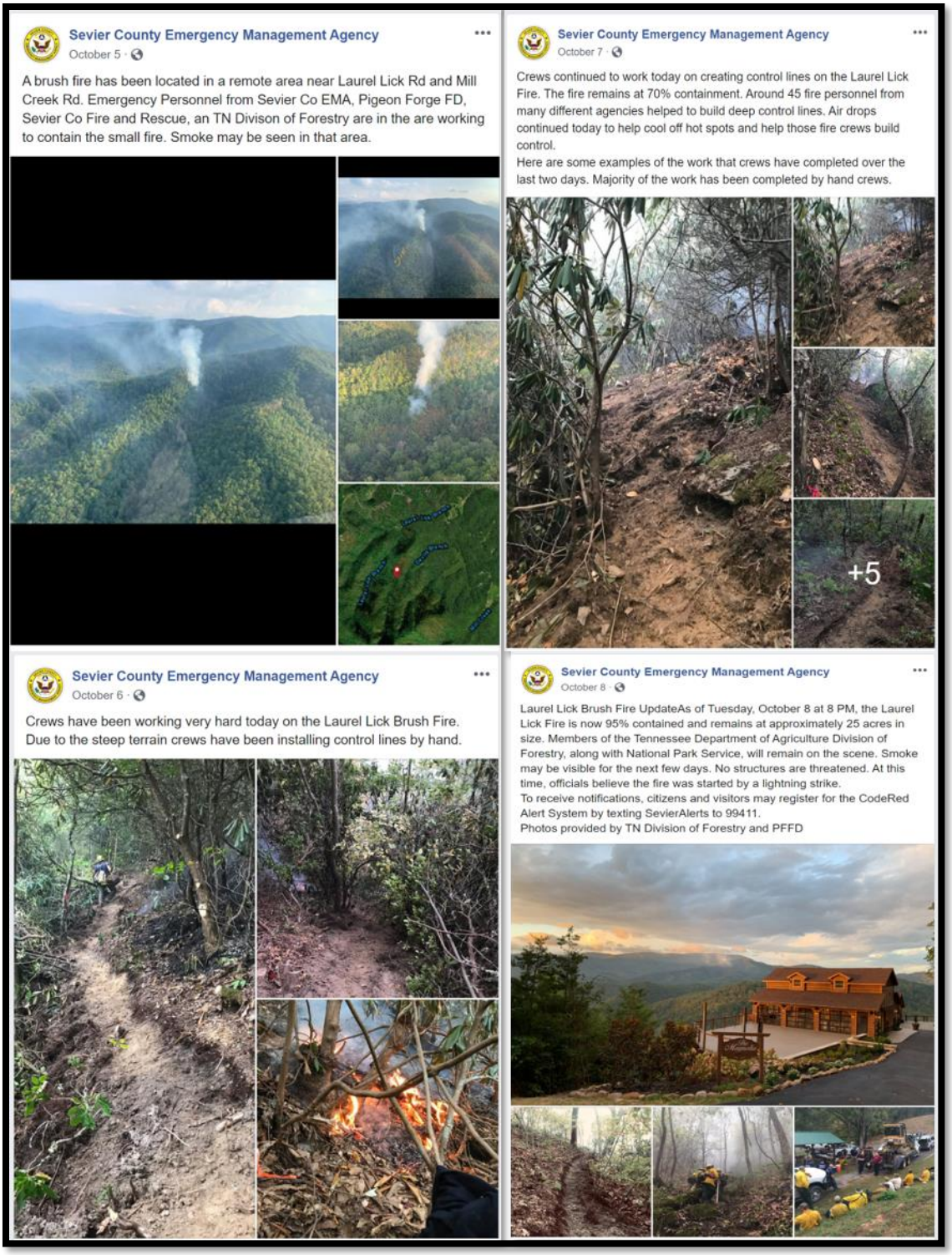

Figure 6-17: Social media documentation and community awareness of recent wildfires (October 2019) impacting Sevier County (Sevier County EMA).

Incidents/Probability

The USGS and USFS Database reports 168 wildfire/conflagration events within the boundaries of Sevier County between the years 2001 and 2016. With 168 events, the annual return rate (frequency) for wildfire/conflagration events in the unincorporated area of Sevier County and Gatlinburg is eight to nine events every year. This equates to an annual probability of approximately 100%.

6.1.13 Winter Storms

Location & Extent

Because winter weather is a climatological hazard and has the same probability of occurring in any area in Sevier County, the entire planning area is equally at risk for winter weather. Based on historic data, Sevier County and Gatlinburg can expect a category 5 on the Ohio Valley Regional Snowfall Index scale.

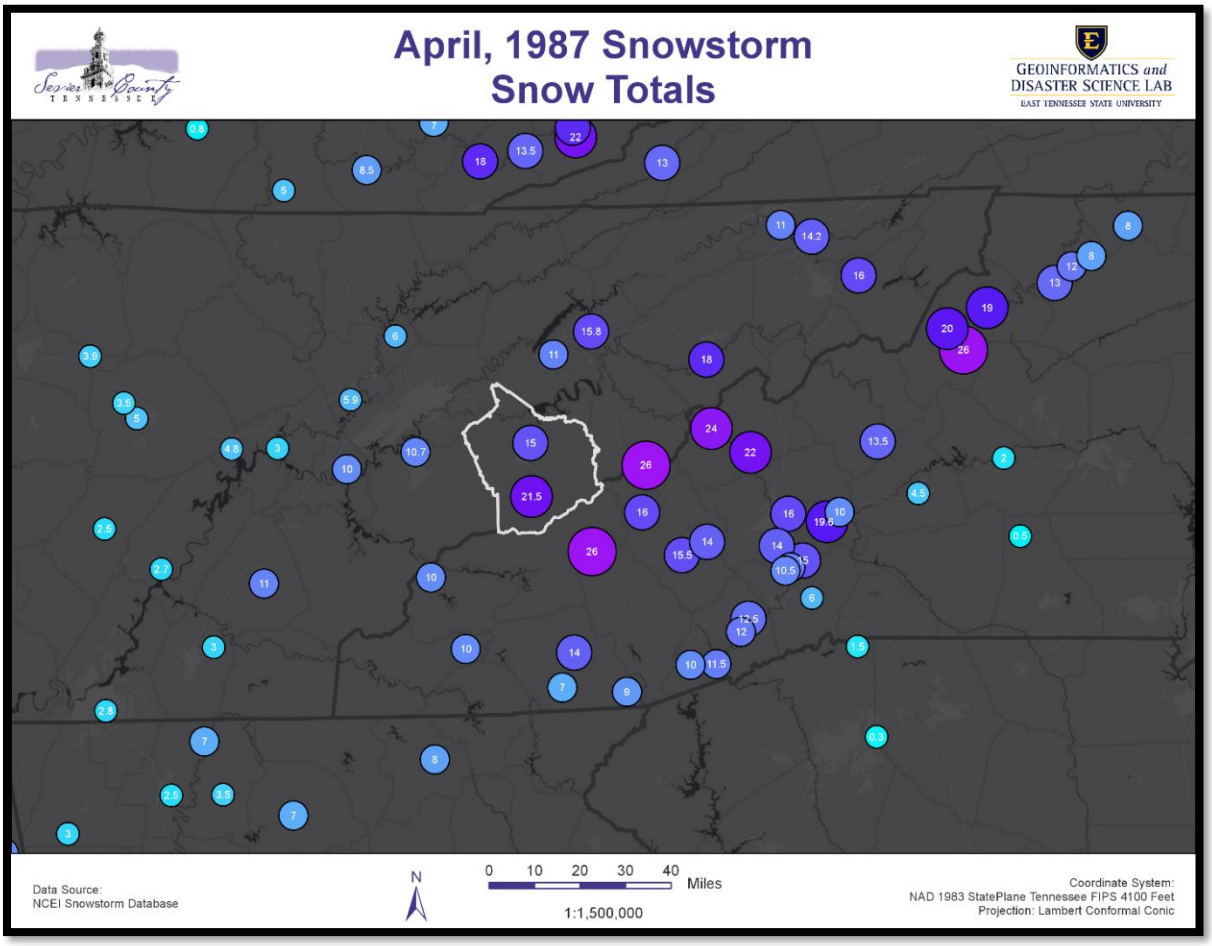

Figure 6-18: Station reported snowfall totals from the April 1987 snowstorm. This event resulted in the highest single day snowfall total for Sevierville, TN (north of Gatlinburg).

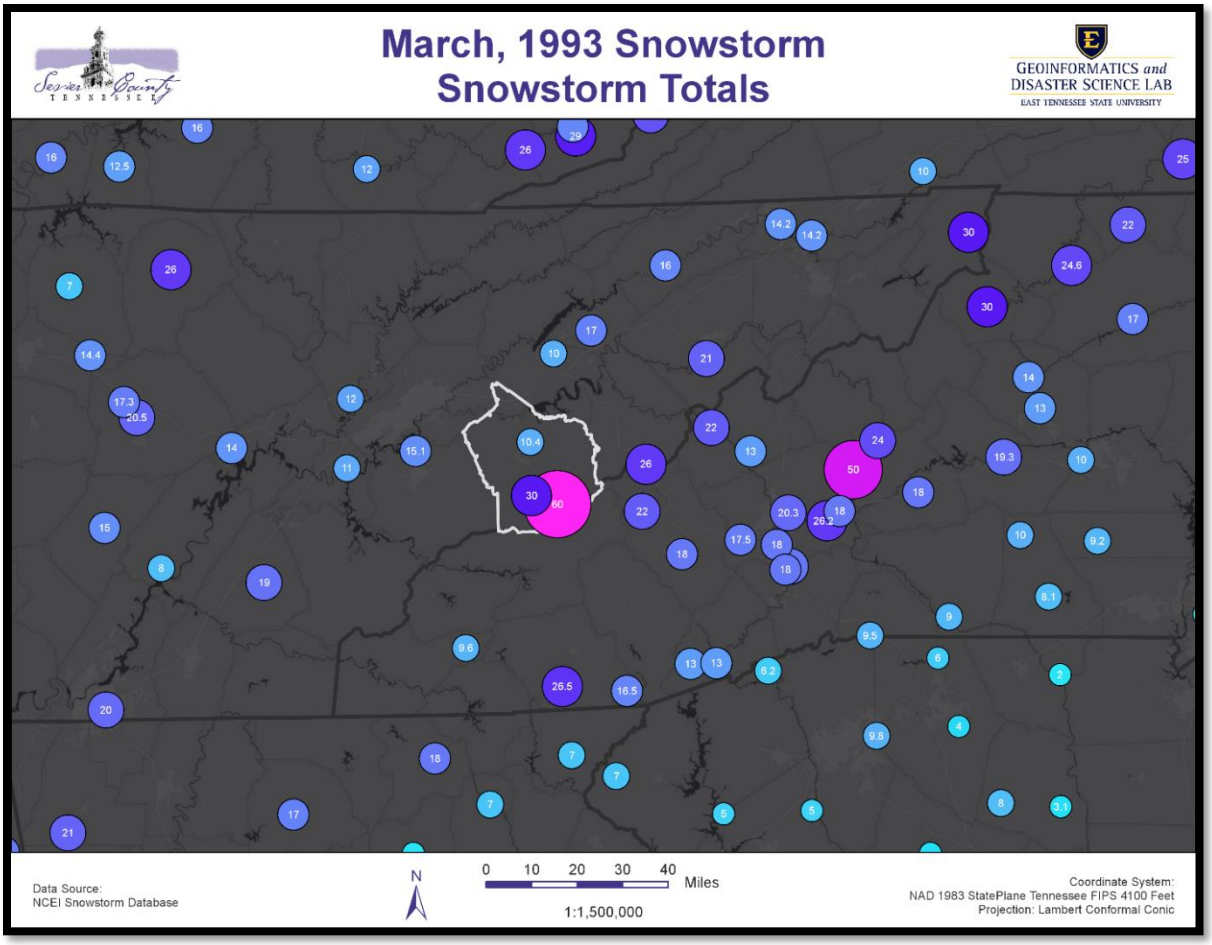

Figure 6-19: Station reported snowfall totals from the March 1993 snowstorm. This event resulted in the highest single day snowfall total for Gatlinburg, TN.

Previous Occurrences

Historically, there have been 102 winter storm events in the unincorporated area of Sevier County and Gatlinburg from 1996 to 2018. There have been no injuries or fatalities due to winter storm events in the Sevier County planning area. The following table briefly outlines the winter storm events that have occurred in the unincorporated area of Sevier County and Gatlinburg.

Table 6-10: Winter Storm Incidents from 1996 to 2018 with Total Losses.
(Source: NCEI Storm Events Database)

Date	Location	Injuries	Fatalities	Property Damage	Crop Damage
1/6/1996	GATLINBURG	0	0	$0	$0
1/6/1996	SOUTHWEST PART	0	0	$0	$0
1/11/1996	SEVIERVILLE	0	0	$0	$0
1/11/1996	GATLINBURG	0	0	$0	$0
2/2/1996	EXTREME N PART OF CO	0	0	$0	$0
2/2/1996	SEVIERVILLE	0	0	$0	$0
3/19/1996	SEYMOUR	0	0	$5,000	$0

Date	Location	Injuries	Fatalities	Property Damage	Crop Damage
3/19/1996	COUNTYWIDE	0	0	$0	$0
12/18/1996	COUNTYWIDE	0	0	$0	$0
12/18/1996	SEVIERVILLE	0	0	$0	$0
1/10/1997	COUNTYWIDE	0	0	$0	$0
1/10/1997	PIGEON FORGE	0	0	$0	$0
12/30/1997	GATLINBURG	0	0	$0	$0
12/30/1997	KODAK	0	0	$0	$0
1/27/1998	GATLINBURG	0	0	$0	$0
1/27/1998	SEVIERVILLE	0	0	$0	$0
1/6/1999	SEVIERVILLE	0	0	$0	$0
1/6/1999	SEVIERVILLE	0	0	$0	$0
3/3/1999	PIGEON FORGE	0	0	$0	$0
3/3/1999	SEVIERVILLE	0	0	$0	$0
3/13/1999	KODAK	0	0	$0	$0
3/13/1999	KODAK	0	0	$0	$0
3/26/1999	BEECH SPGS	0	0	$0	$0
3/26/1999	KODAK	0	0	$0	$0
1/22/2000	PIGEON FORGE	0	0	$0	$0
1/22/2000	SEYMOUR	0	0	$0	$0
12/2/2000	PIGEON FORGE	0	0	$0	$0
12/2/2000	PIGEON FORGE	0	0	$0	$0
12/18/2000	COUNTYWIDE	0	0	$0	$0
12/18/2000	COUNTYWIDE	0	0	$5,000	$0
1/1/2001	GATLINBURG	0	0	$0	$0
1/1/2001	GATLINBURG	0	0	$0	$0
1/20/2001	SEVIERVILLE	0	0	$0	$0
1/20/2001	KODAK	0	0	$0	$0
3/20/2001	HATCHERTOWN	0	0	$0	$0
3/20/2001	SEVIERVILLE	0	0	$0	$0
1/5/2002	KODAK	0	0	$2,000	$0
1/5/2002	SEYMOUR	0	0	$0	$0
12/4/2002	CEDAR BLUFF	0	0	$0	$0
1/5/2003	PIGEON FORGE	0	0	$0	$0
1/16/2003	PITTMAN CENTER	0	0	$0	$0
1/16/2003	COUNTYWIDE	0	0	$0	$0
1/22/2003	COUNTYWIDE	0	0	$0	$0
1/22/2003	SEVIERVILLE	0	0	$0	$0
2/7/2003	SEYMOUR	0	0	$0	$0
2/9/2003	COUNTYWIDE	0	0	$0	$0
4/10/2003	GATLINBURG	0	0	$0	$0
12/18/2003	COUNTYWIDE	0	0	$0	$0

Date	Location	Injuries	Fatalities	Property Damage	Crop Damage
12/19/2003	GATLINBURG	0	0	$0	$0
1/9/2004	GATLINBURG	0	0	$0	$0
1/9/2004	BOYDS CREEK	0	0	$0	$0
2/7/2004	WALDEN CREEK	0	0	$0	$0
12/11/2004	KODAK	0	0	$0	$0
12/19/2004	GATLINBURG	0	0	$0	$0
2/10/2005	SEVIERVILLE	0	0	$0	$0
2/28/2005	KODAK	0	0	$0	$0
11/21/2005	KODAK	0	0	$0	$0
1/14/2006	COUNTYWIDE	0	0	$0	$0
2/11/2006	SEYMOUR	0	0	$0	$0
2/18/2007	COUNTYWIDE	0	0	$0	$0
1/16/2008	PIGEON FORGE	0	0	$0	$0
2/27/2008	PIGEON FORGE	0	0	$0	$0
2/3/2009	COUNTYWIDE	0	0	$0	$0
4/7/2009	KODAK	0	0	$0	$0
12/18/2009	SEVIERVILLE	0	0	$0	$0
1/29/2010	SEYMOUR	0	0	$0	$0
1/29/2010	SEVIERVILLE	0	0	$0	$0
2/9/2010	SEYMOUR	0	0	$0	$0
2/24/2010	KODAK	0	0	$0	$0
12/6/2010	PIGEON FORGE	0	0	$0	$0
12/6/2010	KODAK	0	0	$0	$0
12/12/2010	SEVIERVILLE	0	0	$0	$0
12/12/2010	SEVIERVILLE	0	0	$0	$0
12/12/2010	COUNTYWIDE	0	0	$0	$0
12/12/2010	SEVIERVILLE	0	0	$0	$0
12/25/2010	SEVIERVILLE	0	0	$0	$0
12/26/2010	COUNTYWIDE	0	0	$0	$0
12/26/2010	GATLINBURG	0	0	$0	$0
12/26/2010	SEVIERVILLE	0	0	$0	$0
10/28/2012	SEVIERVILLE	0	0	$0	$0
10/28/2012	KODAK	0	0	$0	$0
10/28/2012	SEYMOUR	0	0	$0	$0
10/28/2012	SEVIERVILLE	0	0	$0	$0
1/17/2013	SEVIERVILLE	0	0	$0	$0
3/5/2013	PITTMAN CENTER	0	0	$0	$0
3/25/2013	GATLINBURG	0	0	$0	$0
11/26/2013	GATLINBURG	0	0	$0	$0
2/12/2014	KODAK	0	0	$0	$0
2/13/2014	COUNTYWIDE	0	0	$0	$0

Date	Location	Injuries	Fatalities	Property Damage	Crop Damage
3/29/2014	GATLINBURG	0	0	$0	$0
11/1/2014	COUNTYWIDE	0	0	$0	$0
2/17/2015	WALDEN CREEK	0	0	$1,000	$0
2/25/2015	KODAK	0	0	$0	$0
2/26/2015	CATLETTSBURG	0	0	$0	$0
1/20/2016	PITTMAN CENTER	0	0	$0	$0
1/22/2016	SEVIERVILLE	0	0	$0	$0
2/8/2016	SEVIERVILLE	0	0	$0	$0
1/6/2017	PIGEON FORGE	0	0	$0	$0
12/8/2017	GATLINBURG	0	0	$0	$0
1/29/2018	SEVIERVILLE	0	0	$0	$0
12/9/2018	BOYDS CREEK	0	0	$0	$0
12/21/2018	CATLETTSBURG	0	0	$0	$0

Since the last plan update, there have been 23 winter storm events that have occurred within the unincorporated areas of Sevier County and Gatlinburg.

Incidents/Probability

The NCEI Storm Events Database reports 102 winter storm events within the boundaries of Sevier County between the years 1996 and 2018. With 102 events, the annual return rate (frequency) for winter storm events in the unincorporated area of Sevier County and Gatlinburg is eight to nine events every year. This equates to an annual probability of approximately 100%.

6.1.14 Dam Failure

Location & Extent

Dams have been an important part of Sevier County's water infrastructure. In addition to the historic economic benefits provided by dams, they are used for flood control, water supply, power generation, recreation, and for mitigating the impact of increased runoff typically caused by land use changes associated with property development. The United Sates Army Corps of Engineers maintains a national inventory of dams in Sevier County.

In addition to proximity, the level of failure and meteorological conditions during a dam failure will greatly contribute to the extent of an incident. A minor failure will have lesser impacts than a total dam failure. Weather conditions also affect extent, as a dam failure without rainy conditions will have lesser extent, but the population will likely receive less warning. Conversely, rainy conditions exacerbate impacts, but allow for more warning due to expected failure.

According to the Federal Guidelines for Dam Safety, two (2) factors influence the severity of a dam failure: the amount of water impounded and the density, type, and value of development and infrastructure located downstream. Most dam failures are described by their potential point of inundation; the hazard potential levels of low, significant and high are further defined in the table below, while the figure on the following page provides a map of the locations of significant- and high-hazard dams. The magnitude and

severity of dam failures may also be assessed in terms of damage, including loss of life and injury, damage to infrastructure, loss of services or utilities, debris, and economic damage. The following figure shows dams in Sevier County and their hazard level.

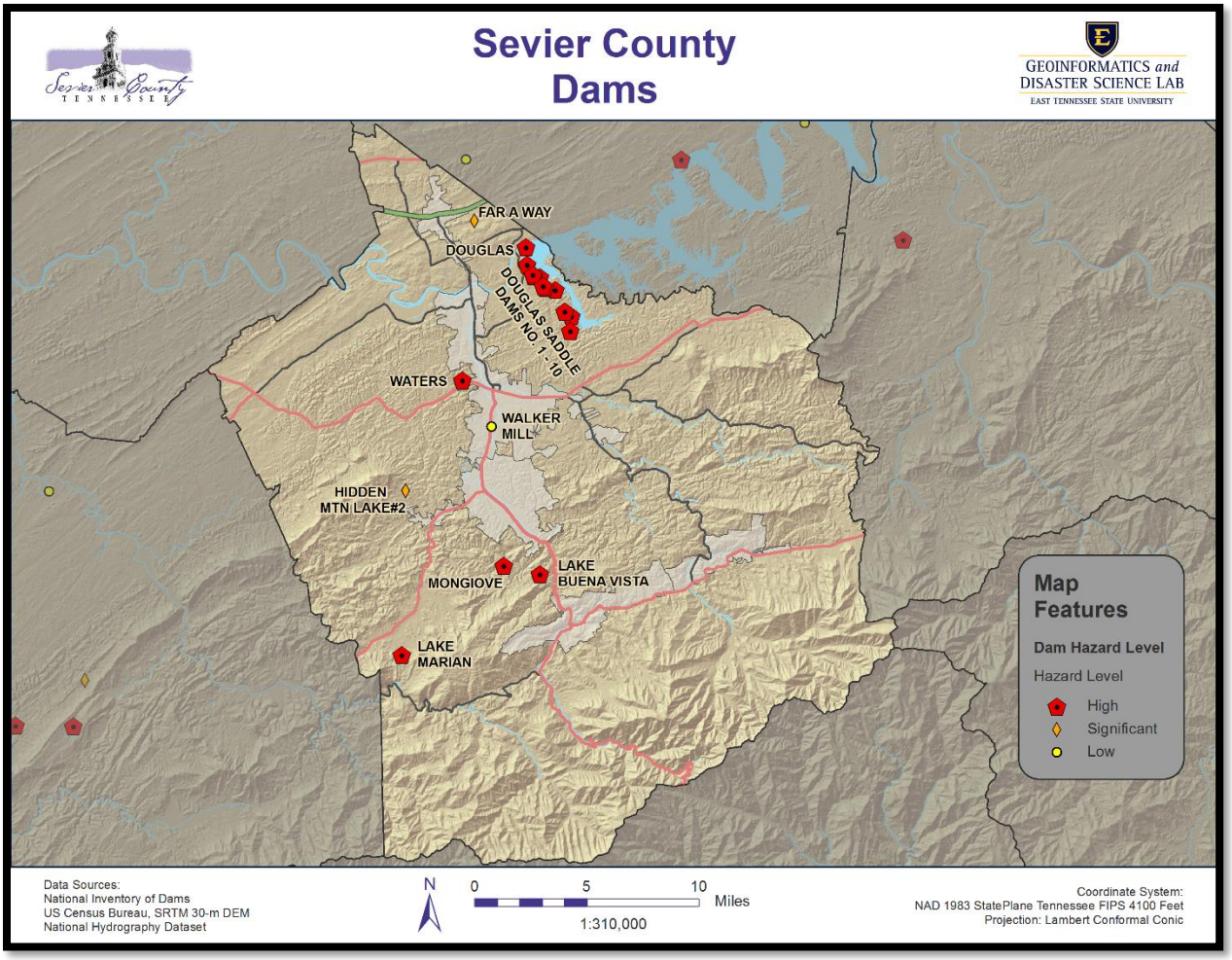

Figure 6-20: Dam Locations with Hazard Level in Sevier County.

Previous Occurrences

Sevier County and Gatlinburg have experienced no dam failures from 1989 to 2018 nor since the last update of the county hazard mitigation plan.

Incidents/Probability

Based on historical records, the annual chance of occurrence for a dam failure is calculated at less than 1% for the county. However, based on the best available data, no dam failures would impact Gatlinburg.

6.1.15 Infrastructure Failure

Location & Extent

Critical infrastructure is located throughout the county. Predicting the precise location of the next infrastructure failure is often difficult and generally dependent on the quality, upkeep, and maintenance

of each piece of infrastructure as well as any protective actions that can mitigate or prevent sources of failure.

The failure of these structures could have potentially devastating impacts, including significant disruption to essential facilities, economic and financial impacts, and physical damage to infrastructure. The reliance of virtually all industries on transportation networks is of key importance. A significant event could have cascading effects on other infrastructure.

Previous Occurrences

Oftentimes, smaller scale infrastructure failures occur as a secondary impact from a natural disaster, such as a temporary closure of a road due to a mass wasting event. Sevier County and Gatlinburg experience these disruptions occasionally and manages them through coordination across agencies. When infrastructure does fail, the county responds quickly to repair the infrastructure.

Incidents/Probability

In general, the county has not experienced any direct, prolonged catastrophic infrastructure failures. However, a significant failure of infrastructure could result in severe disruptions to public life and overall response efforts. Overall, Sevier County and Gatlinburg are vulnerable to infrastructure failure; however, the probability of occurrence is calculated at less than 1% based on previous occurrences.

6.1.16 Civil Disobedience/Terrorism

Location & Extent

Because of their often-spontaneous nature, it is difficult to pinpoint a location for the occurrence of a civil disturbance or terrorism event. However, monitoring social trends and social media can often inform responders about where potential demonstrations or acts of violence may take place. In addition, information gathered in advance may warn officials and provide locations of sites of potential future disturbances or acts of terrorism. Oftentimes, demonstrations and large, crowded gatherings begin peacefully and escalate to instances of sometimes-violent civil disturbance.

Instances of civil disobedience may originate from a number of different public gatherings, including political rallies, sporting events, and peaceful protests. Civil disturbance and acts of terrorism are typically seen in larger urban areas rather than rural unincorporated areas.

The severity of a civil disturbance incident depends on the nature of the disturbance. Significant disturbances can result in mass arrests, civilian curfews, intensive response efforts, property damage, injuries, and deaths. In general, civil disturbance impacts can range from low to high depending on the severity of the incident.

Police dispatched to control traffic corridors or intrusion on private property is considered a low severity civil disturbance. Disruption of businesses and potential property damage are assessed as a moderate civil disturbance. In these cases, police intervention would be required to restore order without employing chemical agents or physical force. A severe civil disturbance incident would involve rioting, arson, looting, assault, and death, where aggressive police action (tear gas, curfews, and mass arrests) may be required.

Civil disturbances may take on different characteristics depending on the severity of an incident. Each level of severity—low, medium, or high—poses risk to property. A low severity rating may be given to a

localized event that results in minimal to no property damage, minimal police action, and no physical harm to the participants, bystanders, or police. While low severity disturbances may simply disrupt usual business activity due to large crowds and inability to access businesses and possibly residences, they have the potential to become incidents of medium or even high severity due to the amount of people involved and the sometimes emotionally-charged atmosphere that can result. A localized event that results in damage to property, police action, and physical harm to people involved, such as police or protestors, may be considered moderately severe. A moderately severe event may cause some damage to businesses and residences but overall the damage is limited.

Civil disturbances involving emotionally-charged and highly contentious business, police, or political action, or unrest based on the outrage of a segment of the population, could be considered high severity. The results and extent of severe civil disturbances are expected to range from financially burdensome on businesses facing considerable damage and possibly looting to potential destruction of public and private property as well as fire and subsequent smoke damage.

Previous Occurrences

Sevier County and its jurisdictions recently experienced what could be considered an act of terrorism – the only such event of note from 1996 to 2019, and since the last plan update

Tanger Outlet Shooting

A gunman opened fire at the Tanger Outlet Mall in Sevierville on April 16, 2019, killing one person and wounded another before killing himself. The shooting appeared to be random, confirming that such events could happen anywhere and anytime, but most often in event areas or high population areas.

Incidents/Probability

Civil disturbances and acts of terrorism have a low probability of occurring in Gatlinburg. Based on previous occurrences and location, there is less than a 5% annual chance of occurrence for civil disturbances and acts of terrorism in the unincorporated areas of Sevier County and Gatlinburg.

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6.2 Vulnerability Assessment

6.2.1 Communicable Diseases Vulnerability

Estimated Impact and Potential Loss

Communicable disease does not have the potential to impact property and crops; however, livestock operations throughout Sevier County and Gatlinburg are subject to disease outbreaks.

Vulnerable Population

Many communicable diseases are transmitted by vectors, such as mosquitoes, ticks, and fleas. Vectors can transmit an array of pathogens, such as viruses, bacteria, and protozoa, which can cause illness in humans (or humans and animals). While everyone in Sevier County and Gatlinburg are susceptible to communicable disease, special attention should be paid to highly vulnerable populations such as those who are socioeconomically disadvantaged, young children, and the elderly.

Vulnerability Score

Table 6-11: Communicable Disease Vulnerability Score.

	Communicable Diseases Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	4	2	3	4	2	1.55	**2.6**

6.2.2 Drought Vulnerability

Estimated Impact and Potential Loss

According to the NCEI database, there has been one drought event that has caused some level of crop damage. The total agricultural damage from this event was $2,000. When annualizing the total cost over the 23-year record, total annual losses based on drought is estimated to be $83. The following table presents an analysis of agricultural exposure that is susceptible to drought by major crop type for Sevier County.

Table 6-12: Agricultural Exposure by Crop Type for Drought in Sevier County.
(Source: United States Department of Agriculture 2017 Census)

Agricultural Exposure by Crop Type for Drought				
Nursery Plants	Hay	Corn	Dry Peas	Soybeans
$428,000	$1,384,000	$98,000	$135,000	$31,000

Vulnerable Population

Drought typically has a larger impact on the agricultural community, and does not directly affect human life or health. However, drought can exacerbate other hazardous conditions, especially wildfires. There have been no reported injuries or loss of life due to drought in Sevier County and Gatlinburg.

Vulnerability Score

Table 6-13: Drought Vulnerability Score.

	Drought Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	3	2	4	1	4	1.6	**2.5**

6.2.3 Earthquake Vulnerability

Estimated Impact and Potential Loss

Sevier County and Gatlinburg are vulnerable to earthquake hazards; however, the impact is largely unknown since there has yet to be an earthquake that has caused any property or crop damage. The USGS database shows that there is a 6.34% chance of a major earthquake (5.0 or greater) within 50 miles of Sevier County and Gatlinburg within the next 50 years.

Vulnerable Population

There has been no recorded earthquake event that has caused loss of life or injuries in the state of Tennessee per the Tennessee Hazard Mitigation Plan, so the impact on population is largely unknown in Sevier County and Gatlinburg.

Vulnerability Score

Table 6-14: Earthquake Vulnerability Score.

	Earthquake Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	1	1	4	4	1	1	**1.7**

6.2.4 Extreme Temperature Vulnerability

Estimated Impact and Potential Loss

All of the Sevier County planning area is vulnerable to extreme temperatures. Extreme heat occurrences often transpire in conjunction with drought occurrences, which leaves soil susceptible to desiccation. Extreme cold occurrences impact all utilities in the area such as exposed pipes that can freeze and burst. Based on historical data, there has been no property damage as a result of extreme temperatures; however, extreme temperatures have the potential to cause thousands of dollars in property damage.

Vulnerable Population

Residents of Sevier County and Gatlinburg who are elderly or in poor health are at acute risk along with residents who work outside in the extreme conditions.

Vulnerability Score

Table 6-15: Extreme Temperatures Vulnerability Score.

	Extreme Temperatures Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	4	3	4	1	3	2.05	**3.0**

6.2.5 Flood Including Extreme Precipitation Vulnerability

Estimated Impact and Potential Loss

Using the Hazus 4.2 Flood Model, along with the Sevier County and Gatlinburg Digital Flood Insurance Rate Maps, the 100-year flood scenario was analyzed to determine losses for the scenario. The following table displays the total economic losses that would result from a 100-year flood scenario.

Table 6-16: Estimated Losses for 100-Year Flood Scenario in Sevier County and its Jurisdictions.

Jurisdiction	Estimated Total Losses
Sevier County (Unincorporated)	$634,000
Gatlinburg	$784,000
Pigeon Forge	$880,000
Pittman Center	$51,000
Sevierville	$960,000
Total	**$3,309,000**

The Hazus 4.2 Flood Model also provided a breakdown by jurisdiction for seven primary sectors throughout Gatlinburg. The losses for Gatlinburg are listed in the following table.

Table 6-17: Estimated Losses for 100-Year Flood Scenario in Gatlinburg by Sector.

Gatlinburg	Estimated Total Losses
Agricultural	$0
Commercial	$344,000
Government	$4,000
Industrial	$100,000
Religious/Non-Profit	$2,000
Residential	$326,000
Education	$8,000
Total	**$784,000**

Vulnerable Population

The total population within the county that is susceptible to a flood hazard is shown in the table below:

Table 6-18: Vulnerable Populations Susceptible to a 100-Year Flood Event for Sevier County and its Jurisdictions.

Number of People Exposed to Flood Hazards			
Jurisdiction	**# in Community**	**# in Hazard Area**	**% in Hazard Area**
Sevier County (Unincorporated)	64,761	6,848	10.6%
Gatlinburg	3,944	977	24.8%
Pigeon Forge	5,875	1,433	24.4%
Pittman Center	502	74	14.7%
Sevierville	14,807	3,144	21.2%
Total	**89,889**	**12,476**	**13.9%**

The Hazus 4.2 Flood Model was also extrapolated to provide an overview of vulnerable populations throughout Sevier County and Gatlinburg. The following table identifies the vulnerable population to floods in Gatlinburg.

Table 6-19: Vulnerable Populates Susceptible to a 100-Year Flood Event in Gatlinburg.

Gatlinburg		
Category	**Total Numbers**	**% of People in Hazard Area**
Number in Hazard Area	977	24.8%
Persons Under 5 Years	50	5.2%
Persons Under 18 Years	160	16.4%
Persons 65 Year and Over	180	18.5%
Caucasian	834	85.3%
Minority	143	14.7%

Vulnerability Score

Table 6-20: Flooding including Extreme Precipitation Vulnerability Score.

	Flooding including Extreme Precipitation Vulnerability Score						
	Probability	**Impact**	**Spatial Extent**	**Warning Time**	**Duration**	**Vulnerability**	**Risk Factor**
Risk Level	3	2	3	3	2	3	**2.7**

6.2.6 Mass Wasting

The entire planning area within Sevier County is susceptible to the effects of mass wasting events. Mass wasting events can cause serious damage to highways, buildings, homes, and other structures that support a wide range of economies and activities. Mass wasting events commonly coincide with other natural disasters such as extreme precipitation events. Expansion of urban development contributes to greater risk of damage by mass wasting.

The USGS recognizes six major impacts caused by mass wasting events:

1. Causes damage in all 50 states, Puerto Rico, and the U.S. Virgin Islands
2. Costs $3.5 billion per year in damage repair
3. Causes between 25 and 50 deaths in the United States annually
4. Reduces real estate values and tourist revenue
5. Leads to lost human, industrial, agricultural, and forest productivity
6. Causes damage to the natural environment

Vulnerable Population

Mass wasting events typically impacts motorists and those living in the vicinity of a vulnerable area. This is demonstrated in a mass wasting event which occurred on August 1, 2019 in Gatlinburg when a tree fell from a slope and fatally injured a 73-year old man. The lack of a detailed mass wasting inventory makes research on the vulnerability of people to mass wasting events highly limited.

Vulnerability Score

Table 6-21: Mass Wasting Vulnerability Score.

	Mass Wasting Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	3	2	2	4	4	3.15	**2.8**

6.2.7 Severe Wind Vulnerability

Estimated Impact and Potential Loss

Since 1996, there have been two reported severe wind events that have occurred within the boundaries of Sevier County and Gatlinburg. The total property damages associated with these events have totaled $22,000. To estimate the potential losses of a severe wind event on an annual basis, the total damage recorded for severe wind events was divided by the total number of years of available severe wind data (1996 - 2018). This provides an annual estimated potential loss of $957. To assess potential losses to the participating jurisdictions, the 2010 Census population was used to assign the estimated potential losses proportionally across the jurisdictions. The following table provides an estimate of potential property losses for Sevier County and its jurisdictions based on the 2010 Census data:

Table 6-22: Estimated Annual Losses for Severe Wind Events in Sevier County and its Jurisdictions.

Unincorporated Sevier County (72.0% of Population)	Gatlinburg (4.4 % of Population)	Pigeon Forge (6.5% of Population)	Pittman Center (0.6% of Population)	Sevierville (16.5% of Population)
$689	$42	$63	$5	$158

Vulnerable Population

There have been no recorded severe wind event that has caused loss of life or injuries in Sevier County and Gatlinburg; however, these events have the potential to significantly impact the aviation community in these areas.

Vulnerability Score

Table 6-23: Severe Wind Vulnerability Score.

	Severe Wind Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	2	2	2	4	1	3.6	**2.5**

6.2.8 Sinkhole Vulnerability

Estimated Impact and Potential Loss

The entire Sevier County planning area is susceptible to subsidence and sinkholes based on the karst topography of the region. While sinkholes have a higher risk of forming in the northern portions of the county, the southern portion is also susceptible to sinkholes.

Vulnerable Population

There are no reported fatalities or injuries associated with sinkhole events.

Vulnerability Score

Table 6-24: Sinkhole Vulnerability Score.

	Sinkhole Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	2	2	1	4	1	1	**1.7**

6.2.9 Thunderstorm Vulnerability

Hail

Estimated Impact and Potential Loss

Since 1996, there have been 25 reported hail events that have occurred within the boundaries of Sevier County and Gatlinburg. The total property damages associated with these events have totaled $13,700. To estimate the potential losses of a hail event on an annual basis, the total damage recorded for hail events was divided by the total number of years of available hail data (1996 - 2018). This provides an annual estimated potential loss of $596. To assess potential losses to the participating jurisdictions, the 2010 Census population was used to assign the estimated potential losses proportionally across the jurisdictions. The following table provides an estimate of potential property losses for Sevier County and its jurisdictions based on the 2010 Census data:

Table 6-25: Estimated Annual Losses for Hail Events in Sevier County and its Jurisdictions.

Unincorporated Sevier County (72.0% of Population)	Gatlinburg (4.4 % of Population)	Pigeon Forge (6.5% of Population)	Pittman Center (0.6% of Population)	Sevierville (16.5% of Population)
$429	$26	$39	$3	$98

Vulnerable Population

There have been no reported injuries or fatalities associated with hail events in Sevier County and Gatlinburg.

Hail Vulnerability Score

Table 6-26: Hail Vulnerability Score.

	Hail Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	4	2	4	3	1	4	**3.2**

Lightning

Estimated Impact and Potential Loss

Since 1996, there have been two reported lightning events that have occurred within the boundaries of Sevier County and Gatlinburg. There has been no reported property or crop damage associated with lightning within the boundaries of Sevier County.

Vulnerable Population

There has been one reported fatality from lightning that has occurred within the boundaries of Sevier County and Gatlinburg. On July 10, 2004, a man was struck by lightning while he was fishing on Douglas Lake. The boat was several hundred yards from Douglas Dam when the incident occurred. He was rendered unconscious and fell into the water.

Lightning Vulnerability Score

Table 6-27: Lightning Vulnerability Score.

	Lightning Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	2	1	2	3	1	4	**2.3**

Wind

Estimated Impact and Potential Loss

Since 1996, there have been 189 reported thunderstorm wind events that have occurred within the boundaries of Sevier County and Gatlinburg. The total property damages associated with these events have totaled $3,089,000. To estimate the potential losses of a thunderstorm wind event on an annual basis, the total damage recorded for thunderstorm wind events was divided by the total number of years of available thunderstorm wind data (1996 - 2018). This provides an annual estimated potential loss of $134,304. To assess potential losses to the participating jurisdictions, the 2010 Census population was used to assign the estimated potential losses proportionally across the jurisdictions. The following table provides an estimate of potential property losses for Sevier County and its jurisdictions based on the 2010 Census data:

Table 6-28: Estimated Annual Losses for Thunderstorm Wind Events in Sevier County and its Jurisdictions.

Unincorporated Sevier County (72.0% of Population)	Gatlinburg (4.4 % of Population)	Pigeon Forge (6.5% of Population)	Pittman Center (0.6% of Population)	Sevierville (16.5% of Population)
$96,760	$5,893	$8,778	$750	$22,123

Vulnerable Population

There have been no reported injuries or fatalities associated with thunderstorm wind events in Sevier County and Gatlinburg.

Wind Vulnerability Score

Table 6-29: Wind Vulnerability Score.

	Wind Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	4	2	4	3	1	4	**3.2**

6.2.10 Tornado Vulnerability

Estimated Impact and Potential Loss

Since 1996, there have been three reported tornadoes that have occurred within the boundaries of Sevier County and Gatlinburg. The total property damages associated with these tornadoes have totaled $58,000. To estimate the potential losses of a tornado on an annual basis, the total damage recorded for thunderstorm wind events was divided by the total number of years of available thunderstorm wind data (1996 - 2018). This provides an annual estimated potential loss of $2,522. To assess potential losses to the participating jurisdictions, the 2010 Census population was used to assign the estimated potential losses proportionally across the jurisdictions. The following table provides an estimate of potential property losses for Sevier County and its jurisdictions based on the 2010 Census data:

Table 6-30: Estimated Annual Losses for Tornado Events in Sevier County and its Jurisdictions.

Unincorporated Sevier County (72.0% of Population)	Gatlinburg (4.4 % of Population)	Pigeon Forge (6.5% of Population)	Pittman Center (0.6% of Population)	Sevierville (16.5% of Population)
$1,817	$111	$165	$14	$415

Vulnerable Population

There have been no reported injuries or fatalities associated with tornadoes; however, residents living in manufactured housing are more vulnerable to tornadoes and are more likely to sustain higher damage totals due to the construction materials. Approximately 22% of all buildings in Sevier County and Gatlinburg are manufactured housing. The following table presents an analysis of building exposure that is susceptible to tornadoes by general occupancy type for Sevier County, along with the percentage of building stock that are manufactured homes.

Table 6-31: Building Exposure by General Occupancy Type for Tornadoes in Sevier County ($1,000).

Residential	Commercial	Industrial	Agricultural	Religion	Government	Education	Manufactured Homes
9,332,162	1,574,531	333,255	31,641	201,848	47,906	95,279	22%

Vulnerability Score

Table 6-32: Tornado Vulnerability Score.

	Tornado Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	3	2	2	4	3	1	**2.2**

6.2.11 Tropical Cyclone (Hurricane) Vulnerability

Estimated Impact and Potential Loss

There has been no reported property or crop damage associated with tropical cyclones within the boundaries of Sevier County and Gatlinburg.

Vulnerable Population

There have been no reported injuries or deaths associated with tropical cyclone within the boundaries of Sevier County and Gatlinburg.

Vulnerability Score

Table 6-33: Tropical Cyclone Vulnerability Score.

	Tropical Cyclone Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	1	1	4	1	2	1	**1.5**

6.2.12 Wildfires/Conflagration Vulnerability

Estimated Impact and Potential Loss

The entire Sevier County planning area is located near areas of wildland-urban interface and intermix or other susceptible land use/land cover types, which makes them vulnerable to wildfires. Southern areas of Sevier County (such as Gatlinburg) are particularly vulnerable since they are located within the Great Smoky Mountain National Park. In November of 2016, a wildfire in Sevier County turned into the largest interface fire to affect the state of Tennessee in 100 years, resulting in $911 million in property and content loss.

Vulnerable Population

Gatlinburg residents near areas of wildland-urban interface and intermix and other wooded land cover types are vulnerable to the effects of wildfire. Fourteen fatalities and 221 people were treated for fire-related injuries in November 2016 when the largest interface fire to affect the state of Tennessee in 100 years occurred in Sevier County.

Vulnerability Score

Table 6-34: Wildfires/Conflagration Vulnerability Score.

	Wildfires/Conflagration Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	4	4	4	2	4	4	**3.9**

6.2.13 Winter Storm Vulnerability

Estimated Impact and Potential Loss

Since 1996, there have been 102 reported winter storm events which have occurred within the boundaries of Sevier County and Gatlinburg. The total property damages associated with these storms have totaled $13,000. To estimate the potential losses of a winter weather event on an annual basis, the total damage recorded for winter storm events was divided by the total number of years of available winter storm data (1996 - 2018). This provides an annual estimated potential loss of $565. To assess potential losses to the participating jurisdictions, the 2010 Census population was used to assign the estimated potential losses proportionally across the jurisdictions. The following table provides an estimate of potential property losses for Sevier County and Gatlinburg based on the 2010 Census data:

Table 6-35: Estimated Annual Losses for Winter Storm Events in Sevier County and its Jurisdictions.

Unincorporated Sevier County (72.0% of Population)	Gatlinburg (4.4 % of Population)	Pigeon Forge (6.5% of Population)	Pittman Center (0.6% of Population)	Sevierville (16.5% of Population)
$407	$25	$37	$3	$93

There have been no injuries or fatalities due to winter storm events in the Sevier County planning area.

Vulnerable Population

All of Gatlinburg's residents are vulnerable to the effects of winter weather.

Vulnerability Score

Table 6-36: Winter Storm Vulnerability Score.

	Winter Storm Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	4	3	4	2	4	2.85	**3.3**

6.2.14 Dam Failure Vulnerability

Estimated Impact and Potential Loss

Sevier County and Gatlinburg are vulnerable to dam failures; however, the impact is largely unknown since there has yet to be a dam failure in the planning area.

Vulnerable Population

There have been no fatalities or injuries associated with dam failure in Sevier County and Gatlinburg; however, homes and businesses in immediate vicinity downstream of a dam location are vulnerable to the impacts of a dam failure. In Gatlinburg, no known dam locations are upstream from vulnerable populations.

Vulnerability Score

Table 6-37: Dam Failure Vulnerability Score.

	Dam Failure Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	1	3	1	3	3	1	**1.8**

6.2.15 Infrastructure Failure Vulnerability

Estimated Impact and Potential Loss

In general, Gatlinburg has not experienced any direct, prolonged catastrophic infrastructure failures. However, a significant failure of infrastructure could result in severe disruptions to public life and overall response efforts.

Vulnerable Population

There are no recorded fatalities or injuries associated with infrastructure failure in Gatlinburg.

Vulnerability Score

Table 6-38: Infrastructure Failure Vulnerability Score.

	Infrastructure Failure Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	1	3	2	4	3	3	**2.5**

6.2.16 Civil Disobedience/Terrorism Vulnerability

Estimated Impact and Potential Loss

The Sevier County planning area experienced one civil disobedience/terrorism event since 1996 (Tanger Outlet Shooting in April 2019), although this did not occur in Gatlinburg.

Vulnerable Population

There were two fatalities and one injury associated with civil disobedience/terrorism events.

Vulnerability Score

Table 6-39: Civil Disobedience/Terrorism Vulnerability Score.

	Civil Disobedience Terrorism Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	1	4	4	4	1	3	**2.9**

6.3 Capability Assessment

This section summarizes the results of the Sevier County Hazard Mitigation Planning Committee and other agency efforts to develop policies, programs, and activities that directly or indirectly support hazard mitigation. It also provides information on resources and gaps in the county's infrastructure, as well as relevant changes in its laws since the last Plan Update, in order to suggest a mitigation strategy. Through this assessment, Sevier County is able to identify strengths that could be used to reduce losses and reduce risk throughout the community. It also identifies areas where mitigation actions might be used to supplement current capabilities and create a more resilient community before, during, and after a hazard event.

Policies, Plans, and Programs

Sevier County and Gatlinburg capabilities are unique to the county as a whole, including planning, regulatory, administrative, technical, financial, education, and outreach resources. There are a number of mitigation-specific acts, plans, executive orders, and policies that address specific goals, objectives, and policy statements which already support or could support pre- and post-disaster hazard mitigation. Many of the ongoing plans and policies hold significant promise for hazard mitigation, and take an integrated and strategic look holistically at hazard mitigation in all jurisdictions to continually propose ways to improve it. These tools are valuable instruments in pre- and post-disaster mitigation as they facilitate the implementation of mitigation activities through the current legal and regulatory framework. Some examples of these types of planning and regulatory efforts for Sevier County and each jurisdiction are the following:

- Comprehensive/Master Plan
- Transportation Plan
- Local Emergency Operations Plan
- Community Wildfire Protection Plan
- Building Codes
- Flood Insurance Rate Maps
- Zoning Ordinance

Some programs and policies, such as the ones just described, might use complementary tools to achieve a common end, but fail to coordinate with or support each other. Thus, coordination among local mitigation policies and programs is essential to hazard mitigation.

Administration, Technical, and Financial

As a community, Sevier County and Gatlinburg have administrative and technical capabilities in place that may be utilized in reducing hazard impacts or implementing hazard mitigation activities. Such capabilities include staff, skillset, and tools available in the community that may be accessed to implement mitigation activities and to effectively coordinate resources. The following are resources in place for Sevier County and its incorporated jurisdictions:

- Maintenance programs to reduce risk (tree trimming, clearing drainage systems)
- Mutual Aid Agreements
- Emergency Manager
- Community Planner

- GIS Data
- Warning Systems/Services (Reverse 911, outdoor warning systems)
- Hazard Data & Information

Financial capabilities are the resources that Sevier County and its incorporated jurisdictions have access to or are eligible to use to fund mitigation actions. The following resources are available to fund mitigation actions in Sevier County and its incorporated jurisdictions:

- Capital Improvements Project Funding
- Authority to levy taxes for specific purposes
- Fees for water, sewer, gas, or electric services

Sevier County and its incorporated jurisdictions have existing programs to implement mitigation activities as well as communicate risk. The existing programs are as follows:

- Local citizen groups or non-profits focused on environmental protection, emergency preparedness, access and functional needs populations, etc.
- Ongoing public education or information programs (responsible water use, fire safety, household preparedness, wildfire preparedness)
- Storm Ready certification
- Firewise Communities certification

The following jurisdictions and entities are recognized by Sevier County under the Hazard Mitigation Plan allowing them to apply for available hazard mitigation funding for as long as these jurisdictions notify the county of their intentions and the county concurs:

- City of Gatlinburg
- City of Pigeon Forge
- Town of Pittman Center
- City of Sevierville
- Unincorporated Areas of Sevier County

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6.4 Summary

Table 6-40: Risk Assessment for the City of Gatlinburg.

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Overall Risk
Wildfires/ Conflagration	4	4	4	2	4	4.0	**3.9**
Winter Storms	4	3	4	2	4	2.9	**3.3**
Thunderstorms (Hail)	4	2	4	3	1	4.0	**3.2**
Thunderstorms (Wind)	4	2	4	3	1	4.0	**3.2**
Extreme Temperatures	4	3	4	1	3	2.1	**3.0**
Civil Disobedience/ Terrorism	1	4	4	4	1	3.0	**2.9**
Mass Wasting	3	2	2	4	4	3.2	**2.8**
Floods Including Extreme Precipitation	3	2	3	3	2	3.0	**2.7**
Communicable Disease	4	2	3	4	2	1.6	**2.6**
Infrastructure	1	3	2	4	3	3.0	**2.5**
Drought	3	2	4	1	4	1.6	**2.5**
Severe Wind	2	2	2	4	1	3.6	**2.5**
Thunderstorms (Lightning)	2	1	2	3	1	4.0	**2.3**
Tornadoes	3	2	2	4	3	1.0	**2.2**
Dam Failure	1	3	1	3	3	1.0	**1.8**
Earthquakes	1	1	4	4	1	1.0	**1.7**
Sinkholes	2	2	1	4	1	1.0	**1.7**
Tropical Cyclones	1	1	4	1	2	1.0	**1.5**

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7. City of Pigeon Forge

7.1 Risk Assessment

This section assesses the various hazard risks that the city of Pigeon Forge faces in order to identify a strategy for mitigation. Having identified the categories of hazards, emergencies, disasters, and catastrophes, this section details the major natural, technological, and human-caused hazards by (1) describing their geographic extent, (2) surveying their previous occurrences, and (3) evaluating their future likelihood of occurrences. To review news stories and other media related to previous occurrences, see Appendix D.

7.1.1 Communicable Diseases

Location & Extent

Tennessee maintains an extensive array of communicable disease personnel both inside and ancillary to the Communicable and Environmental Diseases and Emergency Preparedness (CEDEP) division. Communicable and Environmental Disease and Emergency Preparedness is a program area of the Tennessee Department of Health; it is assigned the responsibility of detecting, preventing, educating, and controlling infectious and environmentally-related illnesses of public health significance. Emergency management personnel are more frequently including pandemic and communicable disease drills in their exercise dockets at locations across the nation. The Centers for Disease Control and Prevention (CDC) has created a pandemic flu toolkit which is aligned with the pandemic phases outlined by the 2013 World Health Organization guidelines.

A biologic or communicable disease threat can occur anywhere, or anytime. Concentrated efforts must be made at surveillance in the following arenas:

Healthcare: Tennessee health care institutions serve as the front lines to communicable disease response and also as potential disease reservoir populations and points of cross contamination. Tennessee maintains excellent hospital and in-patient coverage in all 3 of its primary regions, with Level I trauma facilities. All Tennessee hospitals and healthcare facilities are required to report specific Healthcare Acquired Infections to the NHSN, the National Healthcare Safety Network. The NHSN is a web-based data reporting and submission program, which includes validation routines for many data elements, thus reducing common data entry errors. Hospitals can view, edit, and analyze their data at any time.

Education Facilities and Dormitories: The State of Tennessee mandates a vaccination series for all incoming resident students at educational facilities, consisting of measles, mumps, rubella, meningococcal meningitis, and varicella vaccines. In spite of these vaccine series, dormitory housing at colleges and universities have historically been susceptible to outbreaks of viral meningitis. Vaccination, along with immediate quarantine procedures should be adhered to with particular care in the academic setting where institutional controls are the primary mitigation technique with proven effectiveness

Previous Occurrences

Influenza

In 2012, Tennessee was listed by the CDC as one of the highest influenza burdened states in the nation. On average, 20% of the nation's population will contract the seasonal influenza every year. Tennessee

carries a higher than average mortality and morbidity rate for influenza and associated pneumonia, with 20.9 per 100,000 compared with the national average of 16.2 per 100,000.

HIV/AIDS

The incidence of HIV/AIDS and their associated comorbidities (including tuberculosis) increased in Tennessee from 2006 to 2012 across almost all ages, sexes, and races, with the exception of diagnosed AIDS cases in 2011, which decreased markedly. The 2 are categorized separately by both state and federal agencies due to differing mortalities and comorbidities for each. Currently in Tennessee, 18 community-based organizations are funded to implement a wide-range of science-based HIV prevention programs.

Tertiary Events

Hepatitis C

In 2012, the CDC revised its recommendations to include prophylactic screening for Hepatitis C for anyone born between the years 1945 and 1965. This screening is seen as paramount to reducing potential contamination in the blood supply as Hepatitis C is spread primarily through contaminated needles and drug use. Prior to 1992, blood supply screening techniques were not used resulting in Hep C being transmitted through blood transfusions and organ transplants. The most common mode of transmission for Hep A is person-to-person, resulting from fecal contamination and oral ingestion, and contaminated shellfish. In 1995, a major outbreak of Hepatitis A occurred in Tennessee with Shelby County documenting over 80% of the diagnosed cases. In the fall of 2003, approximately 80 cases were attributed to a Hepatitis A outbreak resulting from ingestion of contaminated green onions at a restaurant in East Tennessee.

Hepatitis B

Hepatitis B is transmitted through blood or body fluids, semen, cervical secretions, and saliva. People with chronic HBV infection are the primary reservoirs for infection. With the exception of the year 2001, from 1995 to 2002, Hepatitis B acute cases steadily decreased. The prevalence of HBV infection among adolescents and adults is 3 to 4 times greater for black individuals than white individuals. Children born to Hepatitis B Surface Antigen positive women are at high risk of becoming chronic carriers of hepatitis B. If these children are administered Hepatitis B Immune Globulin and hepatitis B vaccine at birth, their chances of being protected from the illness are greatly increased. The result is the endorsement of this mitigation procedure by the TDH and the CDC.

Incidents/Probability

The communicable disease events categorized by the CDC and the US Department of Labor as the most likely to adversely affect human performance are any and all strains of influenza. In a typical flu season, between 5% and 20% of the public contract influenza resulting in an average of 36,000 deaths. Pandemic flu viruses may cause illness in 20% to 40% of the population and cause more severe illness and deaths than ordinary seasonal influenza. A pandemic virus vaccine could take 6 to 8 months to produce in conjunction with CDC labs in Atlanta, limiting mitigation success in initial months of an outbreak. Because of this potential, the TDH and CDC consider influenza monitoring and reporting of critical importance.

Based on previous occurrences, there is a 100% annual chance of occurrence for communicable disease occurrence in Sevier County and Pigeon Forge.

7.1.2 Drought

Location & Extent

Drought typically impacts a region and not one specific county or jurisdiction. While the entire planning area can experience drought, the major impact of a drought event in Sevier County is on the agricultural community. There is no set speed of onset or warning period. A drought may begin in as short of period as a week or it may take months to reach an official declared drought. Additionally, the drought can last for as little as a week to up to the entire season.

While different parts of the county have experienced varying levels of drought severity, the location of drought conditions are more related to Sevier County's geographical location and the effects of climate on the region in general. Below is a map of the drought conditions in Sevier County in October 2019.

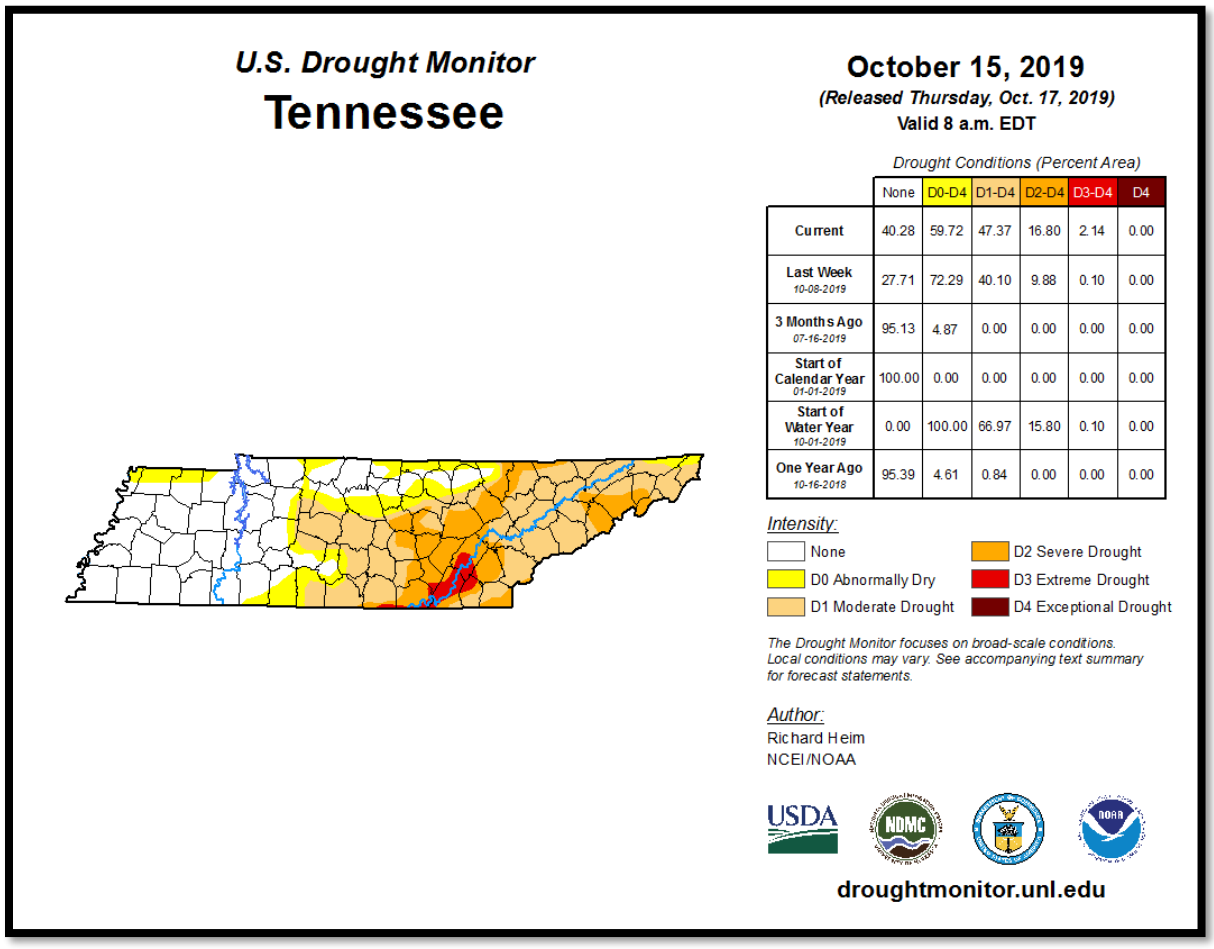

Figure 7-1: Drought Monitor for the State of Tennessee for the Week of October 15, 2019. (Source: U.S. Drought Monitor)

Previous Occurrences

The NCEI database reports a total of one drought event occurring within the boundaries of Sevier County between the years 1996 to 2017. The following table identifies the date of occurrence, estimated crop damage, and severity of the events that have occurred in Sevier County. Based on previous occurrences,

and in accordance with the Palmer Drought Index and United States Drought Monitor, the worst-case scenario for drought in Sevier County would be D4 (Exceptional Drought).

Table 7-1: Previous Occurrences of Drought Events in Sevier County.

Date	Details	Crop Damage	Property Damage	Severity
September 1998	An extremely dry month throughout all of East Tennessee caused drought conditions in the county. Rainfall was approximately 2" inches below normal for the area.	$2,000	$0	D3

Since the last plan update, there have been no new drought events which have caused damage to property or crops. However, drought events have occurred periodically during the period of record (January 1, 2000 to January 1, 2019).

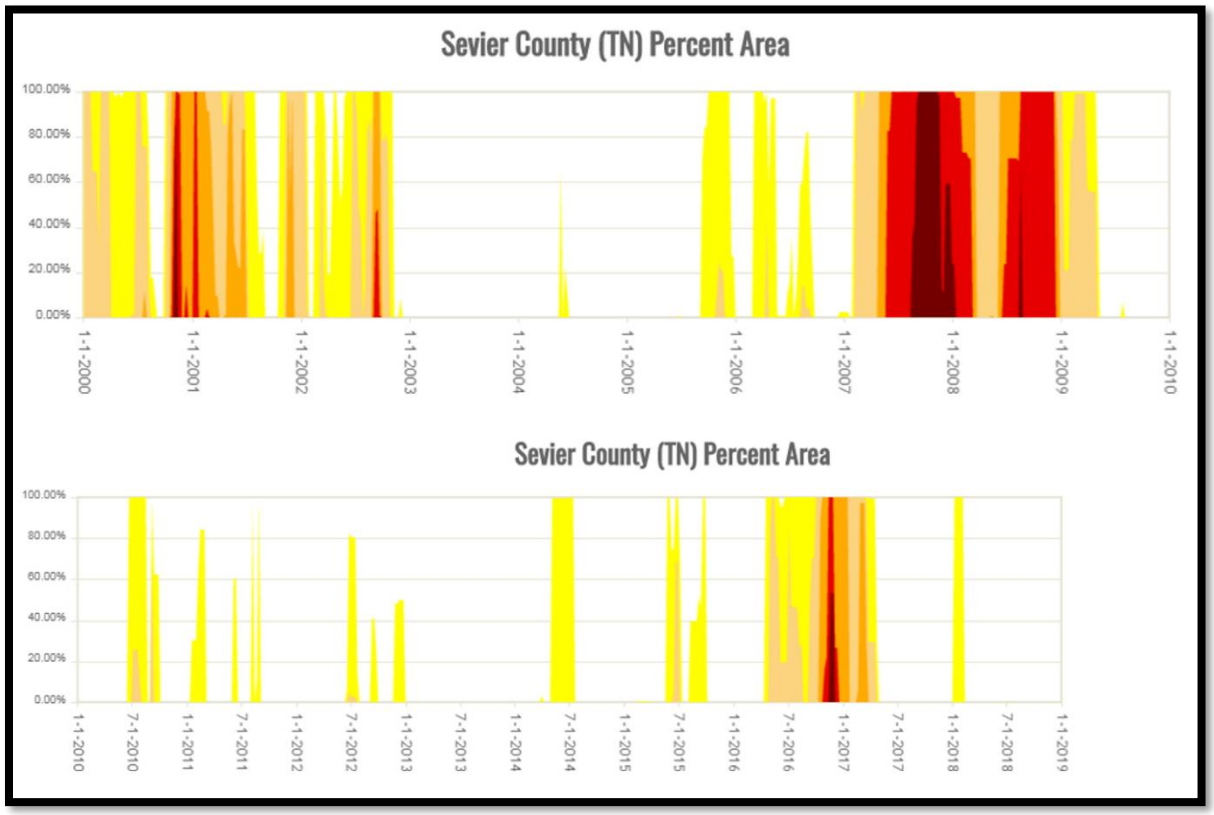

Figure 7-2: Timeline of drought conditions in Sevier County from January 1, 2000 to January 1, 2019. (Source: U.S. Drought Monitor)

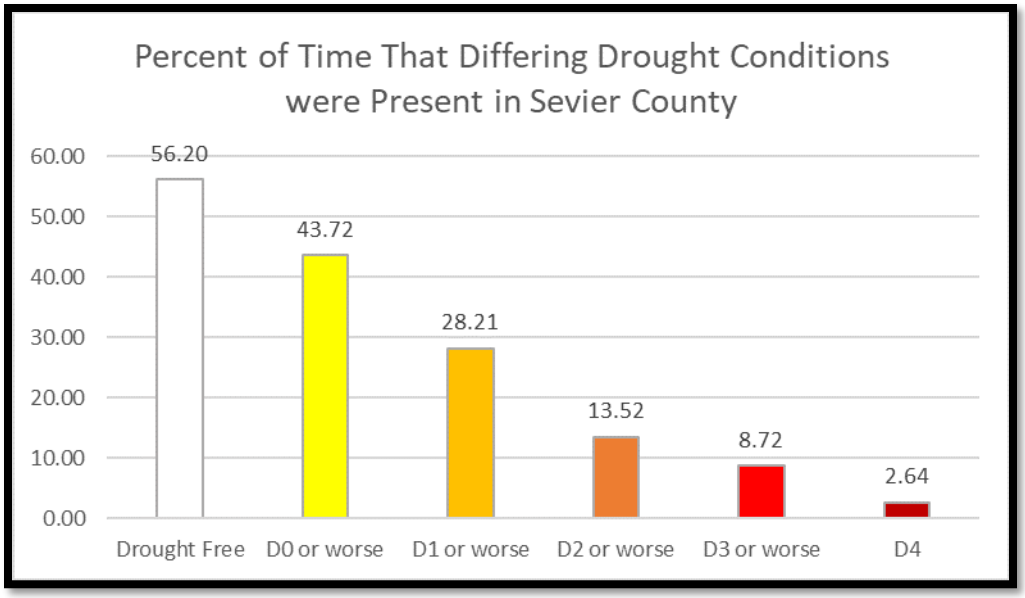

Figure 7-3: Sevier County experienced drought conditions (D0 or worse) during ~43% of the weeks between January 1, 2000 and January 1, 2019. (Source: U.S. Drought Monitor)

Incidents/Probability

Drought conditions can exist which are not recorded in the NCEI database if the event does not cause any direct damage to property or crops and injuries or loss of life. Based on previous occurrences, there is a 4.3% annual chance of occurrence for direct-impact drought in Sevier County and Pigeon Forge. While the chance of a drought that causes damage is approximately 4% annually, Sevier County experienced D2 or worse drought conditions approximately 35% over the past 20-years.

7.1.3 Earthquakes

Location & Extent

Earthquakes strike suddenly and without warning, occur at any time of the year, and at any time of the day. A damaging earthquake occurs without definitive signals and massive earthquakes are accompanied by aftershocks. The duration of shaking can last anywhere from a second to a period of minutes. There are numerous characteristics measured when observing earthquake activity; however, its force, depth, peak ground acceleration, and the distance to the epicenter are the most influential in determining damage.

Earthquakes of magnitude 5.5 or greater are considered potentially threatening to Sevier County and Pigeon Forge, as this is the point at which structures can become damaged. Any earthquake felt at this magnitude or greater would result in cessation of operations until sight inspections can take place.

The Southern Appalachian Seismic Zone (East Tennessee Seismic Zone) is a geographic band stretching from northeastern Alabama through eastern Tennessee into southwestern Virginia, which is subject to frequent small earthquakes. This seismic zone is one of the most active earthquake zones in the eastern United States. Most earthquakes in the Southern Appalachian Zone are small and are detected only with instruments. A few damaging earthquakes have occurred with the largest historic earthquakes measuring 4.6 magnitude on the Richter Scale, occurring in 1973 near Knoxville and April 29, 2003 near Fort Payne,

Alabama. Earthquakes large enough to be felt occur approximately once a year in this zone. The USGS estimates that earthquakes as large as magnitude 7.5 are possible in the Southern Appalachian Zone, which would be as devastating to the region as a major quake along the New Madrid fault. The worst-case scenario for an earthquake in Sevier County would be an MMI of IV, which would be quite noticeable by persons indoors, especially during the daytime.

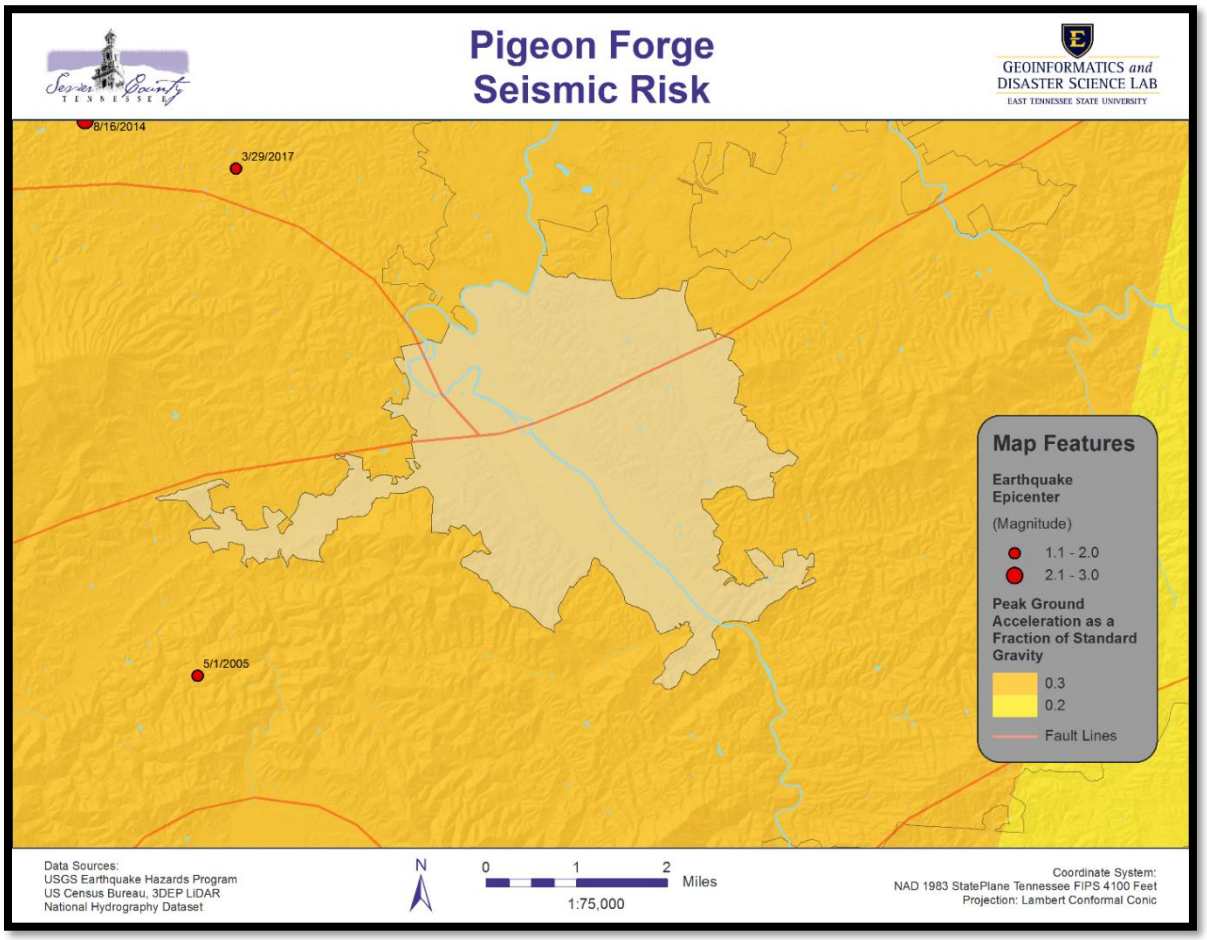

Figure 7-4: Earthquake Epicenters and Fault Lines in Pigeon Forge.

Previous Occurrences

NOAA reports four earthquake events over a magnitude of 2.0 occurring within the boundaries of Sevier County between the years 1996 to 2017. The following table identifies the date of occurrence, magnitude, and focal depth.

Table 7-2: Previous Occurrences of Earthquake Events in Sevier County.

Date	Magnitude	Focal Depth
7/26/2001	3.2	5 kilometers
11/24/2012	3.0	7.1 kilometers
11/24/2012	2.5	8.9 Kilometers
8/3/2017	2.7	7.4 kilometers

Since the last plan update, three earthquake events occurred within the boundaries of Sevier County. Below is a brief synopsis of the events.

November 24, 2012
An earthquake of magnitude 3.0 and depth of 7.1 kilometers occurred approximately five miles northeast of Sevierville at 11:03 AM. No damages, injuries, or fatalities were associated with the event.

November 24, 2012
An earthquake of magnitude 2.5 and depth of 8.9 kilometers occurred approximately five miles northeast of Sevierville at 2:56 PM. No damages, injuries, or fatalities were associated with the event.

August 3, 2017
An earthquake of magnitude 2.7 and depth of 7.4 kilometers occurred approximately four miles north of Sevierville at 5:40 PM. No damages, injuries, or fatalities were associated with the event.

Incidents/Probability
Historically, there have been four earthquake events in Sevier County and Pigeon Forge from 1996 to 2018. With a total of four earthquake events, the annual return rate (frequency) for Sevier County and Pigeon Forge is one event every five to six years. This equates to an annual probability of approximately 16%.

7.1.4 Extreme Temperatures

Location & Extent
Extreme heat and cold can occur in all of Sevier County. Extreme heat is not a hazard that responds to the traditional mitigation measures of building codes or land use restrictions. Heat is the number one weather related killer in the United States, resulting in roughly 175 fatalities each year. In fact, on average, excessive heat claims more lives each year than floods, lightning, tornadoes, and hurricanes combined.

What constitutes extreme cold varies in different parts of the country. In the southern United States, near freezing temperatures are considered extreme cold. Freezing temperatures can cause severe damage to citrus fruit crops and other vegetation. Pipes may freeze and burst in homes that are poorly insulated or without heat. Most people judge extreme cold by the problems it causes rather than just by a temperature or a wind chill factor. In the northern areas of the country, extreme cold means temperatures well below zero.

The speed of onset of extreme temperatures, both hot and cold, is fairly slow and predictable from short and long-term weather forecasts. The scale of measurement for this hazard is temperature and departure from normal temperature.

Previous Occurrences
In winter, the average temperature in Sevier County is approximately 38^{O}F with an average daily minimum temperature of approximately 26^{O}F. The lowest temperatures recorded in Sevier County were -18^{O}F in Gatlinburg and -24^{O}F in Sevierville with both occurring on January 21, 1985.

In summer, the average temperature in Sevier County is approximately 71^{O}F with an average daily maximum temperature of approximately 83^{O}F. The highest temperatures ever recorded in Sevier County

were 106°F in Gatlinburg on June 30, 1936 and 102°F in Sevierville on August 21, 1983. No station data exist specifically for Pigeon Forge, but temperatures are comparable to adjacent Sevierville.

Incidents/Probability

The NCEI Storm Events Database reports no extreme temperature (extreme heat or extreme cold) occurrences within the boundaries of Sevier County between the years 1996 and 2018. However, based on the State of Tennessee Hazard Mitigation Plan, Sevier County and Pigeon Forge have an annual probability of 64% for extreme cold events and 100% for extreme heat events.

7.1.5 Floods Including Extreme Precipitation

Location & Extent

A variety of factors affects the type and severity of flooding in Pigeon Forge including topography, urban development and infrastructure, and geology. Serious flooding in the mountainous or elevated areas is unusual because streams tend to be faster flowing and floodwaters drain quickly.

Intense flooding will cause havoc on the jurisdictions affected. Floods can cause minimal damage in the form of just inches of water to complete submersion of houses and critical facilities. Any amount of damage can render a structure unusable for as long as recovery operations would take depending on the level of damage. Intense and widespread flooding can trap people and entire communities without basic goods or services.

With the location of a large amount of commercial and residential infrastructure adjacent to and between the West Prong of the Little Pigeon River and Mill Creek, Pigeon Forge is prone to flooding. Depths from previous flood events have commonly ranged from 12-16' along parts of the West Prong, while depths of 10-11' have been observed along Mill Creek. Areas along Waldens Creek have experienced flood depths in the range of 11-15'. Dollywood and the surrounding areas also experienced flooding on occasion, often occurring when the Middle Creek overflows its boundaries resulting in flood depths of 6-10'.

The following figure displays the location of the 100- and 500-year floodplains in Pigeon Forge.

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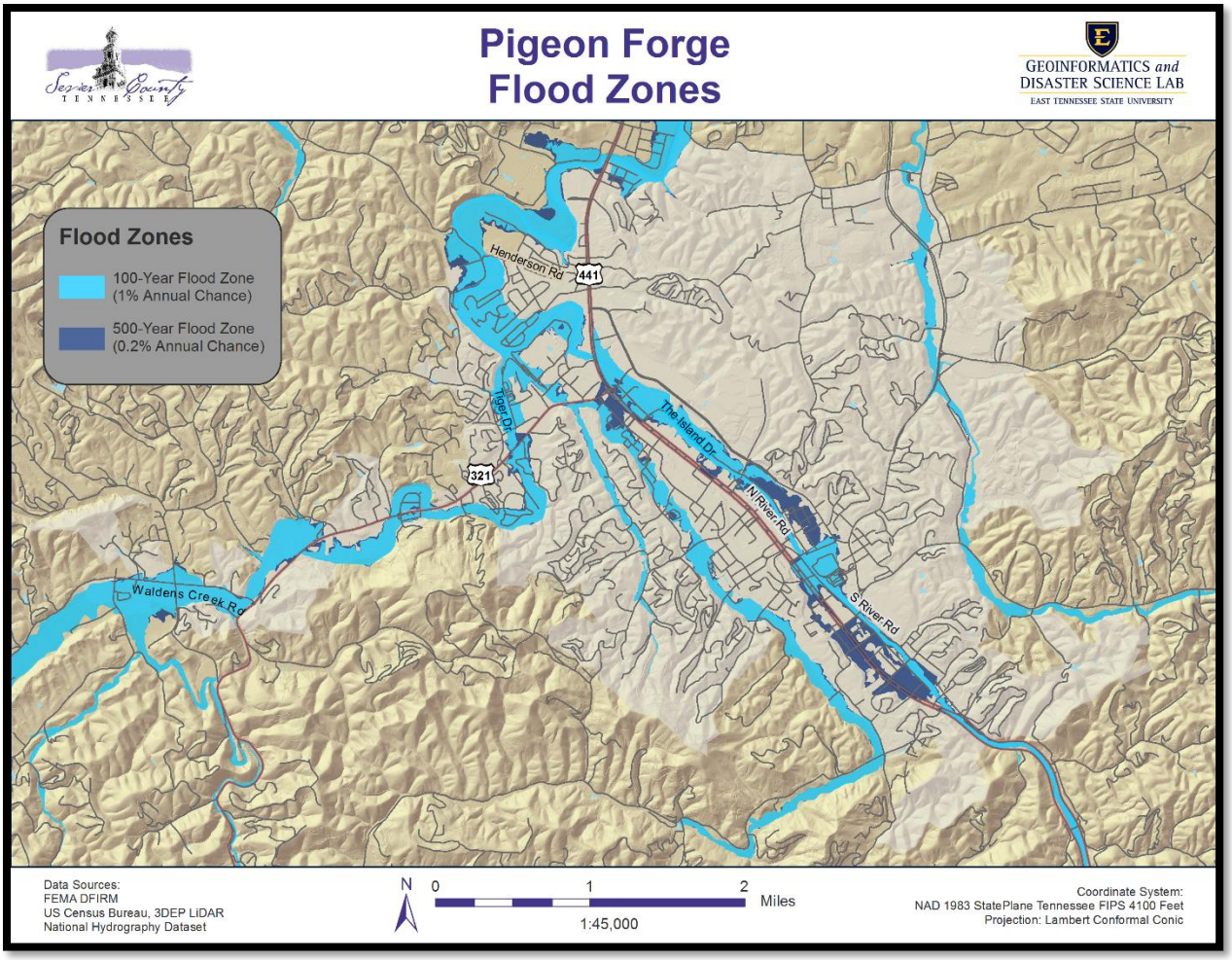

Figure 7-5: 100- and 500-Year Floodplains in Pigeon Forge.

Previous Occurrences

Historically, there have been nine flood and extreme precipitation events in Pigeon Forge from 1996 to 2018. According to NCEI, there have been no injuries or fatalities due to flood and extreme precipitation events Pigeon Forge.

Table 7-3: Flood Events and Extreme Precipitation from 1996 to 2018 with Total Losses. (Source: NCEI Storm Events Database)

Date	Location	Event	Injuries	Fatalities	Property Damage
1/19/1996	COUNTYWIDE	Flash Flood	0	0	$0
6/21/1997	COUNTYWIDE	Flash Flood	0	0	$0
1/7/1998	COUNTYWIDE	Flash Flood	0	0	$0
5/6/1999	PIGEON FORGE	Flood	0	0	$0
7/11/1999	COUNTYWIDE	Flash Flood	0	0	$0
3/17/2002	COUNTYWIDE	Flash Flood	0	0	$0
2/16/2003	COUNTYWIDE	Flash Flood	0	0	$0

Date	Location	Event	Injuries	Fatalities	Property Damage
1/15/2013	PIGEON FORGE	Flood	0	0	$10,000
1/16/2013	PIGEON FORGE	Flood	0	0	$1,000

Since the last plan update (through the end of 2018), there have been two new flooding events in the Pigeon Forge area. Below is a brief synopsis of those events.

January 15, 2013 – Pigeon Forge

A significant synoptic scale event produced several inches of rain over much of the area. Several homes in Pigeon Forge were flooded.

January 16, 2013 – Pigeon Forge

Significant synoptic scale event produced several inches of rain over much of the area. Eight roads were reported closed in the Pigeon Forge area.

While this risk assessment did not include 2019 data for flooding, it should be noted that the early part of 2019 broke many rainfall records, including the wettest month on record (February 2019) according to the Tennessee Climate Office. Extensive flooding occurred in February and April of 2019, possibly exceeding $7 million in damage in Sevier County (Knox News).

Incidents/Probability

With nine events, the annual return rate (frequency) for flooding and extreme precipitation for Pigeon Forge is one event every two to three years. This equates to an annual probability of approximately 36%.

7.1.6 Mass Wasting

Location & Extent

Most mass wasting events within Sevier County are located along road networks. Rockfalls or rock sliding along road cuts is a very common phenomenon. These are mainly due to improper slope management that causes instability within the slope face. Additionally, adverse orientation of geological discontinuities (joints, fractures, and faults) with the slope gradient and aspect play an important role in slope stability. Probability of future failure of a slope depends on various factors including lithology, land cover, drainage condition, and soil cover of the area.

The southern part of Sevier County located within the Great Smoky Mountains National Park near the state boundary between Tennessee and North Carolina has a high concentration of areas that could produce mass wasting events. High rain coupled with fragile lithology and adverse orientation of geological discontinuities have increased the probably of a mass wasting event. Below is a susceptibility map, high concentration map, and prior occurrences of mass wasting events in the Pigeon Forge area.

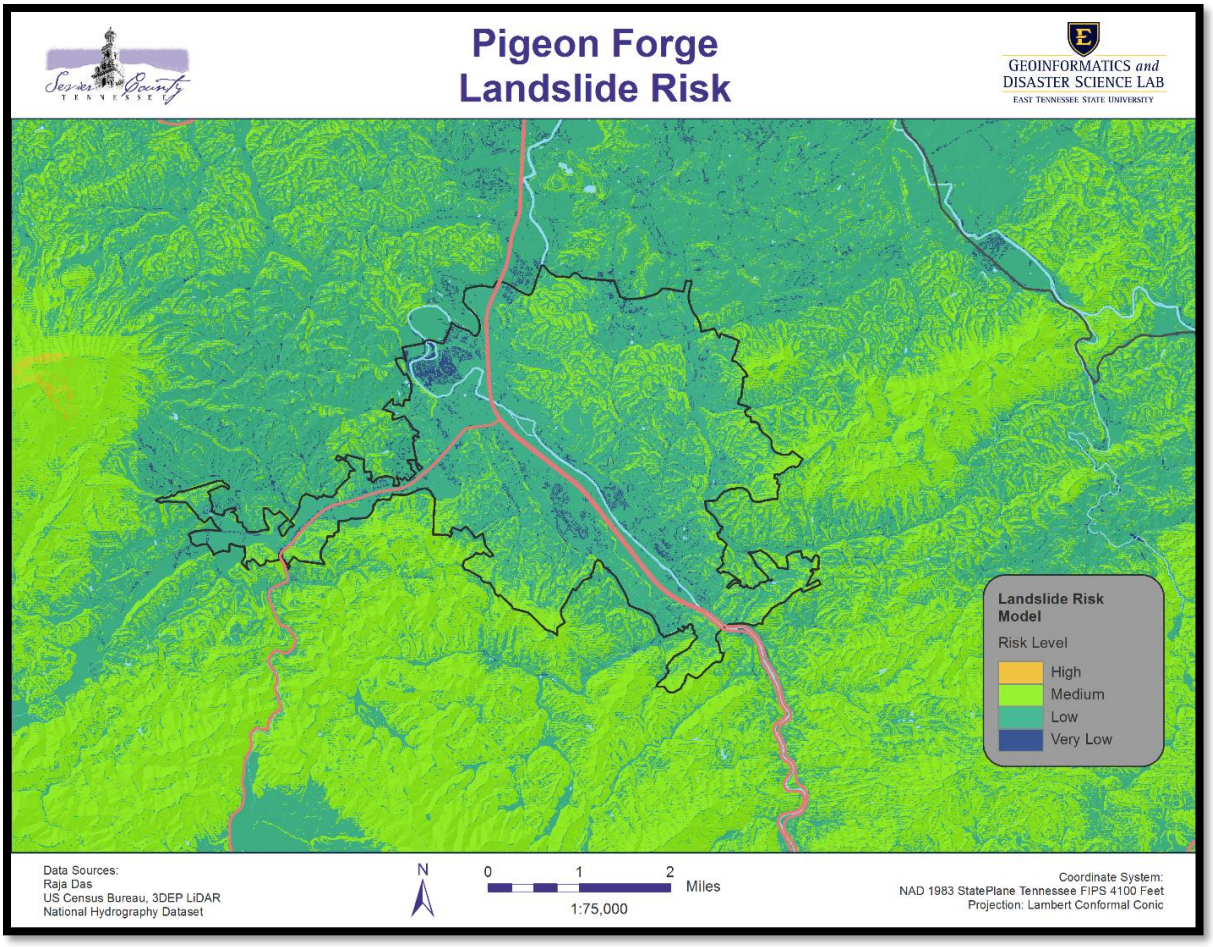

Figure 7-6: Landslide Susceptibility Map in Pigeon Forge.

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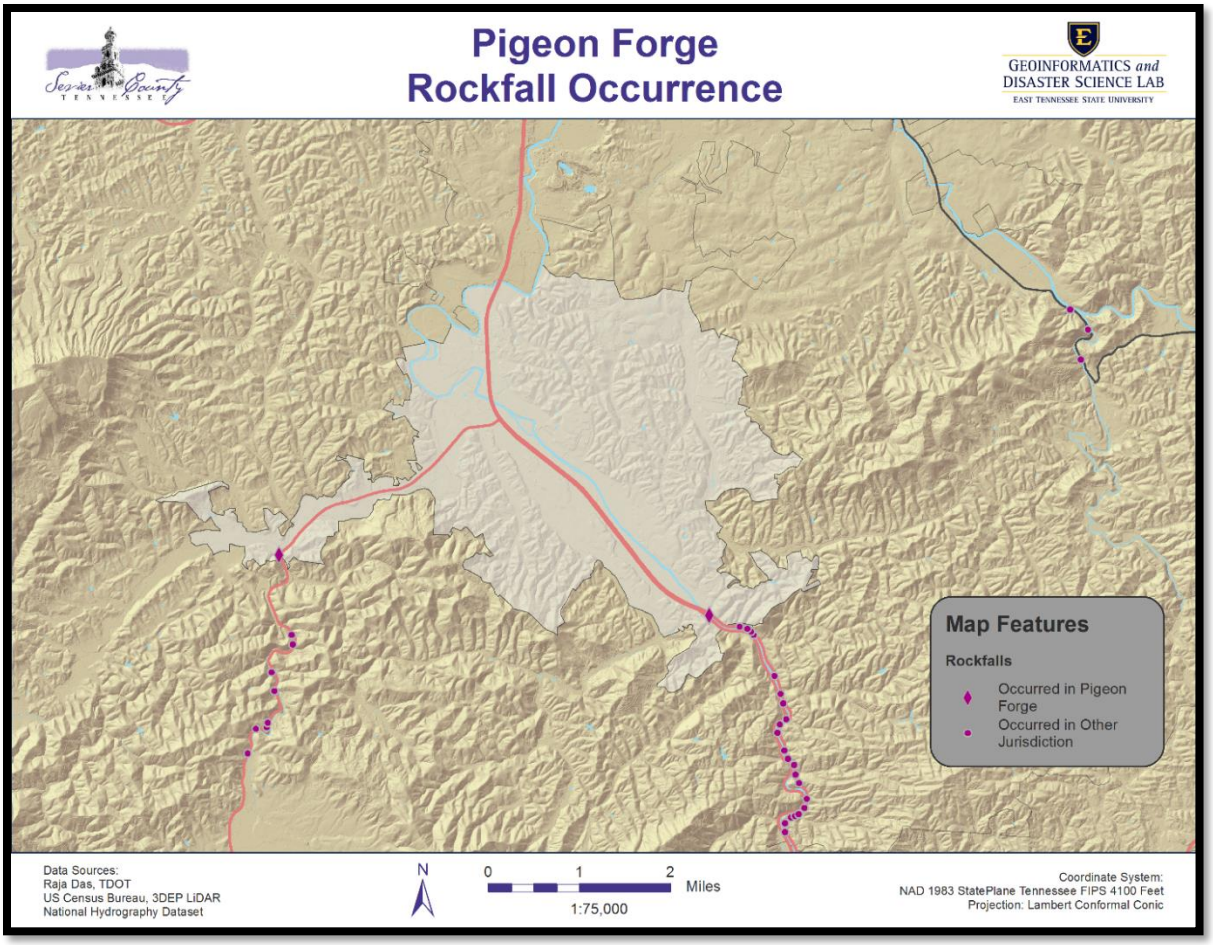

Figure 7-7: Previous Rockfall Events in Pigeon Forge.

Previous Occurrences

Some rockfall locations are available from the Tennessee Department of Transportation (TDOT). The following table outlines major debris flow events related to storms in Sevier County.

Table 7-4: Major Debris Flow Events Related to Storm Events.
(Source: Tennessee Department of Transportation)

Date	Type of Storm	Location
7/10/1942	Thunderstorm	Newfound Gap
9/1/1951	Cloudburst	Mt. LeConte
6/15/1971		Mt. LeConte
3/1975 – 3/1983	Multiple Storms	Anakeesta Ridge
8/3/1978	Thunderstorm	Mt. LeConte
7/1984	Thunderstorm	Anakeesta Ridge
8/10/1984	Thunderstorm	Anakeesta Ridge
8/10/1984	Thunderstorm	Anakeesta Ridge
3/1985	Thunderstorm	Anakeesta Ridge
6/28/1993	Cloudburst	Mt. LeConte

Date	Type of Storm	Location
10/4/1995	Hurricane Opal	Mt. LeConte/Anakeesta Ridge
9/17/2004	Hurricane Ivan	Mt. LeConte/Anakeesta Ridge
8/5/2012	Thunderstorm	Anakeesta Ridge
9/10/2017	Hurricane Irma	Anakeesta Ridge
8/1/2019	Thunderstorm	Gatlinburg

Since the last plan update, there have been three mass wasting events in Sevier County. Below is a brief synopsis of those events.

August 5, 2012 – Anakeesta Ridge
No synopsis available for the event.

September 10, 2017 – Anakeesta Ridge
No synopsis available for the event.

August 1, 2019 - Gatlinburg
A 73-year old man was fatally injured when a tree fell from a slope and hit his Honda sedan. Both the northbound and southbound lanes of the Spur were closed until heavy equipment could complete slope repairs and assessments. Multiple rock slides were also reported.

Incidents/Probability
With four recorded events from 1996 to 2018, the annual return rate (frequency) for mass wasting events for Sevier County and Pigeon Forge is one event every five to six years. This equates to an annual probability of a mass wasting event occurrence of approximately 17%. These events may not directly impact Pigeon Forge, but may have indirect impacts.

7.1.7 Severe Wind

Location & Extent
Mountain waves develop on the lee, or downwind, side of mountains. These waves are generated when strong winds flowing toward mountains in a generally perpendicular fashion are raised up over the mountains. Given the geographical location of Sevier County, the unincorporated areas and all of Pigeon Forge are susceptible to severe wind events. The following figures provide the extent of severe winds within Sevier County and Pigeon Forge.

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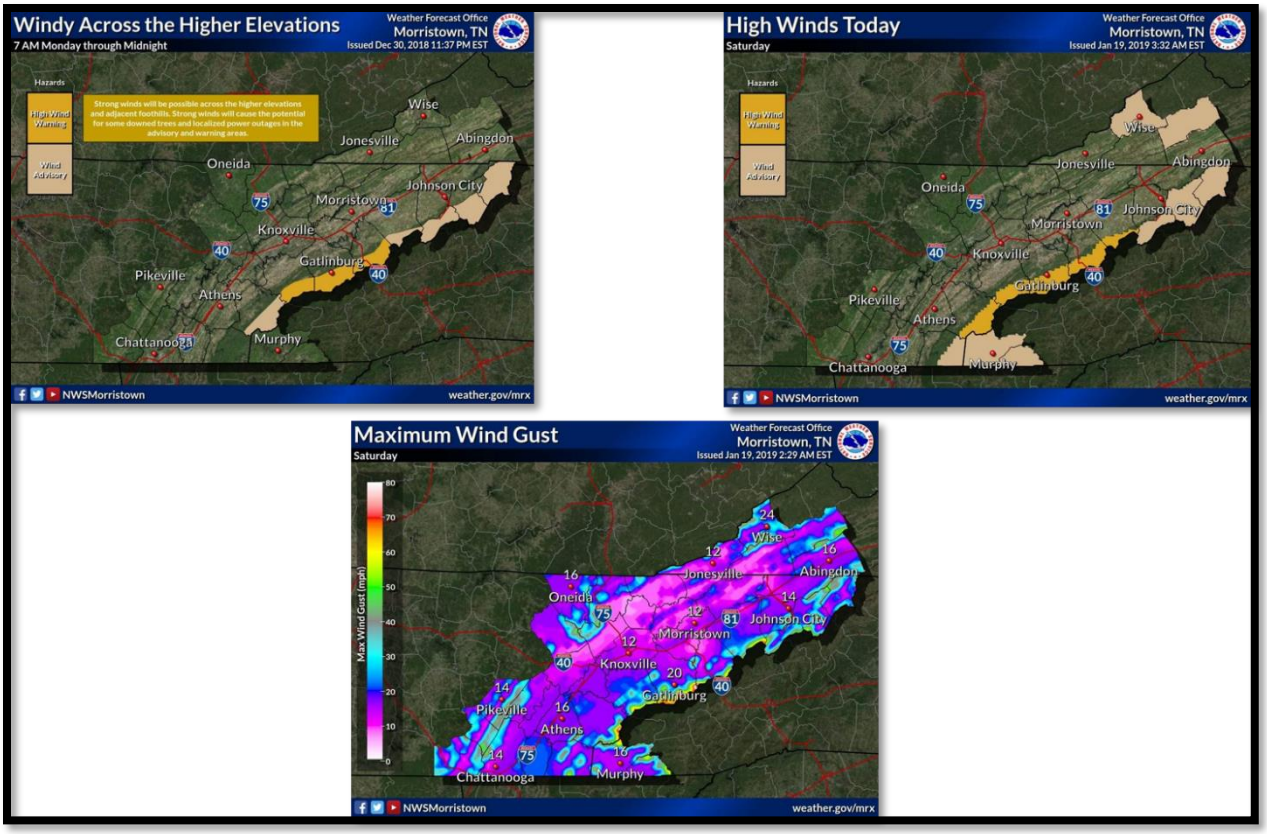

Figure 7-8: Severe Wind Extent and Location within Sevier County and Surrounding Areas, based on standard patterns (these occurring during the 2018-2019 winter months).

Previous Occurrences

Historically, there have been two severe wind events in Sevier County and Pigeon Forge from 1996 to 2018. There have been no injuries or fatalities due to severe wind events in the unincorporated area of Sevier County and Pigeon Forge.

Table 7-5: Severe Wind Events from 1996 to 2018 with Total Losses.
(Source: NCEI Storm Events Database)

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage
2/3/2003	COUNTYWIDE	40	0	0	$2,000
6/21/1997	COUNTYWIDE	45	0	0	$20,000

Since the last plan update, there have been no new severe wind events reported from NCEI, which have caused damage to property or crops and/or loss of life or injuries.

Incidents/Probability

The NCEI Storm Events Database reports two severe wind event occurrences within the boundaries of Sevier County between the years 1996 and 2018. With a total of two events, the annual return rate

(frequency) for severe winds for Sevier County and Pigeon Forge is one event every 11 to 12 years. This equates to an annual probability of approximately 8%.

7.1.8 Sinkholes

Location & Extent

Subsidence can occur slowly and continuously over time or abruptly for various reasons. Subsidence and sinkholes can occur due to either natural processes (karst sinkholes in areas underlain by soluble bedrock or because of human activities. The entire Sevier County planning area is susceptible to subsidence and sinkholes based on the karst topography of the region.

Previous Occurrences

Per the State of Tennessee Hazard Mitigation Plan, there are 586 sinkhole locations within Sevier County. The following figure displays all known sinkhole locations within Sevier County and Pigeon Forge.

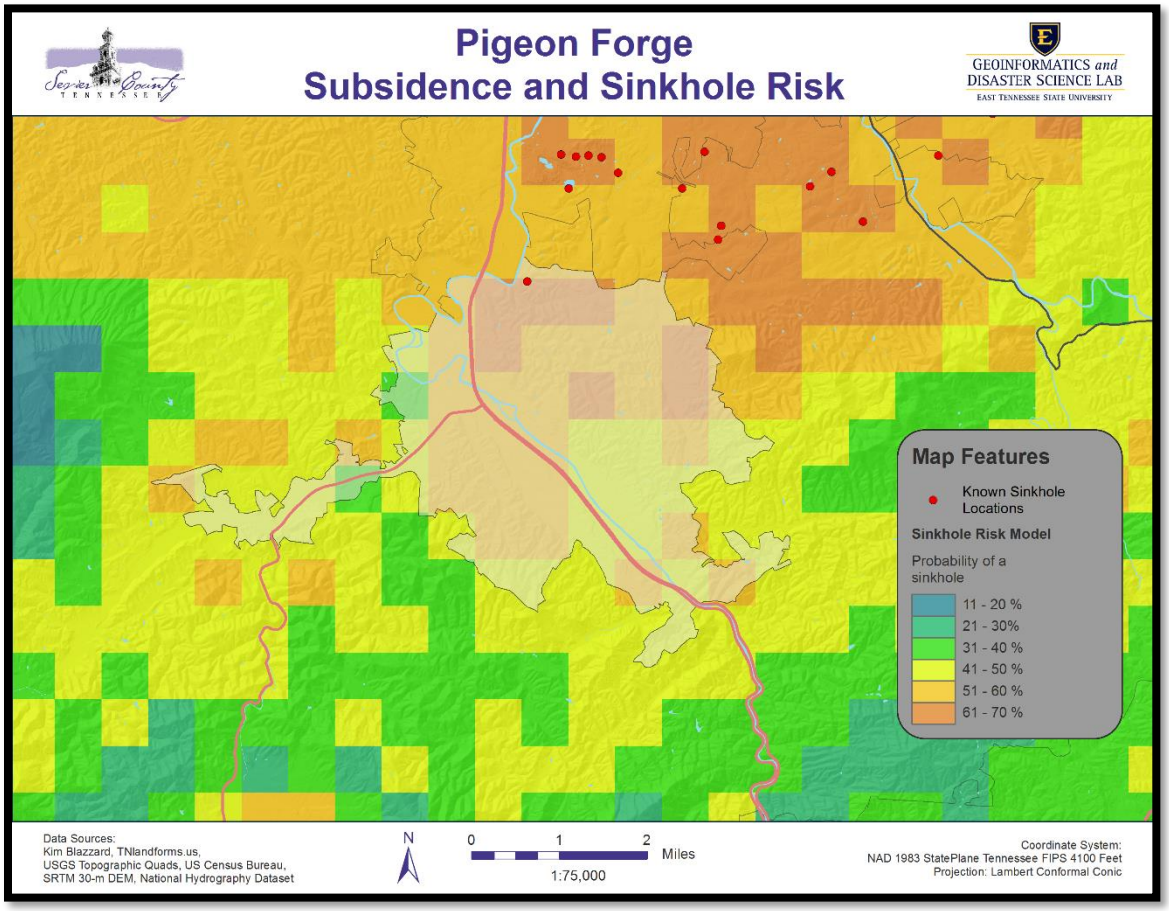

Figure 7-9: Pigeon Forge Subsidence and Sinkhole Locations.

Incidents/Probability

Based on the total number of sinkholes within Sevier County and Pigeon Forge, the annual probability of a sinkhole occurrence is calculated at 100%.

7.1.9 Thunderstorms (Hail, Lightning, and Wind)

Hail

Location & Extent

Because hailstorms are a meteorological phenomenon that can occur anywhere, the entire Sevier County planning area is equally at risk from hailstorms. The worst-case scenario for hailstorms is hail up to 3" in diameter.

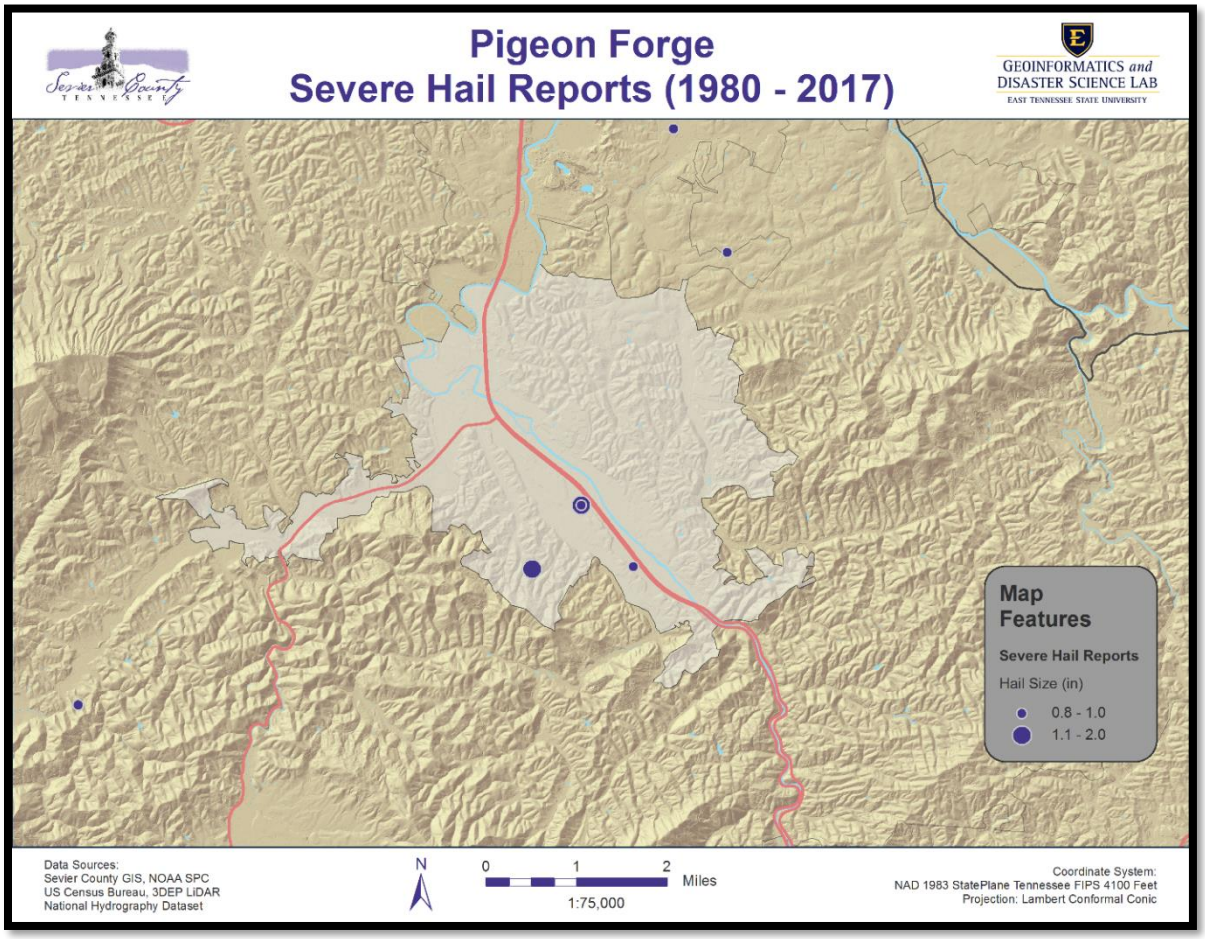

Figure 7-10: Severe Hail Reports and Density in Relation to Pigeon Forge.

Previous Occurrences

Historically, there have been 25 hail events Sevier County, with several of those occurring in Pigeon Forge, from 1996 to 2018. There have been no injuries or fatalities due to hail events in the Sevier County planning area. The following table briefly outlines the hail events that have occurred in Sevier County.

Table 7-6: Hail Incidents from 1996 to 2018 with Total Losses.
(Source: NCEI Storm Events Database)

Date	Location	Diameter (inches)	Injuries	Fatalities	Property Damage
4/10/1992	COUNTYWIDE	1.75	0	0	$0
8/26/1993	COUNTYWIDE	2.75	0	0	$0

Date	Location	Diameter (inches)	Injuries	Fatalities	Property Damage
5/26/1998	COUNTYWIDE	1	0	0	$0
1/18/1999	CUSICK	0.75	0	0	$0
5/13/1999	SEYMOUR	1.75	0	0	$0
4/5/2003	KODAK	1.75	0	0	$0
5/15/2003	COUNTYWIDE	0.75	0	0	$0
12/10/2004	KODAK	0.88	0	0	$0
4/3/2006	SEYMOUR	1.75	0	0	$0
5/20/2006	WALDEN CREEK	0.75	0	0	$0
5/20/2006	KODAK	0.75	0	0	$0
6/2/2006	PIGEON FORGE	0.75	0	0	$0
6/24/2007	KODAK	1	0	0	$0
5/9/2008	SEVIERVILLE	0.88	0	0	$0
7/21/2008	BOYDS CREEK	0.75	0	0	$0
6/17/2009	PITTMAN CTR	1	0	0	$0
5/26/2011	CATES XRDS	0.75	0	0	$0
5/26/2011	MILLICAN	0.88	0	0	$0
8/14/2011	PITNER	1	0	0	$0
2/29/2012	KODAK	1.25	0	0	$0
4/26/2012	KODAK	1	0	0	$0
6/14/2012	HATCHERTOWN	1.5	0	0	$0
7/27/2014	PITNER	1	0	0	$0
6/2/2015	COVE CREEK	1	0	0	$0
4/22/2016	SEVIERVILLE	1.5	0	0	$0

Since the last plan update, there have been six hail events which have occurred within the unincorporated areas of Sevier County and Pigeon Forge. Below is a brief synopsis of these events.

February 29, 2012 – Kodak

A boundary across the area triggered thunderstorms over east Tennessee toward the end of the month. The boundary aided in the development of an EF-0 tornado as well as golfball-size hail and several reports of wind damage.

April 26, 2012 – Kodak

A cold front tracked across east Tennessee during the overnight hours triggering scattered thunderstorms over the area. A few of the storms produced damaging thunderstorm wind and hail as large as quarters.

June 14, 2012 – Hatchertown

Elevated moisture and instability permitted routine afternoon thunderstorms to produce severe weather including hail, wind damage, and flooding. Law enforcement personnel reported thunderstorms produced golfball-size hail 2 miles northeast of Wears Valley in Hatchertown.

July 27, 2014 – Pitner

A potent upper-level storm system impacted the region on Sunday, July 27th, bringing several rounds of severe weather along with locally heavy rainfall. Three tornadoes were observed across east Tennessee; one classified as a strong, EF-3 tornado with winds of 140 mph. Additionally, there were several reports of straight-line wind damage and large hail up 2 to 3 inches in diameter. A storm system of this magnitude is highly unusual for this time of year due to the strength of the front and the record cool temperatures it produced in the middle of the summer season.

June 2, 2015 – Cove Creek

Sufficient instability developed in a moist low level environment underneath an upper level low pressure system parked over the Cumberland Plateau for the development of localized severe convection in the foothills of the Smoky Mountains. Impacts from the storms included wind damage along with the formation of large hail. Quarter sized hail fell three miles north of Wears Valley.

April 22, 2016 – Sevierville

A few severe thunderstorms developed during the afternoon across the region in an environment that could be characterized as weakly unstable. The convection formed in response to a weak upper level impulse riding a few hundred miles east of a cold front.

Incidents/Probability

The NCEI Storm Events Database reports 25 hail events within the boundaries of Sevier County between the years 1996 and 2018. With 25 events, the annual return rate (frequency) for hail events in the unincorporated area of Sevier County and Pigeon Forge is one to two events every year. This equates to an annual probability of approximately 100%.

Lightning

Location & Extent

Lightning is a meteorological phenomenon that can occur anywhere and has the same probability of occurring throughout the entire Sevier County planning area. Based on historical lightning events, the Sevier County planning area can expect a lightning density of 11-12 flashes per square mile per year.

Previous Occurrences

Historically, there have been two lightning events that impacted Sevier County and Pigeon Forge from 1996 to 2018. There have been no injuries and one fatality due to lightning events in the Sevier County planning area. The following table briefly outlines the lightning events that have occurred in Sevier County and Pigeon Forge.

Table 7-7: Lightning Incidents from 1996 to 2018 with Total Losses.
(Source: NCEI Storm Events Database)

Date	Location	Injuries	Fatalities	Property Damage
5/7/1996	PIGEON FORGE	0	0	$0
7/10/2004	KODAK	0	1	$0

Since the last plan update, there have been no lightning events that have caused property damage and/or loss of life or injuries in Sevier County and Pigeon Forge.

Incidents/Probability

The NCEI Storm Events Database reports two lightning events within the boundaries of Sevier County between the years 1996 and 2018. With two 'impact' events, the annual return rate (frequency) for lightning events in the unincorporated area of Sevier County and Pigeon Forge is one event every 11 to 12 years. This equates to an annual probability of approximately 8%.

Wind

Location & Extent

Thunderstorm wind is a meteorological phenomenon that can occur anywhere and has the same probability of occurring throughout the entire Sevier County planning area. Based on historical thunderstorm wind events, the Sevier County planning area can expect thunderstorm wind speeds of approximately 60 knots. The following figure displays the damages caused by thunderstorm winds from 1980 to 2017.

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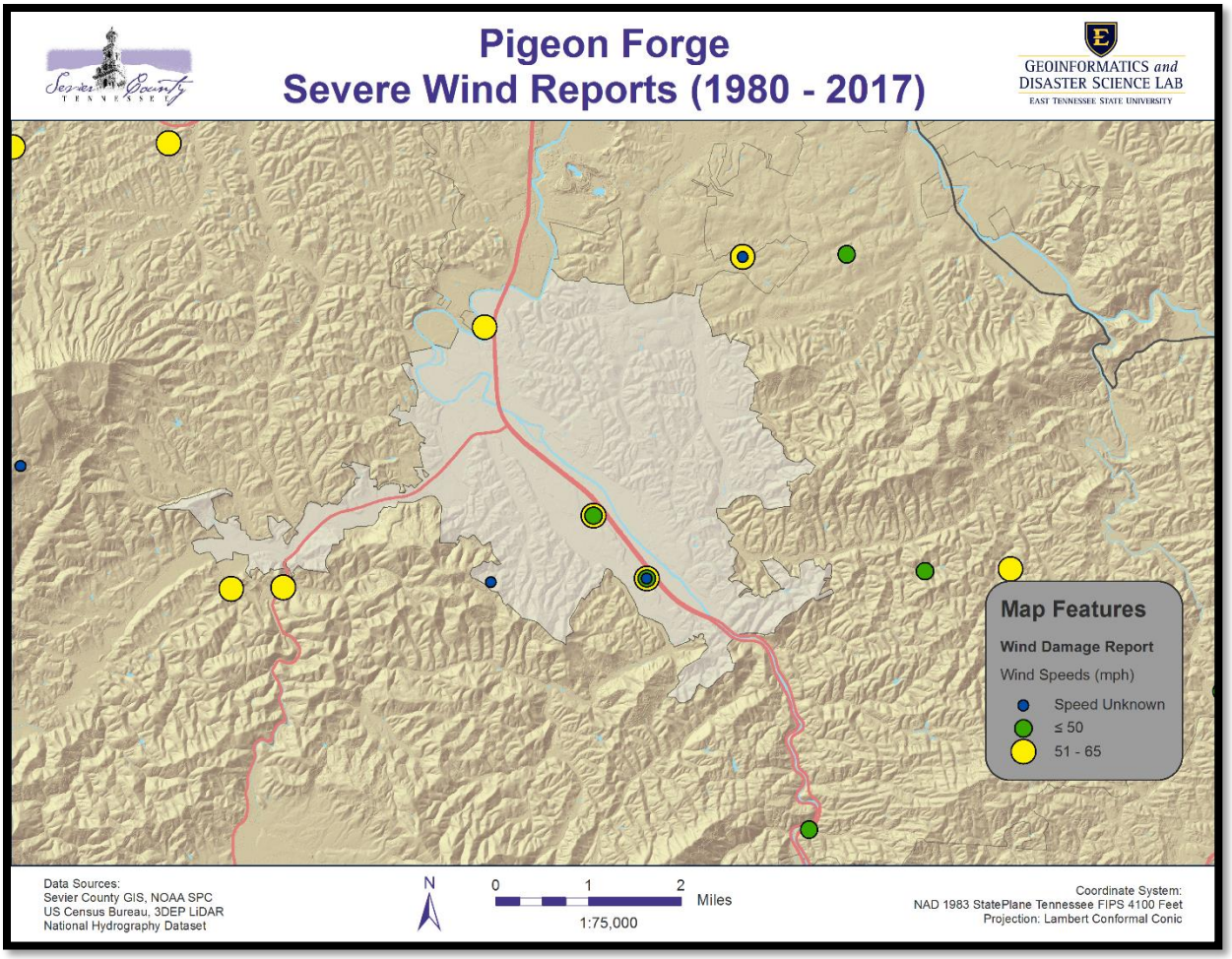

Figure 7-11: Severe Thunderstorm Wind Reports and Density in Relation to Pigeon Forge.

Previous Occurrences

Historically, there have been 189 thunderstorm wind events in the unincorporated area of Sevier County and Pigeon Forge from 1996 to 2018. There have been no injuries or fatalities due to thunderstorm wind events in the Sevier County planning area. The following table briefly outlines the thunderstorm wind events that have occurred in the unincorporated area of Sevier County and Pigeon Forge.

Table 7-8: Thunderstorm Wind Incidents from 1996 to 2018 with Total Losses.
(Source: NCEI Storm Events Database)

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage	Crop Damage
4/20/1996	GATLINBURG	60	0	0	$0	$0
5/27/1996	SOUTHWEST PART		0	0	$10,000	$0
8/8/1996	SEVIERVILLE		0	0	$0	$2,000
1/5/1997	GATLINBURG		0	0	$0	$4,000
3/5/1997	EXTREME N PART OF CO		0	0	$0	$3,000
6/13/1997	SEVIERVILLE		0	0	$0	$10,000

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage	Crop Damage
6/14/1997	SEYMOUR		0	0	$0	$7,000
7/4/1997	COUNTYWIDE		0	0	$25,000	$20,000
8/4/1997	COUNTYWIDE	55	0	0	$0	$20,000
2/17/1998	SEVIERVILLE		0	0	$0	$0
4/3/1998	COUNTYWIDE		0	0	$17,000	$15,000
6/2/1998	PIGEON FORGE		0	0	$0	$20,000
6/2/1998	GATLINBURG		0	0	$0	$15,000
6/5/1998	KODAK		0	0	$5,000	$14,000
6/15/1998	GATLINBURG		0	0	$15,000	$0
6/22/1998	SEVIERVILLE		0	0	$0	$20,000
6/24/1998	SEVIERVILLE		0	0	$0	$20,000
7/19/1998	SEVIERVILLE		0	0	$0	$5,000
11/25/1998	PIGEON FORGE		0	0	$0	$15,000
4/23/1999	SEVIERVILLE		0	0	$0	$7,000
5/6/1999	KODAK		0	0	$0	$2,000
5/7/1999	KODAK		0	0	$0	$5,000
7/24/1999	BEECH SPGS		0	0	$6,000	$0
7/29/1999	KODAK		0	0	$12,000	$0
7/29/1999	PIGEON FORGE		0	0	$10,000	$0
8/23/1999	SEYMOUR		0	0	$4,000	$0
2/13/2000	PIGEON FORGE		0	0	$0	$11,000
5/23/2000	PIGEON FORGE		0	0	$0	$11,000
5/27/2000	COUNTYWIDE		0	0	$0	$6,000
5/27/2000	COUNTYWIDE		0	0	$0	$2,000
7/28/2000	GATLINBURG		0	0	$0	$15,000
7/28/2000	GATLINBURG		0	0	$14,000	$0
7/29/2000	SEVIERVILLE		0	0	$0	$4,000
7/30/2000	KODAK		0	0	$0	$12,000
8/10/2000	HATCHERTOWN		0	0	$0	$15,000
8/18/2000	SEVIERVILLE		0	0	$0	$23,000
11/9/2000	KODAK		0	0	$0	$4,000
11/9/2000	SEYMOUR		0	0	$0	$5,000
5/21/2001	CEDAR BLUFF		0	0	$0	$5,000
7/4/2001	PIGEON FORGE		0	0	$0	$24,000
7/8/2001	PITTMAN CENTER		0	0	$0	$21,000
10/25/2001	COUNTYWIDE		0	0	$16,000	$20,000
1/24/2002	COUNTYWIDE		0	0	$8,000	$0
5/2/2002	SEVIERVILLE		0	0	$15,000	$0
5/2/2002	SEYMOUR		0	0	$12,000	$0
5/13/2002	COUNTYWIDE		0	0	$15,000	$0

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage	Crop Damage
6/4/2002	GATLINBURG		0	0	$15,000	$0
7/2/2002	COUNTYWIDE		0	0	$25,000	$0
7/30/2002	GATLINBURG		0	0	$0	$5,000
8/1/2002	GATLINBURG		0	0	$5,000	$0
9/4/2002	BOYDS CREEK		0	0	$10,000	$0
9/4/2002	WALDEN CREEK		0	0	$15,000	$0
11/10/2002	KODAK	60	0	0	$15,000	$0
2/16/2003	GATLINBURG	60	0	0	$5,000	$0
5/2/2003	SEVIERVILLE	55	0	0	$12,000	$0
5/11/2003	KODAK	55	0	0	$8,000	$0
6/11/2003	KODAK	60	0	0	$12,000	$0
7/6/2003	COUNTYWIDE	60	0	0	$0	$0
7/10/2003	SEYMOUR	60	0	0	$0	$0
8/11/2003	COUNTYWIDE	60	0	0	$0	$0
8/29/2003	PIGEON FORGE	60	0	0	$0	$0
8/31/2003	PIGEON FORGE	60	0	0	$0	$0
11/18/2003	COUNTYWIDE	55	0	0	$10,000	$0
5/26/2004	KODAK	65	0	0	$10,000	$0
5/31/2004	SEVIERVILLE	65	0	0	$20,000	$0
6/2/2004	SEYMOUR	65	0	0	$5,000	$0
6/12/2004	SEVIERVILLE	60	0	0	$10,000	$0
7/5/2004	SEYMOUR	60	0	0	$12,000	$0
7/5/2004	KODAK	60	0	0	$10,000	$0
7/5/2004	PIGEON FORGE	60	0	0	$12,000	$0
7/10/2004	KODAK	60	0	0	$8,000	$0
7/13/2004	SEVIERVILLE	65	0	0	$15,000	$0
7/17/2004	SEVIERVILLE	65	0	0	$30,000	$0
5/20/2005	COUNTYWIDE	65	0	0	$30,000	$0
6/6/2005	SEVIERVILLE	65	0	0	$15,000	$0
6/27/2005	SEVIERVILLE	65	0	0	$18,000	$0
6/30/2005	COUNTYWIDE	55	0	0	$20,000	$0
7/27/2005	GATLINBURG	55	0	0	$10,000	$0
7/31/2005	SEVIERVILLE	55	0	0	$3,000	$0
7/31/2005	SEVIERVILLE	60	0	0	$3,000	$0
4/2/2006	KODAK	60	0	0	$12,000	$0
4/21/2006	SEYMOUR	60	0	0	$12,000	$0
5/20/2006	SEVIERVILLE	60	0	0	$20,000	$0
5/20/2006	SEVIERVILLE	60	0	0	$12,000	$0
5/30/2006	PITTMAN CENTER	60	0	0	$3,000	$0
5/30/2006	GATLINBURG	60	0	0	$20,000	$0

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage	Crop Damage
5/30/2006	GATLINBURG	60	0	0	$15,000	$0
5/31/2006	KODAK	60	0	0	$10,000	$0
6/23/2006	COUNTYWIDE	60	0	0	$6,000	$0
7/28/2006	GATLINBURG	60	0	0	$15,000	$0
8/4/2006	COUNTYWIDE	55	0	0	$6,000	$0
8/5/2006	WALDEN CREEK	60	0	0	$10,000	$0
10/5/2006	KODAK	55	0	0	$0	$0
4/3/2007	CATLETTSBURG	55	0	0	$30,000	$0
6/14/2007	PITTMAN CENTER	50	0	0	$10,000	$0
6/24/2007	SEVIERVILLE	55	0	0	$5,000	$0
6/25/2007	SEVIERVILLE	55	0	0	$20,000	$0
6/28/2007	PIGEON FORGE	55	0	0	$10,000	$0
6/28/2007	GATLINBURG	55	0	0	$15,000	$0
6/28/2007	SEVIERVILLE	50	0	0	$2,000	$0
1/10/2008	BOYDS CREEK	55	0	0	$0	$0
3/19/2008	CATLETTSBURG	50	0	0	$0	$0
6/9/2008	BANNER	55	0	0	$10,000	$0
6/11/2008	BIRD XRD	50	0	0	$10,000	$0
6/12/2008	GATLINBURG	50	0	0	$5,000	$0
6/12/2008	LINE SPG	52	0	0	$2,000	$0
6/12/2008	PITNER	55	0	0	$5,000	$0
6/28/2008	KODAK	55	0	0	$8,000	$0
6/28/2008	PINE GROVE	55	0	0	$8,000	$0
6/28/2008	GLADES	55	0	0	$8,000	$0
7/22/2008	ELKMONT	55	0	0	$0	$0
7/22/2008	GLADES	60	0	0	$0	$0
2/11/2009	CATLETTSBURG	55	0	0	$15,000	$0
4/2/2009	PITNER	55	0	0	$8,000	$0
4/6/2009	KODAK	52	0	0	$8,000	$0
4/6/2009	OAK CITY	50	0	0	$2,000	$0
4/6/2009	KODAK	50	0	0	$2,000	$0
5/28/2009	CUSICK	52	0	0	$0	$0
6/4/2009	MC MAHAN	52	0	0	$2,000	$0
6/4/2009	FAIR GARDEN	52	0	0	$2,000	$0
6/10/2009	KODAK	62	0	0	$5,000	$0
6/17/2009	SEVIERVILLE	50	0	0	$30,000	$0
8/16/2009	SEVIERVILLE	52	0	0	$2,000	$0
8/16/2009	SEVIERVILLE	58	0	0	$15,000	$0
8/22/2009	PITTMAN CENTER	60	0	0	$15,000	$0
8/22/2009	PITTMAN CENTER	50	0	0	$20,000	$0

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage	Crop Damage
7/26/2010	SHADY GROVE	55	0	0	$0	$0
10/26/2010	SEVIERVILLE	55	0	0	$5,000	$0
2/25/2011	SEVIERVILLE	50	0	0	$15,000	$0
2/28/2011	PITTMAN CENTER	60	0	0	$12,000	$0
3/23/2011	CATLETTSBURG	60	0	0	$0	$0
3/23/2011	GLADES	55	0	0	$0	$0
5/22/2011	MILLICAN	50	0	0	$0	$0
5/26/2011	HENRY XRDS	50	0	0	$0	$0
5/26/2011	ALDER BRANCH	50	0	0	$0	$0
6/24/2011	SEVIERVILLE	50	0	0	$5,000	$0
8/8/2011	SEVIERVILLE	52	0	0	$3,000	$0
8/18/2011	SEVIERVILLE	52	0	0	$10,000	$0
2/29/2012	PIGEON FORGE	60	0	0	$5,000	$0
3/2/2012	DU PONT	50	0	0	$0	$0
3/30/2012	CATLETTSBURG	50	0	0	$0	$0
7/1/2012	ELKMONT	60	0	0	$0	$0
7/5/2012	CATLETTSBURG	60	0	0	$1,000,000	$0
7/5/2012	FRENCH BROAD	60	0	0	$1,000,000	$0
7/5/2012	PIGEON FORGE	50	0	0	$0	$0
7/9/2012	BOYDS CREEK	50	0	0	$0	$0
7/10/2012	LINE SPG	50	0	0	$0	$0
7/10/2012	SEVIERVILLE	50	0	0	$0	$0
7/31/2012	MIDDLE CREEK	50	0	0	$0	$0
7/31/2012	PITNER	50	0	0	$0	$0
5/21/2013	CATLETTSBURG	50	0	0	$0	$0
5/22/2013	CATLETTSBURG	50	0	0	$0	$0
6/5/2013	PIGEON FORGE	50	0	0	$2,000	$0
6/5/2013	PIGEON FORGE	50	0	0	$5,000	$0
6/13/2013	PITTMAN CENTER	50	0	0	$8,000	$0
6/13/2013	SEYMOUR	55	0	0	$8,000	$0
6/10/2014	SEVIERVILLE	50	0	0	$10,000	$0
6/23/2014	PIGEON FORGE	50	0	0	$5,000	$0
6/23/2014	SEVIERVILLE	50	0	0	$8,000	$0
6/27/2014	SEYMOUR	50	0	0	$8,000	$0
7/8/2014	PITNER	50	0	0	$0	$0
7/8/2014	LINE SPG	60	0	0	$0	$0
7/27/2014	CATLETTSBURG	50	0	0	$0	$0
9/16/2014	CATLETTSBURG	52	0	0	$0	$0
10/14/2014	PIGEON FORGE	50	0	0	$5,000	$0
4/25/2015	KODAK	50	0	0	$5,000	$0

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage	Crop Damage
4/25/2015	GATLINBURG	50	0	0	$8,000	$0
6/2/2015	GLADES	50	0	0	$0	$0
6/30/2015	KODAK	50	0	0	$0	$0
8/10/2015	PITNER	50	0	0	$0	$0
8/10/2015	LINE SPG	50	0	0	$0	$0
4/22/2016	PITNER	50	0	0	$0	$0
6/2/2016	PIGEON FORGE	50	0	0	$0	$0
6/14/2016	HICKS CROSSING	50	0	0	$0	$0
7/7/2016	LINE SPG	50	0	0	$0	$0
7/7/2016	LINE SPG	50	0	0	$0	$0
7/7/2016	CATLETTSBURG	55	0	0	$0	$0
7/8/2016	ELKMONT	60	0	0	$0	$0
7/8/2016	PITNER	50	0	0	$0	$0
7/12/2016	BEECH SPGS	50	0	0	$0	$0
3/1/2017	CATLETTSBURG	50	0	0	$0	$0
3/1/2017	CATLETTSBURG	50	0	0	$0	$0
3/27/2017	CATES XRDS	50	0	0	$0	$0
5/24/2017	GLADES	50	0	0	$0	$0
5/24/2017	SEVIERVILLE ARPT	50	0	0	$0	$0
6/25/2018	BIRD XRD	50	0	0	$0	$0
6/26/2018	CATLETTSBURG	50	0	0	$0	$0
6/28/2018	GLADES	50	0	0	$0	$0
11/6/2018	PITNER	50	0	0	$0	$0

Since the last plan update, there have been 51 thunderstorm wind events that have occurred within the unincorporated areas of Sevier County and Pigeon Forge.

Incidents/Probability

The NCEI Storm Events Database reports 189 thunderstorm wind events within the boundaries of Sevier County between the years 1996 and 2018. With 189 events, the annual return rate (frequency) for thunderstorm wind events in the unincorporated area of Sevier County and Pigeon Forge is eight to nine events every year. This equates to an annual probability of approximately 100%.

7.1.10 Tornadoes

Location & Extent

While there is a significant tornado record for Sevier County with actual locations, tornadoes in general are a meteorological phenomenon that can occur anywhere and have the same approximate probability of occurring anywhere in the Sevier County planning area. Because a tornado has a similar probability of striking anywhere within the planning area, all of Sevier County and Pigeon Forge are equally at risk for tornadoes. The tornadoes experienced in Sevier County range from EF0 to EF1 on the EF scale. Based on

historical county-level data, the worst-case scenario for Sevier County and Pigeon Forge is an EF1 tornado; however, an EF4 tornado did impact Blount County in 2011 in an area adjacent to Sevier County.

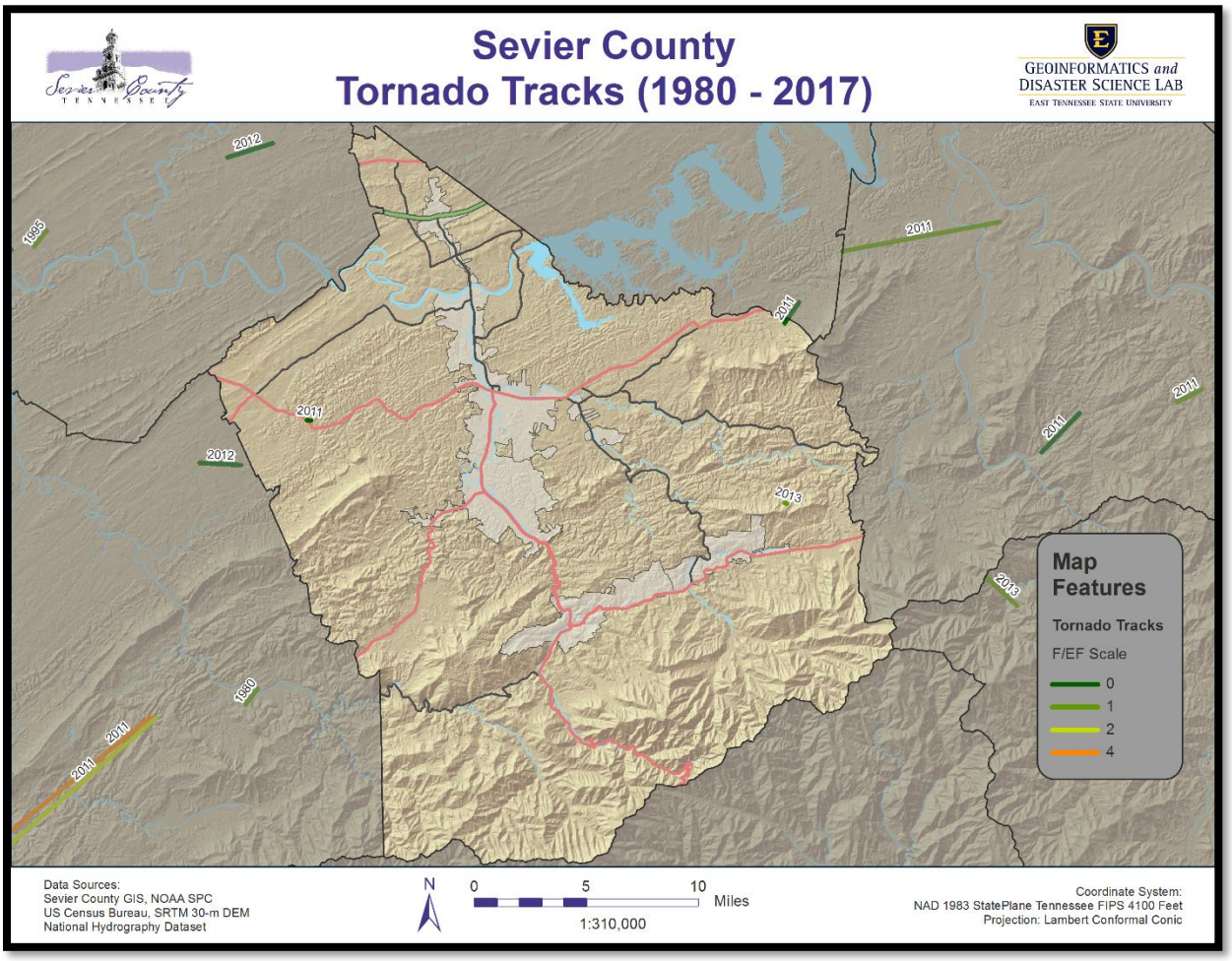

Figure 7-12: Tornado Density and Tracks in Relation to Sevier County.

Previous Occurrences

The NCEI Storm Events Database reports three tornadoes occurring within the boundaries of Sevier County. There have been no injuries due to tornadoes in Sevier County and Pigeon Forge. The following table is a list of all events that have occurred between 1996 and 2018.

Table 7-9: Tornado Incidents from 1996 to 2018 with Total Losses.
(Source: NCEI Storm Events Database)

Date	Location	Magnitude	Injuries	Fatalities	Property Damage
4/27/2011	CUSICK	EF0	0	0	$5,000
4/27/2011	BIRD XRD	EF0	0	0	$3,000
6/13/2013	SEVIERVILLE	EF1	0	0	$50,000

Since the last plan update, there have been no tornado events that have caused property damage and/or loss of life or injuries in Sevier County and Pigeon Forge.

Incidents/Probability

The NCEI Storm Events Database reports three tornado events within the boundaries of Sevier County between the years 1996 and 2018. With three events, the annual return rate (frequency) for tornado events in the unincorporated area of Sevier County and Pigeon Forge is one event every 7 to 8 years. This equates to an annual probability of approximately 12%.

7.1.11 Tropical Cyclones (Hurricanes)

Location & Extent

Tropical cyclones typically impact multiple regions and not one specific jurisdiction. Based on historical data, the Sevier County planning area can expect to experience tropical cyclones at the tropical depression level. Additionally, no portions of Sevier County will be impacted by storm surge based on its geographical location.

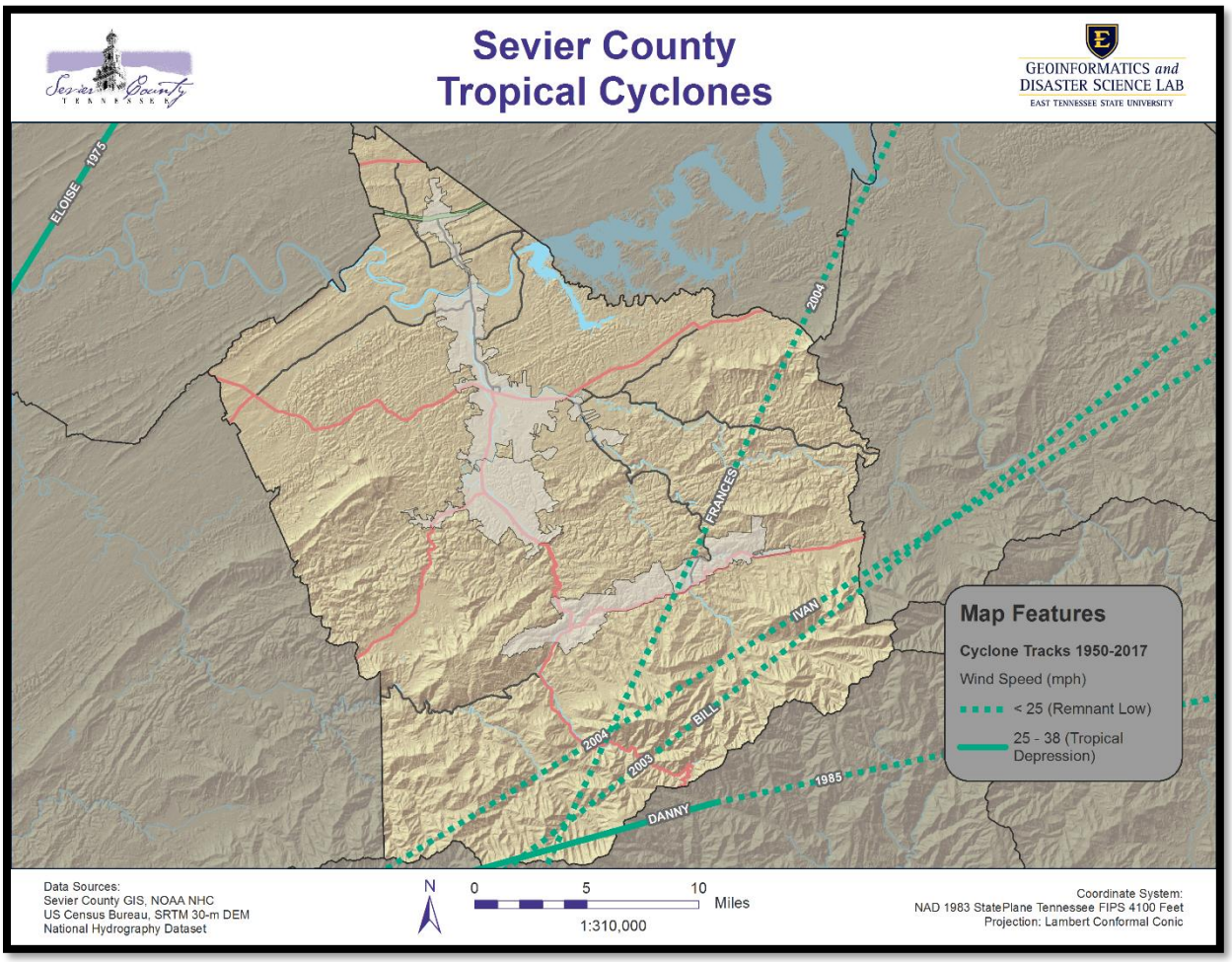

Figure 7-13: Tropical Cyclone Tracks in Relation to Sevier County and Its Jurisdictions.

Previous Occurrences

The NCEI Storm Events Database reports no tropical cyclone (tropical depressions, tropical storms, and hurricanes) occurrences within the boundaries of Sevier County and Pigeon Forge between the years 1996 and 2018.

Incidents/Probability

Based on historical record, the annual probability of tropical cyclones for Sevier County and Pigeon Forge is less than 1%.

7.1.12 Wildfires/Conflagration

Location & Extent

Wildfires affect areas that are populated with forests and grasslands. On the fire danger rating system, Sevier County and Pigeon Forge can expect a moderate to high rating based on current land use/land cover in the area. The following figure displays the areas of wildland-urban interface and intermix for Sevier County and Pigeon Forge, as well as the underlying land cover (aerial imagery). The aerial imagery helps to identify possible wildfire fuel sources such as small wooded and shrub areas that may not be identified by the WUI dataset.

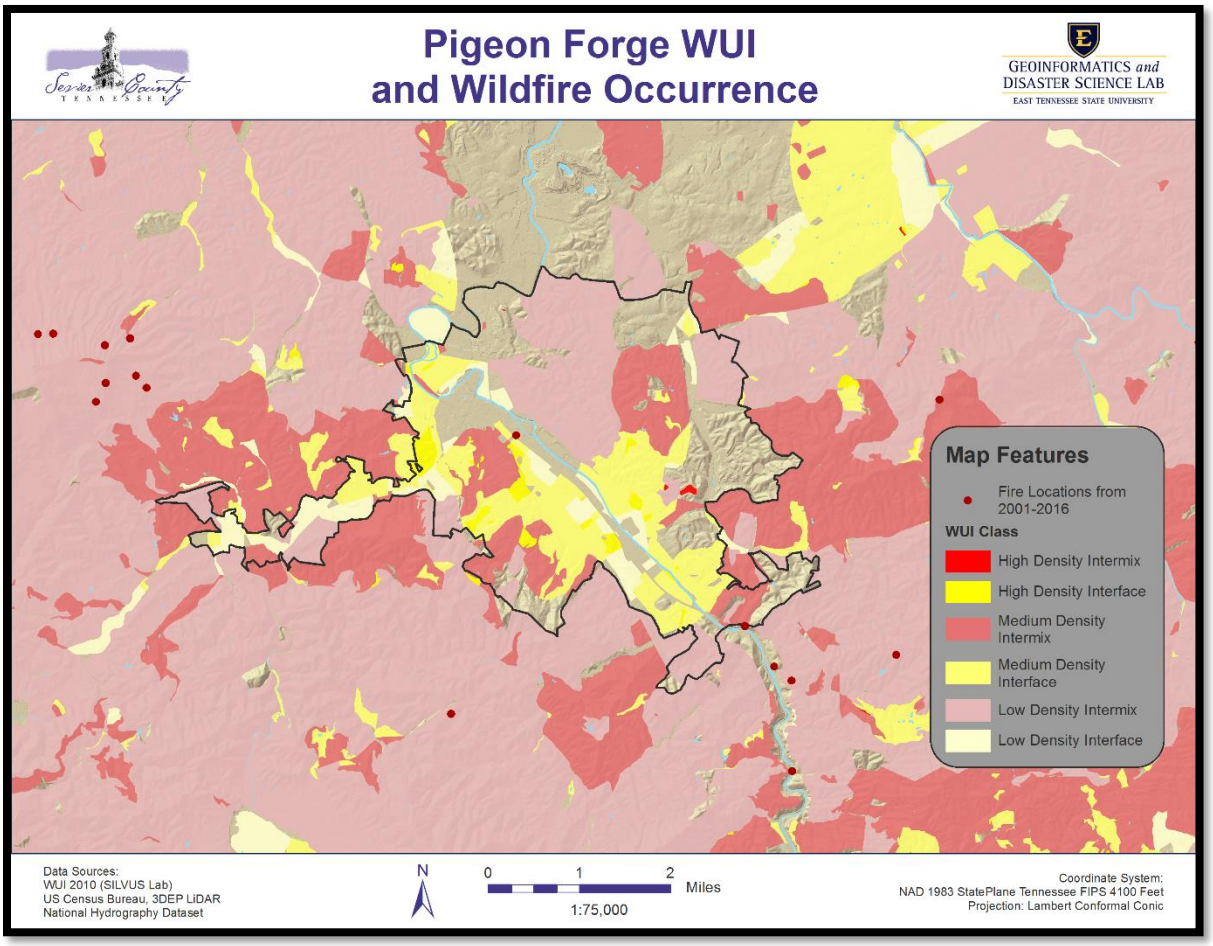

Figure 7-14: Wildland-Urban Interaction for Pigeon Forge.

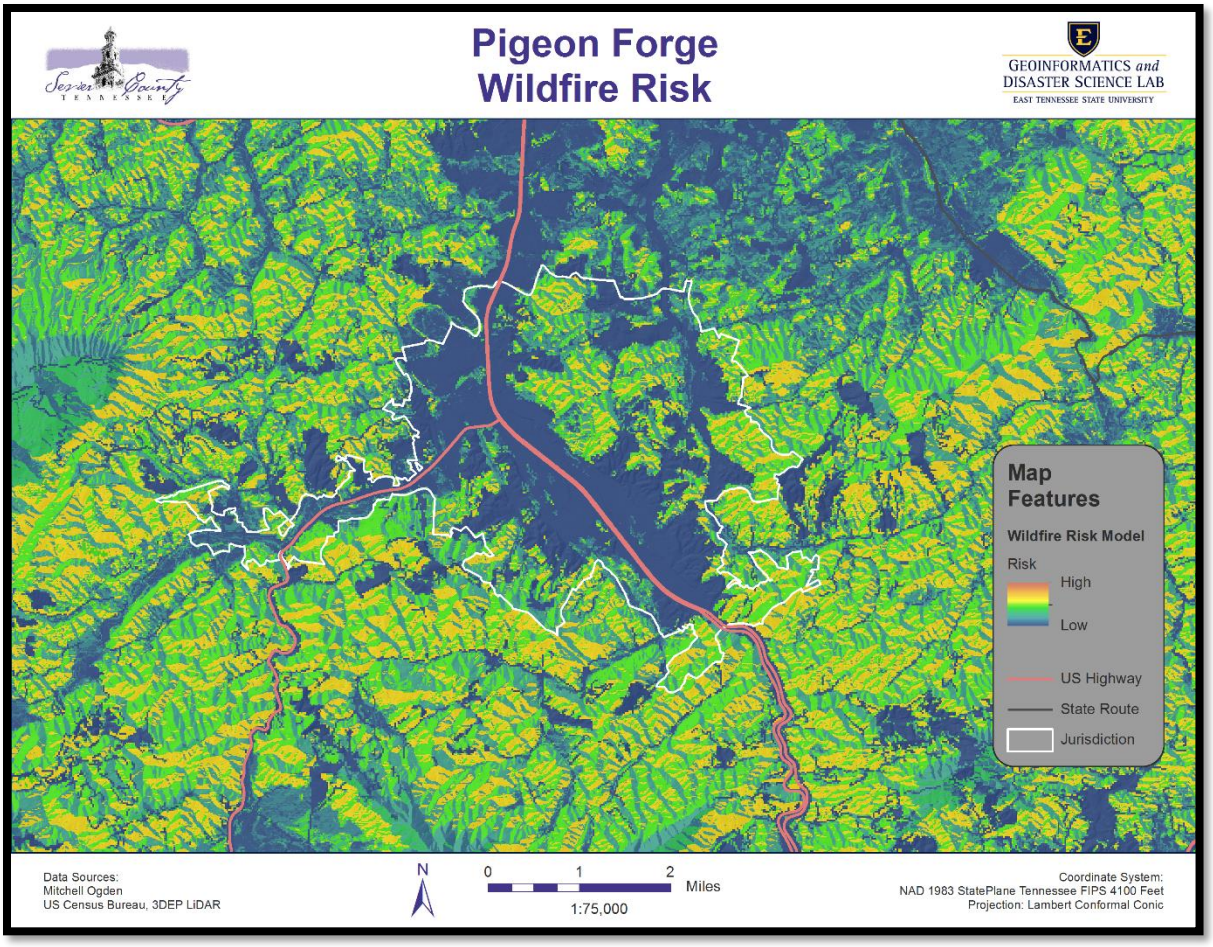

Figure 7-15: Wildfire Risk Model for Pigeon Forge.

Using the record of wildfires in Sevier County, how much of an effect each variable has on wildfire development can be determined through spatial logistic regression and GIS modeling. Calculating wildfire risk through these methods requires data on previous wildfire occurrences and variables related to fire development. Wildfire occurrence data comes from two sources: the United States Forest Service (USFS) and the Geological Survey (USGS). The USGS data recorded only those wildfires that occurred on federal land, primarily the Great Smoky Mountains National Park, for which the USFS dataset includes.

The duration of a wildfire depends on the weather conditions, how dry it is, the availability of fuel to spread, and the ability of responders to contain and extinguish the fire. Historically, some wildfires have lasted only hours while other fires have continued to spread and grow for an entire season. They spread quickly and often begin unnoticed until they have grown large enough to produce dense smoke. If fuel is available, and high wind speeds occur, a wildfire can spread over a large area in a very short amount of time. These factors make the difference between small upstart fires easily controlled by local fire services and fires destroying thousands of acres requiring multiple state and federal assets for containment and suppression.

Previous Occurrences

The USGS and USFS report 168 wildfire/conflagration occurrences within the boundaries of Sevier County and Pigeon Forge from 2001 to 2016. A historic drought in the fall of 2016 preceded historic wildfires. By November 22, all 95 counties in Tennessee were classified in "Severe Drought" (D2) or higher. Tennessee experienced numerous wildfires across the state, including several that required federal assistance. On November 28, 2016, hurricane-force winds rapidly expanded a small wildfire in Sevier County into the largest interface fire to affect the state of Tennessee in 100 years, resulting in an estimated $911 million in property and contents loss. There were 14 fatalities and 221 people treated with fire-related injuries. The fire area was reported at 17,140 acres.

Figure 7-16: Photos showing the 2016 wildfire entering the developed area of Gatlinburg (upper left, The Atlantic), drastically reducing visibility with intense smoke (upper right, WV Metro News), devastating large areas (lower left, CNN), and destroying many homes (lower right, NPR).

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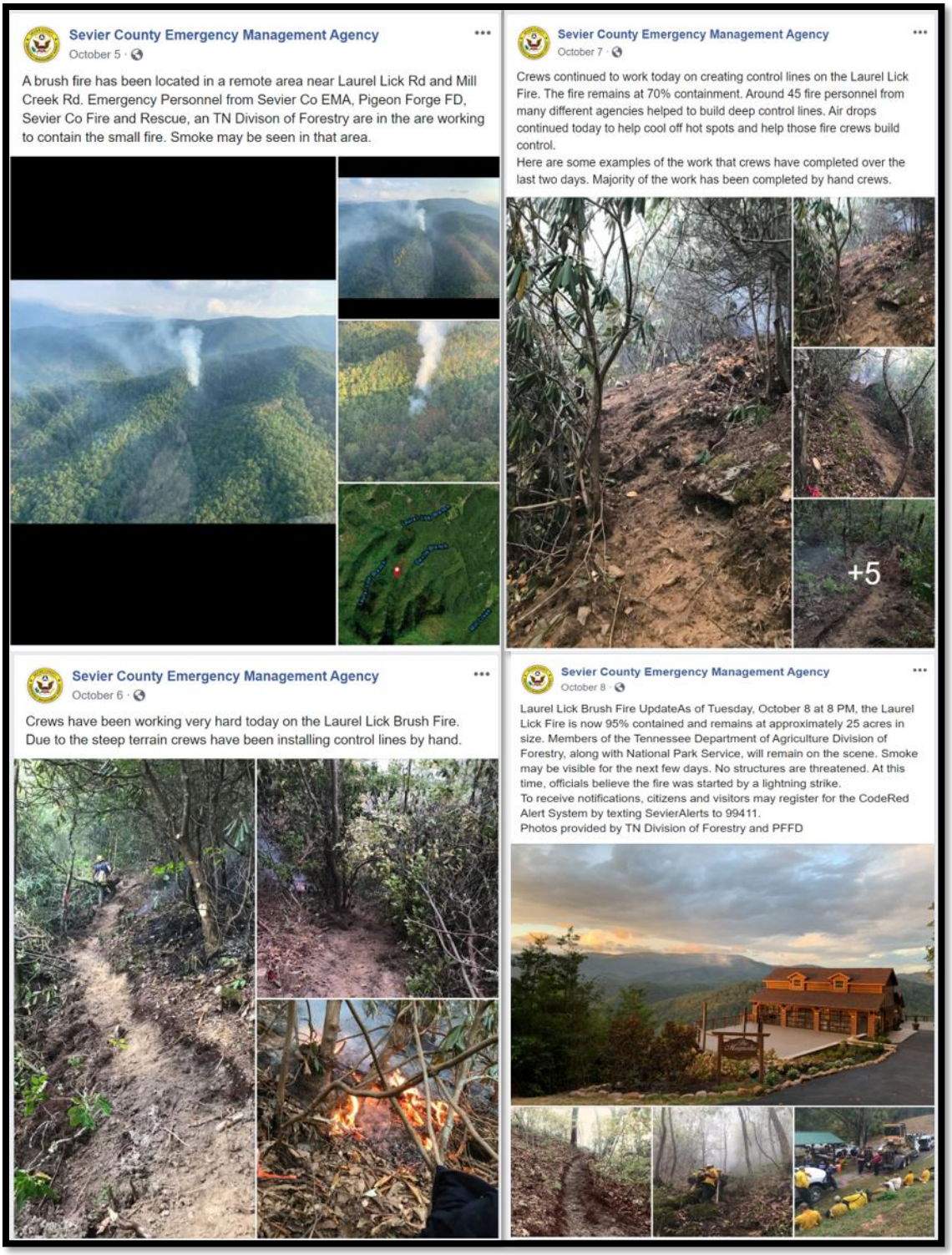

Figure 7-17: Social media documentation and community awareness of recent wildfires (October 2019) impacting Sevier County (Sevier County EMA).

Incidents/Probability

The USGS and USFS Database reports 168 wildfire/conflagration events within the boundaries of Sevier County between the years 2001 and 2016. With 168 events, the annual return rate (frequency) for wildfire/conflagration events in the unincorporated area of Sevier County and Pigeon Forge is eight to nine events every year. This equates to an annual probability of approximately 100%.

7.1.13 Winter Storms

Location & Extent

Because winter weather is a climatological hazard and has the same probability of occurring in any area in Sevier County, the entire planning area is equally at risk for winter weather. Based on historic data, Sevier County and Pigeon Forge can expect a category 5 on the Ohio Valley Regional Snowfall Index scale.

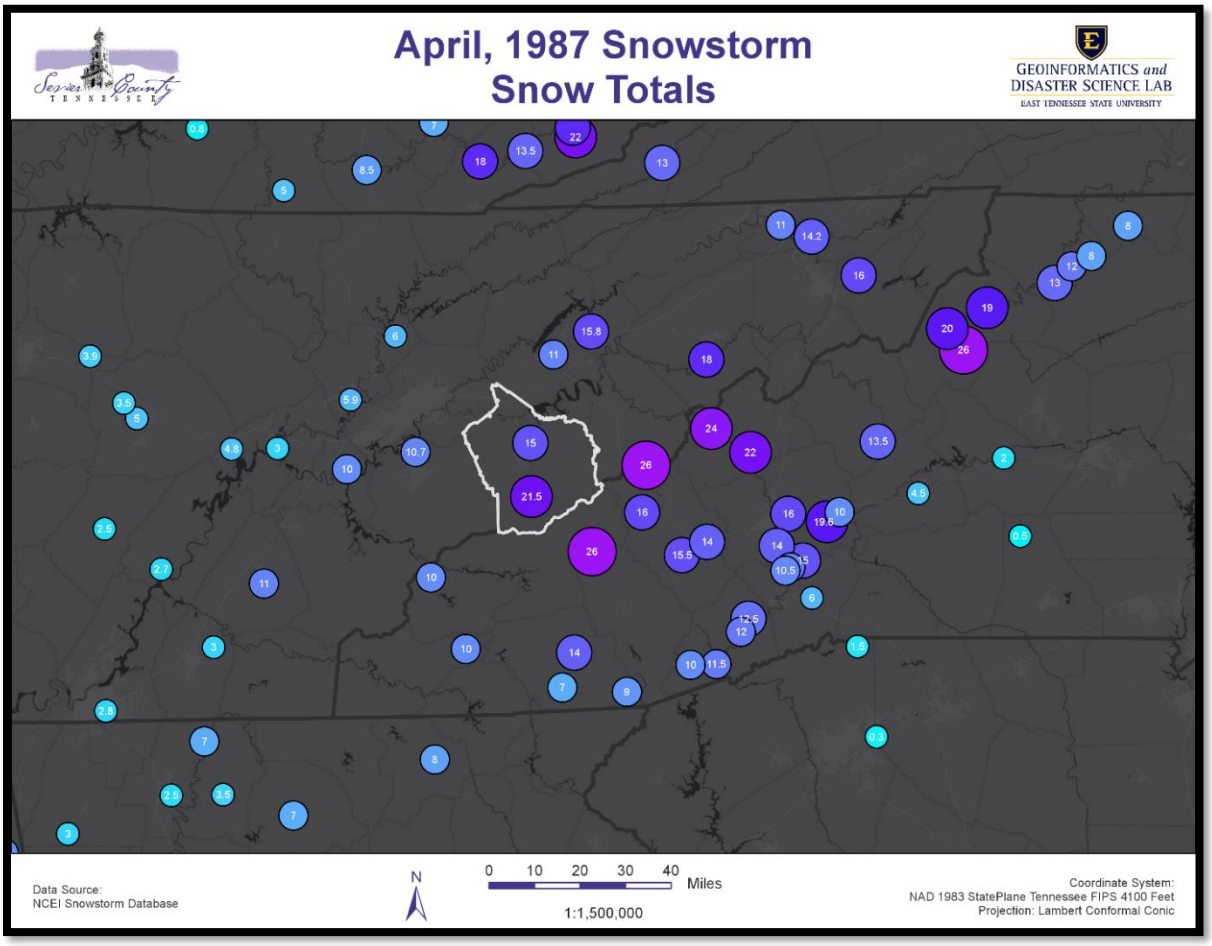

Figure 7-18: Station reported snowfall totals from the April 1987 snowstorm. This event resulted in the highest single day snowfall total for Sevierville, TN.

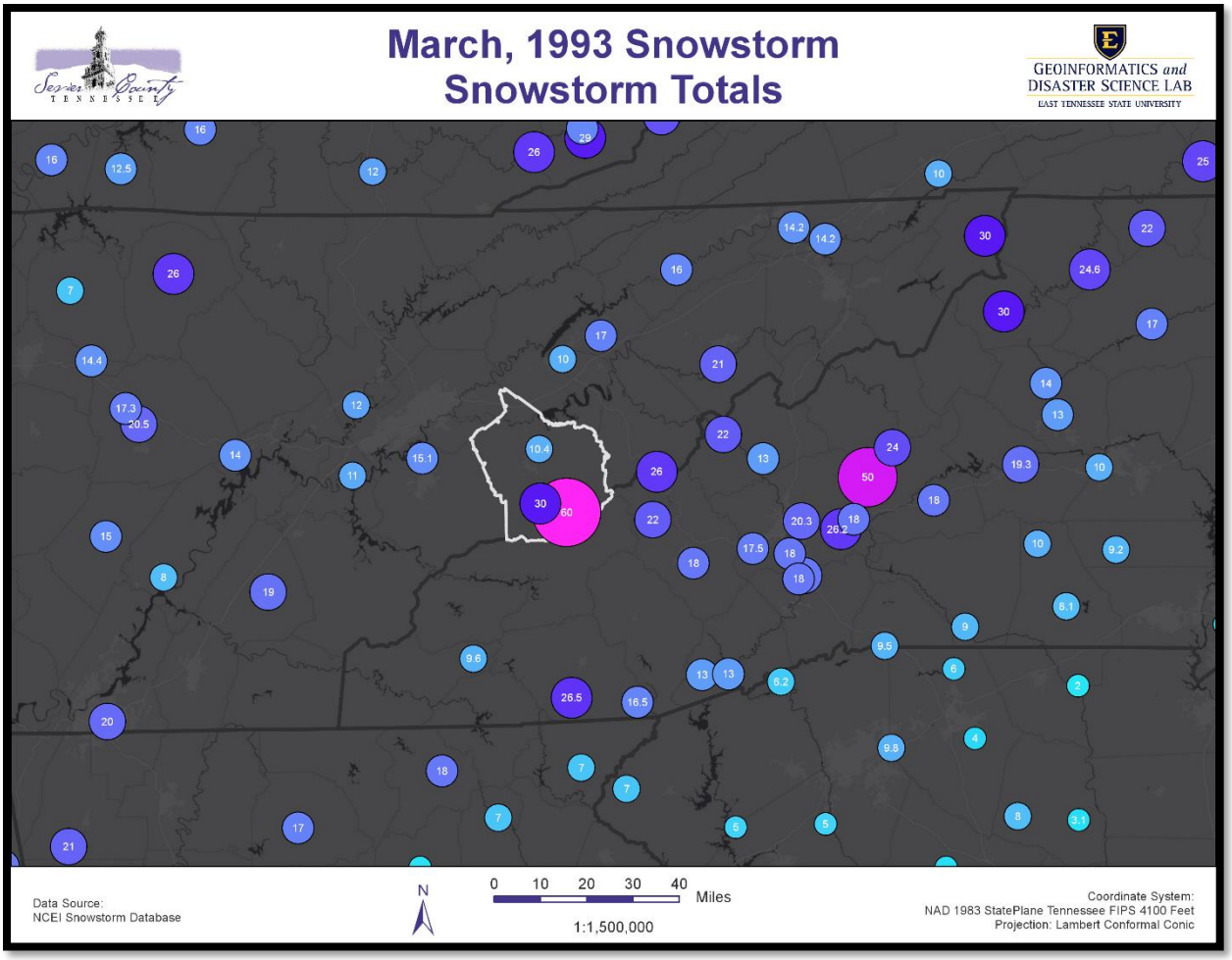

Figure 7-19: Station reported snowfall totals from the March 1993 snowstorm. This event resulted in the highest single day snowfall total for Gatlinburg, TN.

Previous Occurrences

Historically, there have been 102 winter storm events in the unincorporated area of Sevier County and Pigeon Forge from 1996 to 2018. There have been no injuries or fatalities due to winter storm events in the Sevier County planning area. The following table briefly outlines the winter storm events that have occurred in the unincorporated area of Sevier County and Pigeon Forge.

Table 7-10: Winter Storm Incidents from 1996 to 2018 with Total Losses.
(Source: NCEI Storm Events Database)

Date	Location	Injuries	Fatalities	Property Damage	Crop Damage
1/6/1996	GATLINBURG	0	0	$0	$0
1/6/1996	SOUTHWEST PART	0	0	$0	$0
1/11/1996	SEVIERVILLE	0	0	$0	$0
1/11/1996	GATLINBURG	0	0	$0	$0
2/2/1996	EXTREME N PART OF CO	0	0	$0	$0
2/2/1996	SEVIERVILLE	0	0	$0	$0

Date	Location	Injuries	Fatalities	Property Damage	Crop Damage
3/19/1996	SEYMOUR	0	0	$5,000	$0
3/19/1996	COUNTYWIDE	0	0	$0	$0
12/18/1996	COUNTYWIDE	0	0	$0	$0
12/18/1996	SEVIERVILLE	0	0	$0	$0
1/10/1997	COUNTYWIDE	0	0	$0	$0
1/10/1997	PIGEON FORGE	0	0	$0	$0
12/30/1997	GATLINBURG	0	0	$0	$0
12/30/1997	KODAK	0	0	$0	$0
1/27/1998	GATLINBURG	0	0	$0	$0
1/27/1998	SEVIERVILLE	0	0	$0	$0
1/6/1999	SEVIERVILLE	0	0	$0	$0
1/6/1999	SEVIERVILLE	0	0	$0	$0
3/3/1999	PIGEON FORGE	0	0	$0	$0
3/3/1999	SEVIERVILLE	0	0	$0	$0
3/13/1999	KODAK	0	0	$0	$0
3/13/1999	KODAK	0	0	$0	$0
3/26/1999	BEECH SPGS	0	0	$0	$0
3/26/1999	KODAK	0	0	$0	$0
1/22/2000	PIGEON FORGE	0	0	$0	$0
1/22/2000	SEYMOUR	0	0	$0	$0
12/2/2000	PIGEON FORGE	0	0	$0	$0
12/2/2000	PIGEON FORGE	0	0	$0	$0
12/18/2000	COUNTYWIDE	0	0	$0	$0
12/18/2000	COUNTYWIDE	0	0	$5,000	$0
1/1/2001	GATLINBURG	0	0	$0	$0
1/1/2001	GATLINBURG	0	0	$0	$0
1/20/2001	SEVIERVILLE	0	0	$0	$0
1/20/2001	KODAK	0	0	$0	$0
3/20/2001	HATCHERTOWN	0	0	$0	$0
3/20/2001	SEVIERVILLE	0	0	$0	$0
1/5/2002	KODAK	0	0	$2,000	$0
1/5/2002	SEYMOUR	0	0	$0	$0
12/4/2002	CEDAR BLUFF	0	0	$0	$0
1/5/2003	PIGEON FORGE	0	0	$0	$0
1/16/2003	PITTMAN CENTER	0	0	$0	$0
1/16/2003	COUNTYWIDE	0	0	$0	$0
1/22/2003	COUNTYWIDE	0	0	$0	$0
1/22/2003	SEVIERVILLE	0	0	$0	$0
2/7/2003	SEYMOUR	0	0	$0	$0
2/9/2003	COUNTYWIDE	0	0	$0	$0
4/10/2003	GATLINBURG	0	0	$0	$0

Date	Location	Injuries	Fatalities	Property Damage	Crop Damage
12/18/2003	COUNTYWIDE	0	0	$0	$0
12/19/2003	GATLINBURG	0	0	$0	$0
1/9/2004	GATLINBURG	0	0	$0	$0
1/9/2004	BOYDS CREEK	0	0	$0	$0
2/7/2004	WALDEN CREEK	0	0	$0	$0
12/11/2004	KODAK	0	0	$0	$0
12/19/2004	GATLINBURG	0	0	$0	$0
2/10/2005	SEVIERVILLE	0	0	$0	$0
2/28/2005	KODAK	0	0	$0	$0
11/21/2005	KODAK	0	0	$0	$0
1/14/2006	COUNTYWIDE	0	0	$0	$0
2/11/2006	SEYMOUR	0	0	$0	$0
2/18/2007	COUNTYWIDE	0	0	$0	$0
1/16/2008	PIGEON FORGE	0	0	$0	$0
2/27/2008	PIGEON FORGE	0	0	$0	$0
2/3/2009	COUNTYWIDE	0	0	$0	$0
4/7/2009	KODAK	0	0	$0	$0
12/18/2009	SEVIERVILLE	0	0	$0	$0
1/29/2010	SEYMOUR	0	0	$0	$0
1/29/2010	SEVIERVILLE	0	0	$0	$0
2/9/2010	SEYMOUR	0	0	$0	$0
2/24/2010	KODAK	0	0	$0	$0
12/6/2010	PIGEON FORGE	0	0	$0	$0
12/6/2010	KODAK	0	0	$0	$0
12/12/2010	SEVIERVILLE	0	0	$0	$0
12/12/2010	SEVIERVILLE	0	0	$0	$0
12/12/2010	COUNTYWIDE	0	0	$0	$0
12/12/2010	SEVIERVILLE	0	0	$0	$0
12/25/2010	SEVIERVILLE	0	0	$0	$0
12/26/2010	COUNTYWIDE	0	0	$0	$0
12/26/2010	GATLINBURG	0	0	$0	$0
12/26/2010	SEVIERVILLE	0	0	$0	$0
10/28/2012	SEVIERVILLE	0	0	$0	$0
10/28/2012	KODAK	0	0	$0	$0
10/28/2012	SEYMOUR	0	0	$0	$0
10/28/2012	SEVIERVILLE	0	0	$0	$0
1/17/2013	SEVIERVILLE	0	0	$0	$0
3/5/2013	PITTMAN CENTER	0	0	$0	$0
3/25/2013	GATLINBURG	0	0	$0	$0
11/26/2013	GATLINBURG	0	0	$0	$0
2/12/2014	KODAK	0	0	$0	$0

Date	Location	Injuries	Fatalities	Property Damage	Crop Damage
2/13/2014	COUNTYWIDE	0	0	$0	$0
3/29/2014	GATLINBURG	0	0	$0	$0
11/1/2014	COUNTYWIDE	0	0	$0	$0
2/17/2015	WALDEN CREEK	0	0	$1,000	$0
2/25/2015	KODAK	0	0	$0	$0
2/26/2015	CATLETTSBURG	0	0	$0	$0
1/20/2016	PITTMAN CENTER	0	0	$0	$0
1/22/2016	SEVIERVILLE	0	0	$0	$0
2/8/2016	SEVIERVILLE	0	0	$0	$0
1/6/2017	PIGEON FORGE	0	0	$0	$0
12/8/2017	GATLINBURG	0	0	$0	$0
1/29/2018	SEVIERVILLE	0	0	$0	$0
12/9/2018	BOYDS CREEK	0	0	$0	$0
12/21/2018	CATLETTSBURG	0	0	$0	$0

Since the last plan update, there have been 23 winter storm events that have occurred within the unincorporated areas of Sevier County and Pigeon Forge.

Incidents/Probability

The NCEI Storm Events Database reports 102 winter storm events within the boundaries of Sevier County between the years 1996 and 2018. With 102 events, the annual return rate (frequency) for winter storm events in the unincorporated area of Sevier County and Pigeon Forge is eight to nine events every year. This equates to an annual probability of approximately 100%.

7.1.14 Dam Failure

Location & Extent

Dams have been an important part of Sevier County's water infrastructure. In addition to the historic economic benefits provided by dams, they are used for flood control, water supply, power generation, recreation, and for mitigating the impact of increased runoff typically caused by land use changes associated with property development. The United Sates Army Corps of Engineers maintains a national inventory of dams in Sevier County.

In addition to proximity, the level of failure and meteorological conditions during a dam failure will greatly contribute to the extent of an incident. A minor failure will have lesser impacts than a total dam failure. Weather conditions also affect extent, as a dam failure without rainy conditions will have lesser extent, but the population will likely receive less warning. Conversely, rainy conditions exacerbate impacts, but allow for more warning due to expected failure.

According to the Federal Guidelines for Dam Safety, two (2) factors influence the severity of a dam failure: the amount of water impounded and the density, type, and value of development and infrastructure located downstream. Most dam failures are described by their potential point of inundation; the hazard potential levels of low, significant and high are further defined in the table below, while the figure on the

following page provides a map of the locations of significant- and high-hazard dams. The magnitude and severity of dam failures may also be assessed in terms of damage, including loss of life and injury, damage to infrastructure, loss of services or utilities, debris, and economic damage. The following figure shows dams in Sevier County and their hazard level.

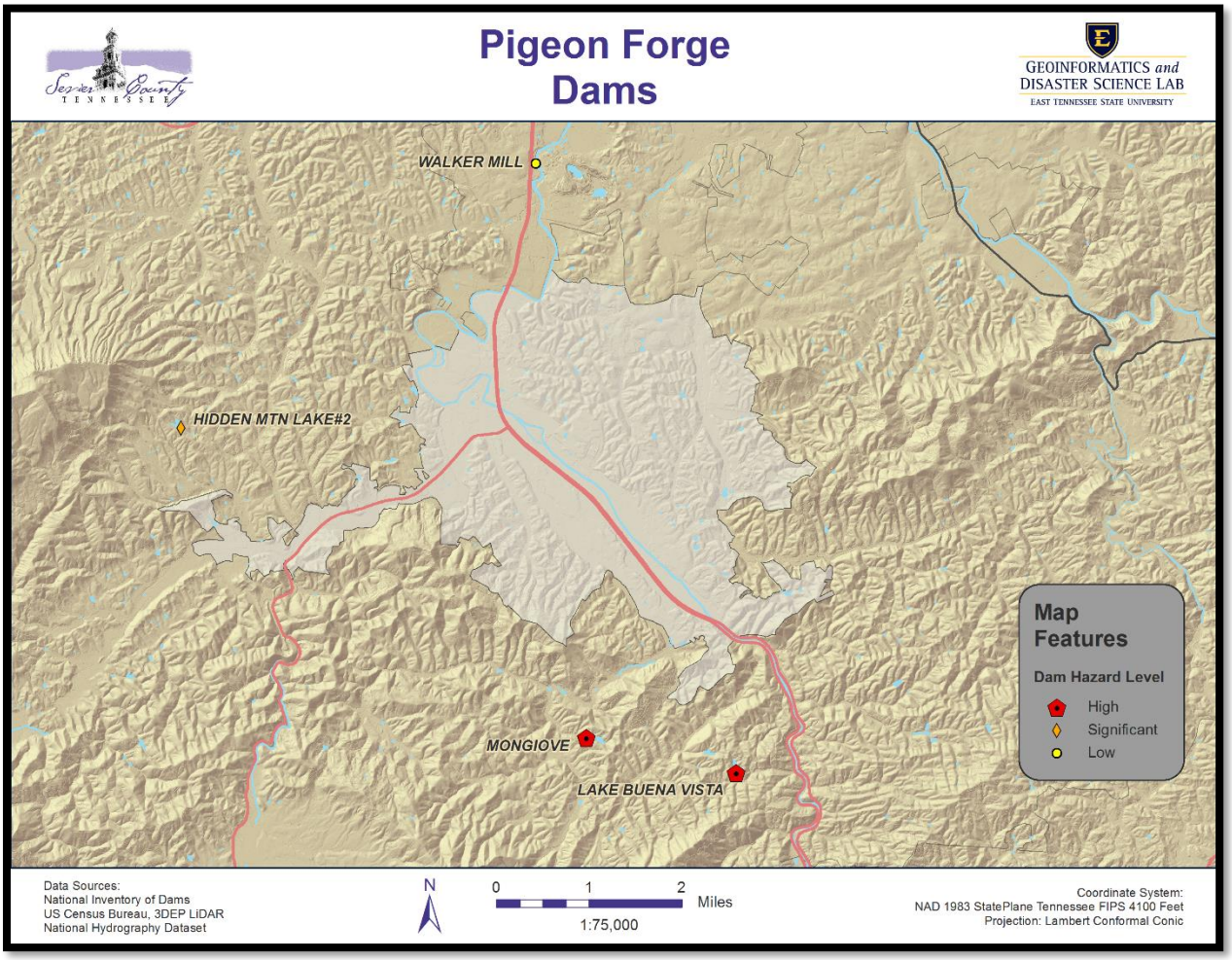

Figure 7-20: Dam Locations with Hazard Level near Pigeon Forge.

Previous Occurrences

Sevier County and Pigeon Forge have experienced no dam failures from 1989 to 2018 nor since the last update of the county hazard mitigation plan.

Incidents/Probability

Based on historical records, the annual chance of occurrence for a dam failure is calculated at less than 1%.

7.1.15 Infrastructure Failure

Location & Extent

Critical infrastructure is located throughout the county. Predicting the precise location of the next infrastructure failure is often difficult and generally dependent on the quality, upkeep, and maintenance of each piece of infrastructure as well as any protective actions that can mitigate or prevent sources of failure.

The failure of these structures could have potentially devastating impacts, including significant disruption to essential facilities, economic and financial impacts, and physical damage to infrastructure. The reliance of virtually all industries on transportation networks is of key importance. A significant event could have cascading effects on other infrastructure.

Previous Occurrences

Oftentimes, smaller scale infrastructure failures occur as a secondary impact from a natural disaster, such as a temporary closure of a road due to a mass wasting event. Sevier County and Pigeon Forge experience these disruptions occasionally and manages them through coordination across agencies. When infrastructure does fail, the county responds quickly to repair the infrastructure.

Incidents/Probability

In general, the county has not experienced any direct, prolonged catastrophic infrastructure failures. However, a significant failure of infrastructure could result in severe disruptions to public life and overall response efforts. Overall, Sevier County and Pigeon Forge are vulnerable to infrastructure failure; however, the probability of occurrence is calculated at less than 1% based on previous occurrences.

7.1.16 Civil Disobedience/Terrorism

Location & Extent

Because of their often-spontaneous nature, it is difficult to pinpoint a location for the occurrence of a civil disturbance or terrorism event. However, monitoring social trends and social media can often inform responders about where potential demonstrations or acts of violence may take place. In addition, information gathered in advance may warn officials and provide locations of sites of potential future disturbances or acts of terrorism. Oftentimes, demonstrations and large, crowded gatherings begin peacefully and escalate to instances of sometimes-violent civil disturbance.

Instances of civil disobedience may originate from a number of different public gatherings, including political rallies, sporting events, and peaceful protests. Civil disturbance and acts of terrorism are typically seen in larger urban areas rather than rural unincorporated areas.

The severity of a civil disturbance incident depends on the nature of the disturbance. Significant disturbances can result in mass arrests, civilian curfews, intensive response efforts, property damage, injuries, and deaths. In general, civil disturbance impacts can range from low to high depending on the severity of the incident.

Police dispatched to control traffic corridors or intrusion on private property is considered a low severity civil disturbance. Disruption of businesses and potential property damage are assessed as a moderate civil disturbance. In these cases, police intervention would be required to restore order without employing

chemical agents or physical force. A severe civil disturbance incident would involve rioting, arson, looting, assault, and death, where aggressive police action (tear gas, curfews, and mass arrests) may be required.

Civil disturbances may take on different characteristics depending on the severity of an incident. Each level of severity—low, medium, or high—poses risk to property. A low severity rating may be given to a localized event that results in minimal to no property damage, minimal police action, and no physical harm to the participants, bystanders, or police. While low severity disturbances may simply disrupt usual business activity due to large crowds and inability to access businesses and possibly residences, they have the potential to become incidents of medium or even high severity due to the amount of people involved and the sometimes emotionally-charged atmosphere that can result. A localized event that results in damage to property, police action, and physical harm to people involved, such as police or protestors, may be considered moderately severe. A moderately severe event may cause some damage to businesses and residences but overall the damage is limited.

Civil disturbances involving emotionally-charged and highly contentious business, police, or political action, or unrest based on the outrage of a segment of the population, could be considered high severity. The results and extent of severe civil disturbances are expected to range from financially burdensome on businesses facing considerable damage and possibly looting to potential destruction of public and private property as well as fire and subsequent smoke damage.

Previous Occurrences

Sevier County and its jurisdictions recently experienced what could be considered an act of terrorism – the only such event of note from 1996 to 2019, and since the last plan update

Tanger Outlet Shooting

A gunman opened fire at the Tanger Outlet Mall in Sevierville on April 16, 2019, killing one person and wounded another before killing himself. The shooting appeared to be random, confirming that such events could happen anywhere and anytime, but most often in event areas or high population areas.

Incidents/Probability

Civil disturbances and acts of terrorism have a low probability of occurring in Pigeon Forge. Based on previous occurrences and location, there is less than a 5% annual chance of occurrence for civil disturbances and acts of terrorism in the unincorporated areas of Sevier County and Pigeon Forge.

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7.2 Vulnerability Assessment

7.2.1 Communicable Diseases Vulnerability

Estimated Impact and Potential Loss

Communicable disease does not have the potential to impact property and crops; however, livestock operations throughout Sevier County and Pigeon Forge are subject to disease outbreaks.

Vulnerable Population

Many communicable diseases are transmitted by vectors, such as mosquitoes, ticks, and fleas. Vectors can transmit an array of pathogens, such as viruses, bacteria, and protozoa, which can cause illness in humans (or humans and animals). While everyone in Sevier County and Pigeon Forge are susceptible to communicable disease, special attention should be paid to highly vulnerable populations such as those who are socioeconomically disadvantaged, young children, and the elderly.

Vulnerability Score

Table 7-11: Communicable Disease Vulnerability Score.

	Communicable Diseases Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	4	2	3	4	2	1.55	**2.6**

7.2.2 Drought Vulnerability

Estimated Impact and Potential Loss

According to the NCEI database, there has been one drought event that has caused some level of crop damage. The total agricultural damage from this event was $2,000. When annualizing the total cost over the 23-year record, total annual losses based on drought is estimated to be $83. The following table presents an analysis of agricultural exposure that is susceptible to drought by major crop type for Sevier County.

Table 7-12: Agricultural Exposure by Crop Type for Drought in Sevier County.
(Source: United States Department of Agriculture 2017 Census)

Agricultural Exposure by Crop Type for Drought				
Nursery Plants	Hay	Corn	Dry Peas	Soybeans
$428,000	$1,384,000	$98,000	$135,000	$31,000

Vulnerable Population

Drought typically has a larger impact on the agricultural community, and does not directly affect human life or health. However, drought can exacerbate other hazardous conditions, especially wildfires. There have been no reported injuries or loss of life due to drought in Sevier County and Pigeon Forge.

Vulnerability Score

Table 7-13: Drought Vulnerability Score.

	Drought Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	3	2	4	1	4	1.3	**2.4**

7.2.3 Earthquake Vulnerability

Estimated Impact and Potential Loss

Sevier County and Pigeon Forge are vulnerable to earthquake hazards; however, the impact is largely unknown since there has yet to be an earthquake that has caused any property or crop damage. The USGS database shows that there is a 6.34% chance of a major earthquake (5.0 or greater) within 50 miles of Sevier County and Pigeon Forge within the next 50 years.

Vulnerable Population

There has been no recorded earthquake event that has caused loss of life or injuries in the state of Tennessee per the Tennessee Hazard Mitigation Plan, so the impact on population is largely unknown in Sevier County and Pigeon Forge.

Vulnerability Score

Table 7-14: Earthquake Vulnerability Score.

	Earthquake Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	1	1	4	4	1	2.35	**2.0**

7.2.4 Extreme Temperature Vulnerability

Estimated Impact and Potential Loss

All of the Sevier County planning area is vulnerable to extreme temperatures. Extreme heat occurrences often transpire in conjunction with drought occurrences, which leaves the soil susceptible to desiccation. Extreme cold occurrences impact all utilities in the area such as exposed pipes that can freeze and burst. Based on historical data, there has been no property damage as a result of extreme temperatures; however, extreme temperatures have the potential to cause thousands of dollars in property damage.

Vulnerable Population

Residents of Sevier County and Pigeon Forge who are elderly or in poor health are at acute risk along with residents who work outside in the extreme conditions.

Vulnerability Score

Table 7-15: Extreme Temperatures Vulnerability Score.

	Extreme Temperatures Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	4	3	4	1	3	1.9	**2.9**

7.2.5 Flood Including Extreme Precipitation Vulnerability

Estimated Impact and Potential Loss

Using the Hazus 4.2 Flood Model, along with the Sevier County and Pigeon Forge Digital Flood Insurance Rate Maps, the 100-year flood scenario was analyzed to determine losses for the scenario. The following table displays the total economic losses that would result from a 100-year flood scenario.

Table 7-16: Estimated Losses for 100-Year Flood Scenario in Sevier County and its Jurisdictions.

Jurisdiction	Estimated Total Losses
Sevier County (Unincorporated)	$634,000
Gatlinburg	$784,000
Pigeon Forge	$880,000
Pittman Center	$51,000
Sevierville	$960,000
Total	**$3,309,000**

The Hazus 4.2 Flood Model also provided a breakdown by jurisdiction for seven primary sectors throughout Pigeon Forge. The losses for Pigeon Forge are listed in the following table.

Table 7-17: Estimated Losses for 100-Year Flood Scenario in Pigeon Forge by Sector.

Pigeon Forge	Estimated Total Losses
Agricultural	$0
Commercial	$465,000
Government	$0
Industrial	$213,000
Religious/Non-Profit	$1,000
Residential	$201,000
Education	$0
Total	**$880,000**

Vulnerable Population

The total population within the county that is susceptible to a flood hazard is shown in the table below:

Table 7-18: Vulnerable Populations Susceptible to a 100-Year Flood Event for Sevier County and its Jurisdictions.

Number of People Exposed to Flood Hazards			
Jurisdiction	**# in Community**	**# in Hazard Area**	**% in Hazard Area**
Sevier County (Unincorporated)	64,761	6,848	10.6%
Gatlinburg	3,944	977	24.8%
Pigeon Forge	5,875	1,433	24.4%
Pittman Center	502	74	14.7%
Sevierville	14,807	3,144	21.2%
Total	**89,889**	**12,476**	**13.9%**

The Hazus 4.2 Flood Model was also extrapolated to provide an overview of vulnerable populations throughout Sevier County and Pigeon Forge. The following table identifies the vulnerable population to floods in Pigeon Forge.

Table 7-19: Vulnerable Populates Susceptible to a 100-Year Flood Event in Pigeon Forge.

Pigeon Forge		
Category	**Total Numbers**	**% of People in Hazard Area**
Number in Hazard Area	1,433	24.4%
Persons Under 5 Years	94	6.5%
Persons Under 18 Years	304	21.2%
Persons 65 Year and Over	222	15.5%
Caucasian	1,156	80.7%
Minority	277	19.4%

Vulnerability Score

Table 7-20: Flooding including Extreme Precipitation Vulnerability Score.

	Flooding including Extreme Precipitation Vulnerability Score						
	Probability	**Impact**	**Spatial Extent**	**Warning Time**	**Duration**	**Vulnerability**	**Risk Factor**
Risk Level	3	2	3	3	2	3.15	**2.7**

7.2.6 Mass Wasting

Estimated Impact and Potential Loss

The entire planning area within Sevier County is susceptible to the effects of mass wasting events. Mass wasting events can cause serious damage to highways, buildings, homes, and other structures that support a wide range of economies and activities. Mass wasting events commonly coincide with other natural disasters such as extreme precipitation events. Expansion of urban development contributes to greater risk of damage by mass wasting.

The USGS recognizes six major impacts caused by mass wasting events:

1. Causes damage in all 50 states, Puerto Rico, and the U.S. Virgin Islands
2. Costs $3.5 billion per year in damage repair
3. Causes between 25 and 50 deaths in the United States annually
4. Reduces real estate values and tourist revenue
5. Leads to lost human, industrial, agricultural, and forest productivity
6. Causes damage to the natural environment

Vulnerable Population

Mass wasting events typically impact motorists and those living in the vicinity of a vulnerable area. This is demonstrated in a mass wasting event which occurred on August 1, 2019 in Gatlinburg when a tree fell from a slope and fatally injured a 73-year old man. The lack of a detailed mass wasting inventory makes research on the vulnerability of people to mass wasting events highly limited.

Vulnerability Score

Table 7-21: Mass Wasting Vulnerability Score.

	Mass Wasting Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	3	2	2	4	4	2	**2.5**

7.2.7 Severe Wind Vulnerability

Estimated Impact and Potential Loss

Since 1996, there have been two reported severe wind events that have occurred within the boundaries of Sevier County and Pigeon Forge. The total property damages associated with these events have totaled $22,000. To estimate the potential losses of a severe wind event on an annual basis, the total damage recorded for severe wind events was divided by the total number of years of available severe wind data (1996 - 2018). This provides an annual estimated potential loss of $957. To assess potential losses to the participating jurisdictions, the 2010 Census population was used to assign the estimated potential losses proportionally across the jurisdictions. The following table provides an estimate of potential property losses for Sevier County and its jurisdictions based on the 2010 Census data:

Table 7-22: Estimated Annual Losses for Severe Wind Events in Sevier County and its Jurisdictions.

Unincorporated Sevier County (72.0% of Population)	Gatlinburg (4.4 % of Population)	Pigeon Forge (6.5% of Population)	Pittman Center (0.6% of Population)	Sevierville (16.5% of Population)
$689	$42	$63	$5	$158

Vulnerable Population

There have been no recorded severe wind event that has caused loss of life or injuries in Sevier County and Pigeon Forge; however, these events have the potential to significantly impact the aviation community in these areas.

Vulnerability Score

Table 7-23: Severe Wind Vulnerability Score.

	Severe Wind Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	2	2	2	4	1	3.05	**2.3**

7.2.8 Sinkhole Vulnerability

Estimated Impact and Potential Loss

The entire Sevier County planning area is susceptible to subsidence and sinkholes based on the karst topography of the region. While sinkholes have a higher risk of forming in the northern portions of the county, the southern portion is also susceptible to sinkholes.

Vulnerable Population

There are no reported fatalities or injuries associated with sinkhole events.

Vulnerability Score

Table 7-24: Sinkhole Vulnerability Score.

	Sinkhole Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	4	2	1	4	1	1	**2.1**

7.2.9 Thunderstorm Vulnerability

Hail

Estimated Impact and Potential Loss

Since 1996, there have been 25 reported hail events that have occurred within the boundaries of Sevier County and Pigeon Forge. The total property damages associated with these events have totaled $13,700. To estimate the potential losses of a hail event on an annual basis, the total damage recorded for hail events was divided by the total number of years of available hail data (1996 - 2018). This provides an annual estimated potential loss of $596. To assess potential losses to the participating jurisdictions, the 2010 Census population was used to assign the estimated potential losses proportionally across the jurisdictions. The following table provides an estimate of potential property losses for Sevier County and its jurisdictions based on the 2010 Census data:

Table 7-25: Estimated Annual Losses for Hail Events in Sevier County and its Jurisdictions.

Unincorporated Sevier County (72.0% of Population)	Gatlinburg (4.4 % of Population)	Pigeon Forge (6.5% of Population)	Pittman Center (0.6% of Population)	Sevierville (16.5% of Population)
$429	$26	$39	$3	$98

Vulnerable Population

There have been no reported injuries or fatalities associated with hail events in Sevier County and Pigeon Forge.

Hail Vulnerability Score

Table 7-26: Hail Vulnerability Score.

	Hail Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	4	2	4	3	1	2.6	**2.9**

Lightning

Estimated Impact and Potential Loss

Since 1996, there have been two reported lightning events that have occurred within the boundaries of Sevier County and Pigeon Forge. There has been no reported property or crop damage associated with lightning within the boundaries of Sevier County.

Vulnerable Population

There has been one reported fatality from lightning that has occurred within the boundaries of Sevier County and Pigeon Forge. On July 10, 2004, a man was struck by lightning while he was fishing on Douglas Lake. The boat was several hundred yards from Douglas Dam when the incident occurred. He was rendered unconscious and fell into the water.

Lightning Vulnerability Score

Table 7-27: Lightning Vulnerability Score.

	Lightning Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	2	1	2	3	1	2.6	**1.9**

Wind

Estimated Impact and Potential Loss

Since 1996, there have been 189 reported thunderstorm wind events that have occurred within the boundaries of Sevier County and Pigeon Forge. The total property damages associated with these events have totaled $3,089,000. To estimate the potential losses of a thunderstorm wind event on an annual basis, the total damage recorded for thunderstorm wind events was divided by the total number of years of available thunderstorm wind data (1996 - 2018). This provides an annual estimated potential loss of $134,304. To assess potential losses to the participating jurisdictions, the 2010 Census population was used to assign the estimated potential losses proportionally across the jurisdictions. The following table provides an estimate of potential property losses for Sevier County and its jurisdictions based on the 2010 Census data:

Table 7-28: Estimated Annual Losses for Thunderstorm Wind Events in Sevier County and its Jurisdictions.

Unincorporated Sevier County (72.0% of Population)	Gatlinburg (4.4 % of Population)	Pigeon Forge (6.5% of Population)	Pittman Center (0.6% of Population)	Sevierville (16.5% of Population)
$96,760	$5,893	$8,778	$750	$22,123

Vulnerable Population

There have been no reported injuries or fatalities associated with thunderstorm wind events in Sevier County and Pigeon Forge.

Wind Vulnerability Score

Table 7-29: Wind Vulnerability Score.

	Wind Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	4	2	4	3	1	2.6	2.9

7.2.10 Tornado Vulnerability

Estimated Impact and Potential Loss

Since 1996, there have been three reported tornadoes that have occurred within the boundaries of Sevier County and Pigeon Forge. The total property damages associated with these tornadoes have totaled $58,000. To estimate the potential losses of a tornado on an annual basis, the total damage recorded for thunderstorm wind events was divided by the total number of years of available thunderstorm wind data (1996 - 2018). This provides an annual estimated potential loss of $2,522. To assess potential losses to the participating jurisdictions, the 2010 Census population was used to assign the estimated potential losses proportionally across the jurisdictions. The following table provides an estimate of potential property losses for Sevier County and its jurisdictions based on the 2010 Census data:

Table 7-30: Estimated Annual Losses for Tornado Events in Sevier County and its Jurisdictions.

Unincorporated Sevier County (72.0% of Population)	Gatlinburg (4.4 % of Population)	Pigeon Forge (6.5% of Population)	Pittman Center (0.6% of Population)	Sevierville (16.5% of Population)
$1,817	$111	$165	$14	$415

Vulnerable Population

There have been no reported injuries or fatalities associated with tornadoes; however, residents living in manufactured housing are more vulnerable to tornadoes and are more likely to sustain higher damage totals due to the construction materials. Approximately 22% of all buildings in Sevier County and Pigeon Forge are manufactured housing. The following table presents an analysis of building exposure that is susceptible to tornadoes by general occupancy type for Sevier County, along with the percentage of building stock that are manufactured homes.

Table 7-31: Building Exposure by General Occupancy Type for Tornadoes in Sevier County ($1,000).

Residential	Commercial	Industrial	Agricultural	Religion	Government	Education	Manufactured Homes
9,332,162	1,574,531	333,255	31,641	201,848	47,906	95,279	22%

Vulnerability Score

Table 7-32: Tornado Vulnerability Score.

	Tornado Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	3	2	2	4	3	2	**2.4**

7.2.11 Tropical Cyclone (Hurricane) Vulnerability

Estimated Impact and Potential Loss

There has been no reported property or crop damage associated with tropical cyclones within the boundaries of Sevier County and Pigeon Forge.

Vulnerable Population

There have been no reported injuries or deaths associated with tropical cyclone within the boundaries of Sevier County and Pigeon Forge.

Vulnerability Score

Table 7-33: Tropical Cyclone Vulnerability Score.

	Tropical Cyclone Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	1	1	4	1	2	1	**1.5**

7.2.12 Wildfires/Conflagration Vulnerability

Estimated Impact and Potential Loss

The entire Sevier County planning area is located near areas of wildland-urban interface and intermix or other susceptible land use/land cover types, which makes them vulnerable to wildfires. Southern areas of Sevier County are particularly vulnerable since they are located within the Great Smoky Mountain National Park. In November of 2016, a wildfire in Sevier County turned into the largest interface fire to affect the state of Tennessee in 100 years, resulting in $911 million in property and content loss.

Vulnerable Population

Sevier County and its jurisdiction residents near areas of wildland-urban interface and intermix and other wooded land cover types are vulnerable to the effects of wildfire. Fourteen fatalities and 221 people were treated for fire-related injuries in November 2016 when the largest interface fire to affect the state of Tennessee in 100 years occurred in Sevier County.

Vulnerability Score

Table 7-34: Wildfires/Conflagration Vulnerability Score.

	Wildfires/Conflagration Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	4	4	4	2	4	4	**3.9**

7.2.13 Winter Storm Vulnerability

Estimated Impact and Potential Loss

Since 1996, there have been 102 reported winter storm events which have occurred within the boundaries of Sevier County and Pigeon Forge. The total property damages associated with these storms have totaled $13,000. To estimate the potential losses of a winter weather event on an annual basis, the total damage recorded for winter storm events was divided by the total number of years of available winter storm data (1996 - 2018). This provides an annual estimated potential loss of $565. To assess potential losses to the participating jurisdictions, the 2010 Census population was used to assign the estimated potential losses proportionally across the jurisdictions. The following table provides an estimate of potential property losses for Sevier County and its jurisdictions based on the 2010 Census data:

Table 7-35: Estimated Annual Losses for Winter Storm Events in Sevier County and its Jurisdictions.

Unincorporated Sevier County (72.0% of Population)	Gatlinburg (4.4 % of Population)	Pigeon Forge (6.5% of Population)	Pittman Center (0.6% of Population)	Sevierville (16.5% of Population)
$407	$25	$37	$3	$93

There have been no injuries or fatalities due to winter storm events in the Sevier County planning area.

Vulnerable Population

All of Sevier County and its jurisdiction residents are vulnerable to the effects of winter weather.

Vulnerability Score

Table 7-36: Winter Storm Vulnerability Score.

	Winter Storm Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	4	3	4	2	4	3	3.4

7.2.14 Dam Failure Vulnerability

Estimated Impact and Potential Loss

Sevier County and Pigeon Forge are vulnerable to dam failures; however, the impact is largely unknown since there has yet to be a dam failure in the planning area.

Vulnerable Population

There have been no fatalities or injuries associated with dam failure in Sevier County and Pigeon Forge; however, homes and businesses in immediate vicinity downstream of a dam location are vulnerable to the impacts of a dam failure.

Vulnerability Score

Table 7-37: Dam Failure Vulnerability Score.

	Dam Failure Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	1	3	2	4	4	2.55	**2.5**

7.2.15 Infrastructure Failure Vulnerability

Estimated Impact and Potential Loss

In general, Pigeon Forge has not experienced any direct, prolonged catastrophic infrastructure failures. However, a significant failure of infrastructure could result in severe disruptions to public life and overall response efforts.

Vulnerable Population

There are no recorded fatalities or injuries associated with infrastructure failure in Pigeon Forge.

Vulnerability Score

Table 7-38: Infrastructure Failure Vulnerability Score.

	Infrastructure Failure Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	1	3	2	4	3	2	**2.3**

7.2.16 Civil Disobedience/Terrorism Vulnerability

Estimated Impact and Potential Loss

The Sevier County planning area experienced one civil disobedience/terrorism event since 1996 (Tanger Outlet Shooting in April 2019), although this did not occur in Pigeon Forge.

Vulnerable Population

There were two fatalities and one injury associated with civil disobedience/terrorism events.

Vulnerability Score

Table 7-39: Civil Disobedience/Terrorism Vulnerability Score.

	Civil Disobedience Terrorism Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	1	4	4	4	1	2.8	**2.9**

7.3 Capability Assessment

This section summarizes the results of the Sevier County Hazard Mitigation Planning Committee and other agency efforts to develop policies, programs, and activities that directly or indirectly support hazard mitigation. It also provides information on resources and gaps in the county's infrastructure, as well as relevant changes in its laws since the last Plan Update, in order to suggest a mitigation strategy. Through this assessment, Sevier County is able to identify strengths that could be used to reduce losses and reduce risk throughout the community. It also identifies areas where mitigation actions might be used to supplement current capabilities and create a more resilient community before, during, and after a hazard event.

Policies, Plans, and Programs

Sevier County and Pigeon Forge capabilities are unique to the county as a whole, including planning, regulatory, administrative, technical, financial, education, and outreach resources. There are a number of mitigation-specific acts, plans, executive orders, and policies that address specific goals, objectives, and policy statements which already support or could support pre- and post-disaster hazard mitigation. Many of the ongoing plans and policies hold significant promise for hazard mitigation, and take an integrated and strategic look holistically at hazard mitigation in all jurisdictions to continually propose ways to improve it. These tools are valuable instruments in pre- and post-disaster mitigation as they facilitate the implementation of mitigation activities through the current legal and regulatory framework. Some examples of these types of planning and regulatory efforts for Sevier County and each jurisdiction are the following:

- Comprehensive/Master Plan
- Transportation Plan
- Local Emergency Operations Plan
- Community Wildfire Protection Plan
- Building Codes
- Flood Insurance Rate Maps
- Zoning Ordinance

Some programs and policies, such as the ones just described, might use complementary tools to achieve a common end, but fail to coordinate with or support each other. Thus, coordination among local mitigation policies and programs is essential to hazard mitigation.

Administration, Technical, and Financial

As a community, Sevier County and Pigeon Forge have administrative and technical capabilities in place that may be utilized in reducing hazard impacts or implementing hazard mitigation activities. Such capabilities include staff, skillset, and tools available in the community that may be accessed to implement mitigation activities and to effectively coordinate resources. The following are resources in place for Sevier County and its incorporated jurisdictions:

- Maintenance programs to reduce risk (tree trimming, clearing drainage systems)
- Mutual Aid Agreements
- Emergency Manager
- Community Planner

- GIS Data
- Warning Systems/Services (Reverse 911, outdoor warning systems)
- Hazard Data & Information

Financial capabilities are the resources that Sevier County and its incorporated jurisdictions have access to or are eligible to use to fund mitigation actions. The following resources are available to fund mitigation actions in Sevier County and its incorporated jurisdictions:

- Capital Improvements Project Funding
- Authority to levy taxes for specific purposes
- Fees for water, sewer, gas, or electric services

Sevier County and its incorporated jurisdictions have existing programs to implement mitigation activities as well as communicate risk. The existing programs are as follows:

- Local citizen groups or non-profits focused on environmental protection, emergency preparedness, access and functional needs populations, etc.
- Ongoing public education or information programs (responsible water use, fire safety, household preparedness, wildfire preparedness)
- Storm Ready certification
- Firewise Communities certification

The following jurisdictions and entities are recognized by Sevier County under the Hazard Mitigation Plan allowing them to apply for available hazard mitigation funding for as long as these jurisdictions notify the county of their intentions and the county concurs:

- City of Gatlinburg
- City of Pigeon Forge
- Town of Pittman Center
- City of Sevierville
- Unincorporated Areas of Sevier County

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7.4 Summary

Table 7-40: Risk Assessment for the City of Pigeon Forge.

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Overall Risk
Wildfires/ Conflagration	4	4	4	2	4	4.0	**3.9**
Winter Storms	4	3	4	2	4	3.0	**3.4**
Extreme Temperatures	4	3	4	1	3	1.9	**2.9**
Civil Disobedience/ Terrorism	1	4	4	4	1	2.8	**2.9**
Thunderstorms (Hail)	4	2	4	3	1	2.6	**2.9**
Thunderstorms (Wind)	4	2	4	3	1	2.6	**2.9**
Floods Including Extreme Precipitation	3	2	3	3	2	3.2	**2.7**
Communicable Disease	4	2	3	4	2	1.6	**2.6**
Mass Wasting	3	2	2	4	4	2.0	**2.5**
Dam Failure	1	3	2	4	4	2.6	**2.5**
Tornadoes	3	2	2	4	3	2.0	**2.4**
Drought	3	2	4	1	4	1.3	**2.4**
Severe Wind	2	2	2	4	1	3.1	**2.3**
Infrastructure	1	3	2	4	3	2.0	**2.3**
Sinkholes	4	2	1	4	1	1.0	**2.1**
Earthquakes	1	1	4	4	1	2.4	**2.0**
Thunderstorms (Lightning)	2	1	2	3	1	2.6	**1.9**
Tropical Cyclones	1	1	4	1	2	1.0	**1.5**

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8. Town of Pittman Center

8.1 Risk Assessment

This section assesses the various hazard risks that the town of Pittman Center faces in order to identify a strategy for mitigation. Having identified the categories of hazards, emergencies, disasters, and catastrophes, this section details the major natural, technological, and human-caused hazards by (1) describing their geographic extent, (2) surveying their previous occurrences, and (3) evaluating their future likelihood of occurrences. To review news stories and other media related to previous occurrences, see Appendix D.

8.1.1 Communicable Diseases

Location & Extent

Tennessee maintains an extensive array of communicable disease personnel both inside and ancillary to the Communicable and Environmental Diseases and Emergency Preparedness (CEDEP) division. Communicable and Environmental Disease and Emergency Preparedness is a program area of the Tennessee Department of Health; it is assigned the responsibility of detecting, preventing, educating, and controlling infectious and environmentally-related illnesses of public health significance. Emergency management personnel are more frequently including pandemic and communicable disease drills in their exercise dockets at locations across the nation. The Centers for Disease Control and Prevention (CDC) has created a pandemic flu toolkit which is aligned with the pandemic phases outlined by the 2013 World Health Organization guidelines.

A biologic or communicable disease threat can occur anywhere, or anytime. Concentrated efforts must be made at surveillance in the following arenas:

Healthcare: Tennessee health care institutions serve as the front lines to communicable disease response and also as potential disease reservoir populations and points of cross contamination. Tennessee maintains excellent hospital and in-patient coverage in all 3 of its primary regions, with Level I trauma facilities. All Tennessee hospitals and healthcare facilities are required to report specific Healthcare Acquired Infections to the NHSN, the National Healthcare Safety Network. The NHSN is a web-based data reporting and submission program, which includes validation routines for many data elements, thus reducing common data entry errors. Hospitals can view, edit, and analyze their data at any time.

Education Facilities and Dormitories: The State of Tennessee mandates a vaccination series for all incoming resident students at educational facilities, consisting of measles, mumps, rubella, meningococcal meningitis, and varicella vaccines. In spite of these vaccine series, dormitory housing at colleges and universities have historically been susceptible to outbreaks of viral meningitis. Vaccination, along with immediate quarantine procedures should be adhered to with particular care in the academic setting where institutional controls are the primary mitigation technique with proven effectiveness

Previous Occurrences

Influenza

In 2012, Tennessee was listed by the CDC as one of the highest influenza burdened states in the nation. On average, 20% of the nation's population will contract the seasonal influenza every year. Tennessee

carries a higher than average mortality and morbidity rate for influenza and associated pneumonia, with 20.9 per 100,000 compared with the national average of 16.2 per 100,000.

HIV/AIDS

The incidence of HIV/AIDS and their associated comorbidities (including tuberculosis) increased in Tennessee from 2006 to 2012 across almost all ages, sexes, and races, with the exception of diagnosed AIDS cases in 2011, which decreased markedly. The 2 are categorized separately by both state and federal agencies due to differing mortalities and comorbidities for each. Currently in Tennessee, 18 community-based organizations are funded to implement a wide-range of science-based HIV prevention programs.

Tertiary Events

Hepatitis C

In 2012, the CDC revised its recommendations to include prophylactic screening for Hepatitis C for anyone born between the years 1945 and 1965. This screening is seen as paramount to reducing potential contamination in the blood supply as Hepatitis C is spread primarily through contaminated needles and drug use. Prior to 1992, blood supply screening techniques were not used resulting in Hep C being transmitted through blood transfusions and organ transplants. The most common mode of transmission for Hep A is person-to-person, resulting from fecal contamination and oral ingestion, and contaminated shellfish. In 1995, a major outbreak of Hepatitis A occurred in Tennessee with Shelby County documenting over 80% of the diagnosed cases. In the fall of 2003, approximately 80 cases were attributed to a Hepatitis A outbreak resulting from ingestion of contaminated green onions at a restaurant in East Tennessee.

Hepatitis B

Hepatitis B is transmitted through blood or body fluids, semen, cervical secretions, and saliva. People with chronic HBV infection are the primary reservoirs for infection. With the exception of the year 2001, from 1995 to 2002, Hepatitis B acute cases steadily decreased. The prevalence of HBV infection among adolescents and adults is 3 to 4 times greater for black individuals than white individuals. Children born to Hepatitis B Surface Antigen positive women are at high risk of becoming chronic carriers of hepatitis B. If these children are administered Hepatitis B Immune Globulin and hepatitis B vaccine at birth, their chances of being protected from the illness are greatly increased. The result is the endorsement of this mitigation procedure by the TDH and the CDC.

Incidents/Probability

The communicable disease events categorized by the CDC and the US Department of Labor as the most likely to adversely affect human performance are any and all strains of influenza. In a typical flu season, between 5% and 20% of the public contract influenza resulting in an average of 36,000 deaths. Pandemic flu viruses may cause illness in 20% to 40% of the population and cause more severe illness and deaths than ordinary seasonal influenza. A pandemic virus vaccine could take 6 to 8 months to produce in conjunction with CDC labs in Atlanta, limiting mitigation success in initial months of an outbreak. Because of this potential, the TDH and CDC consider influenza monitoring and reporting of critical importance.

Based on previous occurrences, there is a 100% annual chance of occurrence for communicable disease occurrence in Sevier County and Pittman Center.

8.1.2 Drought

Location & Extent

Drought typically impacts a region and not one specific county or jurisdiction. While the entire planning area can experience drought, the major impact of a drought event in Sevier County is on the agricultural community. There is no set speed of onset or warning period. A drought may begin in as short of period as a week or it may take months to reach an official declared drought. Additionally, the drought can last for as little as a week to up to the entire season.

While different parts of the county have experienced varying levels of drought severity, the location of drought conditions are more related to Sevier County's geographical location and the effects of climate on the region in general. Below is a map of the drought conditions in Sevier County in October 2019.

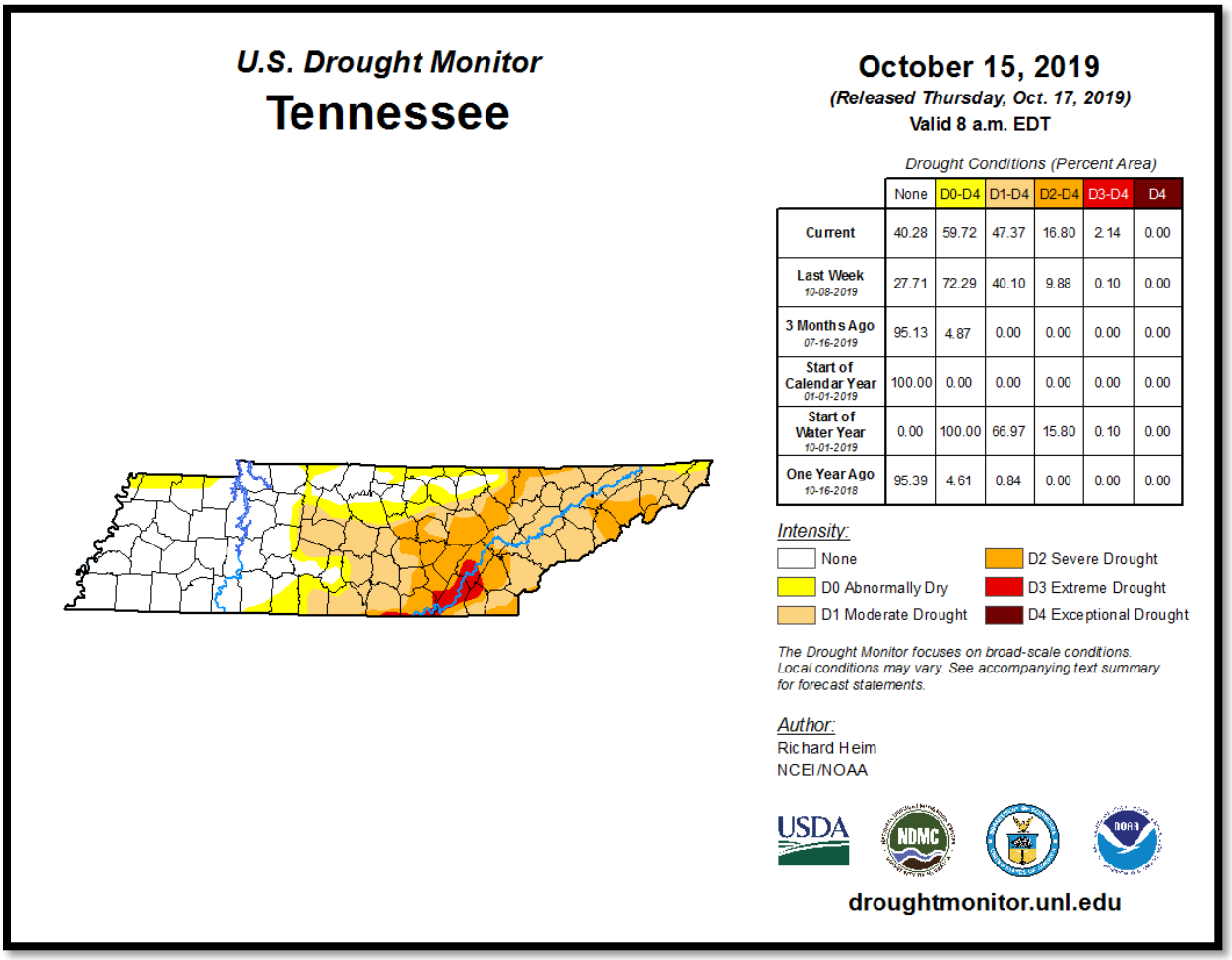

Figure 8-1: Drought Monitor for the State of Tennessee for the Week of October 15, 2019. (Source: U.S. Drought Monitor)

Previous Occurrences

The NCEI database reports a total of one drought event occurring within the boundaries of Sevier County between the years 1996 to 2017. The following table identifies the date of occurrence, estimated crop damage, and severity of the events that have occurred in Sevier County. Based on previous occurrences,

and in accordance with the Palmer Drought Index and United States Drought Monitor, the worst-case scenario for drought in Sevier County would be D4 (Exceptional Drought).

Table 8-1: Previous Occurrences of Drought Events in Sevier County.

Date	Details	Crop Damage	Property Damage	Severity
September 1998	An extremely dry month throughout all of East Tennessee caused drought conditions in the county. Rainfall was approximately 2" inches below normal for the area.	$2,000	$0	D3

Since the last plan update, there have been no new drought events which have caused damage to property or crops. However, drought events have occurred periodically during the period of record (January 1, 2000 to January 1, 2019).

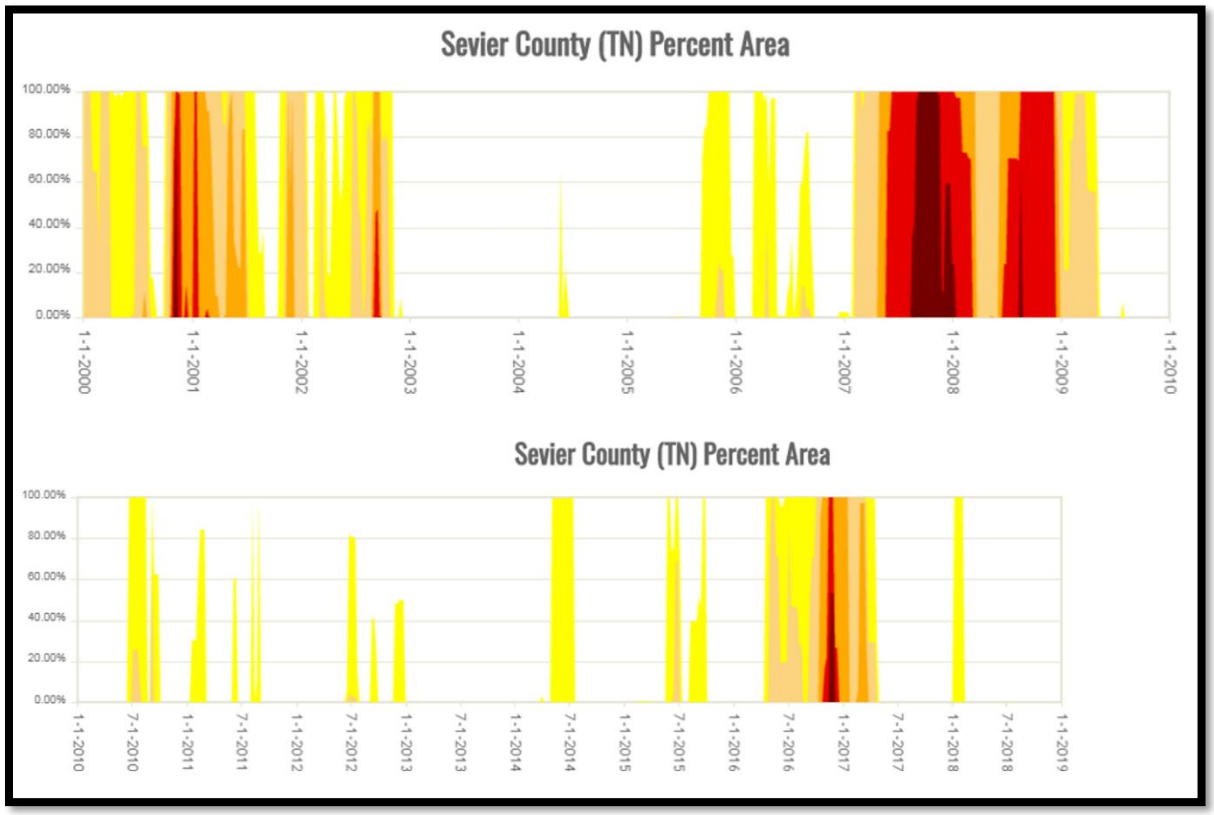

Figure 8-2: Timeline of drought conditions in Sevier County from January 1, 2000 to January 1, 2019. (Source: U.S. Drought Monitor)

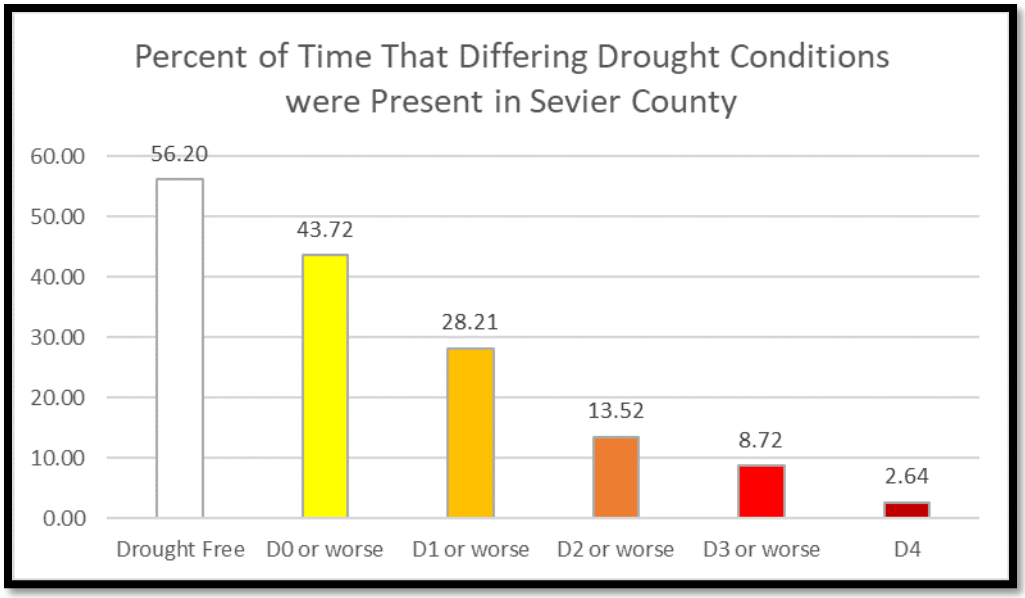

Figure 8-3: Sevier County experienced drought conditions (D0 or worse) during ~43% of the weeks between January 1, 2000 and January 1, 2019. (Source: U.S. Drought Monitor)

Incidents/Probability

Drought conditions can exist which are not recorded in the NCEI database if the event does not cause any direct damage to property or crops and injuries or loss of life. Based on previous occurrences, there is a 4.3% annual chance of occurrence for direct-impact drought events in Sevier County and Pittman Center. While the chance of a drought that causes damage is approximately 4% annually, Sevier County experienced D2 or worse drought conditions approximately 35% over the past 20-years.

8.1.3 Earthquakes

Location & Extent

Earthquakes strike suddenly and without warning, occur at any time of the year, and at any time of the day. A damaging earthquake occurs without definitive signals and massive earthquakes are accompanied by aftershocks. The duration of shaking can last anywhere from a second to a period of minutes. There are numerous characteristics measured when observing earthquake activity; however, its force, depth, peak ground acceleration, and the distance to the epicenter are the most influential in determining damage.

Earthquakes of magnitude 5.5 or greater are considered potentially threatening to Sevier County and Pittman Center, as this is the point at which structures can become damaged. Any earthquake felt at this magnitude or greater would result in cessation of operations until sight inspections can take place.

The Southern Appalachian Seismic Zone (East Tennessee Seismic Zone) is a geographic band stretching from northeastern Alabama through eastern Tennessee into southwestern Virginia, which is subject to frequent small earthquakes. This seismic zone is one of the most active earthquake zones in the eastern United States. Most earthquakes in the Southern Appalachian Zone are small and are detected only with instruments. A few damaging earthquakes have occurred with the largest historic earthquakes measuring 4.6 magnitude on the Richter Scale, occurring in 1973 near Knoxville and April 29, 2003 near Fort Payne,

Alabama. Earthquakes large enough to be felt occur approximately once a year in this zone. The USGS estimates that earthquakes as large as magnitude 7.5 are possible in the Southern Appalachian Zone, which would be as devastating to the region as a major quake along the New Madrid fault. The worst-case scenario for an earthquake in Sevier County would be an MMI of IV, which would be quite noticeable by persons indoors, especially during the daytime.

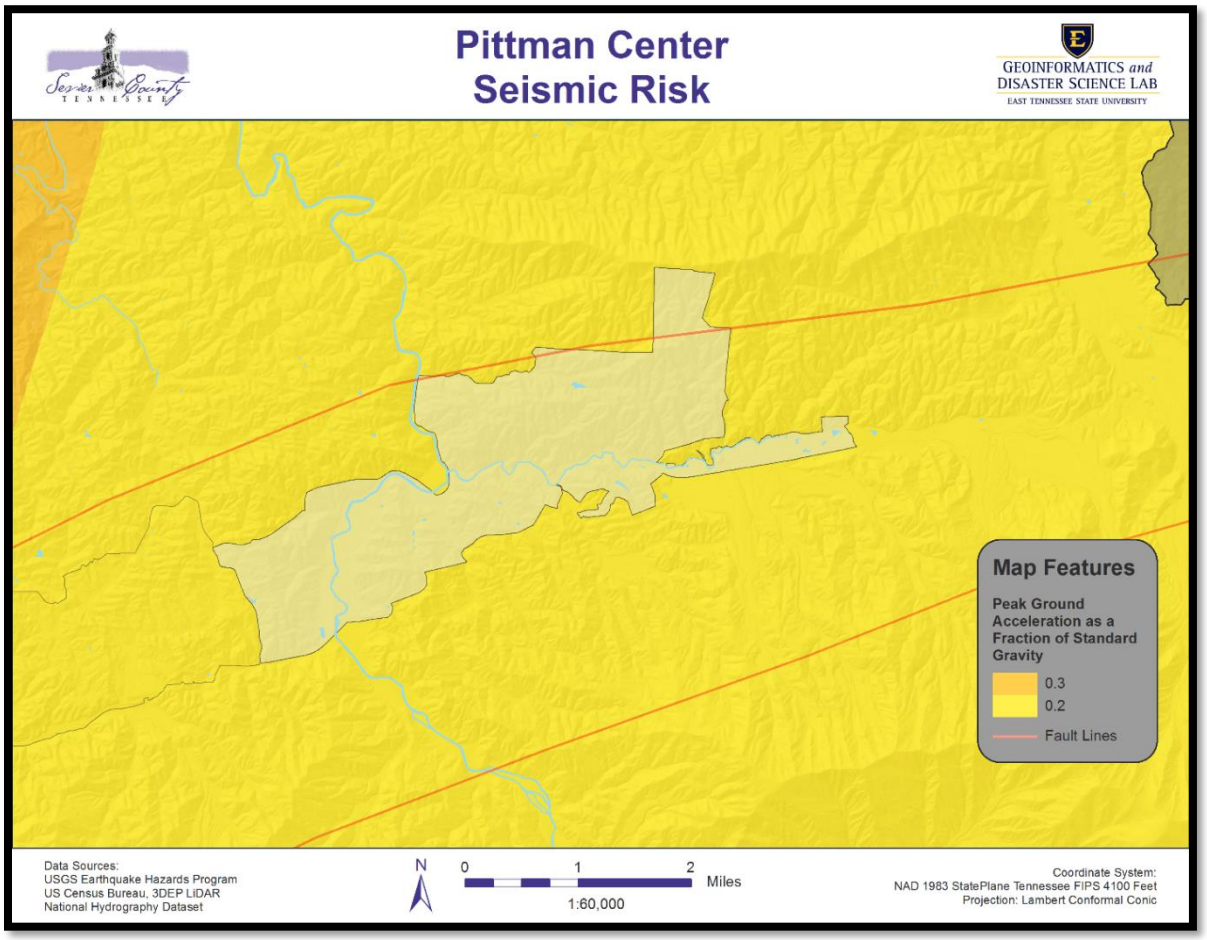

Figure 8-4: Earthquake Epicenters and Fault Lines in Pittman Center.

Previous Occurrences

NOAA reports four earthquake events over a magnitude of 2.0 occurring within the boundaries of Sevier County between the years 1996 to 2017. The following table identifies the date of occurrence, magnitude, and focal depth.

Table 8-2: Previous Occurrences of Earthquake Events in Sevier County.

Date	Magnitude	Focal Depth
7/26/2001	3.2	5 kilometers
11/24/2012	3.0	7.1 kilometers
11/24/2012	2.5	8.9 Kilometers
8/3/2017	2.7	7.4 kilometers

Since the last plan update, three earthquake events occurred within the boundaries of Sevier County. Below is a brief synopsis of the events.

November 24, 2012
An earthquake of magnitude 3.0 and depth of 7.1 kilometers occurred approximately five miles northeast of Sevierville at 11:03 AM. No damages, injuries, or fatalities were associated with the event.

November 24, 2012
An earthquake of magnitude 2.5 and depth of 8.9 kilometers occurred approximately five miles northeast of Sevierville at 2:56 PM. No damages, injuries, or fatalities were associated with the event.

August 3, 2017
An earthquake of magnitude 2.7 and depth of 7.4 kilometers occurred approximately four miles north of Sevierville at 5:40 PM. No damages, injuries, or fatalities were associated with the event.

Incidents/Probability
Historically, there have been four earthquake events impacting Sevier County and Pittman Center from 1996 to 2018. With a total of four earthquake events, the annual return rate (frequency) for Sevier County and Pittman Center is one event every five to six years. This equates to an annual probability of approximately 16%.

8.1.4 Extreme Temperatures

Location & Extent
Extreme heat and cold can occur in all of Sevier County. Extreme heat is not a hazard that responds to the traditional mitigation measures of building codes or land use restrictions. Heat is the number one weather related killer in the United States, resulting in roughly 175 fatalities each year. In fact, on average, excessive heat claims more lives each year than floods, lightning, tornadoes, and hurricanes combined.

What constitutes extreme cold varies in different parts of the country. In the southern United States, near freezing temperatures are considered extreme cold. Freezing temperatures can cause severe damage to citrus fruit crops and other vegetation. Pipes may freeze and burst in homes that are poorly insulated or without heat. Most people judge extreme cold by the problems it causes rather than just by a temperature or a wind chill factor. In the northern areas of the country, extreme cold means temperatures well below zero.

The speed of onset of extreme temperatures, both hot and cold, is fairly slow and predictable from short and long-term weather forecasts. The scale of measurement for this hazard is temperature and departure from normal temperature.

Previous Occurrences
In winter, the average temperature in Sevier County is approximately 38^{O}F with an average daily minimum temperature of approximately 26^{O}F. The lowest temperatures recorded in Sevier County were -18^{O}F in Gatlinburg and -24^{O}F in Sevierville with both occurring on January 21, 1985.

In summer, the average temperature in Sevier County is approximately 71^{O}F with an average daily maximum temperature of approximately 83^{O}F. The highest temperatures ever recorded in Sevier County

were 106°F in Gatlinburg on June 30, 1936 and 102°F in Sevierville on August 21, 1983. No station data exist specifically for Pittman Center, but temperatures are comparable to adjacent Gatlinburg.

Incidents/Probability

The NCEI Storm Events Database reports no extreme temperature (extreme heat or extreme cold) occurrences within the boundaries of Sevier County between the years 1996 and 2018. However, based on the State of Tennessee Hazard Mitigation Plan, Sevier County and Pittman Center have an annual probability of 64% for extreme cold events and 100% for extreme heat events.

8.1.5 Floods Including Extreme Precipitation

Location & Extent

A variety of factors affects the type and severity of flooding in Pittman Center including topography, urban development and infrastructure, and geology. Serious flooding in the mountainous or elevated areas is unusual because streams tend to be faster flowing and flood waters drain quickly.

Intense flooding will cause havoc on the jurisdictions affected. Floods can cause minimal damage in the form of just inches of water to complete submersion of houses and critical facilities. Any amount of damage can render a structure unusable for as long as recovery operations would take depending on the level of damage. Intense and widespread flooding can trap people and entire communities without basic goods or services.

Specifically, depths from previous flood events have commonly ranged from 12-15' along the Little Pigeon River, especially in the Emerts Cove and Greenbrier Island areas. Depths of 7' have occurred when Webb Creek overflows its boundaries in eastern areas of Pittman Center. Sections of Laurel Creek Rd have flooded during previous floods with depths ranging 3-6'.

The following figure displays the location of the 100- and 500-year floodplains in Pittman Center.

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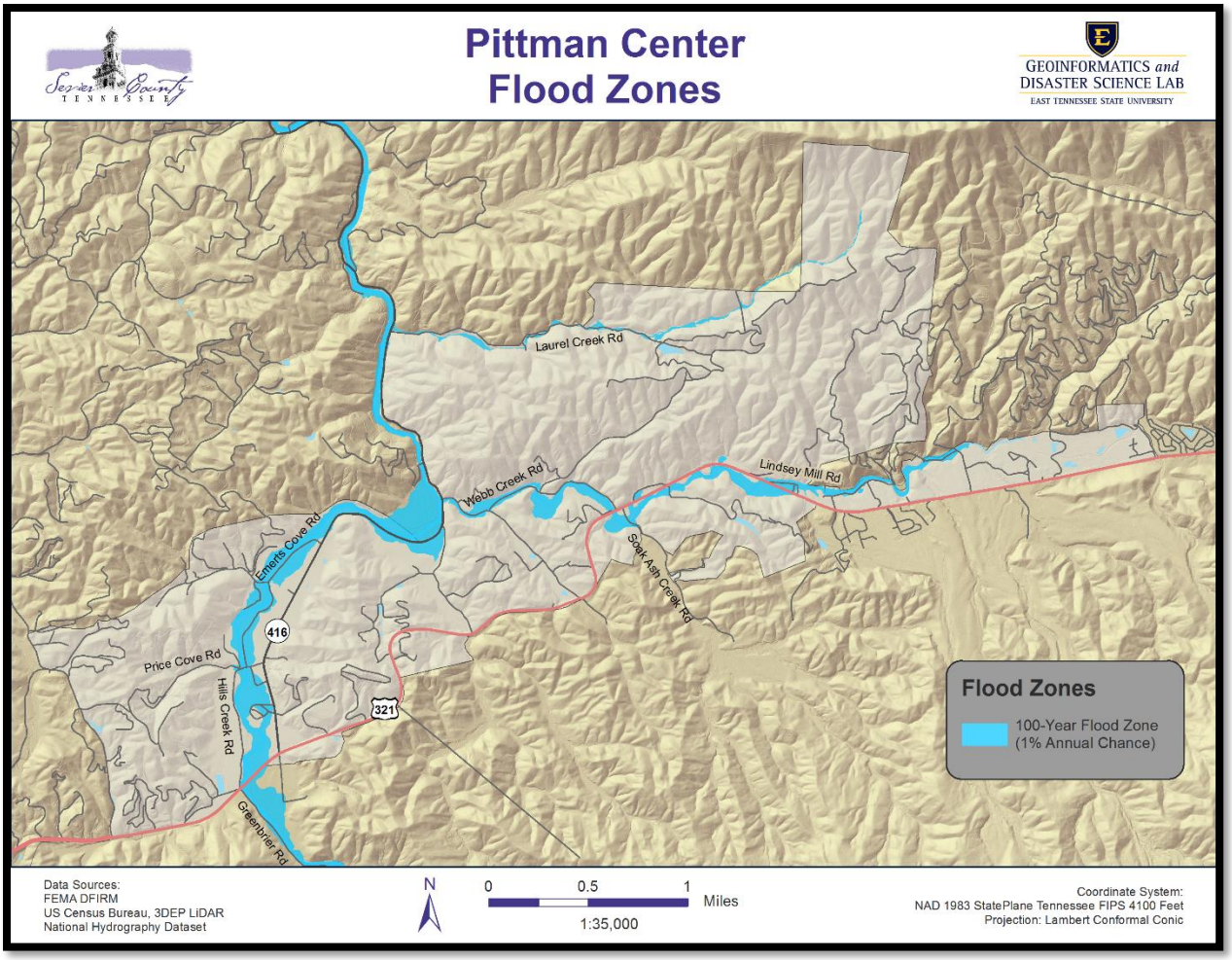

Figure 8-5: 100- and 500-Year Floodplains in Pittman Center.

Previous Occurrences

Historically, there have been eight flood and extreme precipitation events in Pittman Center from 1996 to 2018. According to NCEI, there have been no injuries or fatalities due to flood and extreme precipitation events in Pittman Center.

Table 8-3: Flood Events and Extreme Precipitation from 1996 to 2018 with Total Losses. (Source: NCEI Storm Events Database)

Date	Location	Event	Injuries	Fatalities	Property Damage
1/19/1996	COUNTYWIDE	Flash Flood	0	0	$0
6/21/1997	COUNTYWIDE	Flash Flood	0	0	$0
1/7/1998	COUNTYWIDE	Flash Flood	0	0	$0
5/18/1999	PITTMAN CENTER	Flood	0	0	$0
7/11/1999	COUNTYWIDE	Flash Flood	0	0	$0
3/17/2002	COUNTYWIDE	Flash Flood	0	0	$0
2/16/2003	COUNTYWIDE	Flash Flood	0	0	$0

Date	Location	Event	Injuries	Fatalities	Property Damage
7/31/2004	PITTMAN CENTER	Flash Flood	0	0	$0

Since the last plan update (through the end of 2018), there have been no new flooding events in Pittman Center.

While this risk assessment did not include 2019 data for flooding, it should be noted that the early part of 2019 broke many rainfall records, including the wettest month on record (February 2019) according to the Tennessee Climate Office. Extensive flooding occurred in February and April of 2019, possibly exceeding $7 million in damage in Sevier County (Knox News).

Incidents/Probability

With eight events, the annual return rate (frequency) for flooding and extreme precipitation for Gatlinburg is one event every three to four years. This equates to an annual probability of approximately 32%.

8.1.6 Mass Wasting

Location & Extent

Most mass wasting events within Sevier County are located along road networks. Rockfalls or rock sliding along road cuts is a very common phenomenon. These are mainly due to improper slope management that causes instability within the slope face. Additionally, adverse orientation of geological discontinuities (joints, fractures, and faults) with the slope gradient and aspect play an important role in slope stability. Probability of future failure of a slope depends on various factors including lithology, land cover, drainage condition, and soil cover of the area.

The southern part of Sevier County located within the Great Smoky Mountains National Park near the state boundary between Tennessee and North Carolina has a high concentration of areas that could produce mass wasting events. High rain coupled with fragile lithology and adverse orientation of geological discontinuities have increased the probably of a mass wasting event. Below is a susceptibility map, high concentration map, and prior occurrences of mass wasting events within Sevier County.

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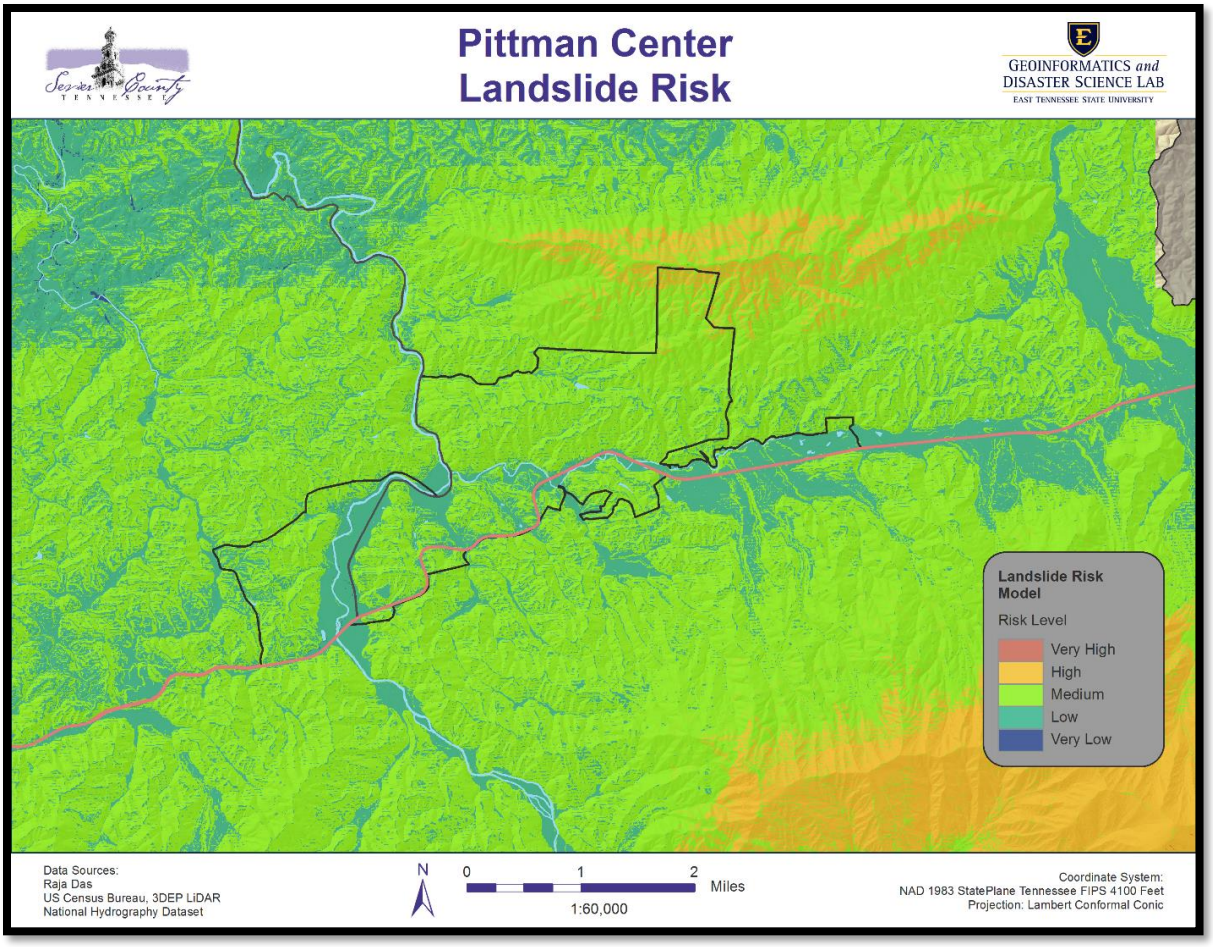

Figure 8-6: Landslide Susceptibility Map in Pittman Center.

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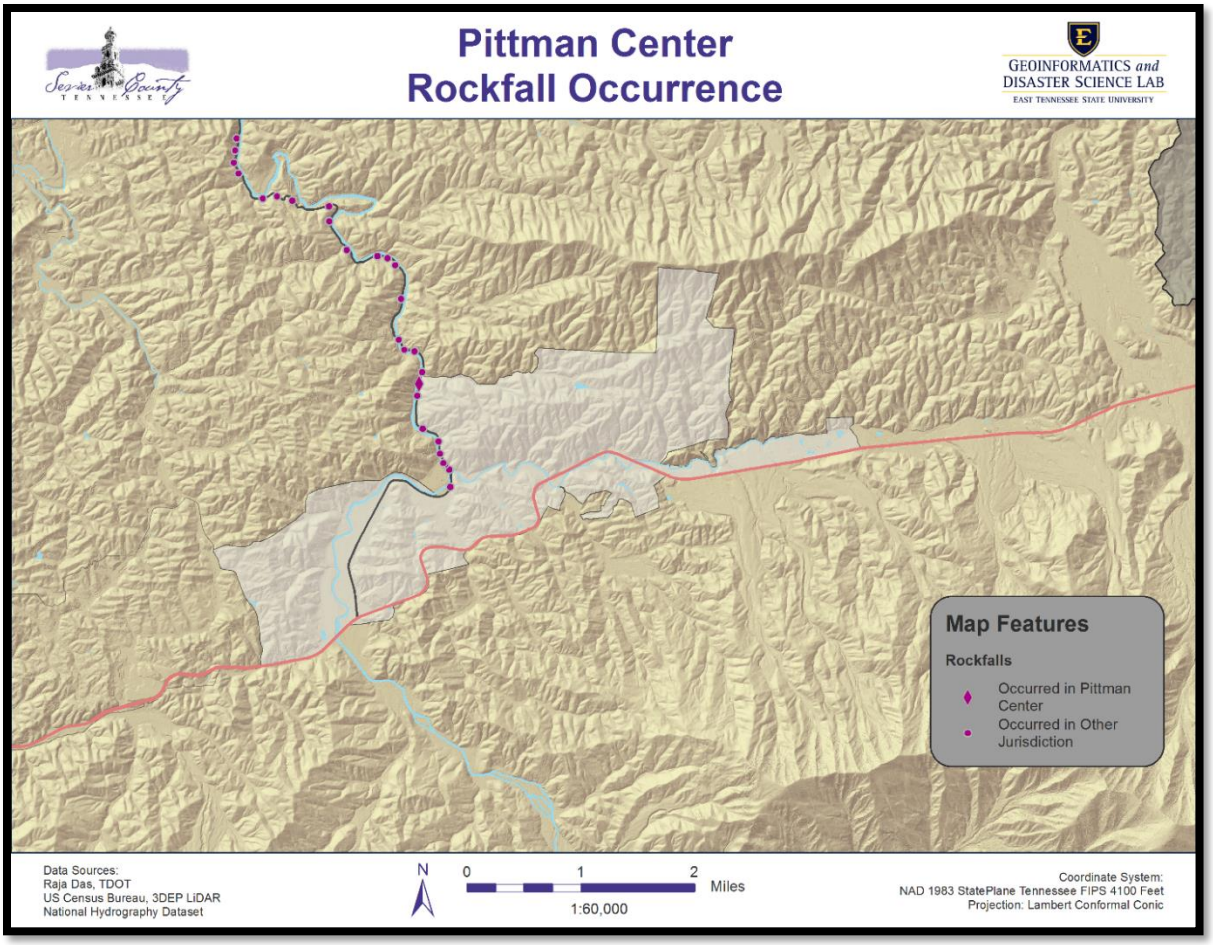

Figure 8-7: Previous Rockfall Events in Pittman Center.

Previous Occurrences

Some rockfall locations are available from the Tennessee Department of Transportation (TDOT). The following table outlines major debris flow events related to storms in Sevier County.

Table 8-4: Major Debris Flow Events Related to Storm Events.
(Source: Tennessee Department of Transportation)

Date	Type of Storm	Location
7/10/1942	Thunderstorm	Newfound Gap
9/1/1951	Cloudburst	Mt. LeConte
6/15/1971		Mt. LeConte
3/1975 – 3/1983	Multiple Storms	Anakeesta Ridge
8/3/1978	Thunderstorm	Mt. LeConte
7/1984	Thunderstorm	Anakeesta Ridge
8/10/1984	Thunderstorm	Anakeesta Ridge
8/10/1984	Thunderstorm	Anakeesta Ridge
3/1985	Thunderstorm	Anakeesta Ridge
6/28/1993	Cloudburst	Mt. LeConte

Date	Type of Storm	Location
10/4/1995	Hurricane Opal	Mt. LeConte/Anakeesta Ridge
9/17/2004	Hurricane Ivan	Mt. LeConte/Anakeesta Ridge
8/5/2012	Thunderstorm	Anakeesta Ridge
9/10/2017	Hurricane Irma	Anakeesta Ridge
8/1/2019	Thunderstorm	Gatlinburg

Since the last plan update, there have been three mass wasting events in Sevier County. These events may not directly impact Pittman Center, but may have indirect impacts. Below is a brief synopsis of those events.

August 5, 2012 – Anakeesta Ridge
No synopsis available for the event.

September 10, 2017 – Anakeesta Ridge
No synopsis available for the event.

August 1, 2019 - Gatlinburg
A 73-year old man was fatally injured when a tree fell from a slope and hit his Honda sedan. Both the northbound and southbound lanes of the Spur were closed until heavy equipment could complete slope repairs and assessments. Multiple rock slides were also reported.

Incidents/Probability
With a total of four recorded events from 1996 to 2018, the annual return rate (frequency) for mass wasting events for Sevier County and Pittman Center is one event every five to six years. This equates to an annual probability of a mass wasting event occurrence of approximately 17%.

8.1.7 Severe Wind

Location & Extent
Mountain waves develop on the lee, or downwind, side of mountains. These waves are generated when strong winds flowing toward mountains in a generally perpendicular fashion are raised up over the mountains. Given the geographical location of Sevier County, the unincorporated areas and all of Pittman Center are susceptible to severe wind events. The following figures provide the extent of severe winds within Sevier County and Pittman Center.

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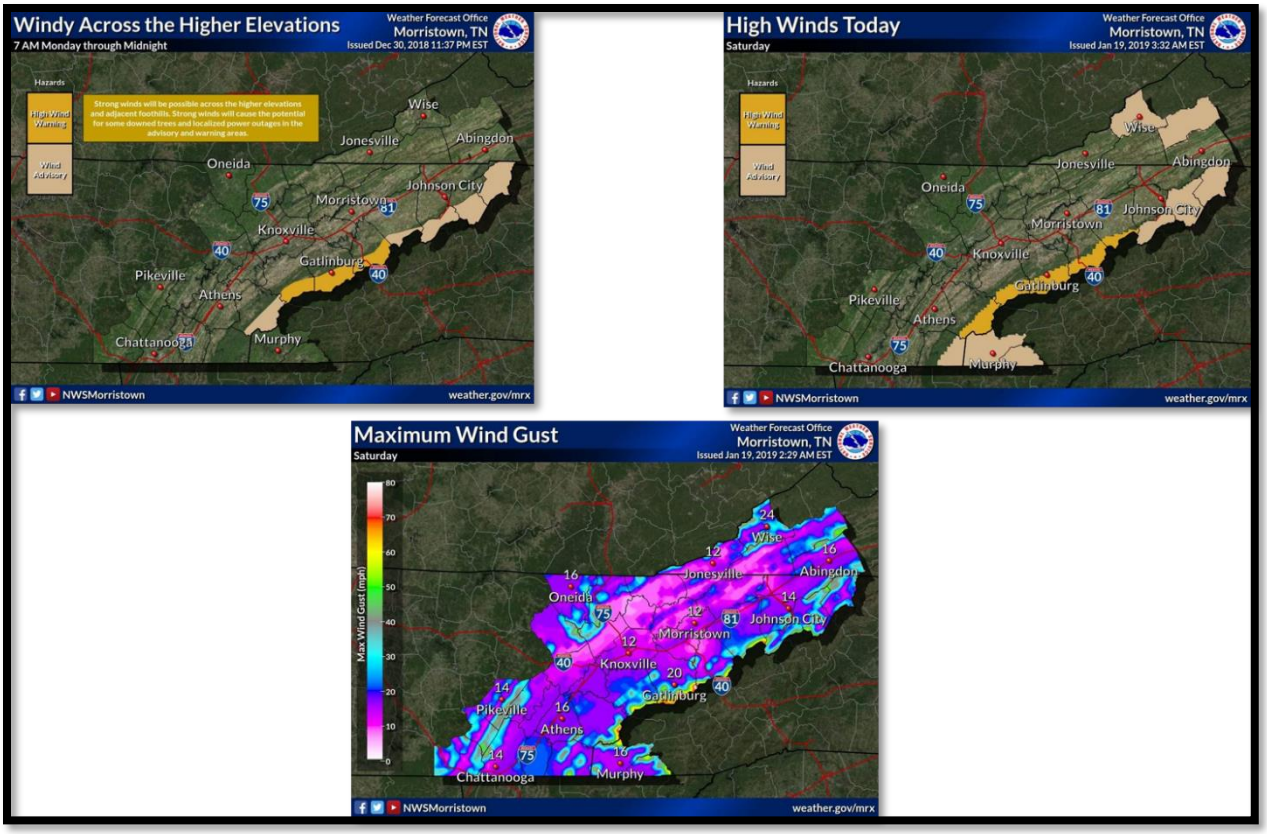

Figure 8-8: Severe Wind Extent and Location within Sevier County and Surrounding Areas, based on standard patterns (these occurring during the 2018-2019 winter months).

Previous Occurrences

Historically, there have been two severe wind events in Sevier County and Pittman Center from 1996 to 2018. There have been no injuries or fatalities due to severe wind events in the unincorporated area of Sevier County and Pittman Center.

Table 8-5: Severe Wind Events from 1996 to 2018 with Total Losses.
(Source: NCEI Storm Events Database)

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage
2/3/2003	COUNTYWIDE	40	0	0	$2,000
6/21/1997	COUNTYWIDE	45	0	0	$20,000

Since the last plan update, there have been no new severe wind events reported from NCEI, which have caused damage to property or crops and/or loss of life or injuries.

Incidents/Probability

The NCEI Storm Events Database reports two severe wind event occurrences within the boundaries of Sevier County between the years 1996 and 2018. With a total of two events, the annual return rate

(frequency) for severe winds for Sevier County and Pittman Center is one event every 11 to 12 years. This equates to an annual probability of approximately 8%.

8.1.8 Sinkholes

Location & Extent

Subsidence can occur slowly and continuously over time or abruptly for various reasons. Subsidence and sinkholes can occur due to either natural processes (karst sinkholes in areas underlain by soluble bedrock or because of human activities. The entire Sevier County planning area is susceptible to subsidence and sinkholes based on the karst topography of the region.

Previous Occurrences

Per the State of Tennessee Hazard Mitigation Plan, there are 586 sinkhole locations within Sevier County. The following figure displays all known sinkhole locations within Pittman Center and underlying risk.

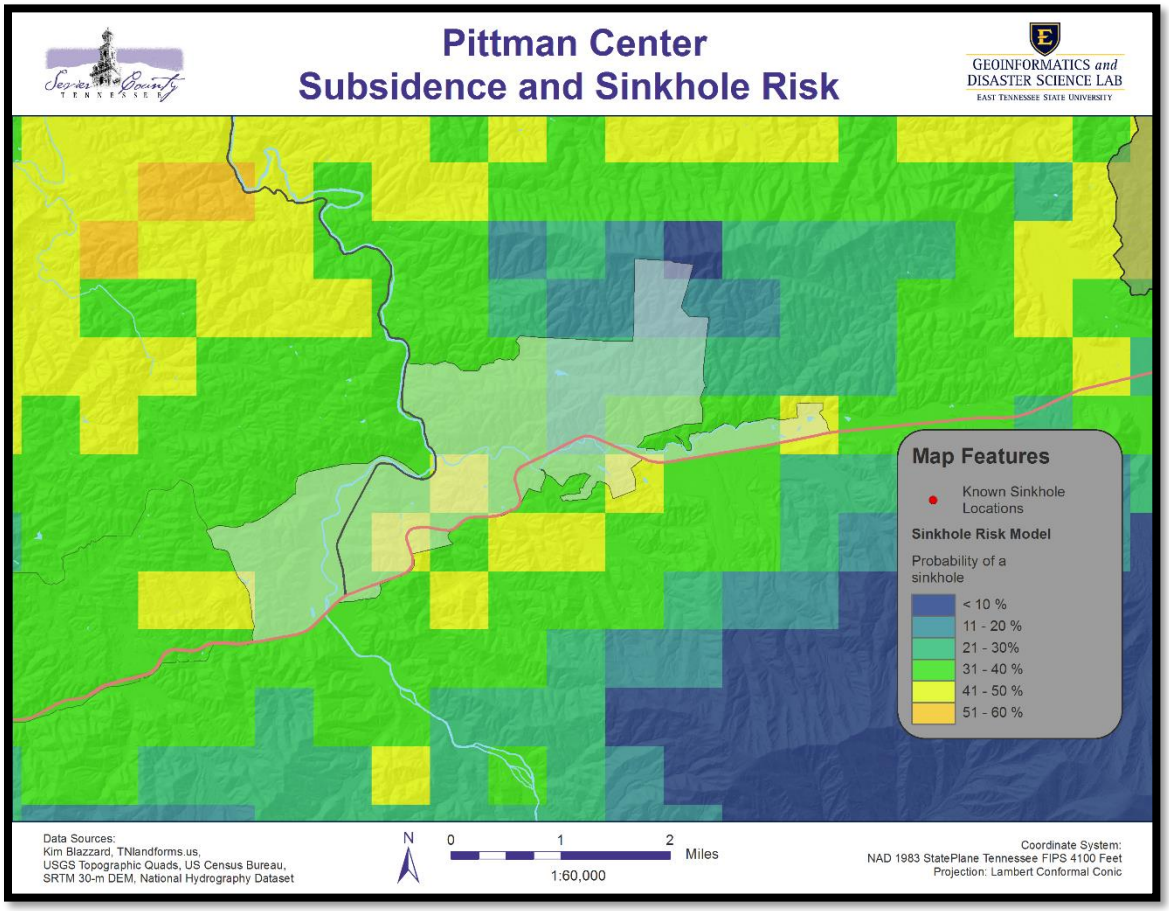

Figure 8-9: Pittman Center Subsidence and Sinkhole Locations and Risk Probability.

Incidents/Probability

Based on the underlying risk factors within Pittman Center, the annual probability of a sinkhole occurrence is calculated at less than 5%.

8.1.9 Thunderstorms (Hail, Lightning, and Wind)

Hail

Location & Extent

Because hailstorms are a meteorological phenomenon that can occur anywhere, the entire Sevier County planning area is equally at risk from hailstorms. The worst-case scenario for hailstorms is hail up to 3" in diameter.

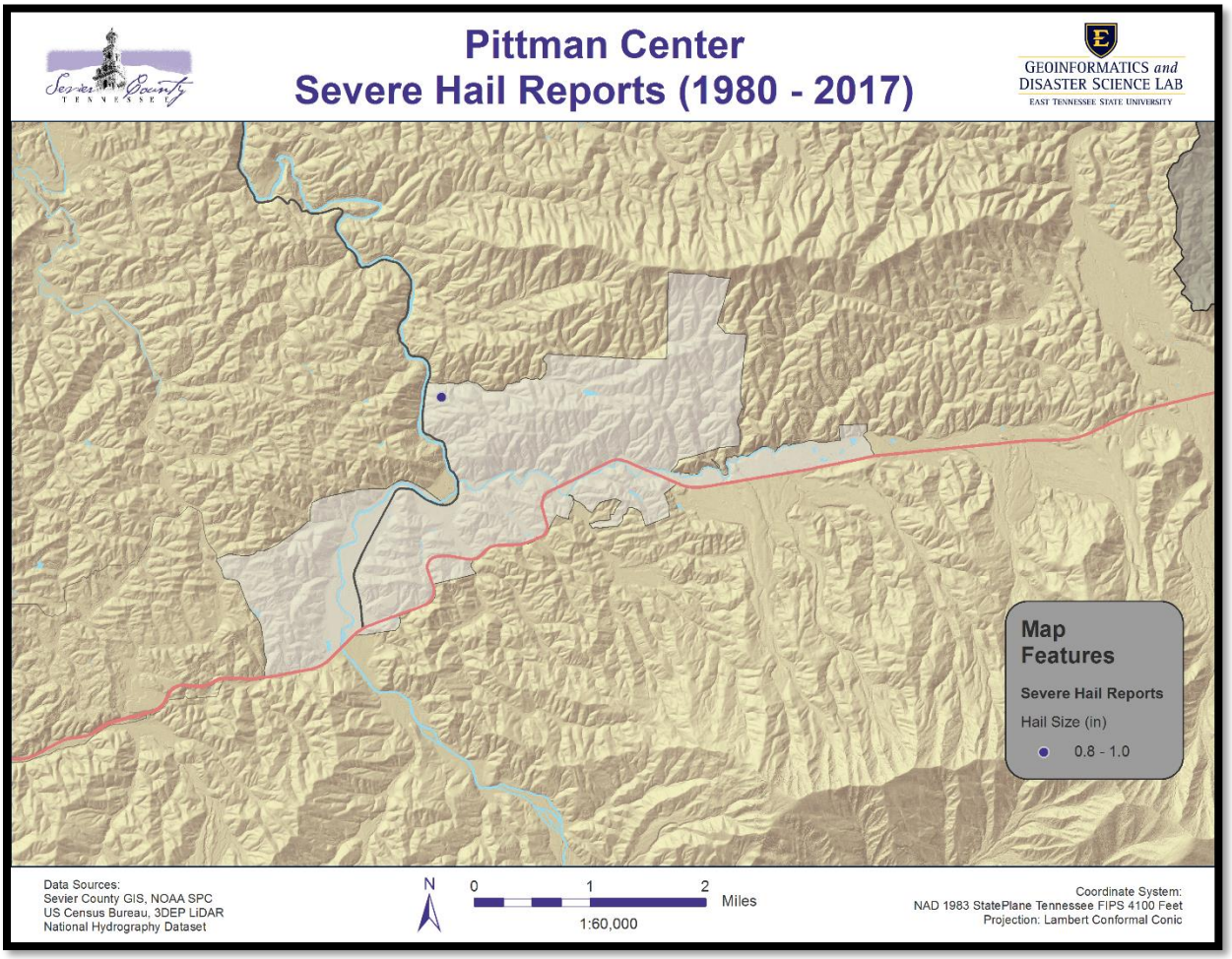

Figure 8-10: Severe Hail Reports and Density in Relation to Pittman Center.

Previous Occurrences

Historically, there have been 25 hail events in Sevier County from 1996 to 2018, with several of those occurring with at least one occurring in Pittman Center. There have been no injuries or fatalities due to hail events in the Pittman Center planning area. The following table briefly outlines the hail events that have occurred in Sevier County.

Table 8-6: Hail Incidents from 1996 to 2018 with Total Losses.
(Source: NCEI Storm Events Database)

Date	Location	Diameter (inches)	Injuries	Fatalities	Property Damage
4/10/1992	COUNTYWIDE	1.75	0	0	$0
8/26/1993	COUNTYWIDE	2.75	0	0	$0
5/26/1998	COUNTYWIDE	1	0	0	$0
1/18/1999	CUSICK	0.75	0	0	$0
5/13/1999	SEYMOUR	1.75	0	0	$0
4/5/2003	KODAK	1.75	0	0	$0
5/15/2003	COUNTYWIDE	0.75	0	0	$0
12/10/2004	KODAK	0.88	0	0	$0
4/3/2006	SEYMOUR	1.75	0	0	$0
5/20/2006	WALDEN CREEK	0.75	0	0	$0
5/20/2006	KODAK	0.75	0	0	$0
6/2/2006	PIGEON FORGE	0.75	0	0	$0
6/24/2007	KODAK	1	0	0	$0
5/9/2008	SEVIERVILLE	0.88	0	0	$0
7/21/2008	BOYDS CREEK	0.75	0	0	$0
6/17/2009	PITTMAN CTR	1	0	0	$0
5/26/2011	CATES XRDS	0.75	0	0	$0
5/26/2011	MILLICAN	0.88	0	0	$0
8/14/2011	PITNER	1	0	0	$0
2/29/2012	KODAK	1.25	0	0	$0
4/26/2012	KODAK	1	0	0	$0
6/14/2012	HATCHERTOWN	1.5	0	0	$0
7/27/2014	PITNER	1	0	0	$0
6/2/2015	COVE CREEK	1	0	0	$0
4/22/2016	SEVIERVILLE	1.5	0	0	$0

Since the last plan update, there have been six hail events which have occurred within the unincorporated areas of Sevier County and Pittman Center. Below is a brief synopsis of these events.

February 29, 2012 – Kodak

A boundary across the area triggered thunderstorms over east Tennessee toward the end of the month. The boundary aided in the development of an EF-0 tornado as well as golfball-size hail and several reports of wind damage.

April 26, 2012 – Kodak

A cold front tracked across east Tennessee during the overnight hours triggering scattered thunderstorms over the area. A few of the storms produced damaging thunderstorm wind and hail as large as quarters.

June 14, 2012 – Hatchertown

Elevated moisture and instability permitted routine afternoon thunderstorms to produce severe weather including hail, wind damage, and flooding. Law enforcement personnel reported thunderstorms produced golfball-size hail 2 miles northeast of Wears Valley in Hatchertown.

July 27, 2014 – Pitner

A potent upper-level storm system impacted the region on Sunday, July 27th, bringing several rounds of severe weather along with locally heavy rainfall. Three tornadoes were observed across east Tennessee; one classified as a strong, EF-3 tornado with winds of 140 mph. Additionally, there were several reports of straight-line wind damage and large hail up 2 to 3 inches in diameter. A storm system of this magnitude is highly unusual for this time of year due to the strength of the front and the record cool temperatures it produced in the middle of the summer season.

June 2, 2015 – Cove Creek

Sufficient instability developed in a moist low level environment underneath an upper level low pressure system parked over the Cumberland Plateau for the development of localized severe convection in the foothills of the Smoky Mountains. Impacts from the storms included wind damage along with the formation of large hail. Quarter sized hail fell three miles north of Wears Valley.

April 22, 2016 – Sevierville

A few severe thunderstorms developed during the afternoon across the region in an environment that could be characterized as weakly unstable. The convection formed in response to a weak upper level impulse riding a few hundred miles east of a cold front.

Incidents/Probability

The NCEI Storm Events Database reports 25 hail events within the boundaries of Sevier County between the years 1996 and 2018. With 25 events, the annual return rate (frequency) for hail events in the unincorporated area of Sevier County and Pittman Center is one to two events every year. This equates to an annual probability of approximately 100%.

Lightning

Location & Extent

Lightning is a meteorological phenomenon that can occur anywhere and has the same probability of occurring throughout the entire Sevier County planning area. Based on historical lightning events, the Sevier County planning area can expect a lightning density of 11-12 flashes per square mile per year.

Previous Occurrences

Historically, there have been two lightning events that impacted Sevier County and Pittman Center from 1996 to 2018. There have been no injuries and one fatality due to lightning events in the Sevier County planning area. The following table briefly outlines the lightning events that have occurred in Sevier County.

Table 8-7: Lightning Incidents from 1996 to 2018 with Total Losses.
(Source: NCEI Storm Events Database)

Date	Location	Injuries	Fatalities	Property Damage
5/7/1996	PIGEON FORGE	0	0	$0
7/10/2004	KODAK	0	1	$0

Since the last plan update, there have been no lightning events that have caused property damage and/or loss of life or injuries in Sevier County and Pittman Center.

Incidents/Probability

The NCEI Storm Events Database reports two lightning events within the boundaries of Sevier County between the years 1996 and 2018. With a total of two 'impact' events, the annual return rate (frequency) for lightning events in the unincorporated area of Sevier County and Pittman Center is one event every 11 to 12 years. This equates to an annual probability of approximately 8%.

Wind

Location & Extent

Thunderstorm wind is a meteorological phenomenon that can occur anywhere and has the same probability of occurring throughout the entire Sevier County planning area. Based on historical thunderstorm wind events, the Sevier County planning area can expect thunderstorm wind speeds of approximately 60 knots. The following figure displays the damages caused by thunderstorm winds from 1980 to 2017.

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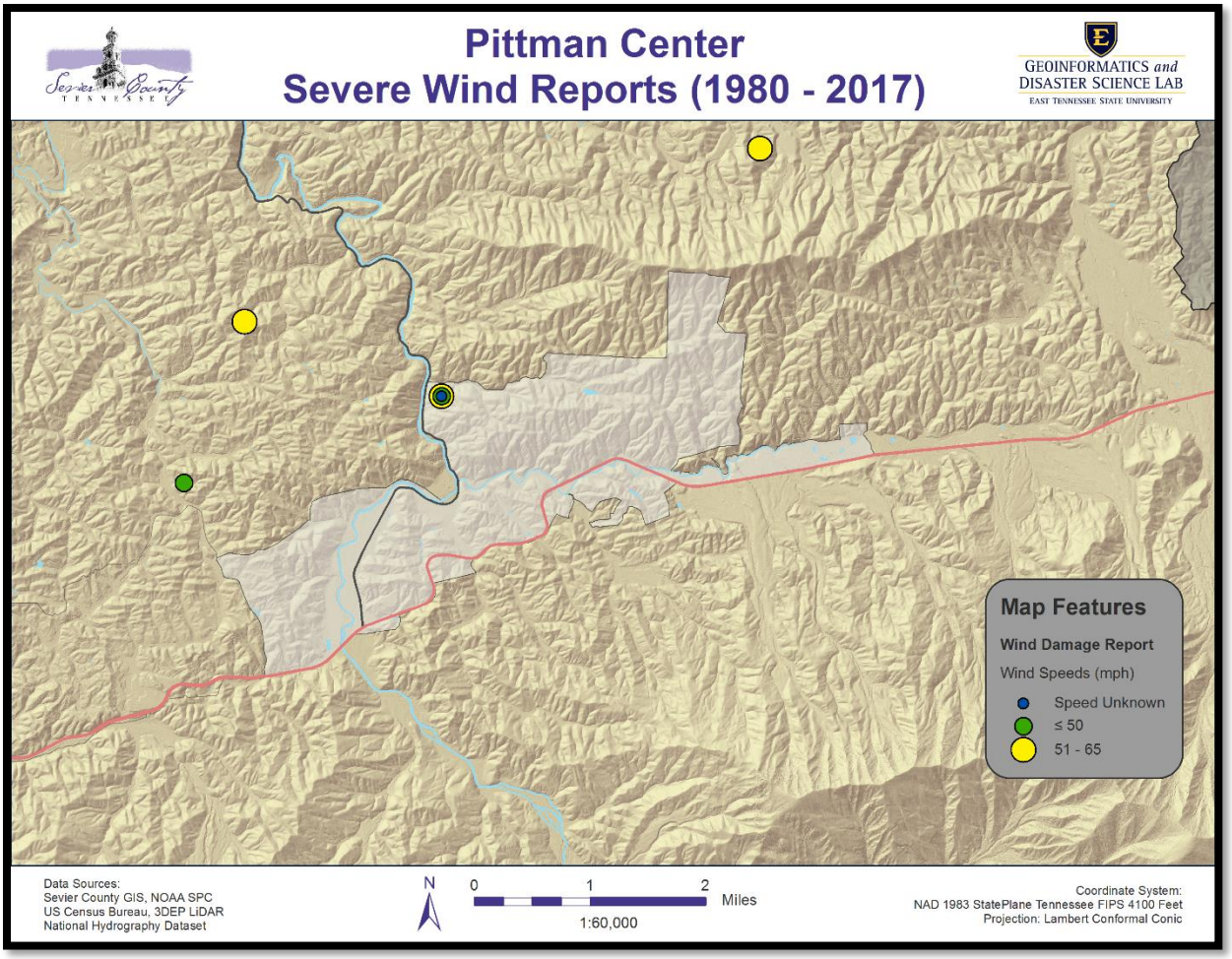

Figure 8-11: Severe Thunderstorm Wind Reports and Density in Relation to Pittman Center.

Previous Occurrences

Historically, there have been 189 thunderstorm wind events in the unincorporated area of Sevier County and Pittman Center from 1996 to 2018. There have been no injuries or fatalities due to thunderstorm wind events in the Sevier County planning area. The following table briefly outlines the thunderstorm wind events that have occurred in the unincorporated area of Sevier County and Pittman Center.

Table 8-8: Thunderstorm Wind Incidents from 1996 to 2018 with Total Losses.
(Source: NCEI Storm Events Database)

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage	Crop Damage
4/20/1996	GATLINBURG	60	0	0	$0	$0
5/27/1996	SOUTHWEST PART		0	0	$10,000	$0
8/8/1996	SEVIERVILLE		0	0	$0	$2,000
1/5/1997	GATLINBURG		0	0	$0	$4,000
3/5/1997	EXTREME N PART OF CO		0	0	$0	$3,000
6/13/1997	SEVIERVILLE		0	0	$0	$10,000

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage	Crop Damage
6/14/1997	SEYMOUR		0	0	$0	$7,000
7/4/1997	COUNTYWIDE		0	0	$25,000	$20,000
8/4/1997	COUNTYWIDE	55	0	0	$0	$20,000
2/17/1998	SEVIERVILLE		0	0	$0	$0
4/3/1998	COUNTYWIDE		0	0	$17,000	$15,000
6/2/1998	PIGEON FORGE		0	0	$0	$20,000
6/2/1998	GATLINBURG		0	0	$0	$15,000
6/5/1998	KODAK		0	0	$5,000	$14,000
6/15/1998	GATLINBURG		0	0	$15,000	$0
6/22/1998	SEVIERVILLE		0	0	$0	$20,000
6/24/1998	SEVIERVILLE		0	0	$0	$20,000
7/19/1998	SEVIERVILLE		0	0	$0	$5,000
11/25/1998	PIGEON FORGE		0	0	$0	$15,000
4/23/1999	SEVIERVILLE		0	0	$0	$7,000
5/6/1999	KODAK		0	0	$0	$2,000
5/7/1999	KODAK		0	0	$0	$5,000
7/24/1999	BEECH SPGS		0	0	$6,000	$0
7/29/1999	KODAK		0	0	$12,000	$0
7/29/1999	PIGEON FORGE		0	0	$10,000	$0
8/23/1999	SEYMOUR		0	0	$4,000	$0
2/13/2000	PIGEON FORGE		0	0	$0	$11,000
5/23/2000	PIGEON FORGE		0	0	$0	$11,000
5/27/2000	COUNTYWIDE		0	0	$0	$6,000
5/27/2000	COUNTYWIDE		0	0	$0	$2,000
7/28/2000	GATLINBURG		0	0	$0	$15,000
7/28/2000	GATLINBURG		0	0	$14,000	$0
7/29/2000	SEVIERVILLE		0	0	$0	$4,000
7/30/2000	KODAK		0	0	$0	$12,000
8/10/2000	HATCHERTOWN		0	0	$0	$15,000
8/18/2000	SEVIERVILLE		0	0	$0	$23,000
11/9/2000	KODAK		0	0	$0	$4,000
11/9/2000	SEYMOUR		0	0	$0	$5,000
5/21/2001	CEDAR BLUFF		0	0	$0	$5,000
7/4/2001	PIGEON FORGE		0	0	$0	$24,000
7/8/2001	PITTMAN CENTER		0	0	$0	$21,000
10/25/2001	COUNTYWIDE		0	0	$16,000	$20,000
1/24/2002	COUNTYWIDE		0	0	$8,000	$0
5/2/2002	SEVIERVILLE		0	0	$15,000	$0
5/2/2002	SEYMOUR		0	0	$12,000	$0
5/13/2002	COUNTYWIDE		0	0	$15,000	$0

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage	Crop Damage
6/4/2002	GATLINBURG		0	0	$15,000	$0
7/2/2002	COUNTYWIDE		0	0	$25,000	$0
7/30/2002	GATLINBURG		0	0	$0	$5,000
8/1/2002	GATLINBURG		0	0	$5,000	$0
9/4/2002	BOYDS CREEK		0	0	$10,000	$0
9/4/2002	WALDEN CREEK		0	0	$15,000	$0
11/10/2002	KODAK	60	0	0	$15,000	$0
2/16/2003	GATLINBURG	60	0	0	$5,000	$0
5/2/2003	SEVIERVILLE	55	0	0	$12,000	$0
5/11/2003	KODAK	55	0	0	$8,000	$0
6/11/2003	KODAK	60	0	0	$12,000	$0
7/6/2003	COUNTYWIDE	60	0	0	$0	$0
7/10/2003	SEYMOUR	60	0	0	$0	$0
8/11/2003	COUNTYWIDE	60	0	0	$0	$0
8/29/2003	PIGEON FORGE	60	0	0	$0	$0
8/31/2003	PIGEON FORGE	60	0	0	$0	$0
11/18/2003	COUNTYWIDE	55	0	0	$10,000	$0
5/26/2004	KODAK	65	0	0	$10,000	$0
5/31/2004	SEVIERVILLE	65	0	0	$20,000	$0
6/2/2004	SEYMOUR	65	0	0	$5,000	$0
6/12/2004	SEVIERVILLE	60	0	0	$10,000	$0
7/5/2004	SEYMOUR	60	0	0	$12,000	$0
7/5/2004	KODAK	60	0	0	$10,000	$0
7/5/2004	PIGEON FORGE	60	0	0	$12,000	$0
7/10/2004	KODAK	60	0	0	$8,000	$0
7/13/2004	SEVIERVILLE	65	0	0	$15,000	$0
7/17/2004	SEVIERVILLE	65	0	0	$30,000	$0
5/20/2005	COUNTYWIDE	65	0	0	$30,000	$0
6/6/2005	SEVIERVILLE	65	0	0	$15,000	$0
6/27/2005	SEVIERVILLE	65	0	0	$18,000	$0
6/30/2005	COUNTYWIDE	55	0	0	$20,000	$0
7/27/2005	GATLINBURG	55	0	0	$10,000	$0
7/31/2005	SEVIERVILLE	55	0	0	$3,000	$0
7/31/2005	SEVIERVILLE	60	0	0	$3,000	$0
4/2/2006	KODAK	60	0	0	$12,000	$0
4/21/2006	SEYMOUR	60	0	0	$12,000	$0
5/20/2006	SEVIERVILLE	60	0	0	$20,000	$0
5/20/2006	SEVIERVILLE	60	0	0	$12,000	$0
5/30/2006	PITTMAN CENTER	60	0	0	$3,000	$0
5/30/2006	GATLINBURG	60	0	0	$20,000	$0

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage	Crop Damage
5/30/2006	GATLINBURG	60	0	0	$15,000	$0
5/31/2006	KODAK	60	0	0	$10,000	$0
6/23/2006	COUNTYWIDE	60	0	0	$6,000	$0
7/28/2006	GATLINBURG	60	0	0	$15,000	$0
8/4/2006	COUNTYWIDE	55	0	0	$6,000	$0
8/5/2006	WALDEN CREEK	60	0	0	$10,000	$0
10/5/2006	KODAK	55	0	0	$0	$0
4/3/2007	CATLETTSBURG	55	0	0	$30,000	$0
6/14/2007	PITTMAN CENTER	50	0	0	$10,000	$0
6/24/2007	SEVIERVILLE	55	0	0	$5,000	$0
6/25/2007	SEVIERVILLE	55	0	0	$20,000	$0
6/28/2007	PIGEON FORGE	55	0	0	$10,000	$0
6/28/2007	GATLINBURG	55	0	0	$15,000	$0
6/28/2007	SEVIERVILLE	50	0	0	$2,000	$0
1/10/2008	BOYDS CREEK	55	0	0	$0	$0
3/19/2008	CATLETTSBURG	50	0	0	$0	$0
6/9/2008	BANNER	55	0	0	$10,000	$0
6/11/2008	BIRD XRD	50	0	0	$10,000	$0
6/12/2008	GATLINBURG	50	0	0	$5,000	$0
6/12/2008	LINE SPG	52	0	0	$2,000	$0
6/12/2008	PITNER	55	0	0	$5,000	$0
6/28/2008	KODAK	55	0	0	$8,000	$0
6/28/2008	PINE GROVE	55	0	0	$8,000	$0
6/28/2008	GLADES	55	0	0	$8,000	$0
7/22/2008	ELKMONT	55	0	0	$0	$0
7/22/2008	GLADES	60	0	0	$0	$0
2/11/2009	CATLETTSBURG	55	0	0	$15,000	$0
4/2/2009	PITNER	55	0	0	$8,000	$0
4/6/2009	KODAK	52	0	0	$8,000	$0
4/6/2009	OAK CITY	50	0	0	$2,000	$0
4/6/2009	KODAK	50	0	0	$2,000	$0
5/28/2009	CUSICK	52	0	0	$0	$0
6/4/2009	MC MAHAN	52	0	0	$2,000	$0
6/4/2009	FAIR GARDEN	52	0	0	$2,000	$0
6/10/2009	KODAK	62	0	0	$5,000	$0
6/17/2009	SEVIERVILLE	50	0	0	$30,000	$0
8/16/2009	SEVIERVILLE	52	0	0	$2,000	$0
8/16/2009	SEVIERVILLE	58	0	0	$15,000	$0
8/22/2009	PITTMAN CENTER	60	0	0	$15,000	$0
8/22/2009	PITTMAN CENTER	50	0	0	$20,000	$0

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage	Crop Damage
7/26/2010	SHADY GROVE	55	0	0	$0	$0
10/26/2010	SEVIERVILLE	55	0	0	$5,000	$0
2/25/2011	SEVIERVILLE	50	0	0	$15,000	$0
2/28/2011	PITTMAN CENTER	60	0	0	$12,000	$0
3/23/2011	CATLETTSBURG	60	0	0	$0	$0
3/23/2011	GLADES	55	0	0	$0	$0
5/22/2011	MILLICAN	50	0	0	$0	$0
5/26/2011	HENRY XRDS	50	0	0	$0	$0
5/26/2011	ALDER BRANCH	50	0	0	$0	$0
6/24/2011	SEVIERVILLE	50	0	0	$5,000	$0
8/8/2011	SEVIERVILLE	52	0	0	$3,000	$0
8/18/2011	SEVIERVILLE	52	0	0	$10,000	$0
2/29/2012	PIGEON FORGE	60	0	0	$5,000	$0
3/2/2012	DU PONT	50	0	0	$0	$0
3/30/2012	CATLETTSBURG	50	0	0	$0	$0
7/1/2012	ELKMONT	60	0	0	$0	$0
7/5/2012	CATLETTSBURG	60	0	0	$1,000,000	$0
7/5/2012	FRENCH BROAD	60	0	0	$1,000,000	$0
7/5/2012	PIGEON FORGE	50	0	0	$0	$0
7/9/2012	BOYDS CREEK	50	0	0	$0	$0
7/10/2012	LINE SPG	50	0	0	$0	$0
7/10/2012	SEVIERVILLE	50	0	0	$0	$0
7/31/2012	MIDDLE CREEK	50	0	0	$0	$0
7/31/2012	PITNER	50	0	0	$0	$0
5/21/2013	CATLETTSBURG	50	0	0	$0	$0
5/22/2013	CATLETTSBURG	50	0	0	$0	$0
6/5/2013	PIGEON FORGE	50	0	0	$2,000	$0
6/5/2013	PIGEON FORGE	50	0	0	$5,000	$0
6/13/2013	PITTMAN CENTER	50	0	0	$8,000	$0
6/13/2013	SEYMOUR	55	0	0	$8,000	$0
6/10/2014	SEVIERVILLE	50	0	0	$10,000	$0
6/23/2014	PIGEON FORGE	50	0	0	$5,000	$0
6/23/2014	SEVIERVILLE	50	0	0	$8,000	$0
6/27/2014	SEYMOUR	50	0	0	$8,000	$0
7/8/2014	PITNER	50	0	0	$0	$0
7/8/2014	LINE SPG	60	0	0	$0	$0
7/27/2014	CATLETTSBURG	50	0	0	$0	$0
9/16/2014	CATLETTSBURG	52	0	0	$0	$0
10/14/2014	PIGEON FORGE	50	0	0	$5,000	$0
4/25/2015	KODAK	50	0	0	$5,000	$0

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage	Crop Damage
4/25/2015	GATLINBURG	50	0	0	$8,000	$0
6/2/2015	GLADES	50	0	0	$0	$0
6/30/2015	KODAK	50	0	0	$0	$0
8/10/2015	PITNER	50	0	0	$0	$0
8/10/2015	LINE SPG	50	0	0	$0	$0
4/22/2016	PITNER	50	0	0	$0	$0
6/2/2016	PIGEON FORGE	50	0	0	$0	$0
6/14/2016	HICKS CROSSING	50	0	0	$0	$0
7/7/2016	LINE SPG	50	0	0	$0	$0
7/7/2016	LINE SPG	50	0	0	$0	$0
7/7/2016	CATLETTSBURG	55	0	0	$0	$0
7/8/2016	ELKMONT	60	0	0	$0	$0
7/8/2016	PITNER	50	0	0	$0	$0
7/12/2016	BEECH SPGS	50	0	0	$0	$0
3/1/2017	CATLETTSBURG	50	0	0	$0	$0
3/1/2017	CATLETTSBURG	50	0	0	$0	$0
3/27/2017	CATES XRDS	50	0	0	$0	$0
5/24/2017	GLADES	50	0	0	$0	$0
5/24/2017	SEVIERVILLE ARPT	50	0	0	$0	$0
6/25/2018	BIRD XRD	50	0	0	$0	$0
6/26/2018	CATLETTSBURG	50	0	0	$0	$0
6/28/2018	GLADES	50	0	0	$0	$0
11/6/2018	PITNER	50	0	0	$0	$0

Since the last plan update, there have been 51 thunderstorm wind events that have occurred within the unincorporated areas of Sevier County and Pittman Center.

Incidents/Probability

The NCEI Storm Events Database reports 189 thunderstorm wind events within the boundaries of Sevier County between the years 1996 and 2018. With 189 events, the annual return rate (frequency) for thunderstorm wind events in the unincorporated area of Sevier County and Pittman Center is eight to nine events every year. This equates to an annual probability of approximately 100%.

8.1.10 Tornadoes

Location & Extent

While there is a significant tornado record for Sevier County with actual locations, tornadoes in general are a meteorological phenomenon that can occur anywhere and have the same approximate probability of occurring anywhere in the Sevier County planning area. Because a tornado has a similar probability of striking anywhere within the planning area, all of Sevier County and Pittman Center are equally at risk for tornadoes. The tornadoes experienced in Sevier County range from EF0 to EF1 on the EF scale. Based on

historical county-level data, the worst-case scenario for Sevier County and Pittman Center is an EF1 tornado; however, an EF4 tornado did impact Blount County in 2011 in an area adjacent to Sevier County.

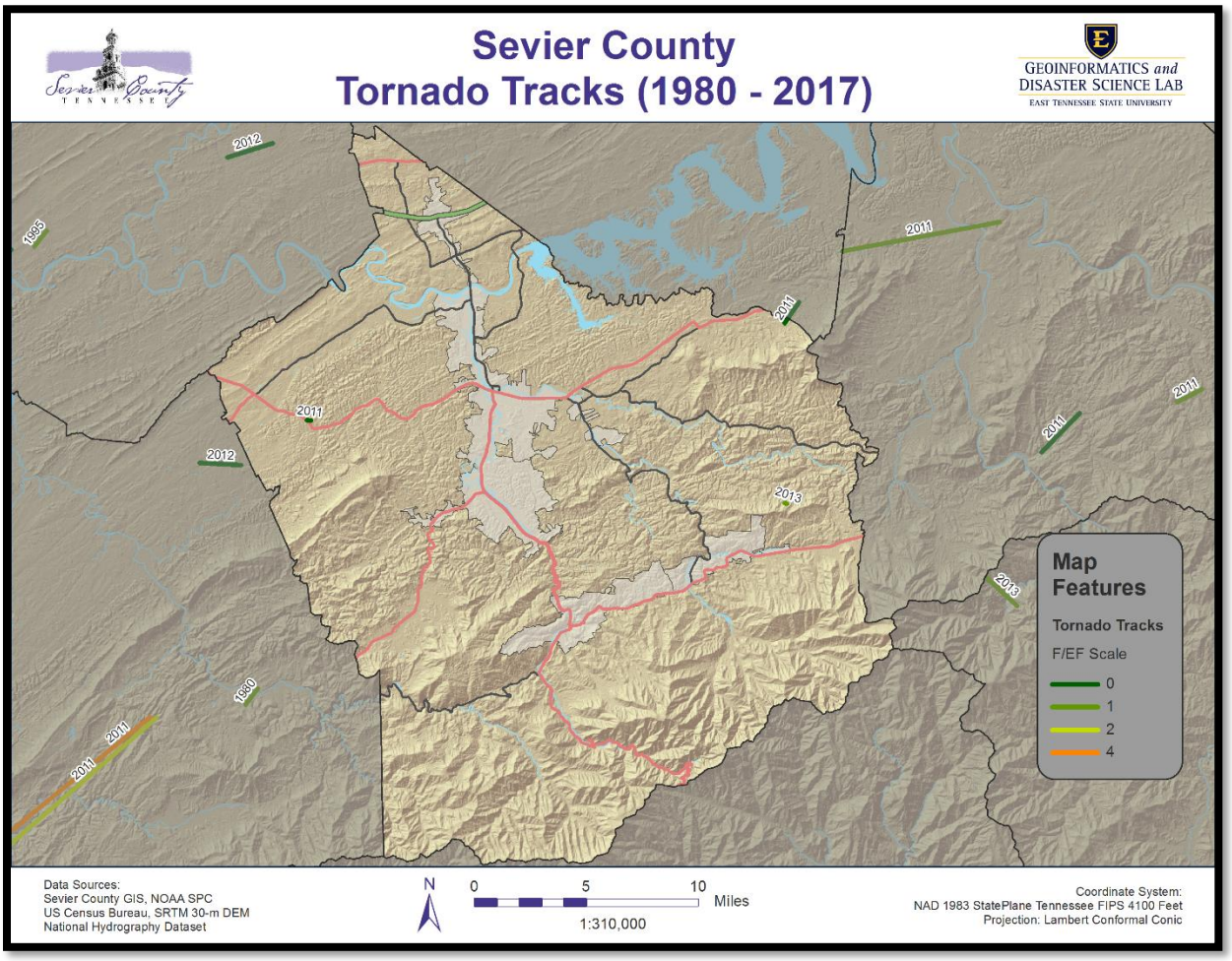

Figure 8-12: Tornado Density and Tracks in Relation to Sevier County.

Previous Occurrences

The NCEI Storm Events Database reports three tornadoes occurring within the boundaries of Sevier County. There have been no injuries due to tornadoes in Sevier County and Pittman Center. The following table is a list of all events that have occurred between 1996 and 2018.

Table 8-9: Tornado Incidents from 1996 to 2018 with Total Losses.
(Source: NCEI Storm Events Database)

Date	Location	Magnitude	Injuries	Fatalities	Property Damage
4/27/2011	CUSICK	EF0	0	0	$5,000
4/27/2011	BIRD XRD	EF0	0	0	$3,000
6/13/2013	SEVIERVILLE	EF1	0	0	$50,000

Since the last plan update, there have been no tornado events that have caused property damage and/or loss of life or injuries in Sevier County and Pittman Center.

Incidents/Probability

The NCEI Storm Events Database reports three tornado events within the boundaries of Sevier County between the years 1996 and 2018. With three events, the annual return rate (frequency) for tornado events in the unincorporated area of Sevier County and Pittman Center is one event every 7 to 8 years. This equates to an annual probability of approximately 12%.

8.1.11 Tropical Cyclones (Hurricanes)

Location & Extent

Tropical cyclones typically impact multiple regions and not one specific jurisdiction. Based on historical data, the Sevier County planning area can expect to experience tropical cyclones at the tropical depression level. Additionally, no portions of Sevier County will be impacted by storm surge based on its geographical location.

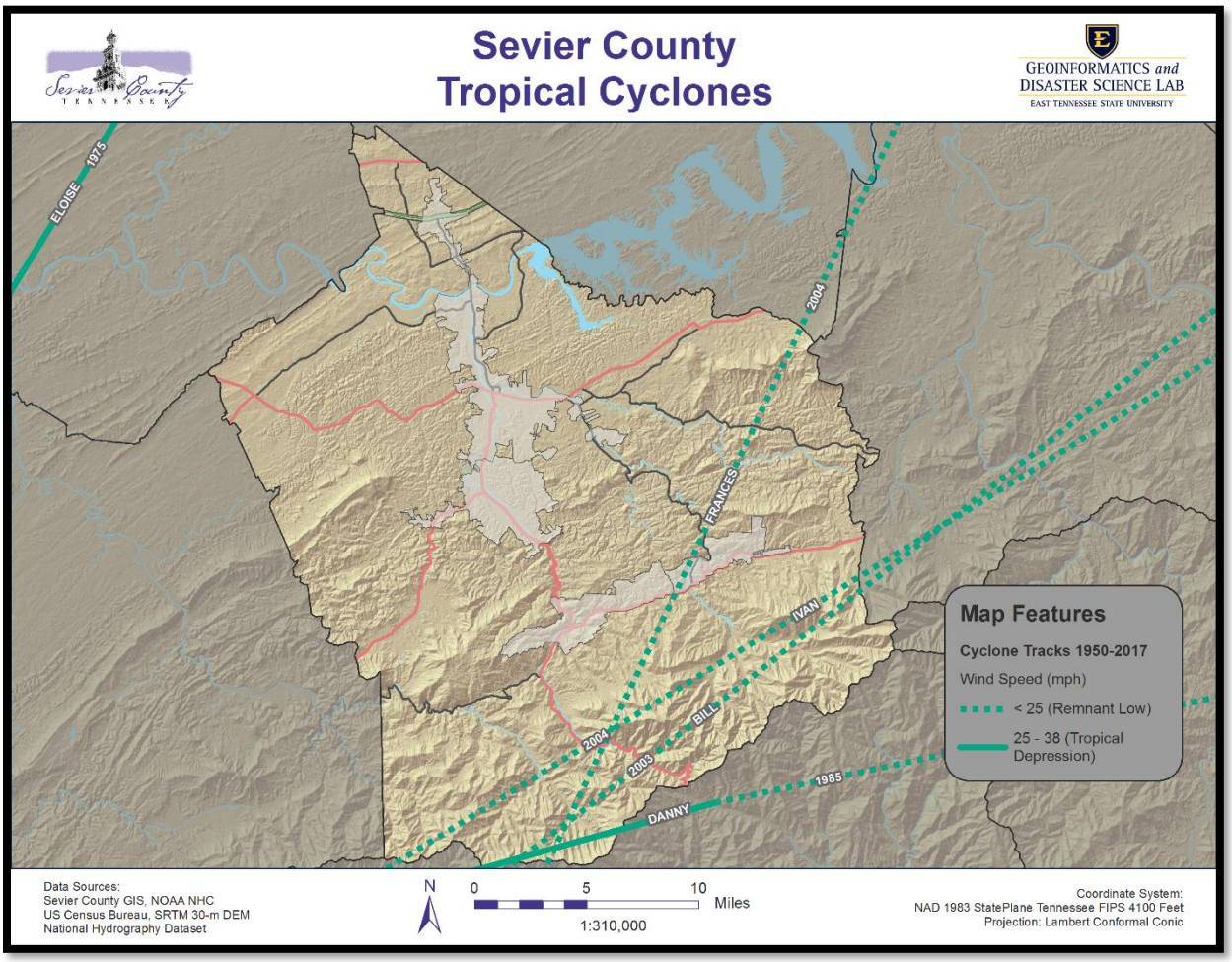

Figure 8-13: Tropical Cyclone Tracks in Relation to Sevier County and Pittman Center.

Previous Occurrences

The NCEI Storm Events Database reports no tropical cyclone (tropical depressions, tropical storms, and hurricanes) occurrences within the boundaries of Sevier County and Pittman Center between the years 1996 and 2018.

Incidents/Probability

Based on historical record, the annual probability of tropical cyclones for Sevier County and Pittman Center is less than 1%.

8.1.12 Wildfires/Conflagration

Location & Extent

Wildfires affect areas that are populated with forests and grasslands. On the fire danger rating system, Sevier County and Pittman Center can expect a moderate to high rating based on current land use/land cover in the area. The following figure displays the areas of wildland-urban interface and intermix for Sevier County and Pittman Center, as well as the underlying land cover (aerial imagery). The aerial imagery helps to identify possible wildfire fuel sources such as small wooded and shrub areas that may not be identified by the WUI dataset.

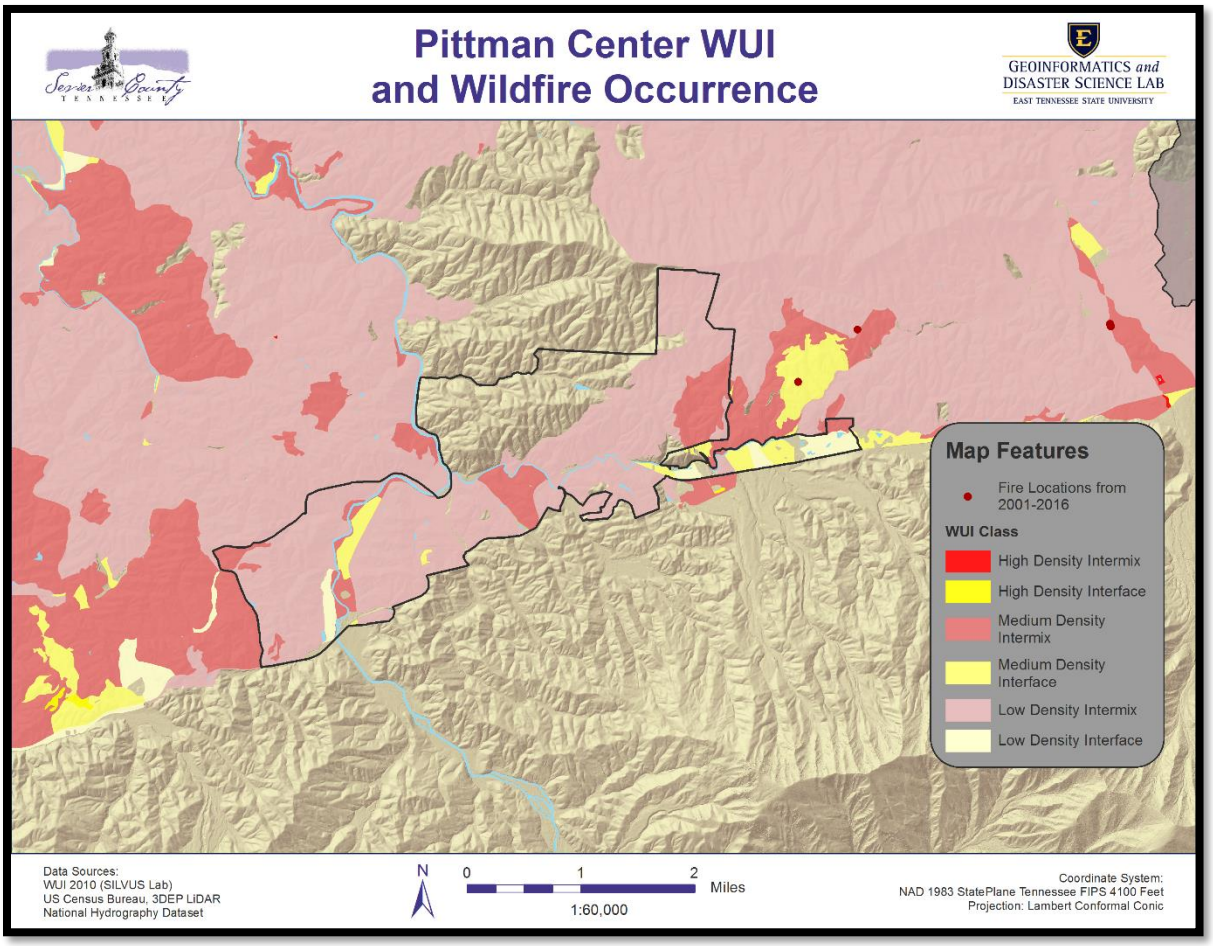

Figure 8-14: Wildland-Urban Interaction for Pittman Center.

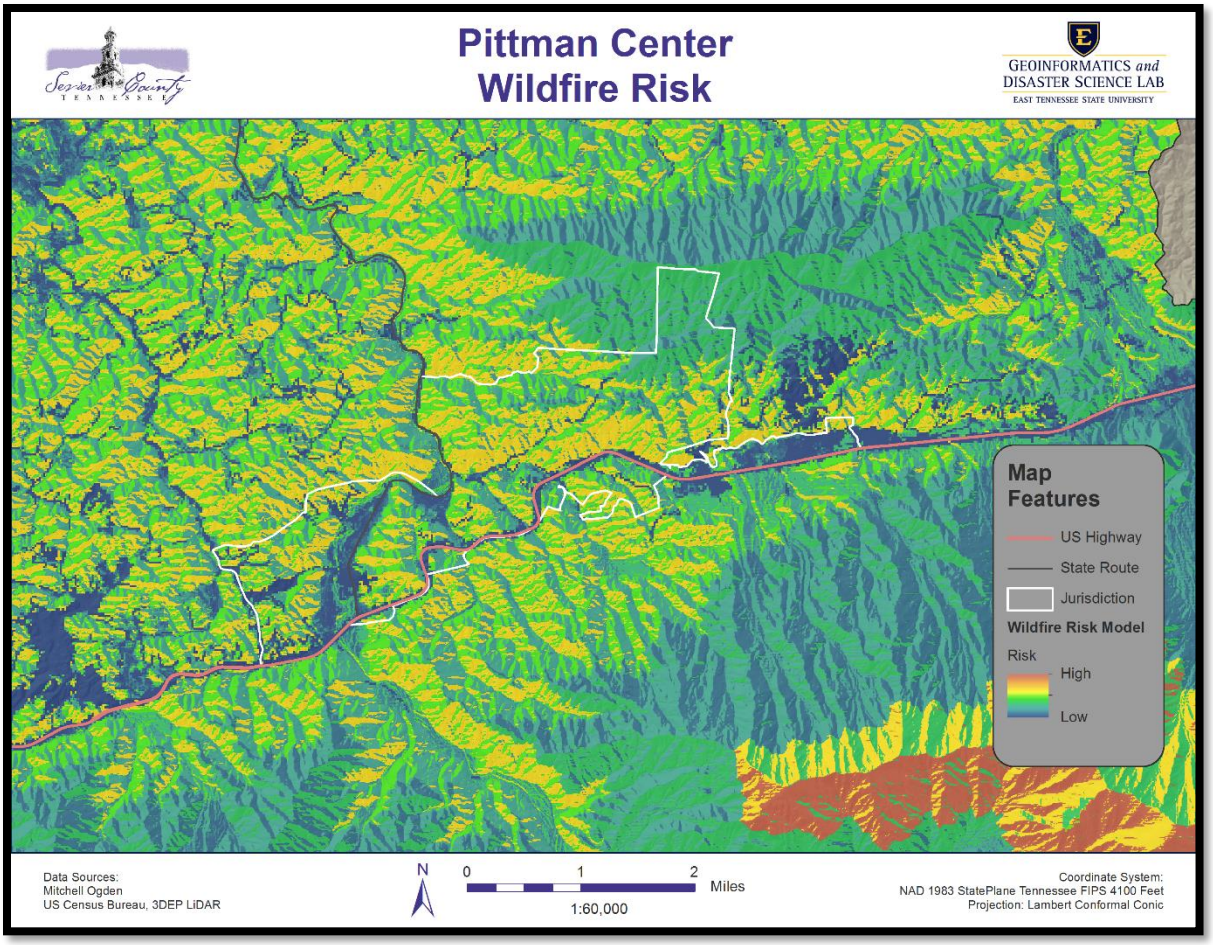

Figure 8-15: Wildfire Risk Model for Pittman Center.

Using the record of wildfires in Sevier County, how much of an effect each variable has on wildfire development can be determined through spatial logistic regression and GIS modeling. Calculating wildfire risk through these methods requires data on previous wildfire occurrences and variables related to fire development. Wildfire occurrence data comes from two sources: the United States Forest Service (USFS) and the Geological Survey (USGS). The USGS data recorded only those wildfires that occurred on federal land, primarily the Great Smoky Mountains National Park, for which the USFS dataset includes.

The duration of a wildfire depends on the weather conditions, how dry it is, the availability of fuel to spread, and the ability of responders to contain and extinguish the fire. Historically, some wildfires have lasted only hours while other fires have continued to spread and grow for an entire season. They spread quickly and often begin unnoticed until they have grown large enough to produce dense smoke. If fuel is available, and high winds occurr, a wildfire can spread over a large area in a very short amount of time. These factors make the difference between small upstart fires easily controlled by local fire services and fires destroying thousands of acres requiring multiple state and federal assets for containment and suppression.

Previous Occurrences

The USGS and USFS report 168 wildfire/conflagration occurrences within the boundaries of Sevier County and Pittman Center from 2001 to 2016. A historic drought in the fall of 2016 preceded historic wildfires. By November 22, all 95 counties in Tennessee were classified in "Severe Drought" (D2) or higher. Tennessee experienced numerous wildfires across the state, including several that required federal assistance. On November 28, 2016, hurricane-force winds rapidly expanded a small wildfire in Sevier County into the largest interface fire to affect the state of Tennessee in 100 years, resulting in an estimated $911 million in property and contents loss. There were 14 fatalities and 221 people treated with fire-related injuries. The fire area was reported at 17,140 acres.

Figure 8-16: Photos showing the 2016 wildfire entering the developed area of Gatlinburg (upper left, The Atlantic), drastically reducing visibility with intense smoke (upper right, WV Metro News), devastating large areas (lower left, CNN), and destroying many homes (lower right, NPR).

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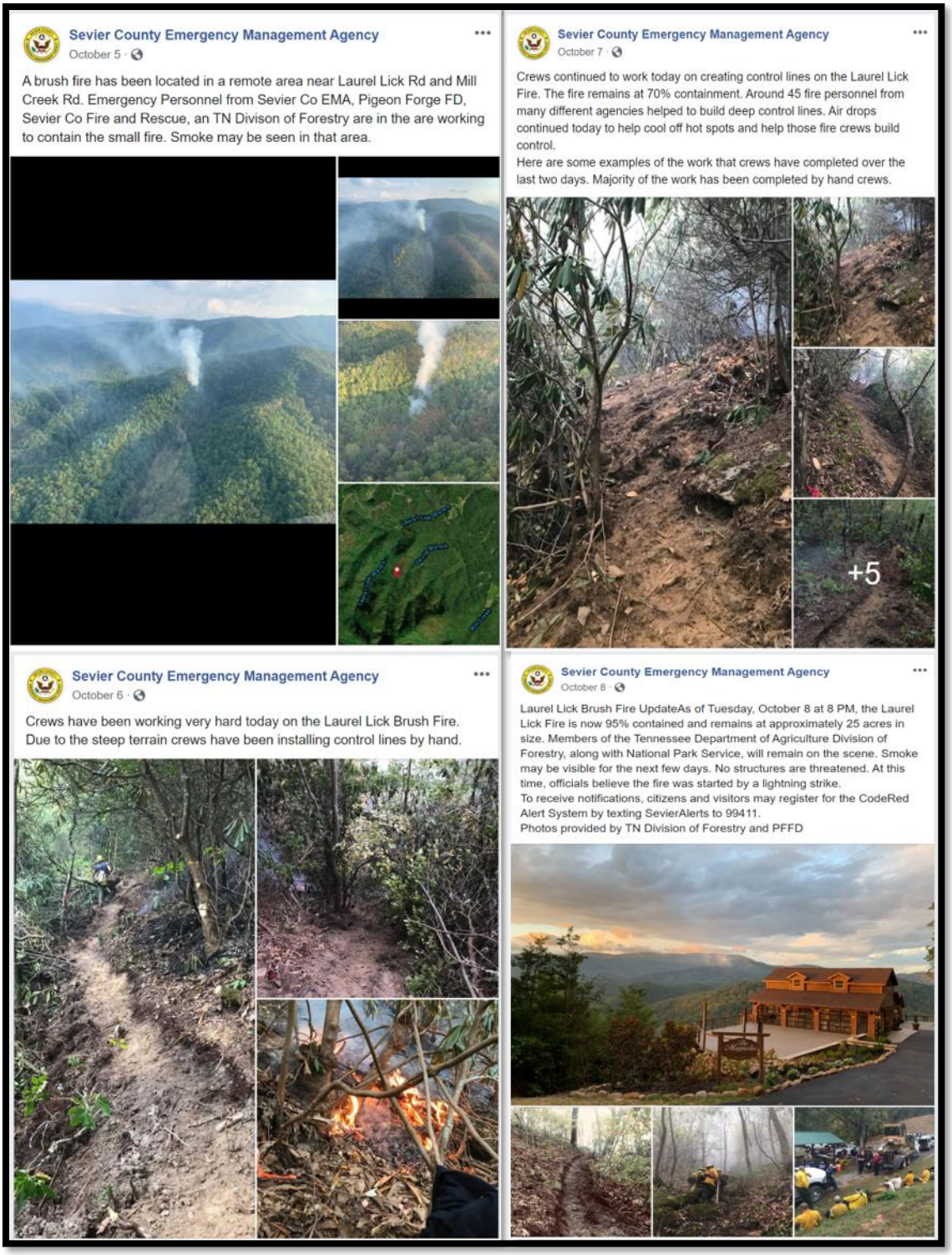

Figure 8-17: Social media documentation and community awareness of recent wildfires (October 2019) impacting Sevier County (Sevier County EMA).

Incidents/Probability

The USGS and USFS Database reports 168 wildfire/conflagration events within the boundaries of Sevier County between the years 2001 and 2016. With 168 events, the annual return rate (frequency) for wildfire/conflagration events in the unincorporated area of Sevier County and Pittman Center is eight to nine events every year. This equates to an annual probability of approximately 100%.

8.1.13 Winter Storms

Location & Extent

Because winter weather is a climatological hazard and has the same probability of occurring in any area in Sevier County, the entire planning area is equally at risk for winter weather. Based on historic data, Sevier County and Pittman Center can expect a category 5 on the Ohio Valley Regional Snowfall Index scale.

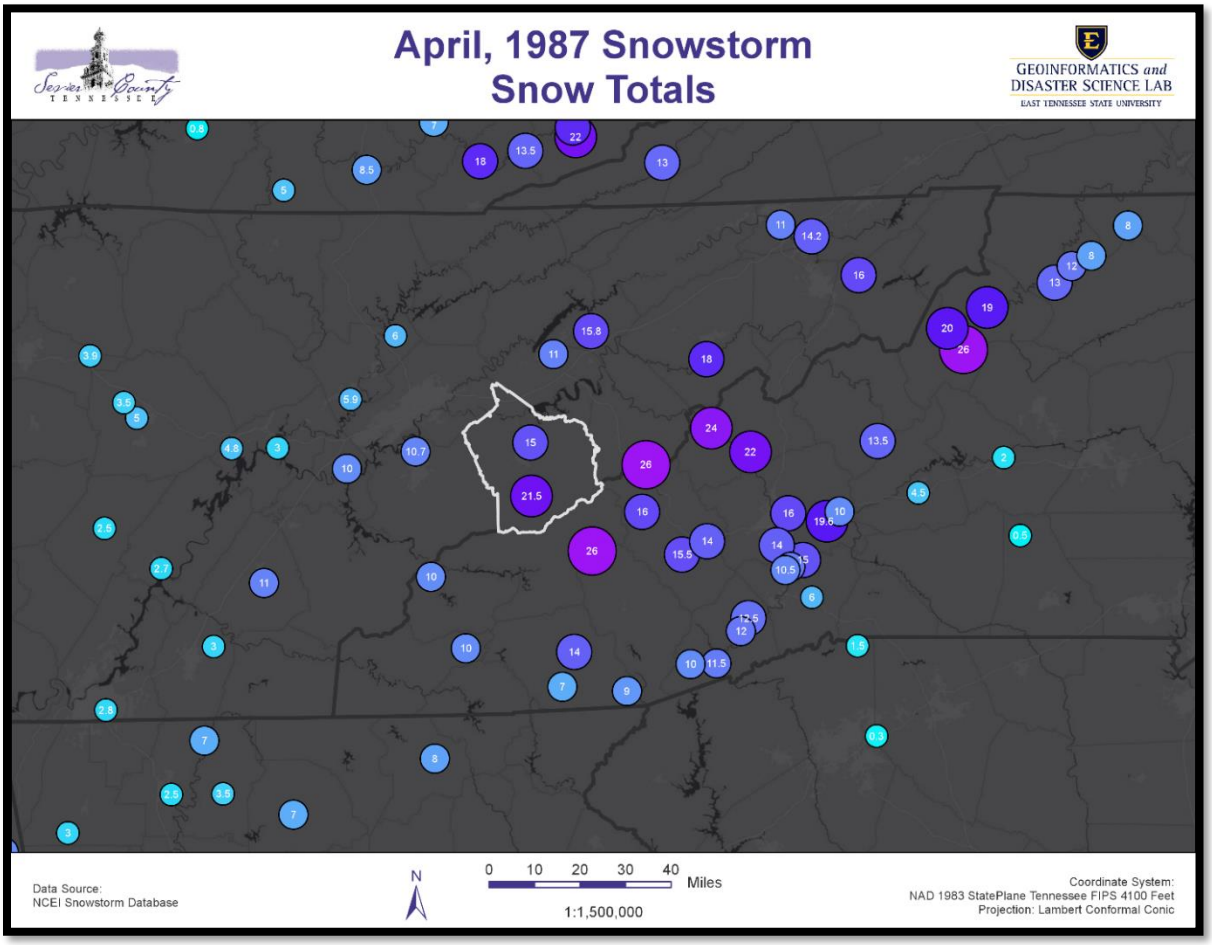

Figure 8-18: Station reported snowfall totals from the April 1987 snowstorm. This event resulted in the highest single day snowfall total for Sevierville, TN.

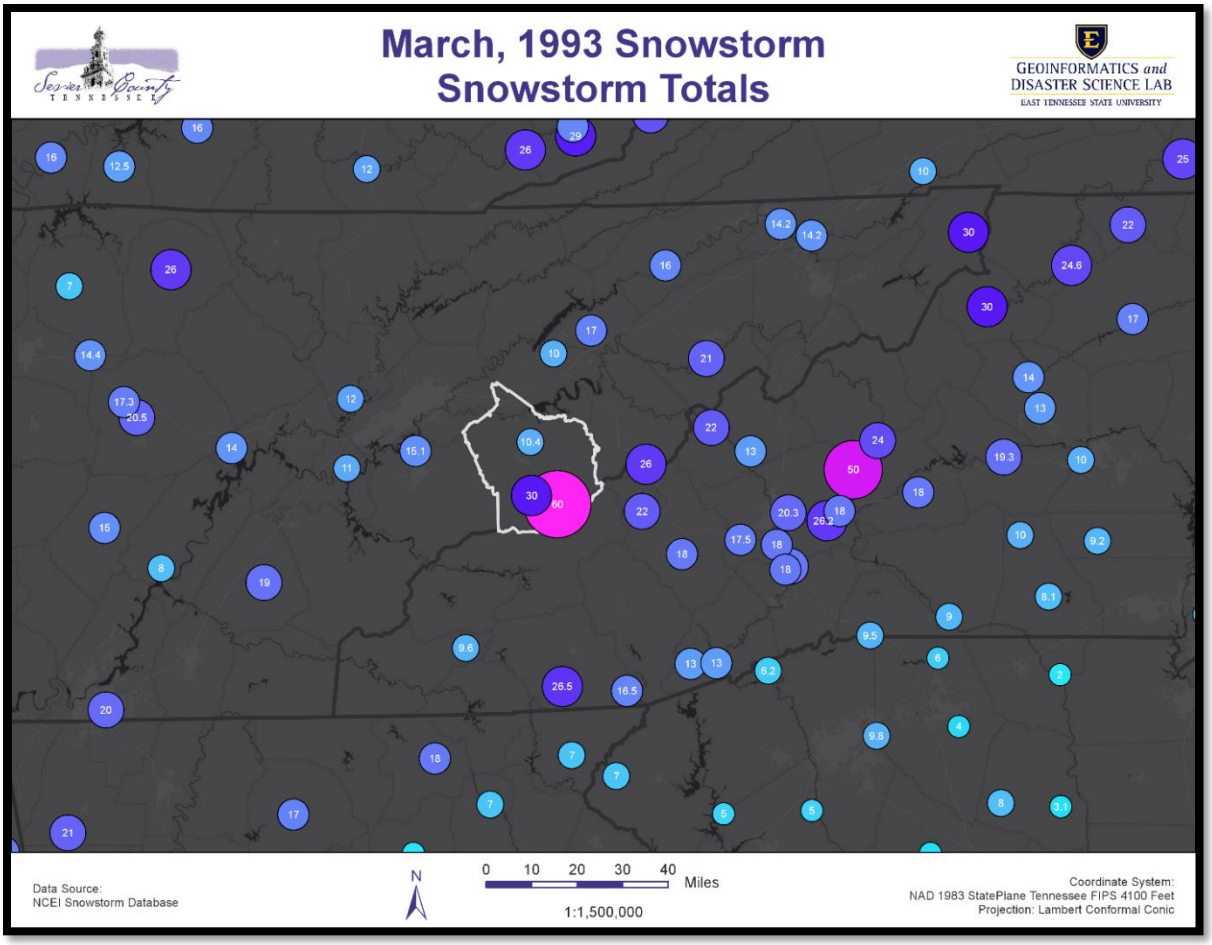

Figure 8-19: Station reported snowfall totals from the March 1993 snowstorm. This event resulted in the highest single day snowfall total for Gatlinburg, TN.

Previous Occurrences

Historically, there have been 102 winter storm events in the unincorporated area of Sevier County and Pittman Center from 1996 to 2018. There have been no injuries or fatalities due to winter storm events in the Sevier County planning area. The following table briefly outlines the winter storm events that have occurred in the unincorporated area of Sevier County and Pittman Center.

Table 8-10: Winter Storm Incidents from 1996 to 2018 with Total Losses.
(Source: NCEI Storm Events Database)

Date	Location	Injuries	Fatalities	Property Damage	Crop Damage
1/6/1996	GATLINBURG	0	0	$0	$0
1/6/1996	SOUTHWEST PART	0	0	$0	$0
1/11/1996	SEVIERVILLE	0	0	$0	$0
1/11/1996	GATLINBURG	0	0	$0	$0
2/2/1996	EXTREME N PART OF CO	0	0	$0	$0
2/2/1996	SEVIERVILLE	0	0	$0	$0
3/19/1996	SEYMOUR	0	0	$5,000	$0

Date	Location	Injuries	Fatalities	Property Damage	Crop Damage
3/19/1996	COUNTYWIDE	0	0	$0	$0
12/18/1996	COUNTYWIDE	0	0	$0	$0
12/18/1996	SEVIERVILLE	0	0	$0	$0
1/10/1997	COUNTYWIDE	0	0	$0	$0
1/10/1997	PIGEON FORGE	0	0	$0	$0
12/30/1997	GATLINBURG	0	0	$0	$0
12/30/1997	KODAK	0	0	$0	$0
1/27/1998	GATLINBURG	0	0	$0	$0
1/27/1998	SEVIERVILLE	0	0	$0	$0
1/6/1999	SEVIERVILLE	0	0	$0	$0
1/6/1999	SEVIERVILLE	0	0	$0	$0
3/3/1999	PIGEON FORGE	0	0	$0	$0
3/3/1999	SEVIERVILLE	0	0	$0	$0
3/13/1999	KODAK	0	0	$0	$0
3/13/1999	KODAK	0	0	$0	$0
3/26/1999	BEECH SPGS	0	0	$0	$0
3/26/1999	KODAK	0	0	$0	$0
1/22/2000	PIGEON FORGE	0	0	$0	$0
1/22/2000	SEYMOUR	0	0	$0	$0
12/2/2000	PIGEON FORGE	0	0	$0	$0
12/2/2000	PIGEON FORGE	0	0	$0	$0
12/18/2000	COUNTYWIDE	0	0	$0	$0
12/18/2000	COUNTYWIDE	0	0	$5,000	$0
1/1/2001	GATLINBURG	0	0	$0	$0
1/1/2001	GATLINBURG	0	0	$0	$0
1/20/2001	SEVIERVILLE	0	0	$0	$0
1/20/2001	KODAK	0	0	$0	$0
3/20/2001	HATCHERTOWN	0	0	$0	$0
3/20/2001	SEVIERVILLE	0	0	$0	$0
1/5/2002	KODAK	0	0	$2,000	$0
1/5/2002	SEYMOUR	0	0	$0	$0
12/4/2002	CEDAR BLUFF	0	0	$0	$0
1/5/2003	PIGEON FORGE	0	0	$0	$0
1/16/2003	PITTMAN CENTER	0	0	$0	$0
1/16/2003	COUNTYWIDE	0	0	$0	$0
1/22/2003	COUNTYWIDE	0	0	$0	$0
1/22/2003	SEVIERVILLE	0	0	$0	$0
2/7/2003	SEYMOUR	0	0	$0	$0
2/9/2003	COUNTYWIDE	0	0	$0	$0
4/10/2003	GATLINBURG	0	0	$0	$0
12/18/2003	COUNTYWIDE	0	0	$0	$0

Date	Location	Injuries	Fatalities	Property Damage	Crop Damage
12/19/2003	GATLINBURG	0	0	$0	$0
1/9/2004	GATLINBURG	0	0	$0	$0
1/9/2004	BOYDS CREEK	0	0	$0	$0
2/7/2004	WALDEN CREEK	0	0	$0	$0
12/11/2004	KODAK	0	0	$0	$0
12/19/2004	GATLINBURG	0	0	$0	$0
2/10/2005	SEVIERVILLE	0	0	$0	$0
2/28/2005	KODAK	0	0	$0	$0
11/21/2005	KODAK	0	0	$0	$0
1/14/2006	COUNTYWIDE	0	0	$0	$0
2/11/2006	SEYMOUR	0	0	$0	$0
2/18/2007	COUNTYWIDE	0	0	$0	$0
1/16/2008	PIGEON FORGE	0	0	$0	$0
2/27/2008	PIGEON FORGE	0	0	$0	$0
2/3/2009	COUNTYWIDE	0	0	$0	$0
4/7/2009	KODAK	0	0	$0	$0
12/18/2009	SEVIERVILLE	0	0	$0	$0
1/29/2010	SEYMOUR	0	0	$0	$0
1/29/2010	SEVIERVILLE	0	0	$0	$0
2/9/2010	SEYMOUR	0	0	$0	$0
2/24/2010	KODAK	0	0	$0	$0
12/6/2010	PIGEON FORGE	0	0	$0	$0
12/6/2010	KODAK	0	0	$0	$0
12/12/2010	SEVIERVILLE	0	0	$0	$0
12/12/2010	SEVIERVILLE	0	0	$0	$0
12/12/2010	COUNTYWIDE	0	0	$0	$0
12/12/2010	SEVIERVILLE	0	0	$0	$0
12/25/2010	SEVIERVILLE	0	0	$0	$0
12/26/2010	COUNTYWIDE	0	0	$0	$0
12/26/2010	GATLINBURG	0	0	$0	$0
12/26/2010	SEVIERVILLE	0	0	$0	$0
10/28/2012	SEVIERVILLE	0	0	$0	$0
10/28/2012	KODAK	0	0	$0	$0
10/28/2012	SEYMOUR	0	0	$0	$0
10/28/2012	SEVIERVILLE	0	0	$0	$0
1/17/2013	SEVIERVILLE	0	0	$0	$0
3/5/2013	PITTMAN CENTER	0	0	$0	$0
3/25/2013	GATLINBURG	0	0	$0	$0
11/26/2013	GATLINBURG	0	0	$0	$0
2/12/2014	KODAK	0	0	$0	$0
2/13/2014	COUNTYWIDE	0	0	$0	$0

Date	Location	Injuries	Fatalities	Property Damage	Crop Damage
3/29/2014	GATLINBURG	0	0	$0	$0
11/1/2014	COUNTYWIDE	0	0	$0	$0
2/17/2015	WALDEN CREEK	0	0	$1,000	$0
2/25/2015	KODAK	0	0	$0	$0
2/26/2015	CATLETTSBURG	0	0	$0	$0
1/20/2016	PITTMAN CENTER	0	0	$0	$0
1/22/2016	SEVIERVILLE	0	0	$0	$0
2/8/2016	SEVIERVILLE	0	0	$0	$0
1/6/2017	PIGEON FORGE	0	0	$0	$0
12/8/2017	GATLINBURG	0	0	$0	$0
1/29/2018	SEVIERVILLE	0	0	$0	$0
12/9/2018	BOYDS CREEK	0	0	$0	$0
12/21/2018	CATLETTSBURG	0	0	$0	$0

Since the last plan update, there have been 23 winter storm events that have occurred within the unincorporated areas of Sevier County and Pittman Center.

Incidents/Probability

The NCEI Storm Events Database reports 102 winter storm events within the boundaries of Sevier County between the years 1996 and 2018. With 102 events, the annual return rate (frequency) for winter storm events in the unincorporated area of Sevier County and Pittman Center is eight to nine events every year. This equates to an annual probability of approximately 100%.

8.1.14 Dam Failure

Location & Extent

Dams have been an important part of Sevier County's water infrastructure. In addition to the historic economic benefits provided by dams, they are used for flood control, water supply, power generation, recreation, and for mitigating the impact of increased runoff typically caused by land use changes associated with property development. The United Sates Army Corps of Engineers maintains a national inventory of dams in Sevier County.

In addition to proximity, the level of failure and meteorological conditions during a dam failure will greatly contribute to the extent of an incident. A minor failure will have lesser impacts than a total dam failure. Weather conditions also affect extent, as a dam failure without rainy conditions will have lesser extent, but the population will likely receive less warning. Conversely, rainy conditions exacerbate impacts, but allow for more warning due to expected failure.

According to the Federal Guidelines for Dam Safety, two (2) factors influence the severity of a dam failure: the amount of water impounded and the density, type, and value of development and infrastructure located downstream. Most dam failures are described by their potential point of inundation; the hazard potential levels of low, significant and high are further defined in the table below, while the figure on the following page provides a map of the locations of significant- and high-hazard dams. The magnitude and

severity of dam failures may also be assessed in terms of damage, including loss of life and injury, damage to infrastructure, loss of services or utilities, debris, and economic damage. The following figure shows dams in Sevier County and their hazard level.

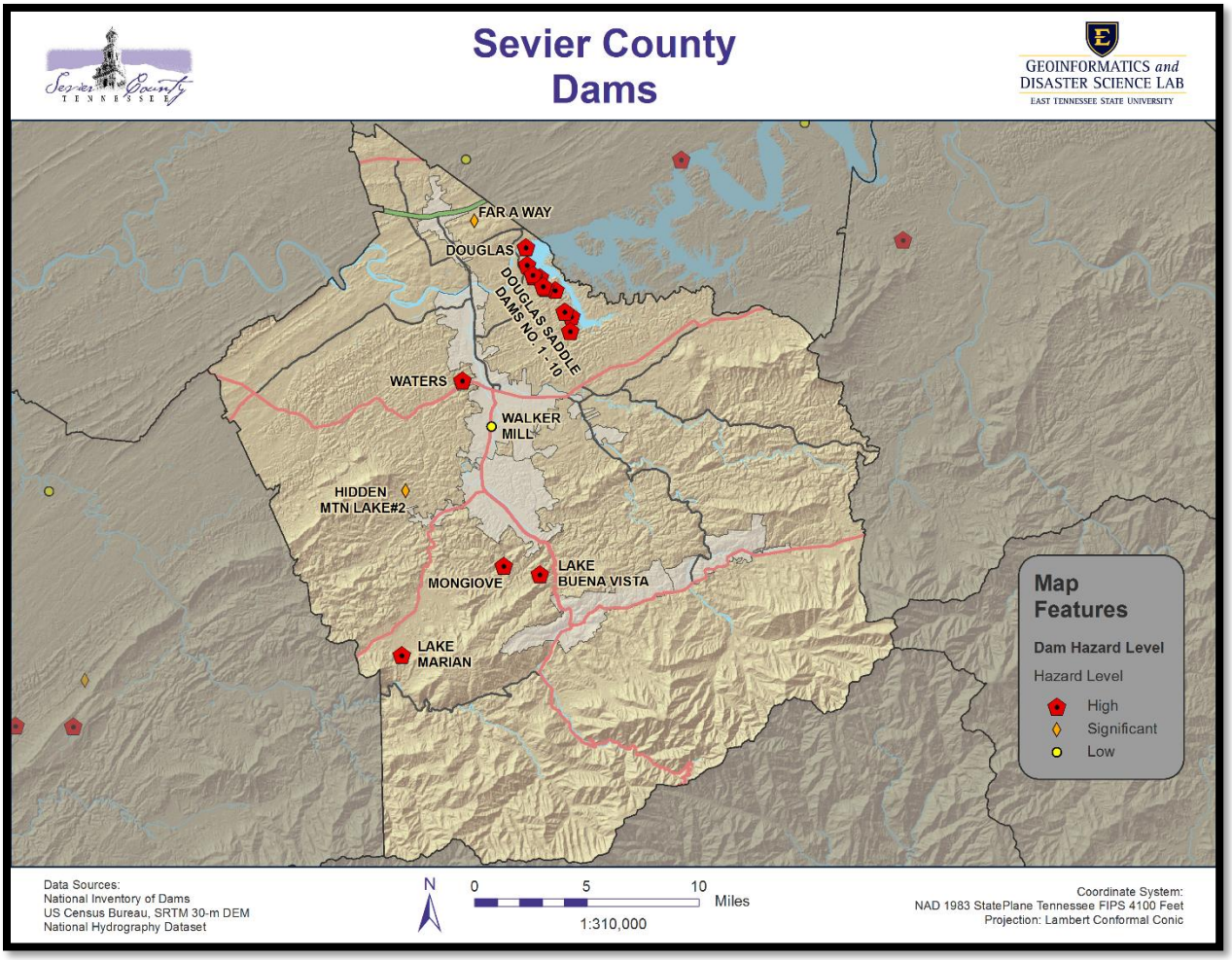

Figure 8-20: Dam Locations with Hazard Level in Sevier County.

Previous Occurrences

Sevier County and Pittman Center have experienced no dam failures from 1989 to 2018 nor since the last update of the county hazard mitigation plan.

Incidents/Probability

Based on historical records, the annual chance of occurrence for a dam failure is calculated at less than 1% for the county. However, based on the best available data, no dam failures would impact Pittman Center.

8.1.15 Infrastructure Failure

Location & Extent

Critical infrastructure is located throughout the county. Predicting the precise location of the next infrastructure failure is often difficult and generally dependent on the quality, upkeep, and maintenance of each piece of infrastructure as well as any protective actions that can mitigate or prevent sources of failure.

The failure of these structures could have potentially devastating impacts, including significant disruption to essential facilities, economic and financial impacts, and physical damage to infrastructure. The reliance of virtually all industries on transportation networks is of key importance. A significant event could have cascading effects on other infrastructure.

Previous Occurrences

Oftentimes, smaller scale infrastructure failures occur as a secondary impact from a natural disaster, such as a temporary closure of a road due to a mass wasting event. Sevier County and Pittman Center experience these disruptions occasionally and manages them through coordination across agencies. When infrastructure does fail, the county responds quickly to repair the infrastructure.

Incidents/Probability

In general, the county has not experienced any direct, prolonged catastrophic infrastructure failures. However, a significant failure of infrastructure could result in severe disruptions to public life and overall response efforts. Overall, Sevier County and Pittman Center are vulnerable to infrastructure failure; however, the probability of occurrence is calculated at less than 1% based on previous occurrences.

8.1.16 Civil Disobedience/Terrorism

Location & Extent

Because of their often-spontaneous nature, it is difficult to pinpoint a location for the occurrence of a civil disturbance or terrorism event. However, monitoring social trends and social media can often inform responders about where potential demonstrations or acts of violence may take place. In addition, information gathered in advance may warn officials and provide locations of sites of potential future disturbances or acts of terrorism. Oftentimes, demonstrations and large, crowded gatherings begin peacefully and escalate to instances of sometimes-violent civil disturbance.

Instances of civil disobedience may originate from a number of different public gatherings, including political rallies, sporting events, and peaceful protests. Civil disturbance and acts of terrorism are typically seen in larger urban areas rather than rural unincorporated areas.

The severity of a civil disturbance incident depends on the nature of the disturbance. Significant disturbances can result in mass arrests, civilian curfews, intensive response efforts, property damage, injuries, and deaths. In general, civil disturbance impacts can range from low to high depending on the severity of the incident.

Police dispatched to control traffic corridors or intrusion on private property is considered a low severity civil disturbance. Disruption of businesses and potential property damage are assessed as a moderate civil disturbance. In these cases, police intervention would be required to restore order without employing

chemical agents or physical force. A severe civil disturbance incident would involve rioting, arson, looting, assault, and death, where aggressive police action (tear gas, curfews, and mass arrests) may be required.

Civil disturbances may take on different characteristics depending on the severity of an incident. Each level of severity—low, medium, or high—poses risk to property. A low severity rating may be given to a localized event that results in minimal to no property damage, minimal police action, and no physical harm to the participants, bystanders, or police. While low severity disturbances may simply disrupt usual business activity due to large crowds and inability to access businesses and possibly residences, they have the potential to become incidents of medium or even high severity due to the amount of people involved and the sometimes emotionally-charged atmosphere that can result. A localized event that results in damage to property, police action, and physical harm to people involved, such as police or protestors, may be considered moderately severe. A moderately severe event may cause some damage to businesses and residences but overall the damage is limited.

Civil disturbances involving emotionally-charged and highly contentious business, police, or political action, or unrest based on the outrage of a segment of the population, could be considered high severity. The results and extent of severe civil disturbances are expected to range from financially burdensome on businesses facing considerable damage and possibly looting to potential destruction of public and private property as well as fire and subsequent smoke damage.

Previous Occurrences

Sevier County and its jurisdictions recently experienced what could be considered an act of terrorism – the only such event of note from 1996 to 2019, and since the last plan update

Tanger Outlet Shooting

A gunman opened fire at the Tanger Outlet Mall in Sevierville on April 16, 2019, killing one person and wounded another before killing himself. The shooting appeared to be random, confirming that such events could happen anywhere and anytime, but most often in event areas or high population areas.

Incidents/Probability

Civil disturbances and acts of terrorism have a low probability of occurring in Pittman Center. Based on previous occurrences and location, there is less than a 5% annual chance of occurrence for civil disturbances and acts of terrorism in the unincorporated areas of Sevier County and Pittman Center.

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8.2 Vulnerability Assessment

8.2.1 Communicable Diseases Vulnerability

Estimated Impact and Potential Loss

Communicable disease does not have the potential to impact property and crops; however, livestock operations throughout Sevier County and Pittman Center are subject to disease outbreaks.

Vulnerable Population

Many communicable diseases are transmitted by vectors, such as mosquitoes, ticks, and fleas. Vectors can transmit an array of pathogens, such as viruses, bacteria, and protozoa, which can cause illness in humans (or humans and animals). While everyone in Sevier County and Pittman Center are susceptible to communicable disease, special attention should be paid to highly vulnerable populations such as those who are socioeconomically disadvantaged, young children, and the elderly.

Vulnerability Score

Table 8-11: Communicable Disease Vulnerability Score.

	Communicable Diseases Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	4	2	3	4	2	1.7	**2.6**

8.2.2 Drought Vulnerability

Estimated Impact and Potential Loss

According to the NCEI database, there has been one drought event that has caused some level of crop damage. The total agricultural damage from this event was $2,000. When annualizing the total cost over the 23-year record, total annual losses based on drought is estimated to be $83. The following table presents an analysis of agricultural exposure that is susceptible to drought by major crop type for Sevier County.

Table 8-12: Agricultural Exposure by Crop Type for Drought in Sevier County.
(Source: United States Department of Agriculture 2017 Census)

Agricultural Exposure by Crop Type for Drought				
Nursery Plants	Hay	Corn	Dry Peas	Soybeans
$428,000	$1,384,000	$98,000	$135,000	$31,000

Vulnerable Population

Drought typically has a larger impact on the agricultural community, and does not directly affect human life or health. However, drought can exacerbate other hazardous conditions, especially wildfires. There have been no reported injuries or loss of life due to drought in Sevier County and Pittman Center.

Vulnerability Score

Table 8-13: Drought Vulnerability Score.

	Drought Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	3	2	4	1	4	2.0	**2.6**

8.2.3 Earthquake Vulnerability

Estimated Impact and Potential Loss

Sevier County and Pittman Center are vulnerable to earthquake hazards; however, the impact is largely unknown since there has yet to be an earthquake that has caused any property or crop damage. The USGS database shows that there is a 6.34% chance of a major earthquake (5.0 or greater) within 50 miles of Sevier County and Pittman Center within the next 50 years.

Vulnerable Population

There has been no recorded earthquake event that has caused loss of life or injuries in the state of Tennessee per the Tennessee Hazard Mitigation Plan, so the impact on population is largely unknown in Sevier County and Pittman Center.

Vulnerability Score

Table 8-14: Earthquake Vulnerability Score.

	Earthquake Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	1	1	4	4	1	1.3	**1.8**

8.2.4 Extreme Temperature Vulnerability

Estimated Impact and Potential Loss

All of the Sevier County planning area is vulnerable to extreme temperature occurrences. Extreme heat occurrences often transpire in conjunction with drought occurrences, which leaves the soil susceptible to desiccation. Extreme cold occurrences impact all utilities in the area such as exposed water pipes that can freeze and burst. Based on historical data, there has been no property damage as a result of extreme temperatures; however, an extreme temperature incident has the potential to cause thousands of dollars in property damage.

Vulnerable Population

Residents of Sevier County and Pittman Center who are elderly or in poor health are at acute risk along with residents who work outside in the extreme conditions.

Vulnerability Score

Table 8-15: Extreme Temperatures Vulnerability Score.

	Extreme Temperatures Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	4	3	4	1	3	**2.0**	**3.0**

8.2.5 Flood Including Extreme Precipitation Vulnerability

Estimated Impact and Potential Loss

Using the Hazus 4.2 Flood Model, along with the Sevier County and Pittman Center Digital Flood Insurance Rate Maps, the 100-year flood scenario was analyzed to determine losses for the scenario. The following table displays the total economic losses that would result from a 100-year flood scenario.

Table 8-16: Estimated Losses for 100-Year Flood Scenario in Sevier County and its Jurisdictions.

Jurisdiction	Estimated Total Losses
Sevier County (Unincorporated)	$634,000
Gatlinburg	$784,000
Pigeon Forge	$880,000
Pittman Center	$51,000
Sevierville	$960,000
Total	**$3,309,000**

The Hazus 4.2 Flood Model also provided a breakdown by jurisdiction for seven primary sectors throughout Pittman Center. The losses for Pittman Center are listed in the following table.

Table 8-17: Estimated Losses for 100-Year Flood Scenario in Pittman Center by Sector.

Pittman Center	Estimated Total Losses
Agricultural	$2,000
Commercial	$11,000
Government	$0
Industrial	$15,000
Religious/Non-Profit	$0
Residential	$23,000
Education	$0
Total	**$51,000**

Vulnerable Population

The total population within the county that is susceptible to a flood hazard is shown in the table below:

Table 8-18: Vulnerable Populations Susceptible to a 100-Year Flood Event for Sevier County and its Jurisdictions.

Number of People Exposed to Flood Hazards			
Jurisdiction	**# in Community**	**# in Hazard Area**	**% in Hazard Area**
Sevier County (Unincorporated)	64,761	6,848	10.6%
Gatlinburg	3,944	977	24.8%
Pigeon Forge	5,875	1,433	24.4%
Pittman Center	502	74	14.7%
Sevierville	14,807	3,144	21.2%
Total	**89,889**	**12,476**	**13.9%**

The Hazus 4.2 Flood Model was also extrapolated to provide an overview of vulnerable populations throughout Sevier County and Pittman Center. The following table identifies the vulnerable population to floods in Pittman Center.

Table 8-19: Vulnerable Populates Susceptible to a 100-Year Flood Event in Pittman Center.

Pittman Center		
Category	**Total Numbers**	**% of People in Hazard Area**
Number in Hazard Area	74	14.7%
Persons Under 5 Years	4	4.8%
Persons Under 18 Years	15	20.1%
Persons 65 Year and Over	14	18.3%
Caucasian	71	96.6%
Minority	3	3.4%

Vulnerability Score

Table 8-20: Flooding including Extreme Precipitation Vulnerability Score.

	Flooding including Extreme Precipitation Vulnerability Score						
	Probability	**Impact**	**Spatial Extent**	**Warning Time**	**Duration**	**Vulnerability**	**Risk Factor**
Risk Level	3	2	3	3	2	3.0	**2.7**

8.2.6 Mass Wasting

Estimated Impact and Potential Loss

The entire planning area within Sevier County is susceptible to the effects of mass wasting events. Mass wasting events can cause serious damage to highways, buildings, homes, and other structures that support a wide range of economies and activities. Mass wasting events commonly coincide with other natural disasters such as extreme precipitation events. Expansion of urban development contributes to greater risk of damage by mass wasting.

The USGS recognizes six major impacts caused by mass wasting events:

1. Causes damage in all 50 states, Puerto Rico, and the U.S. Virgin Islands
2. Costs $3.5 billion per year in damage repair
3. Causes between 25 and 50 deaths in the United States annually
4. Reduces real estate values and tourist revenue
5. Leads to lost human, industrial, agricultural, and forest productivity
6. Causes damage to the natural environment

Vulnerable Population

Mass wasting events typically impact motorists and those living in the vicinity of a vulnerable area. This is demonstrated in a mass wasting event which occurred on August 1, 2019 in Gatlinburg when a tree fell from a slope and fatally injured a 73-year old man. The lack of a detailed mass wasting inventory makes research on the vulnerability of people to mass wasting events highly limited.

Vulnerability Score

Table 8-21: Mass Wasting Vulnerability Score.

	Mass Wasting Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	3	2	2	4	4	2.3	**2.6**

8.2.7 Severe Wind Vulnerability

Estimated Impact and Potential Loss

Since 1996, there have been two reported severe wind events that have occurred within the boundaries of Sevier County and Pittman Center. The total property damages associated with these events have totaled $22,000. To estimate the potential losses of a severe wind event on an annual basis, the total damage recorded for severe wind events was divided by the total number of years of available severe wind data (1996 - 2018). This provides an annual estimated potential loss of $957. To assess potential losses to the participating jurisdictions, the 2010 Census population was used to assign the estimated potential losses proportionally across the jurisdictions. The following table provides an estimate of potential property losses for Sevier County and its jurisdictions based on the 2010 Census data:

Table 8-22: Estimated Annual Losses for Severe Wind Events in Sevier County and its Jurisdictions.

Unincorporated Sevier County (72.0% of Population)	Gatlinburg (4.4 % of Population)	Pigeon Forge (6.5% of Population)	Pittman Center (0.6% of Population)	Sevierville (16.5% of Population)
$689	$42	$63	$5	$158

Vulnerable Population

There have been no recorded severe wind event that has caused loss of life or injuries in Sevier County and Pittman Center; however, these events have the potential to significantly impact the aviation community in these areas.

Vulnerability Score

Table 8-23: Severe Wind Vulnerability Score.

	Severe Wind Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	2	2	2	4	1	2.0	**2.1**

8.2.8 Sinkhole Vulnerability

Estimated Impact and Potential Loss

The entire Sevier County planning area is susceptible to subsidence and sinkholes based on the karst topography of the region. While sinkholes have a higher risk of forming in the northern portions of the county, the southern portion is also susceptible to sinkholes.

Vulnerable Population

There are no reported fatalities or injuries associated with sinkhole events.

Vulnerability Score

Table 8-24: Sinkhole Vulnerability Score.

	Sinkhole Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	4	2	1	4	1	1.2	**1.7**

8.2.9 Thunderstorm Vulnerability

Hail

Estimated Impact and Potential Loss

Since 1996, there have been 25 reported hail events that have occurred within the boundaries of Sevier County and Pittman Center. The total property damages associated with these events have totaled $13,700. To estimate the potential losses of a hail event on an annual basis, the total damage recorded for hail events was divided by the total number of years of available hail data (1996 - 2018). This provides an annual estimated potential loss of $596. To assess potential losses to the participating jurisdictions, the 2010 Census population was used to assign the estimated potential losses proportionally across the jurisdictions. The following table provides an estimate of potential property losses for Sevier County and its jurisdictions based on the 2010 Census data:

Table 8-25: Estimated Annual Losses for Hail Events in Sevier County and its Jurisdictions.

Unincorporated Sevier County (72.0% of Population)	Gatlinburg (4.4 % of Population)	Pigeon Forge (6.5% of Population)	Pittman Center (0.6% of Population)	Sevierville (16.5% of Population)
$429	$26	$39	$3	$98

Vulnerable Population

There have been no reported injuries or fatalities associated with hail events in Sevier County and Pittman Center.

Hail Vulnerability Score

Table 8-26: Hail Vulnerability Score.

	Hail Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	4	2	4	3	1	2.0	**2.7**

Lightning

Estimated Impact and Potential Loss

Since 1996, there have been two reported lightning events that have occurred within the boundaries of Sevier County and Pittman Center. There has been no reported property or crop damage associated with lightning within the boundaries of Sevier County.

Vulnerable Population

There has been one reported fatality from lightning that has occurred within the boundaries of Sevier County and Pittman Center. On July 10, 2004, a man was struck by lightning while he was fishing on Douglas Lake. The boat was several hundred yards from Douglas Dam when the incident occurred. He was rendered unconscious and fell into the water.

Lightning Vulnerability Score

Table 8-27: Lightning Vulnerability Score.

	Lightning Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	2	1	2	3	1	2.0	**1.8**

Wind

Estimated Impact and Potential Loss

Since 1996, there have been 189 reported thunderstorm wind events that have occurred within the boundaries of Sevier County and Pittman Center. The total property damages associated with these events have totaled $3,089,000. To estimate the potential losses of a thunderstorm wind event on an annual basis, the total damage recorded for thunderstorm wind events was divided by the total number of years of available thunderstorm wind data (1996 - 2018). This provides an annual estimated potential loss of $134,304. To assess potential losses to the participating jurisdictions, the 2010 Census population was used to assign the estimated potential losses proportionally across the jurisdictions. The following table provides an estimate of potential property losses for Sevier County and its jurisdictions based on the 2010 Census data:

Table 8-28: Estimated Annual Losses for Thunderstorm Wind Events in Sevier County and its Jurisdictions.

Unincorporated Sevier County (72.0% of Population)	Gatlinburg (4.4 % of Population)	Pigeon Forge (6.5% of Population)	Pittman Center (0.6% of Population)	Sevierville (16.5% of Population)
$96,760	$5,893	$8,778	$750	$22,123

Vulnerable Population

There have been no reported injuries or fatalities associated with thunderstorm wind events in Sevier County and Pittman Center.

Wind Vulnerability Score

Table 8-29: Wind Vulnerability Score.

	Wind Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	4	2	4	3	1	2.0	**2.7**

8.2.10 Tornado Vulnerability

Estimated Impact and Potential Loss

Since 1996, there have been three reported tornadoes that have occurred within the boundaries of Sevier County and Pittman Center. The total property damages associated with these tornadoes have totaled $58,000. To estimate the potential losses of a tornado on an annual basis, the total damage recorded for thunderstorm wind events was divided by the total number of years of available thunderstorm wind data (1996 - 2018). This provides an annual estimated potential loss of $2,522. To assess potential losses to the participating jurisdictions, the 2010 Census population was used to assign the estimated potential losses proportionally across the jurisdictions. The following table provides an estimate of potential property losses for Sevier County and its jurisdictions based on the 2010 Census data:

Table 8-30: Estimated Annual Losses for Tornado Events in Sevier County and its Jurisdictions.

Unincorporated Sevier County (72.0% of Population)	Gatlinburg (4.4 % of Population)	Pigeon Forge (6.5% of Population)	Pittman Center (0.6% of Population)	Sevierville (16.5% of Population)
$1,817	$111	$165	$14	$415

Vulnerable Population

There have been no reported injuries or fatalities associated with tornadoes; however, residents living in manufactured housing are more vulnerable to tornadoes and are more likely to sustain higher damage totals due to the construction materials. Approximately 22% of all buildings in Sevier County and Pittman Center are manufactured housing. The following table presents an analysis of building exposure that is susceptible to tornadoes by general occupancy type for Sevier County, along with the percentage of building stock that are manufactured homes.

Table 8-31: Building Exposure by General Occupancy Type for Tornadoes in Sevier County ($1,000).

Residential	Commercial	Industrial	Agricultural	Religion	Government	Education	Manufactured Homes
9,332,162	1,574,531	333,255	31,641	201,848	47,906	95,279	22%

Vulnerability Score

Table 8-32: Tornado Vulnerability Score.

	Tornado Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	3	2	2	4	3	1.2	**2.2**

8.2.11 Tropical Cyclone (Hurricane) Vulnerability

Estimated Impact and Potential Loss

There has been no reported property or crop damage associated with tropical cyclones within the boundaries of Sevier County and Pittman Center.

Vulnerable Population

There have been no reported injuries or deaths associated with tropical cyclone within the boundaries of Sevier County and Pittman Center.

Vulnerability Score

Table 8-33: Tropical Cyclone Vulnerability Score.

	Tropical Cyclone Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	1	1	4	1	2	1.0	**1.5**

8.2.12 Wildfires/Conflagration Vulnerability

Estimated Impact and Potential Loss

The entire Sevier County planning area is located near areas of wildland-urban interface and intermix or other susceptible land use/land cover types, which makes them vulnerable to wildfires. Southern areas of Sevier County are particularly vulnerable since they are located within the Great Smoky Mountain National Park. In November of 2016, a wildfire in Sevier County turned into the largest interface fire to affect the state of Tennessee in 100 years, resulting in $911 million in property and content loss.

Vulnerable Population

Sevier County and its jurisdiction residents near areas of wildland-urban interface and intermix and other wooded land cover types are vulnerable to the effects of wildfire. Fourteen fatalities and 221 people were treated for fire-related injuries in November 2016 when the largest interface fire to affect the state of Tennessee in 100 years occurred in Sevier County.

Vulnerability Score

Table 8-34: Wildfires/Conflagration Vulnerability Score.

	Wildfires/Conflagration Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	4	4	4	2	4	3.0	**3.6**

8.2.13 Winter Storm Vulnerability

Estimated Impact and Potential Loss

Since 1996, there have been 102 reported winter storm events which have occurred within the boundaries of Sevier County and Pittman Center. The total property damages associated with these storms have totaled $13,000. To estimate the potential losses of a winter weather event on an annual basis, the total damage recorded for winter storm events was divided by the total number of years of available winter storm data (1996 - 2018). This provides an annual estimated potential loss of $565. To assess potential losses to the participating jurisdictions, the 2010 Census population was used to assign the estimated potential losses proportionally across the jurisdictions. The following table provides an estimate of potential property losses for Sevier County and its jurisdictions based on the 2010 Census data:

Table 8-35: Estimated Annual Losses for Winter Storm Events in Sevier County and its Jurisdictions.

Unincorporated Sevier County (72.0% of Population)	Gatlinburg (4.4 % of Population)	Pigeon Forge (6.5% of Population)	Pittman Center (0.6% of Population)	Sevierville (16.5% of Population)
$407	$25	$37	$3	$93

There have been no injuries or fatalities due to winter storm events in the Sevier County planning area.

Vulnerable Population

All of Sevier County and its jurisdiction residents are vulnerable to the effects of winter weather.

Vulnerability Score

Table 8-36: Winter Storm Vulnerability Score.

	Winter Storm Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	4	3	4	2	4	**2.0**	**3.1**

8.2.14 Dam Failure Vulnerability

Estimated Impact and Potential Loss

Sevier County and Pittman Center are vulnerable to dam failures; however, the impact is largely unknown since there has yet to be a dam failure in the planning area.

Vulnerable Population

There have been no fatalities or injuries associated with dam failure in Sevier County and Pittman Center; however, homes and businesses in immediate vicinity downstream of a dam location are vulnerable to the impacts of a dam failure. In Pittman Center, no known dam locations are upstream from vulnerable populations.

Vulnerability Score

Table 8-37: Dam Failure Vulnerability Score.

	Dam Failure Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	1	3	2	4	4	**1.0**	**1.8**

8.2.15 Infrastructure Failure Vulnerability

Estimated Impact and Potential Loss

In general, Pittman Center has not experienced any direct, prolonged catastrophic infrastructure failures. However, a significant failure of infrastructure could result in severe disruptions to public life and overall response efforts.

Vulnerable Population

There are no recorded fatalities or injuries associated with infrastructure failure Pittman Center.

Vulnerability Score

Table 8-38: Infrastructure Failure Vulnerability Score.

	Infrastructure Failure Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	1	3	2	4	3	2.0	**2.3**

8.2.16 Civil Disobedience/Terrorism Vulnerability

Estimated Impact and Potential Loss

The Sevier County planning area experienced one civil disobedience/terrorism event since 1996 (Tanger Outlet Shooting in April 2019), although this did not occur in Pittman Center.

Vulnerable Population

There were two fatalities and one injury associated with civil disobedience/terrorism events.

Vulnerability Score

Table 8-39: Civil Disobedience/Terrorism Vulnerability Score.

	Civil Disobedience Terrorism Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	1	4	4	4	1	2.7	**2.9**

8.3 Capability Assessment

This section summarizes the results of the Sevier County Hazard Mitigation Planning Committee and other agency efforts to develop policies, programs, and activities that directly or indirectly support hazard mitigation. It also provides information on resources and gaps in the county's infrastructure, as well as relevant changes in its laws since the last Plan Update, in order to suggest a mitigation strategy. Through this assessment, Sevier County is able to identify strengths that could be used to reduce losses and reduce risk throughout the community. It also identifies areas where mitigation actions might be used to supplement current capabilities and create a more resilient community before, during, and after a hazard event.

Policies, Plans, and Programs

Sevier County and Pittman Center capabilities are unique to the county as a whole, including planning, regulatory, administrative, technical, financial, education, and outreach resources. There are a number of mitigation-specific acts, plans, executive orders, and policies that address specific goals, objectives, and policy statements which already support or could support pre- and post-disaster hazard mitigation. Many of the ongoing plans and policies hold significant promise for hazard mitigation, and take an integrated and strategic look holistically at hazard mitigation in all jurisdictions to continually propose ways to improve it. These tools are valuable instruments in pre- and post-disaster mitigation as they facilitate the implementation of mitigation activities through the current legal and regulatory framework. Some examples of these types of planning and regulatory efforts for Sevier County and each jurisdiction are the following:

- Comprehensive/Master Plan
- Transportation Plan
- Local Emergency Operations Plan
- Community Wildfire Protection Plan
- Building Codes
- Flood Insurance Rate Maps
- Zoning Ordinance

Some programs and policies, such as the ones just described, might use complementary tools to achieve a common end, but fail to coordinate with or support each other. Thus, coordination among local mitigation policies and programs is essential to hazard mitigation.

Administration, Technical, and Financial

As a community, Sevier County and Pittman Center have administrative and technical capabilities in place that may be utilized in reducing hazard impacts or implementing hazard mitigation activities. Such capabilities include staff, skillset, and tools available in the community that may be accessed to implement mitigation activities and to effectively coordinate resources. The following are resources in place for Sevier County and its incorporated jurisdictions:

- Maintenance programs to reduce risk (tree trimming, clearing drainage systems)
- Mutual Aid Agreements
- Emergency Manager
- Community Planner

- GIS Data
- Warning Systems/Services (Reverse 911, outdoor warning systems)
- Hazard Data & Information

Financial capabilities are the resources that Sevier County and its incorporated jurisdictions have access to or are eligible to use to fund mitigation actions. The following resources are available to fund mitigation actions in Sevier County and its incorporated jurisdictions:

- Capital Improvements Project Funding
- Authority to levy taxes for specific purposes
- Fees for water, sewer, gas, or electric services

Sevier County and its incorporated jurisdictions have existing programs to implement mitigation activities as well as communicate risk. The existing programs are as follows:

- Local citizen groups or non-profits focused on environmental protection, emergency preparedness, access and functional needs populations, etc.
- Ongoing public education or information programs (responsible water use, fire safety, household preparedness, wildfire preparedness)
- Storm Ready certification
- Firewise Communities certification

The following jurisdictions and entities are recognized by Sevier County under the Hazard Mitigation Plan allowing them to apply for available hazard mitigation funding for as long as these jurisdictions notify the county of their intentions and the county concurs:

- City of Gatlinburg
- City of Pigeon Forge
- Town of Pittman Center
- City of Sevierville
- Unincorporated Areas of Sevier County

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8.4 Summary

Table 8-40: Risk Assessment for the Town of Pittman Center.

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Overall Risk
Wildfires/ Conflagration	4	4	4	2	4	3.0	**3.6**
Winter Storms	4	3	4	2	4	2.0	**3.1**
Extreme Temperatures	4	3	4	1	3	2.0	**3.0**
Civil Disobedience/ Terrorism	1	4	4	4	1	2.7	**2.9**
Thunderstorms (Hail)	4	2	4	3	1	2.0	**2.7**
Thunderstorms (Wind)	4	2	4	3	1	2.0	**2.7**
Floods Including Extreme Precipitation	3	2	3	3	2	3.0	**2.7**
Communicable Disease	4	2	3	4	2	1.7	**2.6**
Drought	3	2	4	1	4	2.0	**2.6**
Mass Wasting	3	2	2	4	4	2.3	**2.6**
Infrastructure	1	3	2	4	3	2.0	**2.3**
Tornadoes	3	2	2	4	3	1.2	**2.2**
Severe Wind	2	2	2	4	1	2.0	**2.1**
Dam Failure	1	3	1	3	3	1.0	**1.8**
Earthquakes	1	1	4	4	1	1.3	**1.8**
Thunderstorms (Lightning)	2	1	2	3	1	2.0	**1.8**
Sinkholes	2	2	1	4	1	1.2	**1.7**
Tropical Cyclones	1	1	4	1	2	1.0	**1.5**

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9. City of Sevierville

9.1 Risk Assessment

This section assesses the various hazard risks that the city of Sevierville faces in order to identify a strategy for mitigation. Having identified the categories of hazards, emergencies, disasters, and catastrophes, this section details the major natural, technological, and human-caused hazards by (1) describing their geographic extent, (2) surveying their previous occurrences, and (3) evaluating their future likelihood of occurrences. To review news stories and other media related to previous occurrences, see Appendix D.

9.1.1 Communicable Diseases

Location & Extent

Tennessee maintains an extensive array of communicable disease personnel both inside and ancillary to the Communicable and Environmental Diseases and Emergency Preparedness (CEDEP) division. Communicable and Environmental Disease and Emergency Preparedness is a program area of the Tennessee Department of Health; it is assigned the responsibility of detecting, preventing, educating, and controlling infectious and environmentally-related illnesses of public health significance. Emergency management personnel are more frequently including pandemic and communicable disease drills in their exercise dockets at locations across the nation. The Centers for Disease Control and Prevention (CDC) has created a pandemic flu toolkit that is aligned with the pandemic phases outlined by the 2013 World Health Organization guidelines.

A biologic or communicable disease threat can occur anywhere, or anytime. Concentrated efforts must be made at surveillance in the following arenas:

Healthcare: Tennessee health care institutions serve as the front lines to communicable disease response and as potential disease reservoir populations and points of cross contamination. Tennessee maintains excellent hospital and in-patient coverage in all three of its primary regions, with Level I trauma facilities. All Tennessee hospitals and healthcare facilities are required to report specific Healthcare Acquired Infections to the NHSN, the National Healthcare Safety Network. The NHSN is a web-based data reporting and submission program, which includes validation routines for many data elements, thus reducing common data entry errors. Hospitals can view, edit, and analyze their data at any time.

Education Facilities and Dormitories: The State of Tennessee mandates a vaccination series for all incoming resident students at educational facilities, consisting of measles, mumps, rubella, meningococcal meningitis, and varicella vaccines. In spite of these vaccine series, dormitory housing at colleges and universities have historically been susceptible to outbreaks of viral meningitis. Vaccination, along with immediate quarantine procedures should be adhered to with particular care in the academic setting where institutional controls are the primary mitigation technique with proven effectiveness

Previous Occurrences

Influenza

In 2012, Tennessee was listed by the CDC as one of the highest influenza burdened states in the nation. On average, 20% of the nation's population will contract the seasonal influenza every year. Tennessee

carries a higher than average mortality and morbidity rate for influenza and associated pneumonia, with 20.9 per 100,000 compared with the national average of 16.2 per 100,000.

HIV/AIDS

The incidence of HIV/AIDS and their associated comorbidities (including tuberculosis) increased in Tennessee from 2006 to 2012 across almost all ages, sexes, and races, with the exception of diagnosed AIDS cases in 2011, which decreased markedly. The 2 are categorized separately by both state and federal agencies due to differing mortalities and comorbidities for each. Currently in Tennessee, 18 community-based organizations are funded to implement a wide-range of science-based HIV prevention programs.

Tertiary Events

Hepatitis C

In 2012, the CDC revised its recommendations to include prophylactic screening for Hepatitis C for anyone born between the years 1945 and 1965. This screening is seen as paramount to reducing potential contamination in the blood supply as Hepatitis C is spread primarily through contaminated needles and drug use. Prior to 1992, blood supply screening techniques were not used resulting in Hep C being transmitted through blood transfusions and organ transplants. The most common mode of transmission for Hep A is person-to-person, resulting from fecal contamination and oral ingestion, and contaminated shellfish. In 1995, a major outbreak of Hepatitis A occurred in Tennessee with Shelby County documenting over 80% of the diagnosed cases. In the fall of 2003, approximately 80 cases were attributed to a Hepatitis A outbreak resulting from ingestion of contaminated green onions at a restaurant in East Tennessee.

Hepatitis B

Hepatitis B is transmitted through blood or body fluids, semen, cervical secretions, and saliva. People with chronic HBV infection are the primary reservoirs for infection. With the exception of the year 2001, from 1995 to 2002, Hepatitis B acute cases steadily decreased. The prevalence of HBV infection among adolescents and adults is 3 to 4 times greater for black individuals than white individuals. Children born to Hepatitis B Surface Antigen positive women are at high risk of becoming chronic carriers of hepatitis B. If these children are administered Hepatitis B Immune Globulin and hepatitis B vaccine at birth, their chances of being protected from the illness are greatly increased. The result is the endorsement of this mitigation procedure by the TDH and the CDC.

Incidents/Probability

The communicable disease events categorized by the CDC and the US Department of Labor as the most likely to adversely affect human performance are any and all strains of influenza. In a typical flu season, between 5% and 20% of the public contract influenza resulting in an average of 36,000 deaths. Pandemic flu viruses may cause illness in 20% to 40% of the population and cause more severe illness and deaths than ordinary seasonal influenza. A pandemic virus vaccine could take 6 to 8 months to produce in conjunction with CDC labs in Atlanta, limiting mitigation success in initial months of an outbreak. Because of this potential, the TDH and CDC consider influenza monitoring and reporting of critical importance.

Based on previous occurrences, there is a 100% annual chance of occurrence for communicable disease occurrence in Sevier County and Sevierville.

9.1.2 Drought

Location & Extent

Drought typically impacts a region and not one specific county or jurisdiction. While the entire planning area can experience drought, the major impact of a drought event in Sevier County is on the agricultural community. There is no set speed of onset or warning period. A drought may begin in as short of period as a week or it may take months to reach an official declared drought. Additionally, the drought can last for as little as a week to up to the entire season.

While different parts of the county have experienced varying levels of drought severity, the location of drought conditions are more related to Sevier County's geographical location and the effects of climate on the region in general. Below is a map of the drought conditions in Sevier County in October 2019.

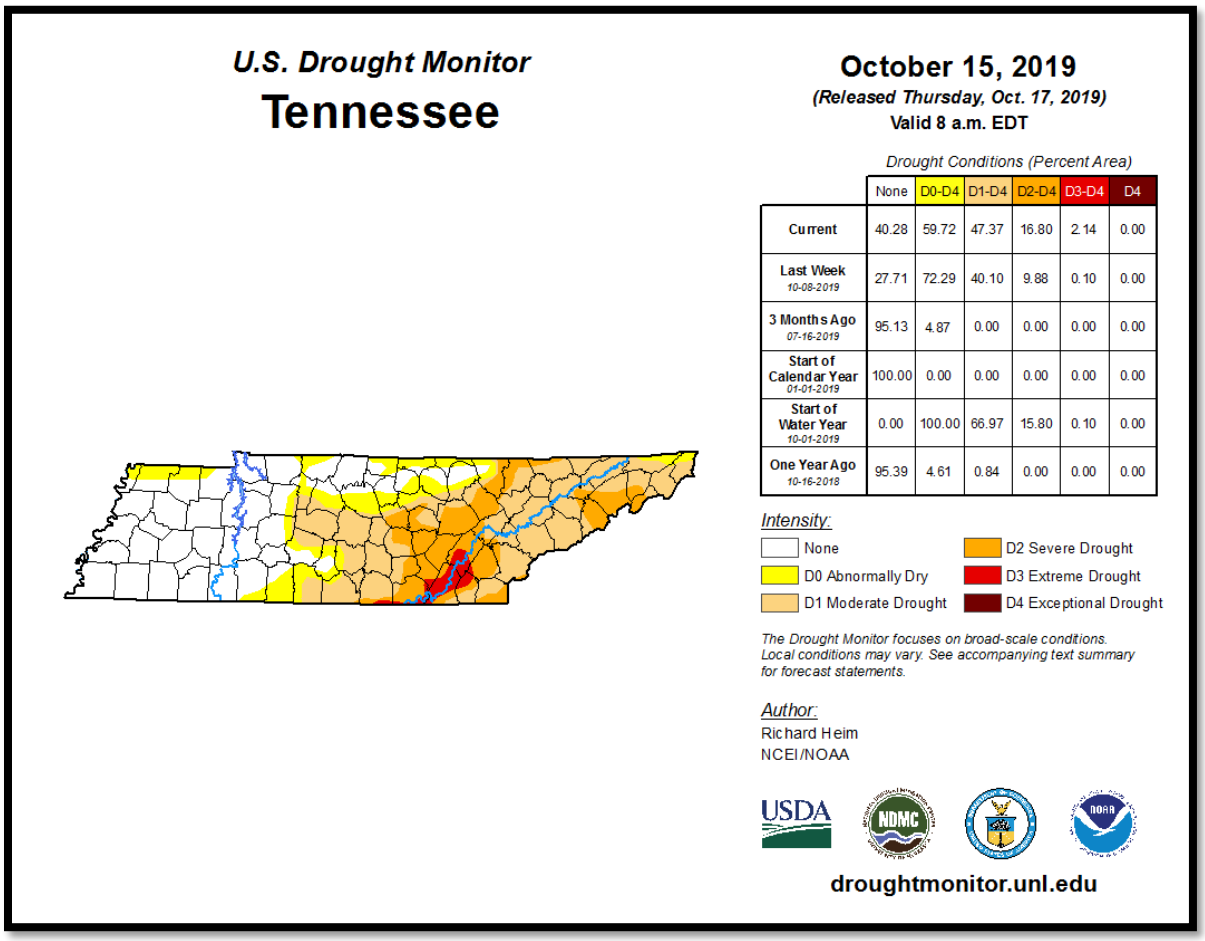

Figure 9-1: Drought Monitor for the State of Tennessee for the Week of October 15, 2019. (Source: U.S. Drought Monitor)

Previous Occurrences

The NCEI database reports a total of one drought event occurring within the boundaries of Sevier County between the years 1996 to 2017. The following table identifies the date of occurrence, estimated crop damage, and severity of the events that have occurred in Sevier County. Based on previous occurrences,

and in accordance with the Palmer Drought Index and United States Drought Monitor, the worst-case scenario for drought in Sevier County would be D4 (Exceptional Drought).

Table 9-1: Previous Occurrences of Drought Events in Sevier County.

Date	Details	Crop Damage	Property Damage	Severity
September 1998	An extremely dry month throughout all of East Tennessee caused drought conditions in the county. Rainfall was approximately 2" inches below normal for the area.	$2,000	$0	D3

Since the last plan update, there have been no new drought events which have caused damage to property or crops. However, drought events have occurred periodically during the period of record (January 1, 2000 to January 1, 2019).

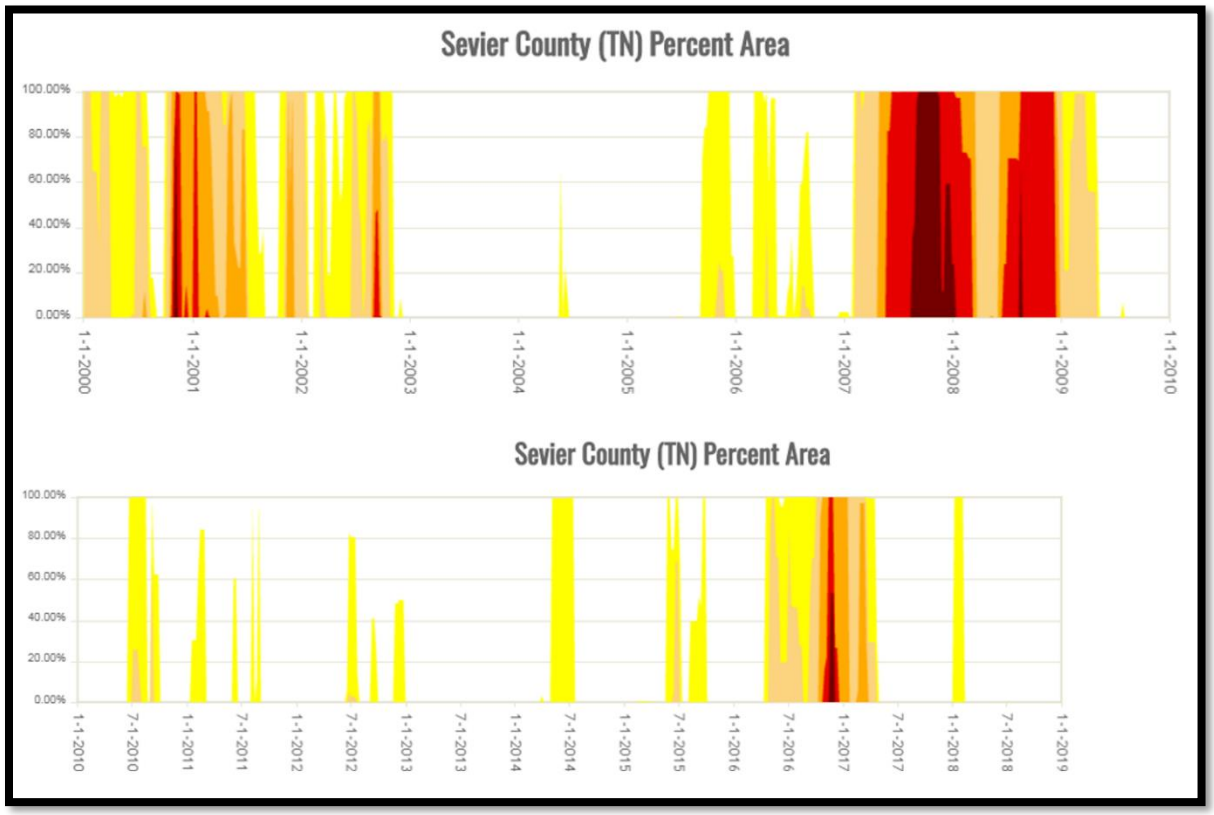

Figure 9-2: Timeline of drought conditions in Sevier County from January 1, 2000 to January 1, 2019. (Source: U.S. Drought Monitor)

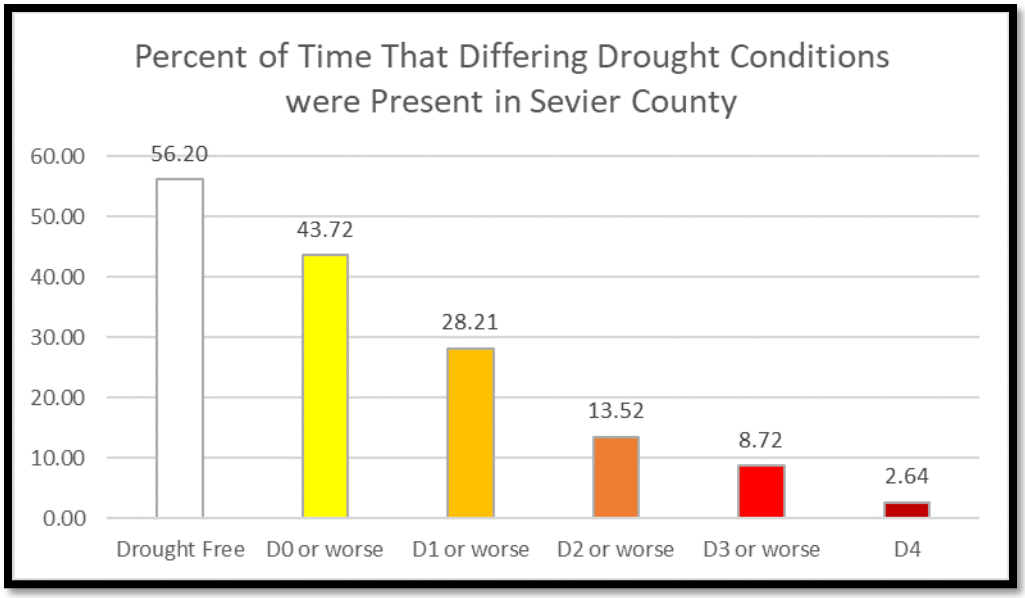

Figure 9-3: Sevier County experienced drought conditions (D0 or worse) during ~43% of the weeks between January 1, 2000 and January 1, 2019. (Source: U.S. Drought Monitor)

Incidents/Probability

Drought conditions can exist which are not recorded in the NCEI database if the event does not cause any direct damage to property or crops and injuries or loss of life. Based on previous occurrences, there is a 4.3% annual chance of occurrence for direct-impact drought events in Sevier County and Sevierville. While the chance of a drought that causes damage is approximately 4% annually, Sevier County experienced D2 or worse drought conditions approximately 35% over the past 20-years.

9.1.3 Earthquakes

Location & Extent

Earthquakes strike suddenly and without warning, occur at any time of the year, and at any time of the day. A damaging earthquake occurs without definitive signals and massive earthquakes are accompanied by aftershocks. The duration of shaking can last anywhere from a second to a period of minutes. There are numerous characteristics measured when observing earthquake activity; however, its force, depth, peak ground acceleration, and the distance to the epicenter are the most influential in determining damage.

Earthquakes of magnitude 5.5 or greater are considered potentially threatening to Sevier County and Sevierville, as this is the point at which structures can become damaged. Any earthquake felt at this magnitude or greater would result in cessation of operations until sight inspections can take place.

The Southern Appalachian Seismic Zone (East Tennessee Seismic Zone) is a geographic band stretching from northeastern Alabama through eastern Tennessee into southwestern Virginia, which is subject to frequent small earthquakes. This seismic zone is one of the most active earthquake zones in the eastern United States. Most earthquakes in the Southern Appalachian Zone are small and are detected only with instruments. A few damaging earthquakes have occurred with the largest historic earthquakes measuring 4.6 magnitude on the Richter Scale, occurring in 1973 near Knoxville and April 29, 2003 near Fort Payne,

Alabama. Earthquakes large enough to be felt occur approximately once a year in this zone. The USGS estimates that earthquakes as large as magnitude 7.5 are possible in the Southern Appalachian Zone, which would be as devastating to the region as a major quake along the New Madrid fault. The worst-case scenario for an earthquake in Sevier County would be an MMI of IV, which would be quite noticeable by persons indoors, especially during the daytime.

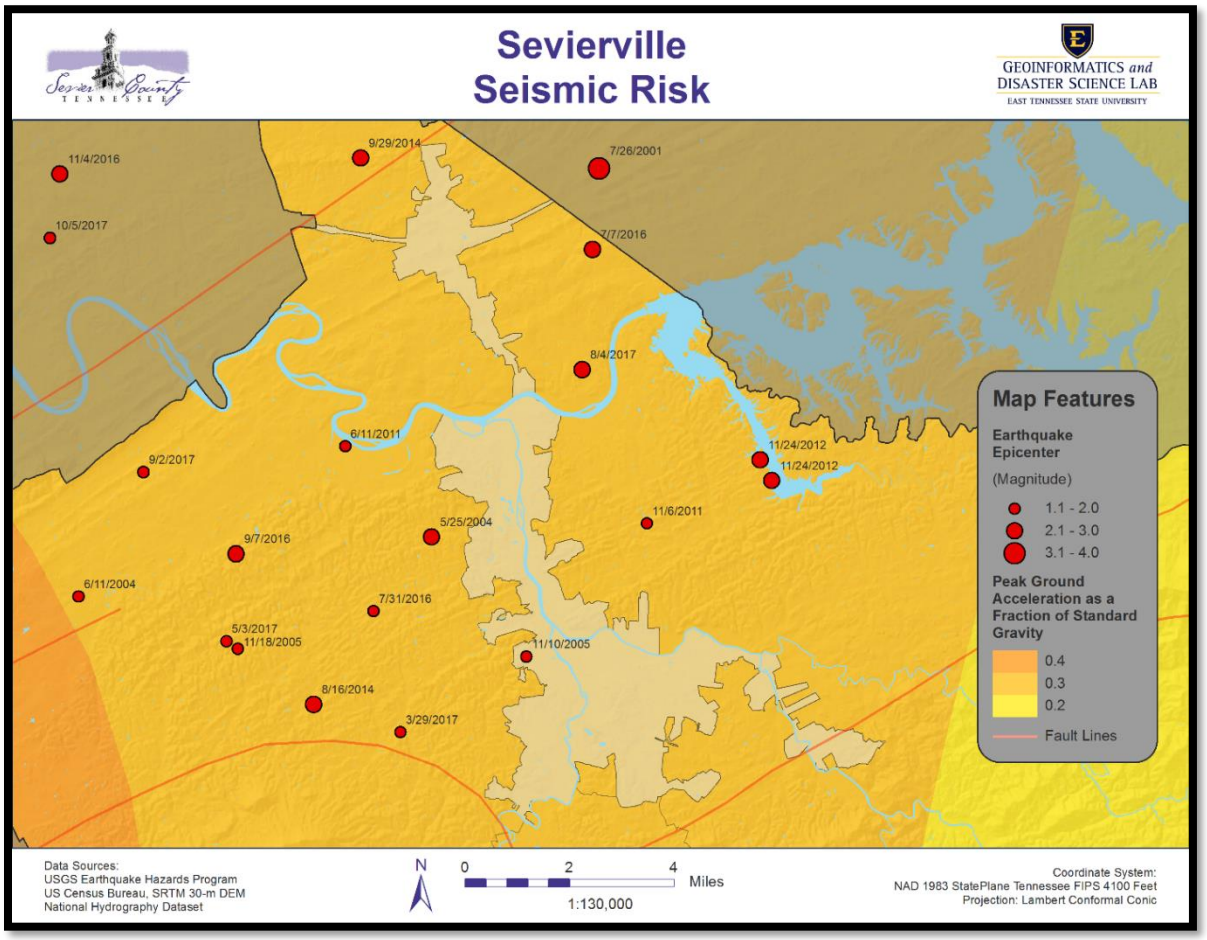

Figure 9-4: Earthquake Epicenters and Fault Lines in Sevierville.

Previous Occurrences

NOAA reports four earthquake events over a magnitude of 2.0 occurring within the boundaries of Sevier County between the years 1996 to 2017. The following table identifies the date of occurrence, magnitude, and focal depth.

Table 9-2: Previous Occurrences of Earthquake Events in Sevier County.

Date	Magnitude	Focal Depth
7/26/2001	3.2	5 kilometers
11/24/2012	3.0	7.1 kilometers
11/24/2012	2.5	8.9 Kilometers
8/3/2017	2.7	7.4 kilometers

Since the last plan update, three earthquake events occurred within the boundaries of Sevier County. Below is a brief synopsis of the events.

November 24, 2012
An earthquake of magnitude 3.0 and depth of 7.1 kilometers occurred approximately five miles northeast of Sevierville at 11:03 AM. No damages, injuries, or fatalities were associated with the event.

November 24, 2012
An earthquake of magnitude 2.5 and depth of 8.9 kilometers occurred approximately five miles northeast of Sevierville at 2:56 PM. No damages, injuries, or fatalities were associated with the event.

August 3, 2017
An earthquake of magnitude 2.7 and depth of 7.4 kilometers occurred approximately four miles north of Sevierville at 5:40 PM. No damages, injuries, or fatalities were associated with the event.

Incidents/Probability
Historically, there have been four earthquake events in Sevier County and Sevierville from 1996 to 2018. With a total of four earthquake events, the annual return rate (frequency) for Sevier County and Sevierville is one event every five to six years. This equates to an annual probability of approximately 16%.

9.1.4 Extreme Temperatures

Location & Extent
Extreme heat and cold can occur in all of Sevier County. Extreme heat is not a hazard that responds to the traditional mitigation measures of building codes or land use restrictions. Heat is the number one weather related killer in the United States, resulting in roughly 175 fatalities each year. In fact, on average, excessive heat claims more lives each year than floods, lightning, tornadoes, and hurricanes combined.

What constitutes extreme cold varies in different parts of the country. In the southern United States, near freezing temperatures are considered extreme cold. Freezing temperatures can cause severe damage to citrus fruit crops and other vegetation. Pipes may freeze and burst in homes that are poorly insulated or without heat. Most people judge extreme cold by the problems it causes rather than just by a temperature or a wind chill factor. In the northern areas of the country, extreme cold means temperatures well below zero.

The speed of onset of extreme temperatures, both hot and cold, is fairly slow and predictable from short and long-term weather forecasts. The scale of measurement for this hazard is temperature and departure from normal temperature.

Previous Occurrences
In winter, the average temperature in Sevier County is approximately 38^{o}F with an average daily minimum temperature of approximately 26^{o}F. The lowest temperatures recorded in Sevier County were -18^{o}F in Gatlinburg and -24^{o}F in Sevierville with both occurring on January 21, 1985.

In summer, the average temperature in Sevier County is approximately 71^{o}F with an average daily maximum temperature of approximately 83^{o}F. The highest temperatures ever recorded in Sevier County were 106^{o}F in Gatlinburg on June 30, 1936 and 102^{o}F in Sevierville on August 21, 1983.

Incidents/Probability

The NCEI Storm Events Database reports no extreme temperature (extreme heat or extreme cold) occurrences within the boundaries of Sevier County between the years 1996 and 2018. However, based on the State of Tennessee Hazard Mitigation Plan, Sevier County and Sevierville have an annual probability of 64% for extreme cold events and 100% for extreme heat events.

9.1.5 Floods Including Extreme Precipitation

Location & Extent

A variety of factors affects the type and severity of flooding in Sevierville including topography, urban development and infrastructure, and geology. Serious flooding in the mountainous or elevated areas is unusual because streams tend to be faster flowing and flood waters drain quickly.

Intense flooding will cause havoc on the jurisdictions affected. Floods can cause minimal damage in the form of just inches of water to complete submersion of houses and critical facilities. Any amount of damage can render a structure unusable for as long as recovery operations would take depending on the level of damage. Intense and widespread flooding can trap people and entire communities without basic goods or services.

As the West Prong of the Little Pigeon River flows northward from Pigeon Forge into Sevierville, many adjacent areas experience flooding. Depths as high as 17' (along the river banks) have occurred, although depths of 3-5' are most common near commercial areas such as the Tanger Outlet Mall. Downtown Sevierville, where the West Prong and Little Pigeon River come together, has a long history of flooding, with depths of 15' or more (closer to the river banks). The main business district has experienced depths of several feet in the past. Depths of 2-4' have occasionally occurred along the Dolly Parton Parkway in eastern areas of Sevierville. Flood depths of 10'+ have occurred along the northern stretches of the Little Pigeon River near the Winfield Dunn Parkway and Sevierville Golf Club.

The following figure displays the location of the 100- and 500-year floodplains in Sevierville.

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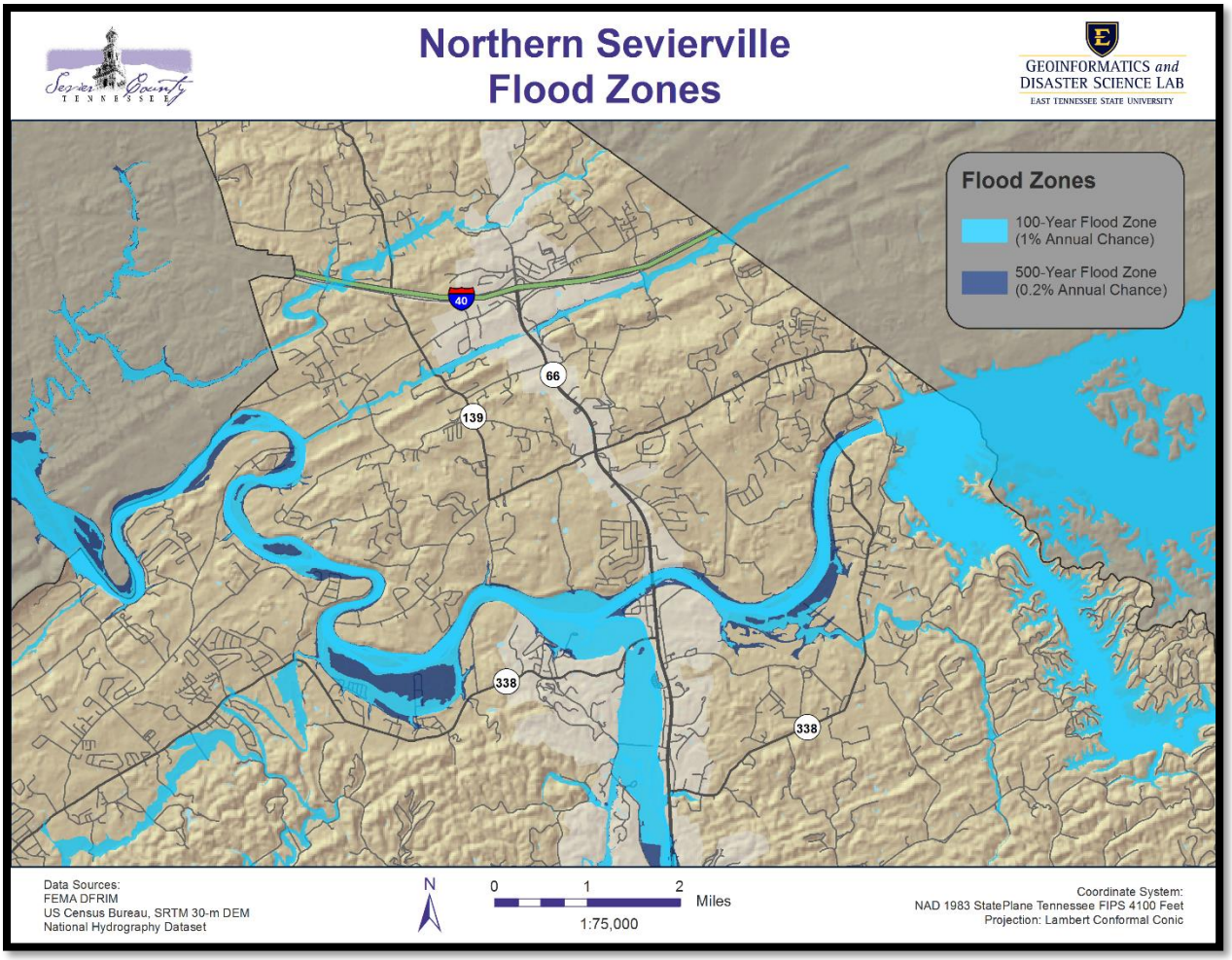

Figure 9-5: 100- and 500-Year Floodplains in Northern Sevierville.

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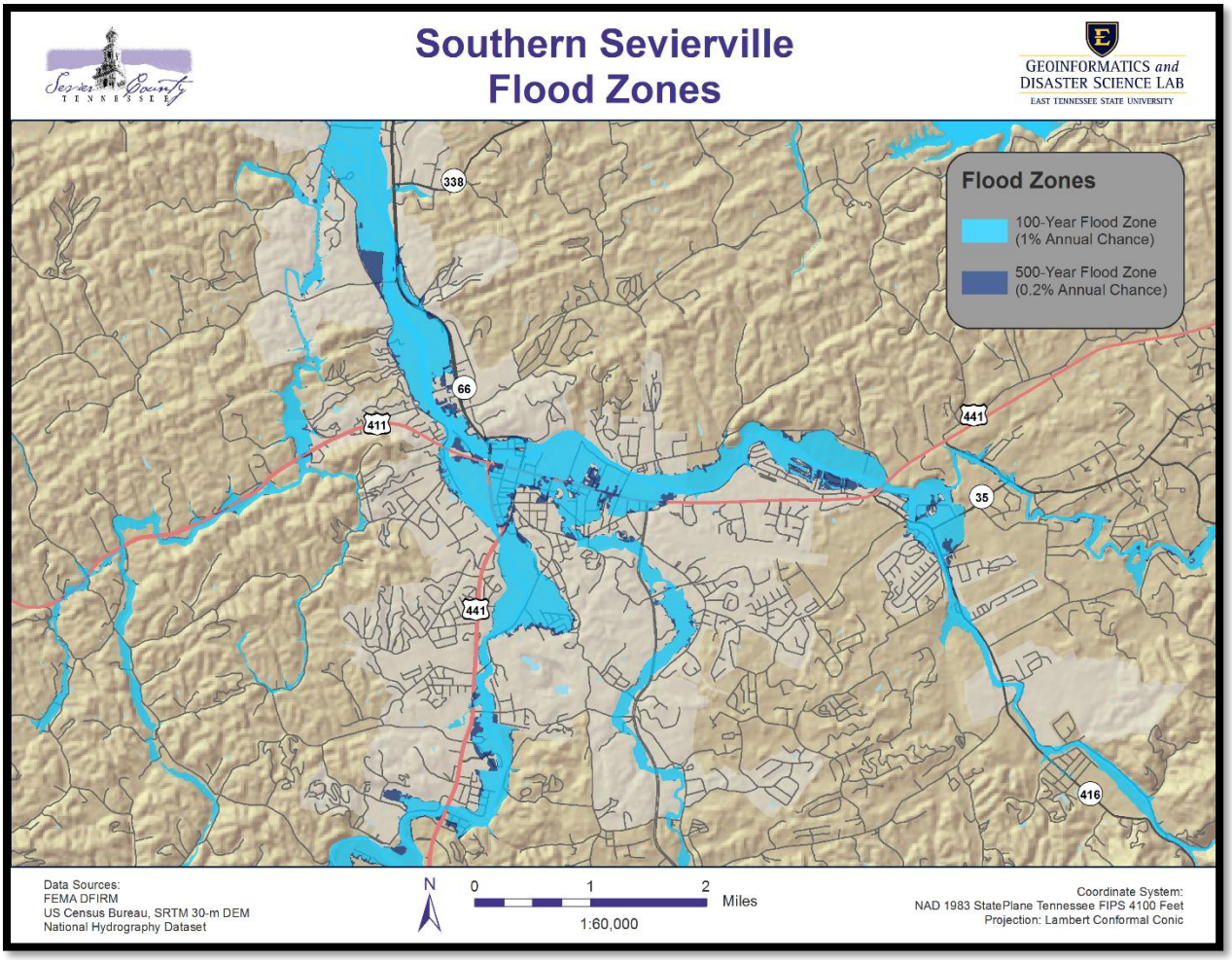

Figure 9-6: 100- and 500-Year Floodplains in Southern Sevierville.

Previous Occurrences

Historically, there have been 15 flood and extreme precipitation events in Sevierville from 1996 to 2018. According to NCEI, there have been no injuries or fatalities due to flood and extreme precipitation events in the Sevierville.

Table 9-3: Flood Events and Extreme Precipitation from 1996 to 2018 with Total Losses. (Source: NCEI Storm Events Database)

Date	Location	Event	Injuries	Fatalities	Property Damage
1/19/1996	COUNTYWIDE	Flash Flood	0	0	$0
8/8/1996	SEVIERVILLE	Flash Flood	0	0	$0
6/14/1997	SEVIERVILLE	Flash Flood	0	0	$0
6/21/1997	COUNTYWIDE	Flash Flood	0	0	$0
1/7/1998	COUNTYWIDE	Flash Flood	0	0	$0
7/11/1999	COUNTYWIDE	Flash Flood	0	0	$0
3/17/2002	COUNTYWIDE	Flash Flood	0	0	$0

Date	Location	Event	Injuries	Fatalities	Property Damage
2/16/2003	COUNTYWIDE	Flash Flood	0	0	$0
8/11/2003	SEVIERVILLE	Flash Flood	0	0	$0
9/26/2009	SEVIERVILLE	Flood	0	0	$0
12/9/2009	SEVIERVILLE	Flood	0	0	$0
6/24/2011	SEVIERVILLE	Flash Flood	0	0	$20,000
1/16/2013	SEVIERVILLE	Flood	0	0	$0
1/30/2013	SEVIERVILLE	Flood	0	0	$1,000
5/21/2013	SEVIERVILLE ARPT	Flash Flood	0	0	$1,000

Since the last plan update (through the end of 2018), there have been three new flooding events in the Sevierville area. Below is a brief synopsis of those events.

January 16, 2013 – Sevierville

Significant synoptic scale event produced several inches of rain over much of the area. Three roads reported closed in Sevierville.

January 30, 2013 – Sevierville

Heavy rain returned to the region. Though not as heavy as the event of the 15th-16th, the very wet soils enabled this event to produce widespread flooding. Nine roads closed across Sevierville due to water.

May 21, 2013 – Sevierville Airport

An outflow boundary from a complex of thunderstorms building across the Mid-South interacted with moderate to strongly unstable air across Eastern Tennessee mainly north of interstate 40. The slow moving storms produced mainly wind damage with some hail as well as some flash flooding. Flash flooding occurred around intersection of Earnest McMahon Rd and Pullen Road.

While this risk assessment did not include 2019 data for flooding, it should be noted that the early part of 2019 broke many rainfall records, including the wettest month on record (February 2019) according to the Tennessee Climate Office. Extensive flooding occurred in February and April of 2019, possibly exceeding $7 million in damage in Sevier County (Knox News).

Incidents/Probability

With 15 events, the annual return rate (frequency) for flooding and extreme precipitation for Gatlinburg is one event every one to two years. This equates to an annual probability of approximately 60%.

9.1.6 Mass Wasting

Location & Extent

Most mass wasting events within Sevier County are located along road networks. Rockfalls or rock sliding along road cuts is a very common phenomenon. These are mainly due to improper slope management that causes instability within the slope face. Additionally, adverse orientation of geological discontinuities (joints, fractures, and faults) with the slope gradient and aspect play an important role in slope stability.

Probability of future failure of a slope depends on various factors including lithology, land cover, drainage condition, and soil cover of the area.

The southern part of Sevier County located within the Great Smoky Mountains National Park near the state boundary between Tennessee and North Carolina has a high concentration of areas that could produce mass wasting events. High rain coupled with fragile lithology and adverse orientation of geological discontinuities have increased the probably of a mass wasting event. Below is a susceptibility map, high concentration map, and prior occurrences of mass wasting events within Sevier County.

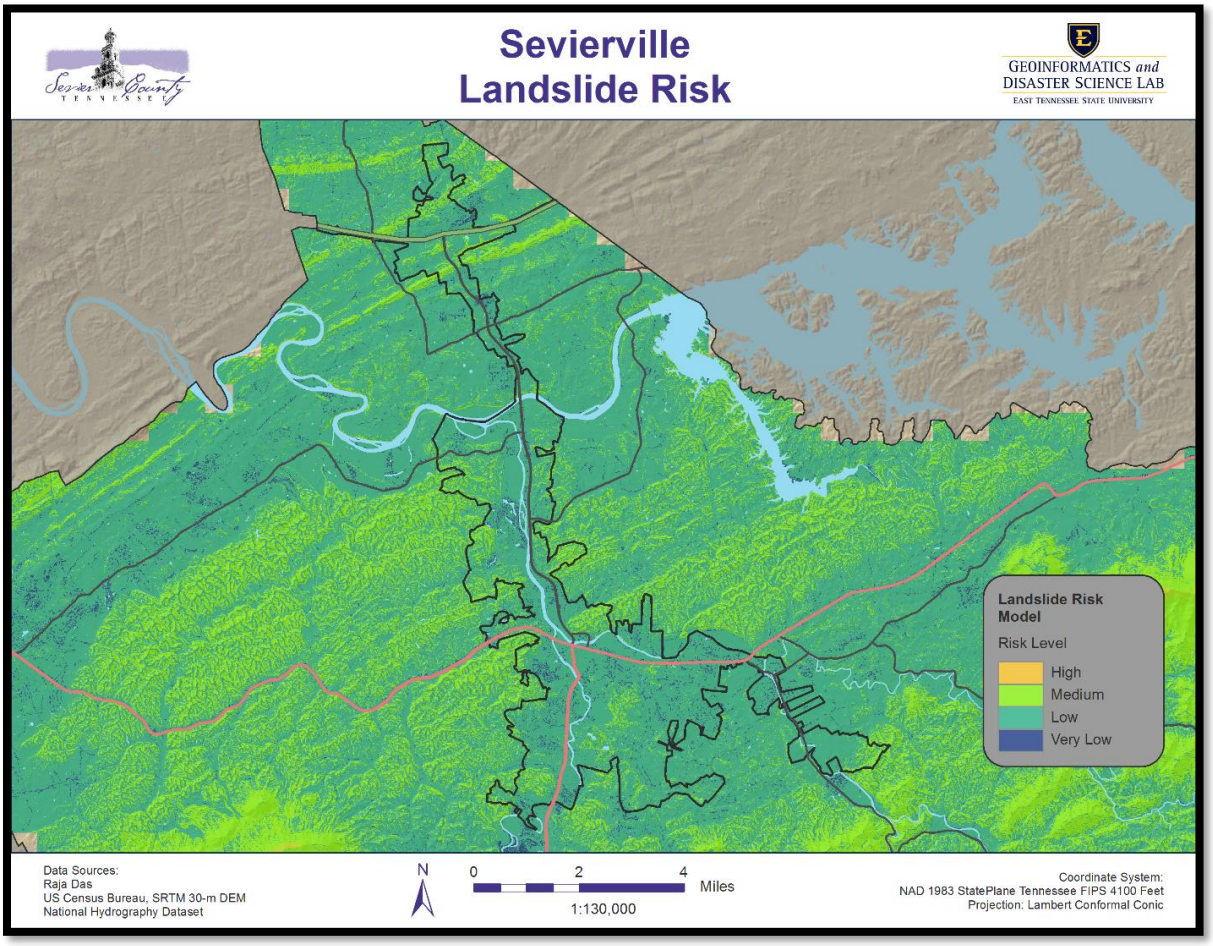

Figure 9-7: Landslide Susceptibility Map in Sevierville.

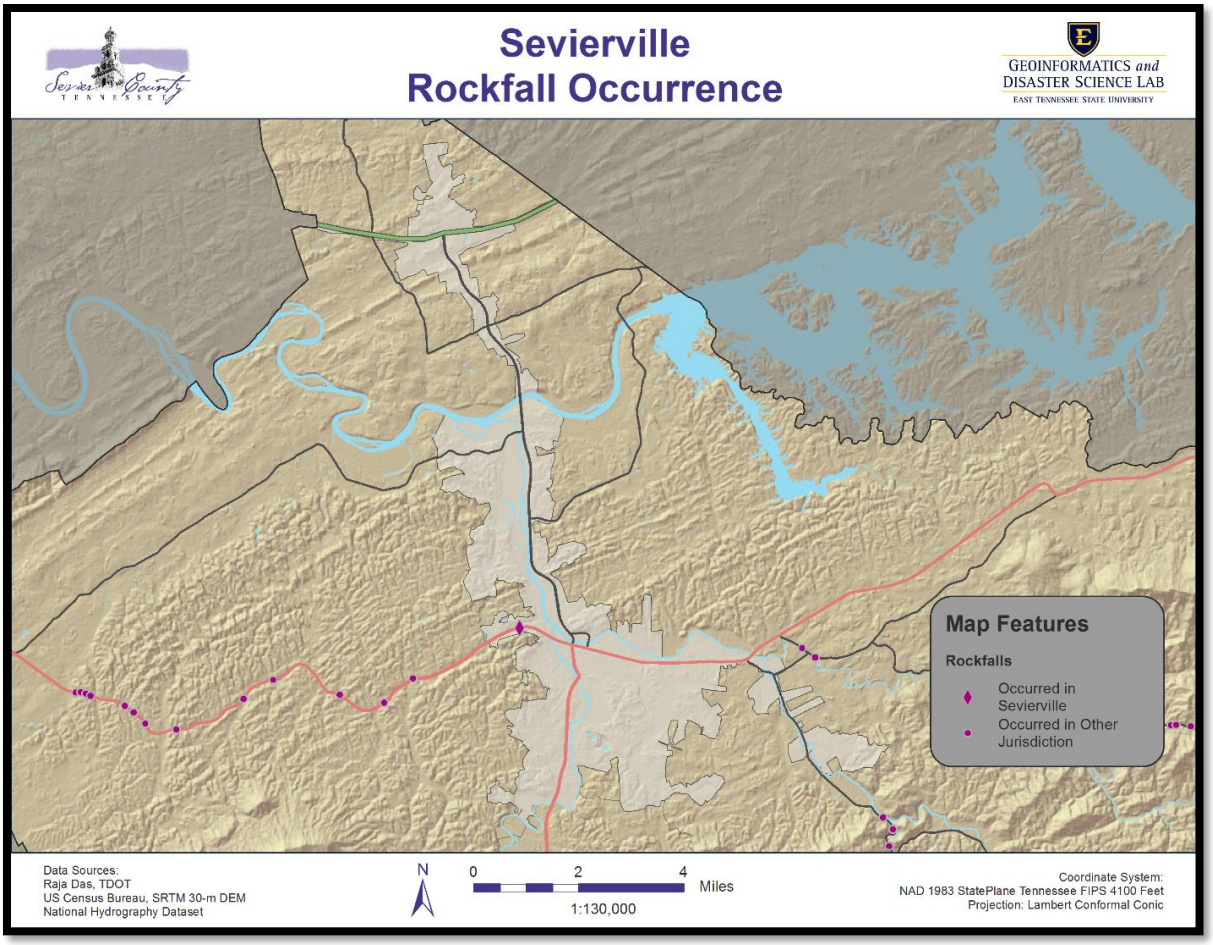

Figure 9-8: Previous Rockfall Events in Sevierville.

Previous Occurrences

Some rockfall locations are available from the Tennessee Department of Transportation (TDOT). The following table outlines major debris flow events related to storms in Sevier County.

Table 9-4: Major Debris Flow Events Related to Storm Events.
(Source: Tennessee Department of Transportation)

Date	Type of Storm	Location
7/10/1942	Thunderstorm	Newfound Gap
9/1/1951	Cloudburst	Mt. LeConte
6/15/1971		Mt. LeConte
3/1975 – 3/1983	Multiple Storms	Anakeesta Ridge
8/3/1978	Thunderstorm	Mt. LeConte
7/1984	Thunderstorm	Anakeesta Ridge
8/10/1984	Thunderstorm	Anakeesta Ridge
8/10/1984	Thunderstorm	Anakeesta Ridge
3/1985	Thunderstorm	Anakeesta Ridge
6/28/1993	Cloudburst	Mt. LeConte
10/4/1995	Hurricane Opal	Mt. LeConte/Anakeesta Ridge

Date	Type of Storm	Location
9/17/2004	Hurricane Ivan	Mt. LeConte/Anakeesta Ridge
8/5/2012	Thunderstorm	Anakeesta Ridge
9/10/2017	Hurricane Irma	Anakeesta Ridge
8/1/2019	Thunderstorm	Gatlinburg

Since the last plan update, there have been three mass wasting events in Sevier County potentially impacting Sevierville. These events may not directly impact Sevierville, but may have indirect impacts. Below is a brief synopsis of those events.

August 5, 2012 – Anakeesta Ridge

No synopsis available for the event.

September 10, 2017 – Anakeesta Ridge

No synopsis available for the event.

August 1, 2019 - Gatlinburg

A 73-year old man was fatally injured when a tree fell from a slope and hit his Honda sedan. Both the northbound and southbound lanes of the Spur were closed until heavy equipment could complete slope repairs and assessments. Multiple rock slides were also reported.

Incidents/Probability

With a total of four recorded from 1996 to 2018, the annual return rate (frequency) for mass wasting events for Sevier County and Sevierville is one event every five to six years. This equates to an annual probability of a mass wasting event occurrence of approximately 17%.

9.1.7 Severe Wind

Location & Extent

Mountain waves develop on the lee, or downwind, side of mountains. These waves are generated when strong winds flowing toward mountains in a generally perpendicular fashion are raised up over the mountains. Given the geographical location of Sevier County, the unincorporated areas and all of Sevierville are susceptible to severe wind events. The following figures provide the extent of severe winds within Sevier County and Sevierville.

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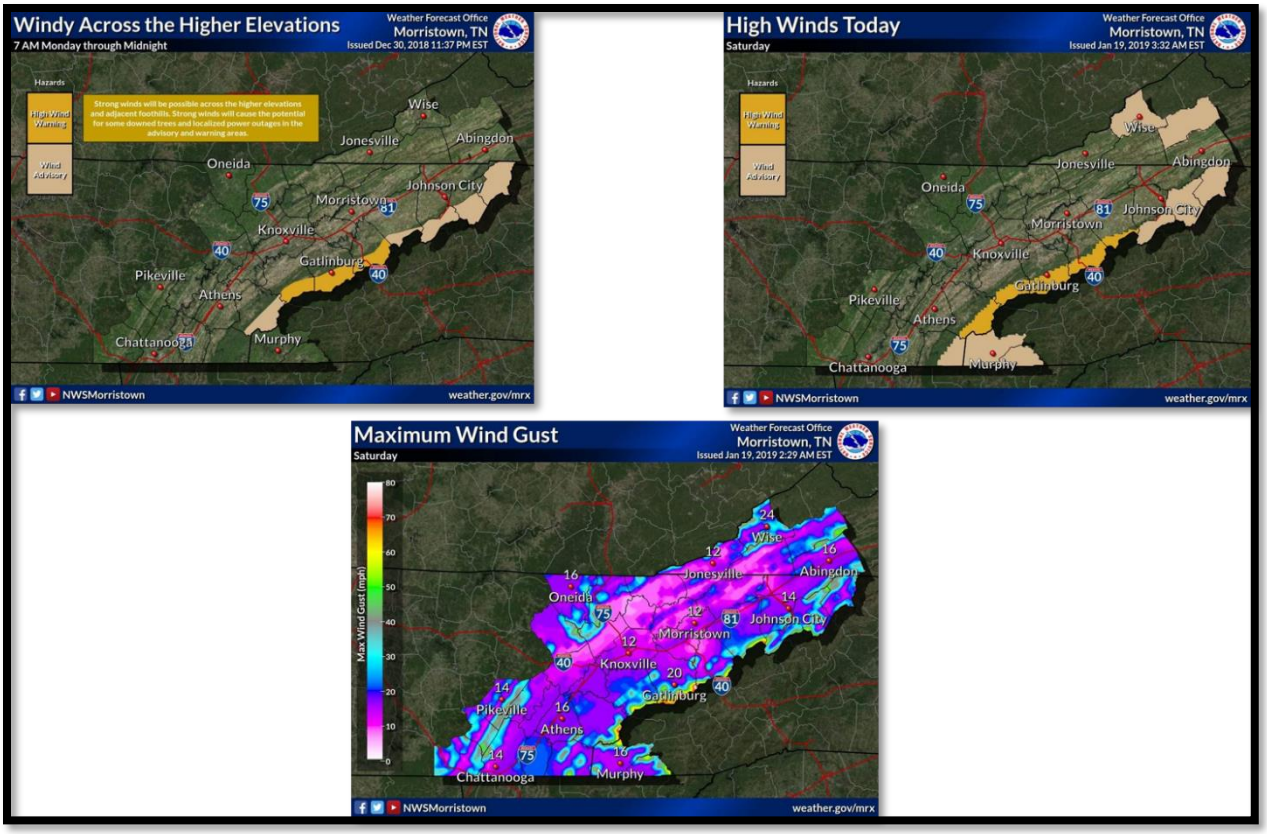

Figure 9-9: Severe Wind Extent and Location within Sevier County and Surrounding Areas, based on standard patterns (these occurring during the 2018-2019 winter months)..

Previous Occurrences

Historically, there have been two severe wind events in Sevier County and Sevierville from 1996 to 2018. There have been no injuries or fatalities due to severe wind events in the unincorporated area of Sevier County and Sevierville.

Table 9-5: Severe Wind Events from 1996 to 2018 with Total Losses.
(Source: NCEI Storm Events Database)

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage
2/3/2003	COUNTYWIDE	40	0	0	$2,000
6/21/1997	COUNTYWIDE	45	0	0	$20,000

Since the last plan update, there have been no new severe wind events reported from NCEI, which have caused damage to property or crops and/or loss of life or injuries.

Incidents/Probability

The NCEI Storm Events Database reports two severe wind event occurrences within the boundaries of Sevier County between the years 1996 and 2018. With a total of two events, the annual return rate

(frequency) for severe winds for Sevier County and Sevierville is one event every 11 to 12 years. This equates to an annual probability of approximately 8%.

9.1.8 Sinkholes

Location & Extent

Subsidence can occur slowly and continuously over time or abruptly for various reasons. Subsidence and sinkholes can occur due to either natural processes (karst sinkholes in areas underlain by soluble bedrock or because of human activities. The entire Sevier County planning area is susceptible to subsidence and sinkholes based on the karst topography of the region.

Previous Occurrences

Per the State of Tennessee Hazard Mitigation Plan, there are 586 sinkhole locations within Sevier County. The following figure displays all known sinkhole locations within Sevierville and underlying risk.

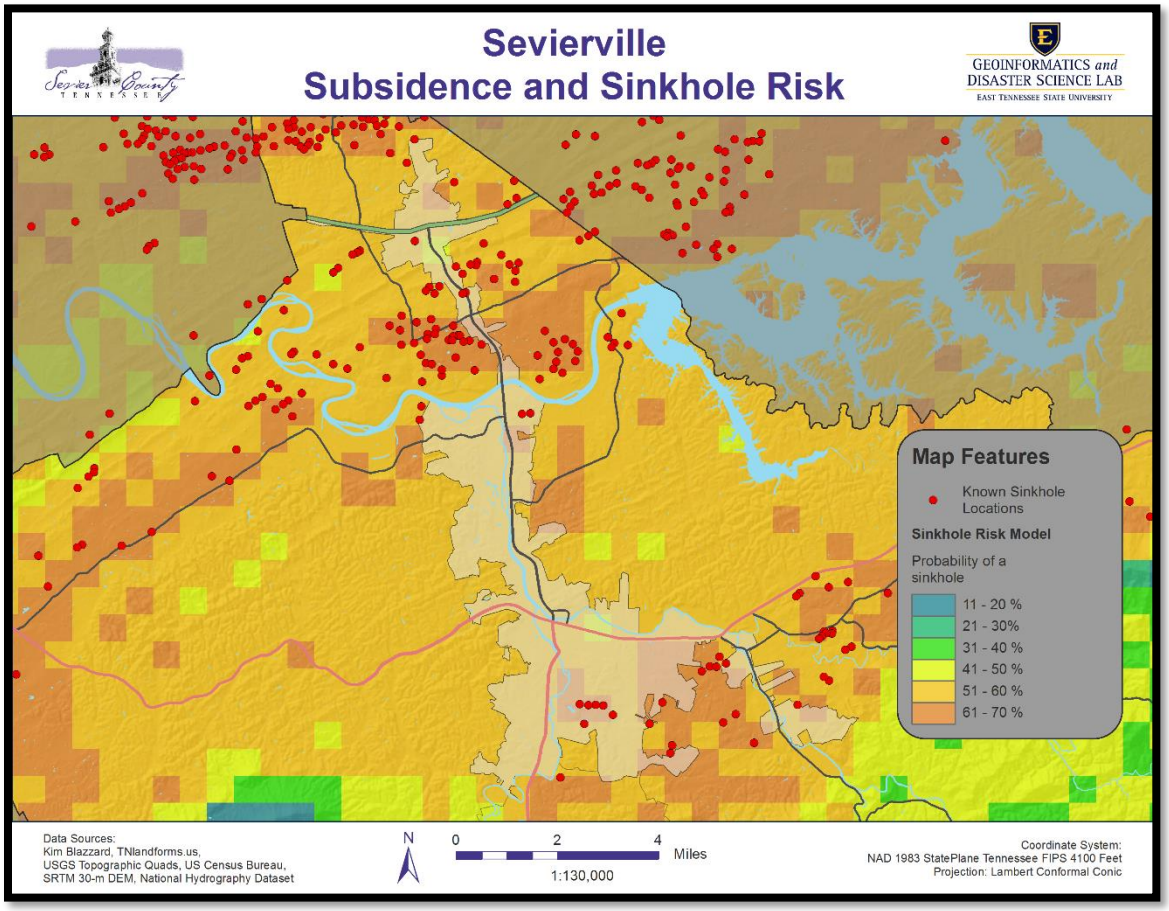

Figure 9-10: Sevierville Subsidence and Sinkhole Locations and Risk.

May 2019

A sinkhole opened on the Dolly Parton Parkway in Sevierville, shutting down an eastbound lane for several hours.

Incidents/Probability

Based on the total number of sinkholes within Sevier County and Sevierville, the annual probability of a sinkhole occurrence is calculated at 100%.

9.1.9 Thunderstorms (Hail, Lightning, and Wind)

Hail

Location & Extent

Because hailstorms are a meteorological phenomenon that can occur anywhere, the entire Sevier County planning area is equally at risk from hailstorms. The worst-case scenario for hailstorms is hail up to 3" in diameter.

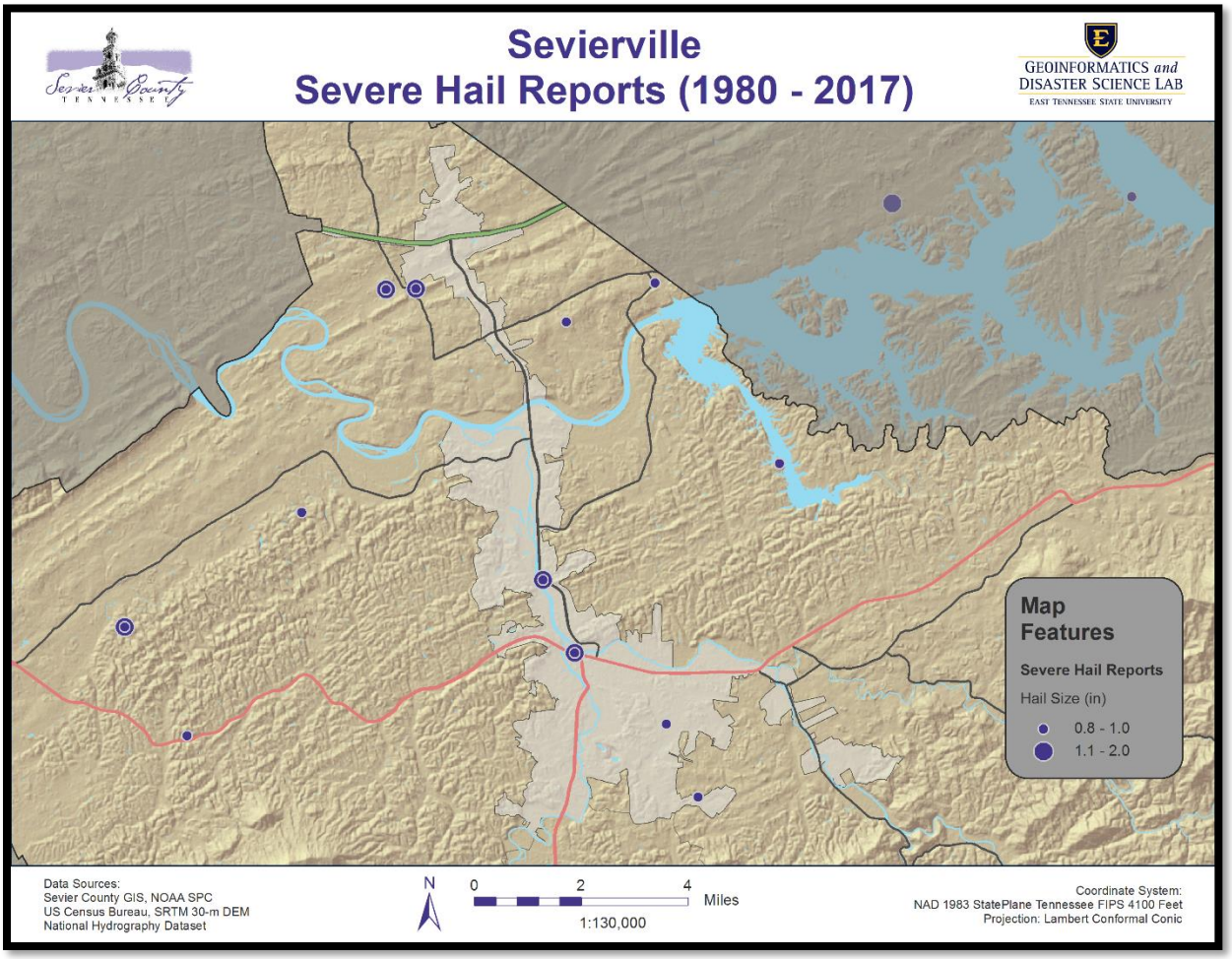

Figure 9-11: Severe Hail Reports and Density in Relation to Sevierville.

Previous Occurrences

Historically, there have been 25 hail events in the unincorporated area of Sevier County and Sevierville from 1996 to 2018. There have been no injuries or fatalities due to hail events in the Sevierville planning area. The following table briefly outlines the hail events that have occurred in Sevier County and Sevierville.

Table 9-6: Hail Incidents from 1996 to 2018 with Total Losses.
(Source: NCEI Storm Events Database)

Date	Location	Diameter (inches)	Injuries	Fatalities	Property Damage
4/10/1992	COUNTYWIDE	1.75	0	0	$0
8/26/1993	COUNTYWIDE	2.75	0	0	$0
5/26/1998	COUNTYWIDE	1	0	0	$0
1/18/1999	CUSICK	0.75	0	0	$0
5/13/1999	SEYMOUR	1.75	0	0	$0
4/5/2003	KODAK	1.75	0	0	$0
5/15/2003	COUNTYWIDE	0.75	0	0	$0
12/10/2004	KODAK	0.88	0	0	$0
4/3/2006	SEYMOUR	1.75	0	0	$0
5/20/2006	WALDEN CREEK	0.75	0	0	$0
5/20/2006	KODAK	0.75	0	0	$0
6/2/2006	PIGEON FORGE	0.75	0	0	$0
6/24/2007	KODAK	1	0	0	$0
5/9/2008	SEVIERVILLE	0.88	0	0	$0
7/21/2008	BOYDS CREEK	0.75	0	0	$0
6/17/2009	PITTMAN CTR	1	0	0	$0
5/26/2011	CATES XRDS	0.75	0	0	$0
5/26/2011	MILLICAN	0.88	0	0	$0
8/14/2011	PITNER	1	0	0	$0
2/29/2012	KODAK	1.25	0	0	$0
4/26/2012	KODAK	1	0	0	$0
6/14/2012	HATCHERTOWN	1.5	0	0	$0
7/27/2014	PITNER	1	0	0	$0
6/2/2015	COVE CREEK	1	0	0	$0
4/22/2016	SEVIERVILLE	1.5	0	0	$0

Since the last plan update, there have been six hail events that have occurred within the unincorporated areas of Sevier County and Sevierville. Below is a brief synopsis of these events.

February 29, 2012 – Kodak

A boundary across the area triggered thunderstorms over east Tennessee toward the end of the month. The boundary aided in the development of an EF-0 tornado as well as golfball-size hail and several reports of wind damage.

April 26, 2012 – Kodak

A cold front tracked across east Tennessee during the overnight hours triggering scattered thunderstorms over the area. A few of the storms produced damaging thunderstorm wind and hail as large as quarters.

June 14, 2012 – Hatchertown

Elevated moisture and instability permitted routine afternoon thunderstorms to produce severe weather including hail, wind damage, and flooding. Law enforcement personnel reported thunderstorms produced golfball-size hail 2 miles northeast of Wears Valley in Hatchertown.

July 27, 2014 – Pitner

A potent upper-level storm system impacted the region on Sunday, July 27th, bringing several rounds of severe weather along with locally heavy rainfall. Three tornadoes were observed across east Tennessee; one classified as a strong, EF-3 tornado with winds of 140 mph. Additionally, there were several reports of straight-line wind damage and large hail up 2 to 3 inches in diameter. A storm system of this magnitude is highly unusual for this time of year due to the strength of the front and the record cool temperatures it produced in the middle of the summer season.

June 2, 2015 – Cove Creek

Sufficient instability developed in a moist low level environment underneath an upper level low pressure system parked over the Cumberland Plateau for the development of localized severe convection in the foothills of the Smoky Mountains. Impacts from the storms included wind damage along with the formation of large hail. Quarter sized hail fell three miles north of Wears Valley.

April 22, 2016 – Sevierville

A few severe thunderstorms developed during the afternoon across the region in an environment that could be characterized as weakly unstable. The convection formed in response to a weak upper level impulse riding a few hundred miles east of a cold front.

Incidents/Probability

The NCEI Storm Events Database reports 25 hail events within the boundaries of Sevier County between the years 1996 and 2018. With 25 events, the annual return rate (frequency) for hail events in the unincorporated area of Sevier County and Sevierville is one to two events every year. This equates to an annual probability of approximately 100%.

Lightning

Location & Extent

Lightning is a meteorological phenomenon that can occur anywhere and has the same probability of occurring throughout the entire Sevier County planning area. Based on historical lightning events, the Sevier County planning area can expect a lightning density of 11-12 flashes per square mile per year.

Previous Occurrences

Historically, there have been two lightning events that impacted the unincorporated area of Sevier County and Sevierville from 1996 to 2018. There have been no injuries and one fatality due to lightning events in the Sevier County planning area. The following table briefly outlines the lightning events that have occurred in Sevier County.

Table 9-7: Lightning Incidents from 1996 to 2018 with Total Losses.
(Source: NCEI Storm Events Database)

Date	Location	Injuries	Fatalities	Property Damage
5/7/1996	PIGEON FORGE	0	0	$0
7/10/2004	KODAK	0	1	$0

Since the last plan update, there have been no lightning events that have caused property damage and/or loss of life or injuries in Sevier County and Sevierville.

Incidents/Probability

The NCEI Storm Events Database reports two lightning events within the boundaries of Sevier County between the years 1996 and 2018. With a total of two 'impact' events, the annual return rate (frequency) for lightning events in the unincorporated area of Sevier County and Sevierville is one event every 11 to 12 years. This equates to an annual probability of approximately 8%.

Wind

Location & Extent

Thunderstorm wind is a meteorological phenomenon that can occur anywhere and has the same probability of occurring throughout the entire Sevier County planning area. Based on historical thunderstorm wind events, the Sevier County planning area can expect thunderstorm wind speeds of approximately 60 knots. The following figure displays the damages caused by thunderstorm winds from 1980 to 2017.

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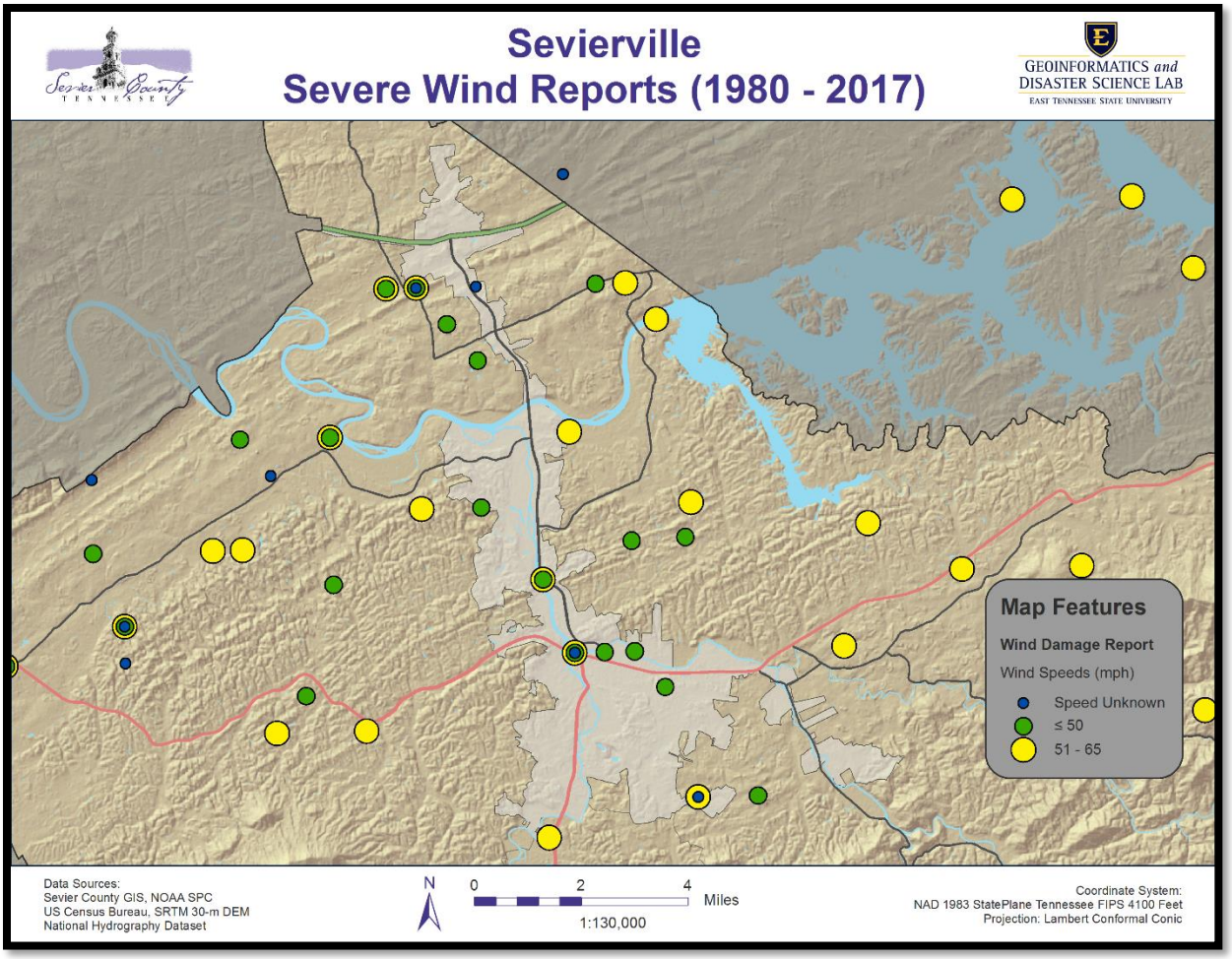

Figure 9-12: Severe Thunderstorm Wind Reports and Density in Relation to Sevierville.

Previous Occurrences

Historically, there have been 189 thunderstorm wind events in the unincorporated area of Sevier County and Sevierville from 1996 to 2018. There have been no injuries or fatalities due to thunderstorm wind events in the Sevier County planning area. The following table briefly outlines the thunderstorm wind events that have occurred in the unincorporated area of Sevier County and Sevierville.

Table 9-8: Thunderstorm Wind Incidents from 1996 to 2018 with Total Losses.
(Source: NCEI Storm Events Database)

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage	Crop Damage
4/20/1996	GATLINBURG	60	0	0	$0	$0
5/27/1996	SOUTHWEST PART		0	0	$10,000	$0
8/8/1996	SEVIERVILLE		0	0	$0	$2,000
1/5/1997	GATLINBURG		0	0	$0	$4,000
3/5/1997	EXTREME N PART OF CO		0	0	$0	$3,000
6/13/1997	SEVIERVILLE		0	0	$0	$10,000

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage	Crop Damage
6/14/1997	SEYMOUR		0	0	$0	$7,000
7/4/1997	COUNTYWIDE		0	0	$25,000	$20,000
8/4/1997	COUNTYWIDE	55	0	0	$0	$20,000
2/17/1998	SEVIERVILLE		0	0	$0	$0
4/3/1998	COUNTYWIDE		0	0	$17,000	$15,000
6/2/1998	PIGEON FORGE		0	0	$0	$20,000
6/2/1998	GATLINBURG		0	0	$0	$15,000
6/5/1998	KODAK		0	0	$5,000	$14,000
6/15/1998	GATLINBURG		0	0	$15,000	$0
6/22/1998	SEVIERVILLE		0	0	$0	$20,000
6/24/1998	SEVIERVILLE		0	0	$0	$20,000
7/19/1998	SEVIERVILLE		0	0	$0	$5,000
11/25/1998	PIGEON FORGE		0	0	$0	$15,000
4/23/1999	SEVIERVILLE		0	0	$0	$7,000
5/6/1999	KODAK		0	0	$0	$2,000
5/7/1999	KODAK		0	0	$0	$5,000
7/24/1999	BEECH SPGS		0	0	$6,000	$0
7/29/1999	KODAK		0	0	$12,000	$0
7/29/1999	PIGEON FORGE		0	0	$10,000	$0
8/23/1999	SEYMOUR		0	0	$4,000	$0
2/13/2000	PIGEON FORGE		0	0	$0	$11,000
5/23/2000	PIGEON FORGE		0	0	$0	$11,000
5/27/2000	COUNTYWIDE		0	0	$0	$6,000
5/27/2000	COUNTYWIDE		0	0	$0	$2,000
7/28/2000	GATLINBURG		0	0	$0	$15,000
7/28/2000	GATLINBURG		0	0	$14,000	$0
7/29/2000	SEVIERVILLE		0	0	$0	$4,000
7/30/2000	KODAK		0	0	$0	$12,000
8/10/2000	HATCHERTOWN		0	0	$0	$15,000
8/18/2000	SEVIERVILLE		0	0	$0	$23,000
11/9/2000	KODAK		0	0	$0	$4,000
11/9/2000	SEYMOUR		0	0	$0	$5,000
5/21/2001	CEDAR BLUFF		0	0	$0	$5,000
7/4/2001	PIGEON FORGE		0	0	$0	$24,000
7/8/2001	PITTMAN CENTER		0	0	$0	$21,000
10/25/2001	COUNTYWIDE		0	0	$16,000	$20,000
1/24/2002	COUNTYWIDE		0	0	$8,000	$0
5/2/2002	SEVIERVILLE		0	0	$15,000	$0
5/2/2002	SEYMOUR		0	0	$12,000	$0
5/13/2002	COUNTYWIDE		0	0	$15,000	$0

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage	Crop Damage
6/4/2002	GATLINBURG		0	0	$15,000	$0
7/2/2002	COUNTYWIDE		0	0	$25,000	$0
7/30/2002	GATLINBURG		0	0	$0	$5,000
8/1/2002	GATLINBURG		0	0	$5,000	$0
9/4/2002	BOYDS CREEK		0	0	$10,000	$0
9/4/2002	WALDEN CREEK		0	0	$15,000	$0
11/10/2002	KODAK	60	0	0	$15,000	$0
2/16/2003	GATLINBURG	60	0	0	$5,000	$0
5/2/2003	SEVIERVILLE	55	0	0	$12,000	$0
5/11/2003	KODAK	55	0	0	$8,000	$0
6/11/2003	KODAK	60	0	0	$12,000	$0
7/6/2003	COUNTYWIDE	60	0	0	$0	$0
7/10/2003	SEYMOUR	60	0	0	$0	$0
8/11/2003	COUNTYWIDE	60	0	0	$0	$0
8/29/2003	PIGEON FORGE	60	0	0	$0	$0
8/31/2003	PIGEON FORGE	60	0	0	$0	$0
11/18/2003	COUNTYWIDE	55	0	0	$10,000	$0
5/26/2004	KODAK	65	0	0	$10,000	$0
5/31/2004	SEVIERVILLE	65	0	0	$20,000	$0
6/2/2004	SEYMOUR	65	0	0	$5,000	$0
6/12/2004	SEVIERVILLE	60	0	0	$10,000	$0
7/5/2004	SEYMOUR	60	0	0	$12,000	$0
7/5/2004	KODAK	60	0	0	$10,000	$0
7/5/2004	PIGEON FORGE	60	0	0	$12,000	$0
7/10/2004	KODAK	60	0	0	$8,000	$0
7/13/2004	SEVIERVILLE	65	0	0	$15,000	$0
7/17/2004	SEVIERVILLE	65	0	0	$30,000	$0
5/20/2005	COUNTYWIDE	65	0	0	$30,000	$0
6/6/2005	SEVIERVILLE	65	0	0	$15,000	$0
6/27/2005	SEVIERVILLE	65	0	0	$18,000	$0
6/30/2005	COUNTYWIDE	55	0	0	$20,000	$0
7/27/2005	GATLINBURG	55	0	0	$10,000	$0
7/31/2005	SEVIERVILLE	55	0	0	$3,000	$0
7/31/2005	SEVIERVILLE	60	0	0	$3,000	$0
4/2/2006	KODAK	60	0	0	$12,000	$0
4/21/2006	SEYMOUR	60	0	0	$12,000	$0
5/20/2006	SEVIERVILLE	60	0	0	$20,000	$0
5/20/2006	SEVIERVILLE	60	0	0	$12,000	$0
5/30/2006	PITTMAN CENTER	60	0	0	$3,000	$0
5/30/2006	GATLINBURG	60	0	0	$20,000	$0

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage	Crop Damage
5/30/2006	GATLINBURG	60	0	0	$15,000	$0
5/31/2006	KODAK	60	0	0	$10,000	$0
6/23/2006	COUNTYWIDE	60	0	0	$6,000	$0
7/28/2006	GATLINBURG	60	0	0	$15,000	$0
8/4/2006	COUNTYWIDE	55	0	0	$6,000	$0
8/5/2006	WALDEN CREEK	60	0	0	$10,000	$0
10/5/2006	KODAK	55	0	0	$0	$0
4/3/2007	CATLETTSBURG	55	0	0	$30,000	$0
6/14/2007	PITTMAN CENTER	50	0	0	$10,000	$0
6/24/2007	SEVIERVILLE	55	0	0	$5,000	$0
6/25/2007	SEVIERVILLE	55	0	0	$20,000	$0
6/28/2007	PIGEON FORGE	55	0	0	$10,000	$0
6/28/2007	GATLINBURG	55	0	0	$15,000	$0
6/28/2007	SEVIERVILLE	50	0	0	$2,000	$0
1/10/2008	BOYDS CREEK	55	0	0	$0	$0
3/19/2008	CATLETTSBURG	50	0	0	$0	$0
6/9/2008	BANNER	55	0	0	$10,000	$0
6/11/2008	BIRD XRD	50	0	0	$10,000	$0
6/12/2008	GATLINBURG	50	0	0	$5,000	$0
6/12/2008	LINE SPG	52	0	0	$2,000	$0
6/12/2008	PITNER	55	0	0	$5,000	$0
6/28/2008	KODAK	55	0	0	$8,000	$0
6/28/2008	PINE GROVE	55	0	0	$8,000	$0
6/28/2008	GLADES	55	0	0	$8,000	$0
7/22/2008	ELKMONT	55	0	0	$0	$0
7/22/2008	GLADES	60	0	0	$0	$0
2/11/2009	CATLETTSBURG	55	0	0	$15,000	$0
4/2/2009	PITNER	55	0	0	$8,000	$0
4/6/2009	KODAK	52	0	0	$8,000	$0
4/6/2009	OAK CITY	50	0	0	$2,000	$0
4/6/2009	KODAK	50	0	0	$2,000	$0
5/28/2009	CUSICK	52	0	0	$0	$0
6/4/2009	MC MAHAN	52	0	0	$2,000	$0
6/4/2009	FAIR GARDEN	52	0	0	$2,000	$0
6/10/2009	KODAK	62	0	0	$5,000	$0
6/17/2009	SEVIERVILLE	50	0	0	$30,000	$0
8/16/2009	SEVIERVILLE	52	0	0	$2,000	$0
8/16/2009	SEVIERVILLE	58	0	0	$15,000	$0
8/22/2009	PITTMAN CENTER	60	0	0	$15,000	$0
8/22/2009	PITTMAN CENTER	50	0	0	$20,000	$0

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage	Crop Damage
7/26/2010	SHADY GROVE	55	0	0	$0	$0
10/26/2010	SEVIERVILLE	55	0	0	$5,000	$0
2/25/2011	SEVIERVILLE	50	0	0	$15,000	$0
2/28/2011	PITTMAN CENTER	60	0	0	$12,000	$0
3/23/2011	CATLETTSBURG	60	0	0	$0	$0
3/23/2011	GLADES	55	0	0	$0	$0
5/22/2011	MILLICAN	50	0	0	$0	$0
5/26/2011	HENRY XRDS	50	0	0	$0	$0
5/26/2011	ALDER BRANCH	50	0	0	$0	$0
6/24/2011	SEVIERVILLE	50	0	0	$5,000	$0
8/8/2011	SEVIERVILLE	52	0	0	$3,000	$0
8/18/2011	SEVIERVILLE	52	0	0	$10,000	$0
2/29/2012	PIGEON FORGE	60	0	0	$5,000	$0
3/2/2012	DU PONT	50	0	0	$0	$0
3/30/2012	CATLETTSBURG	50	0	0	$0	$0
7/1/2012	ELKMONT	60	0	0	$0	$0
7/5/2012	CATLETTSBURG	60	0	0	$1,000,000	$0
7/5/2012	FRENCH BROAD	60	0	0	$1,000,000	$0
7/5/2012	PIGEON FORGE	50	0	0	$0	$0
7/9/2012	BOYDS CREEK	50	0	0	$0	$0
7/10/2012	LINE SPG	50	0	0	$0	$0
7/10/2012	SEVIERVILLE	50	0	0	$0	$0
7/31/2012	MIDDLE CREEK	50	0	0	$0	$0
7/31/2012	PITNER	50	0	0	$0	$0
5/21/2013	CATLETTSBURG	50	0	0	$0	$0
5/22/2013	CATLETTSBURG	50	0	0	$0	$0
6/5/2013	PIGEON FORGE	50	0	0	$2,000	$0
6/5/2013	PIGEON FORGE	50	0	0	$5,000	$0
6/13/2013	PITTMAN CENTER	50	0	0	$8,000	$0
6/13/2013	SEYMOUR	55	0	0	$8,000	$0
6/10/2014	SEVIERVILLE	50	0	0	$10,000	$0
6/23/2014	PIGEON FORGE	50	0	0	$5,000	$0
6/23/2014	SEVIERVILLE	50	0	0	$8,000	$0
6/27/2014	SEYMOUR	50	0	0	$8,000	$0
7/8/2014	PITNER	50	0	0	$0	$0
7/8/2014	LINE SPG	60	0	0	$0	$0
7/27/2014	CATLETTSBURG	50	0	0	$0	$0
9/16/2014	CATLETTSBURG	52	0	0	$0	$0
10/14/2014	PIGEON FORGE	50	0	0	$5,000	$0
4/25/2015	KODAK	50	0	0	$5,000	$0

Date	Location	Wind Speed (Knots)	Injuries	Fatalities	Property Damage	Crop Damage
4/25/2015	GATLINBURG	50	0	0	$8,000	$0
6/2/2015	GLADES	50	0	0	$0	$0
6/30/2015	KODAK	50	0	0	$0	$0
8/10/2015	PITNER	50	0	0	$0	$0
8/10/2015	LINE SPG	50	0	0	$0	$0
4/22/2016	PITNER	50	0	0	$0	$0
6/2/2016	PIGEON FORGE	50	0	0	$0	$0
6/14/2016	HICKS CROSSING	50	0	0	$0	$0
7/7/2016	LINE SPG	50	0	0	$0	$0
7/7/2016	LINE SPG	50	0	0	$0	$0
7/7/2016	CATLETTSBURG	55	0	0	$0	$0
7/8/2016	ELKMONT	60	0	0	$0	$0
7/8/2016	PITNER	50	0	0	$0	$0
7/12/2016	BEECH SPGS	50	0	0	$0	$0
3/1/2017	CATLETTSBURG	50	0	0	$0	$0
3/1/2017	CATLETTSBURG	50	0	0	$0	$0
3/27/2017	CATES XRDS	50	0	0	$0	$0
5/24/2017	GLADES	50	0	0	$0	$0
5/24/2017	SEVIERVILLE ARPT	50	0	0	$0	$0
6/25/2018	BIRD XRD	50	0	0	$0	$0
6/26/2018	CATLETTSBURG	50	0	0	$0	$0
6/28/2018	GLADES	50	0	0	$0	$0
11/6/2018	PITNER	50	0	0	$0	$0

Since the last plan update, there have been 51 thunderstorm wind events that have occurred within the unincorporated areas of Sevier County and Sevierville.

Incidents/Probability

The NCEI Storm Events Database reports 189 thunderstorm wind events within the boundaries of Sevier County between the years 1996 and 2018. With 189 events, the annual return rate (frequency) for thunderstorm wind events in the unincorporated area of Sevier County and Sevierville is eight to nine events every year. This equates to an annual probability of approximately 100%.

9.1.10 Tornadoes

Location & Extent

While there is a significant tornado record for Sevier County with actual locations, tornadoes in general are a meteorological phenomenon that can occur anywhere and have the same approximate probability of occurring anywhere in the Sevier County planning area. Because a tornado has a similar probability of striking anywhere within the planning area, all of Sevier County and Sevierville are equally at risk for tornadoes. The tornadoes experienced in Sevier County range from EF0 to EF1 on the EF scale. Based on

historical county-level data, the worst-case scenario for Sevier County and Sevierville is an EF1 tornado; however, an EF4 tornado did impact Blount County in 2011 in an area adjacent to Sevier County.

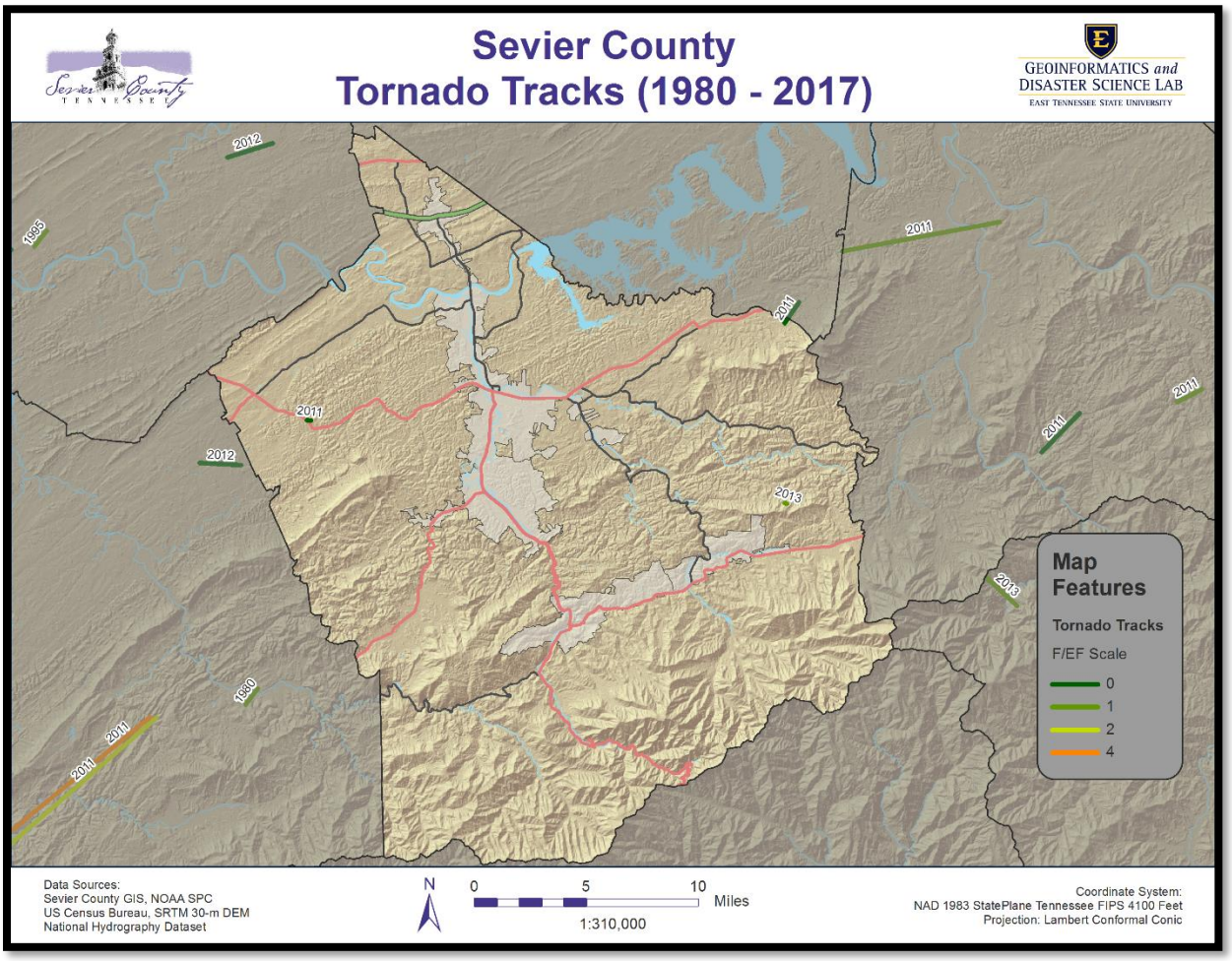

Figure 9-13: Tornado Density and Tracks in Relation to Sevier County.

Previous Occurrences

The NCEI Storm Events Database reports three tornadoes occurring within the boundaries of Sevier County. There have been no injuries due to tornadoes in Sevier County and Sevierville. The following table is a list of all events that have occurred between 1996 and 2018.

Table 9-9: Tornado Incidents from 1996 to 2018 with Total Losses.
(Source: NCEI Storm Events Database)

Date	Location	Magnitude	Injuries	Fatalities	Property Damage
4/27/2011	CUSICK	EF0	0	0	$5,000
4/27/2011	BIRD XRD	EF0	0	0	$3,000
6/13/2013	SEVIERVILLE	EF1	0	0	$50,000

Since the last plan update, there have been no tornado events that have caused property damage and/or loss of life or injuries in Sevier County and Sevierville.

Incidents/Probability

The NCEI Storm Events Database reports three tornado events within the boundaries of Sevier County between the years 1996 and 2018. With three events, the annual return rate (frequency) for tornado events in the unincorporated area of Sevier County and Sevierville is one event every 7 to 8 years. This equates to an annual probability of approximately 12%.

9.1.11 Tropical Cyclones (Hurricanes)

Location & Extent

Tropical cyclones typically impact multiple regions and not one specific jurisdiction. Based on historical data, the Sevier County planning area can expect to experience tropical cyclones at the tropical depression level. Additionally, no portions of Sevier County will be impacted by storm surge based on its geographical location.

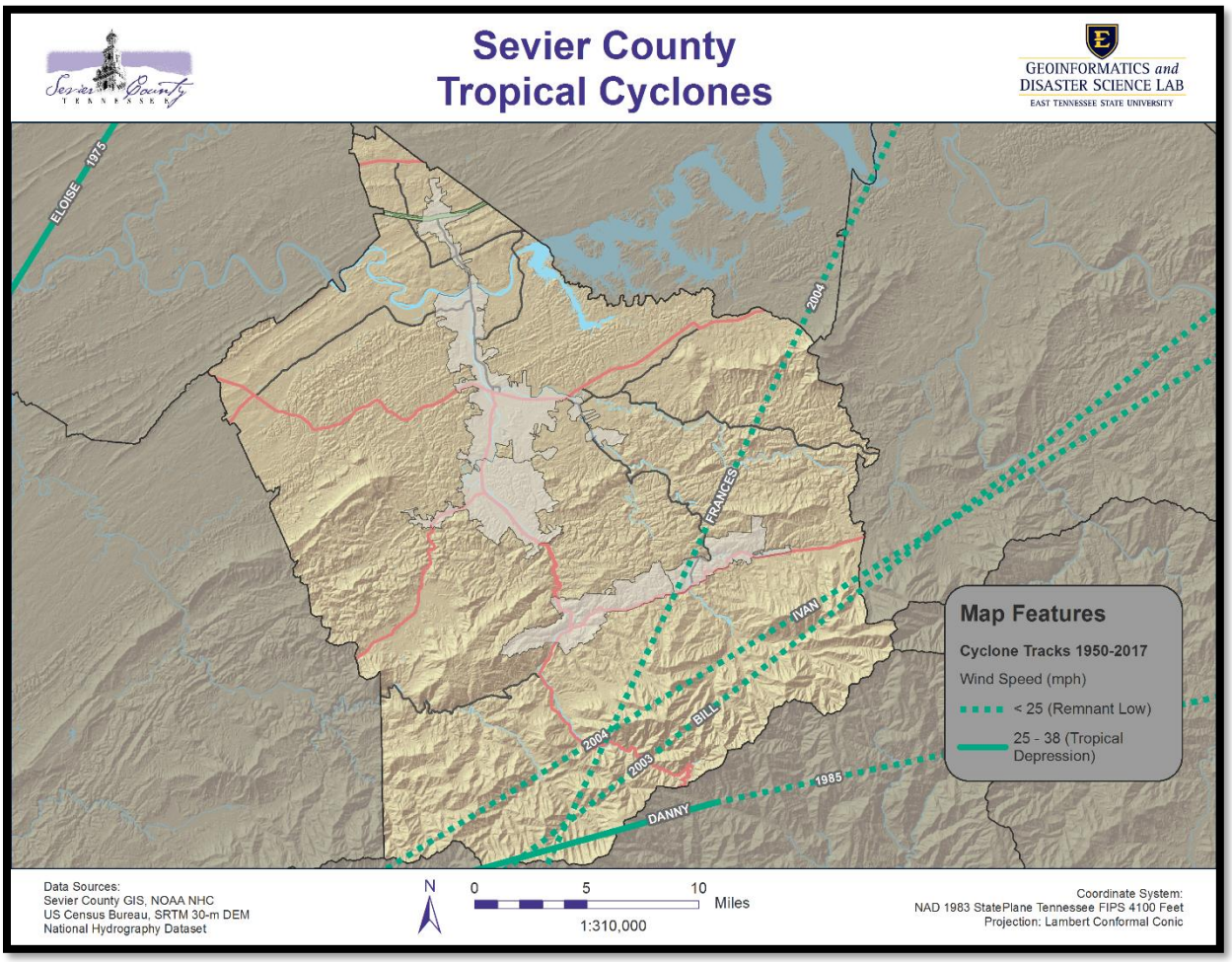

Figure 9-14: Tropical Cyclone Tracks in Relation to Sevier County and Sevierville.

Previous Occurrences

The NCEI Storm Events Database reports no tropical cyclone (tropical depressions, tropical storms, and hurricanes) occurrences within the boundaries of Sevier County and Sevierville between the years 1996 and 2018.

Incidents/Probability

Based on historical record, the annual probability of tropical cyclones for Sevier County and Sevierville is less than 1%.

9.1.12 Wildfires/Conflagration

Location & Extent

Wildfires affect areas that are populated with forests and grasslands. On the fire danger rating system, Sevier County and Sevierville can expect a moderate to high rating based on current land use/land cover in the area. The following figure displays the areas of wildland-urban interface and intermix for Sevier County and Sevierville, as well as the underlying land cover (aerial imagery). The aerial imagery helps to identify possible wildfire fuel sources such as small wooded and shrub areas that may not be identified by the WUI dataset.

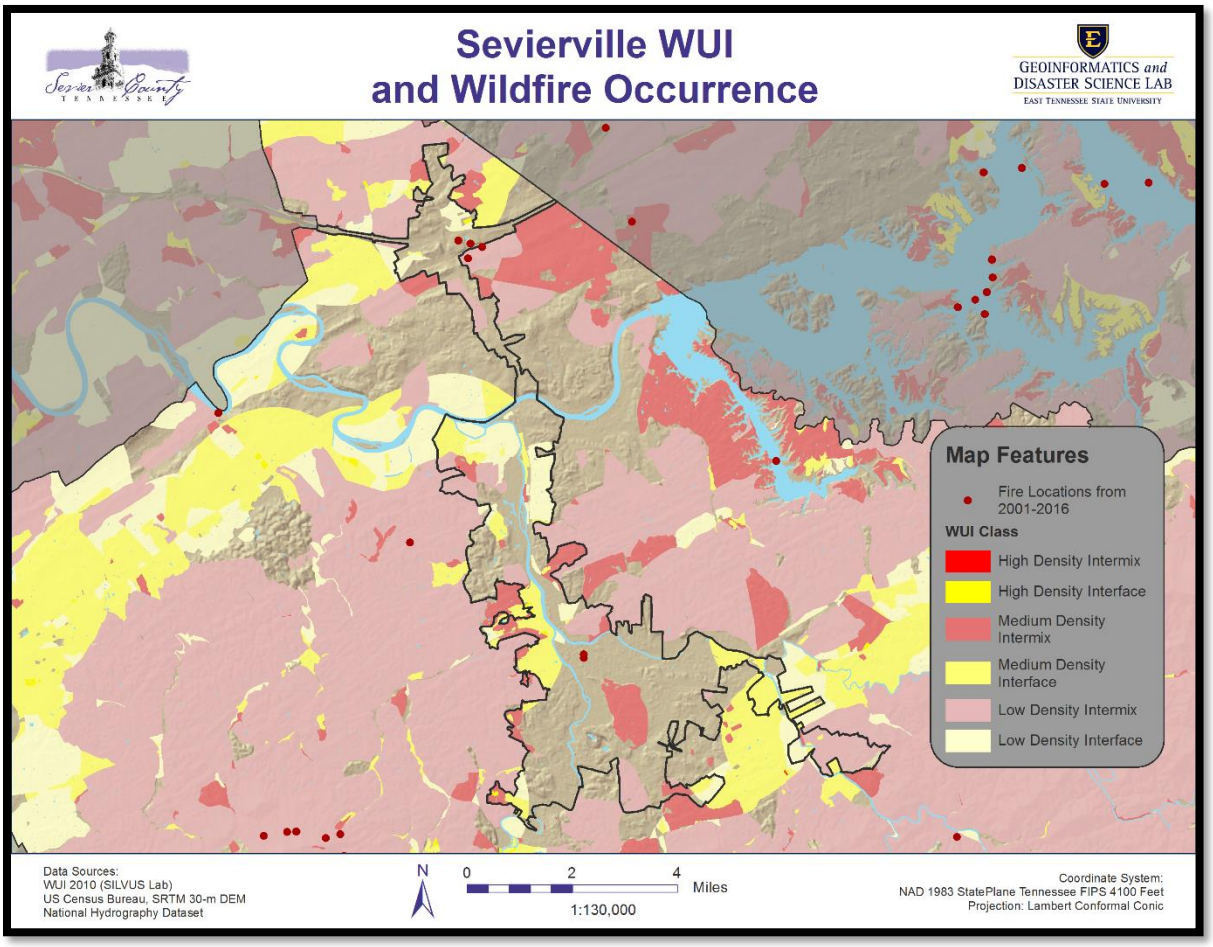

Figure 9-15: Wildland-Urban Interaction for Sevierville.

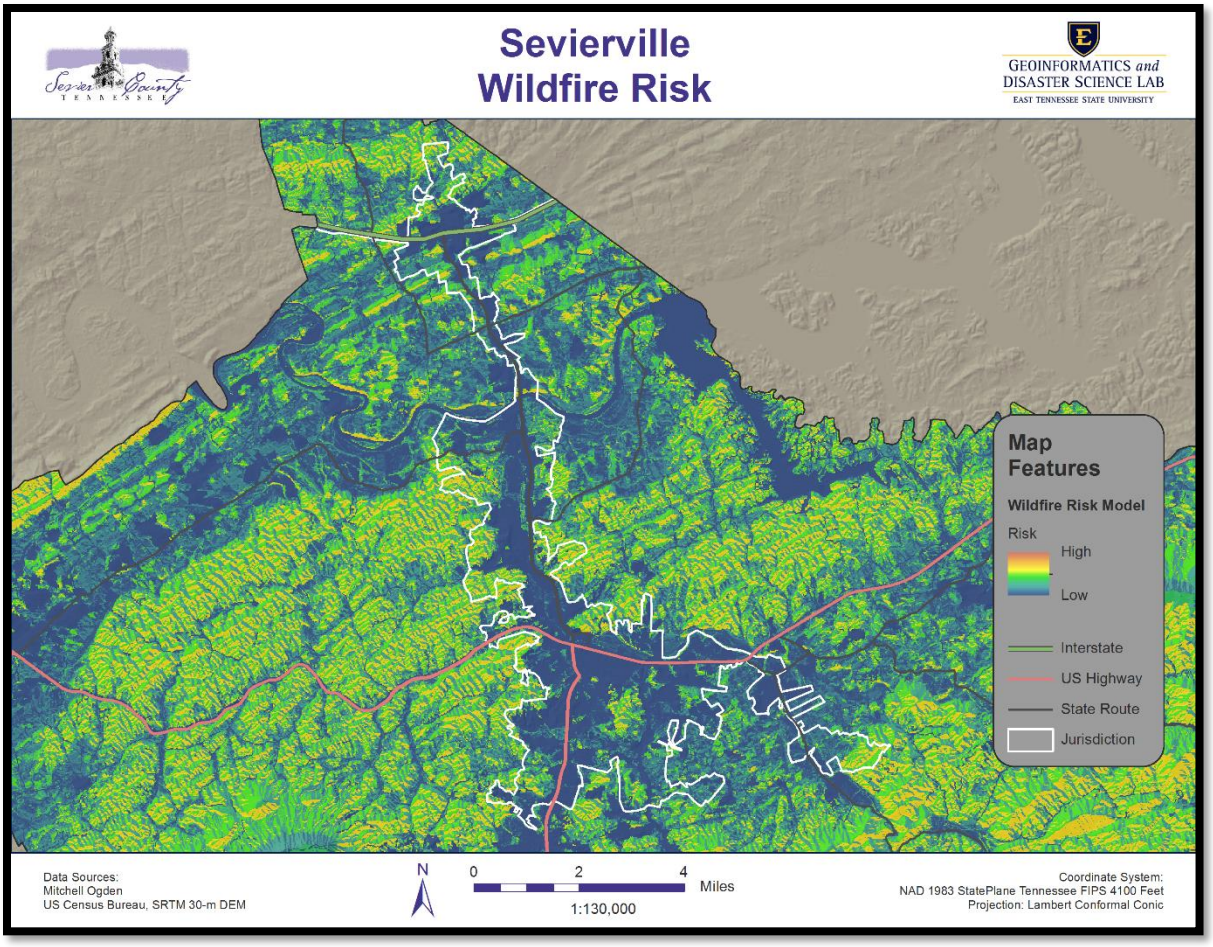

Figure 9-16: Wildfire Risk Model for Sevierville.

Using the record of wildfires in Sevier County, how much of an effect each variable has on wildfire development can be determined through spatial logistic regression and GIS modeling. Calculating wildfire risk through these methods requires data on previous wildfire occurrences and variables related to fire development. Wildfire occurrence data comes from two sources: the United States Forest Service (USFS) and the Geological Survey (USGS). The USGS data recorded only those wildfires that occurred on federal land, primarily the Great Smoky Mountains National Park, for which the USFS dataset includes.

The duration of a wildfire depends on the weather conditions, how dry it is, the availability of fuel to spread, and the ability of responders to contain and extinguish the fire. Historically, some wildfires have lasted only hours while other fires have continued to spread and grow for an entire season. They spread quickly and often begin unnoticed until they have grown large enough to produce dense smoke. If fuel is available, and high wind speeds occur, a wildfire can spread over a large area in a very short amount of time. These factors make the difference between small upstart fires easily controlled by local fire services and fires destroying thousands of acres requiring multiple state and federal assets for containment and suppression.

Previous Occurrences

The USGS and USFS report 168 wildfire/conflagration occurrences within the boundaries of Sevier County and Sevierville from 2001 to 2016. A historic drought in the fall of 2016 preceded historic wildfires. By November 22, all 95 counties in Tennessee were classified in "Severe Drought" (D2) or higher. Tennessee experienced numerous wildfires across the state, including several that required federal assistance. On November 28, 2016, hurricane-force winds rapidly expanded a small wildfire in Sevier County into the largest interface fire to affect the state of Tennessee in 100 years, resulting in an estimated $911 million in property and contents loss. There were 14 fatalities and 221 people treated with fire-related injuries. The fire area was reported at 17,140 acres.

Figure 9-17: Photos showing the 2016 wildfire entering the developed area of Gatlinburg (upper left, The Atlantic), drastically reducing visibility with intense smoke (upper right, WV Metro News), devastating large areas (lower left, CNN), and destroying many homes (lower right, NPR).

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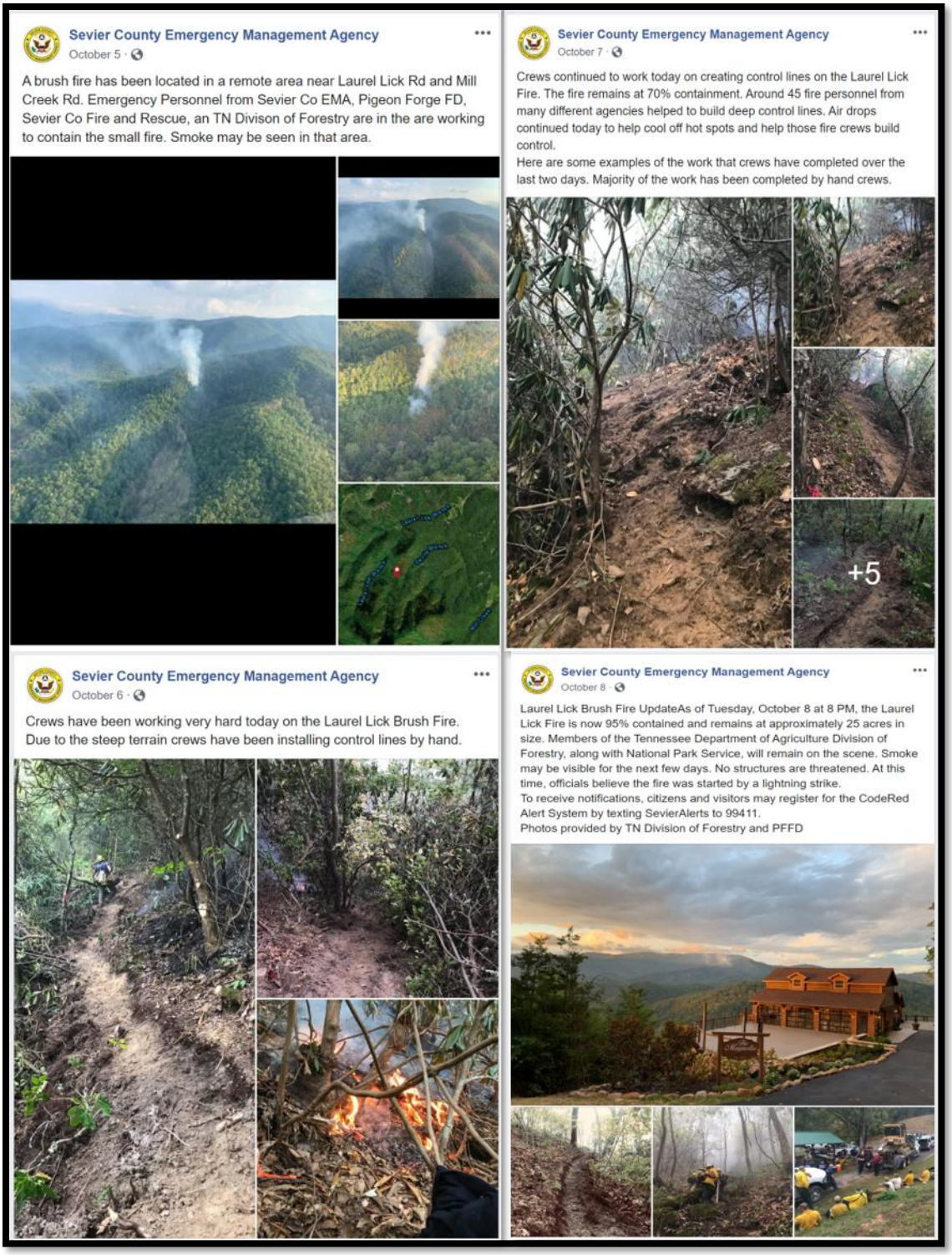

Figure 9-18: Social media documentation and community awareness of recent wildfires (October 2019) impacting Sevier County (Sevier County EMA).

Incidents/Probability

The USGS and USFS Database reports 168 wildfire/conflagration events within the boundaries of Sevier County between the years 2001 and 2016. With 168 events, the annual return rate (frequency) for wildfire/conflagration events in the unincorporated area of Sevier County and Sevierville is eight to nine events every year. This equates to an annual probability of approximately 100%.

9.1.13 Winter Storms

Location & Extent

Because winter weather is a climatological hazard and has the same probability of occurring in any area in Sevier County, the entire planning area is equally at risk for winter weather. Based on historic data, Sevier County and Sevierville can expect a category 5 on the Ohio Valley Regional Snowfall Index scale.

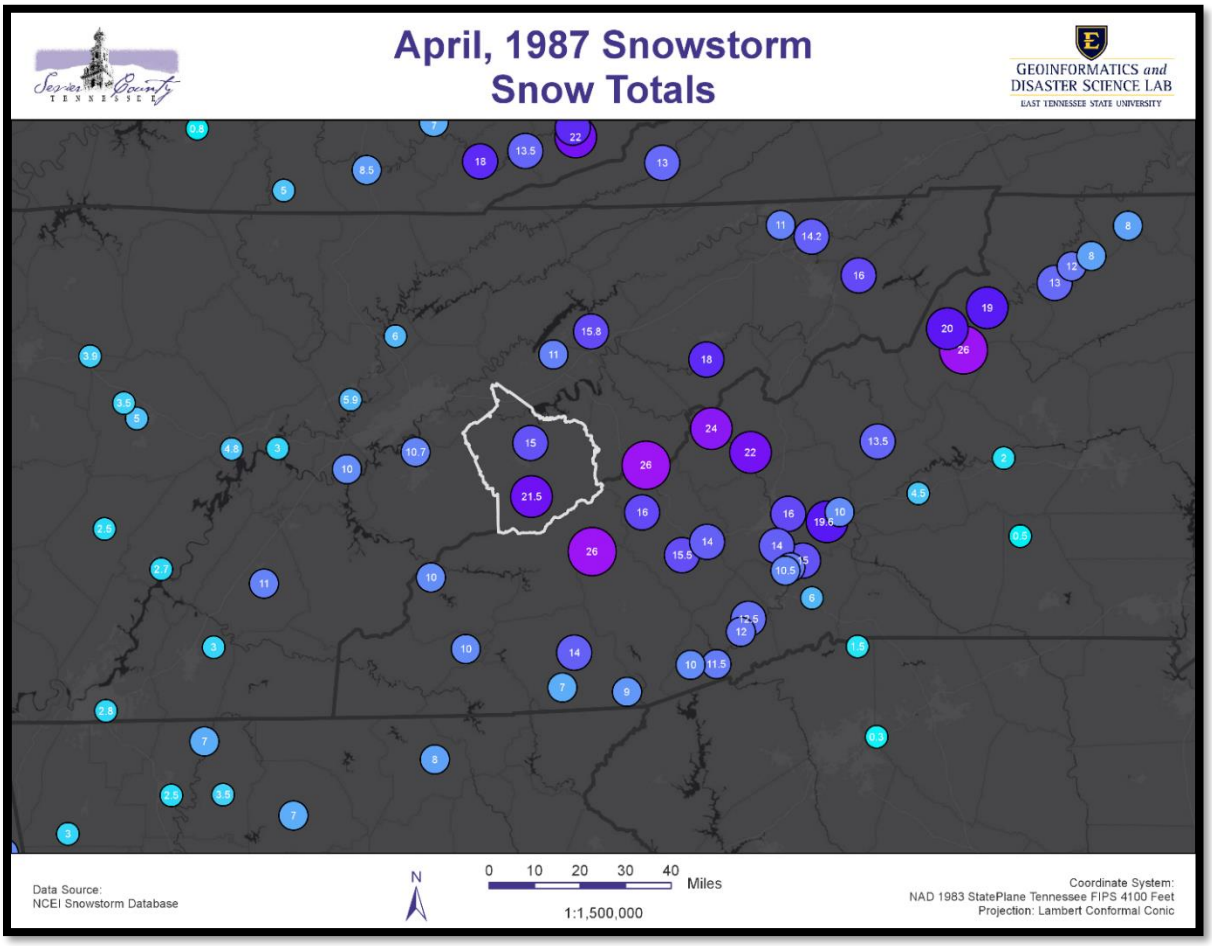

Figure 9-19: Station reported snowfall totals from the April 1987 snowstorm. This event resulted in the highest single day snowfall total for Sevierville, TN.

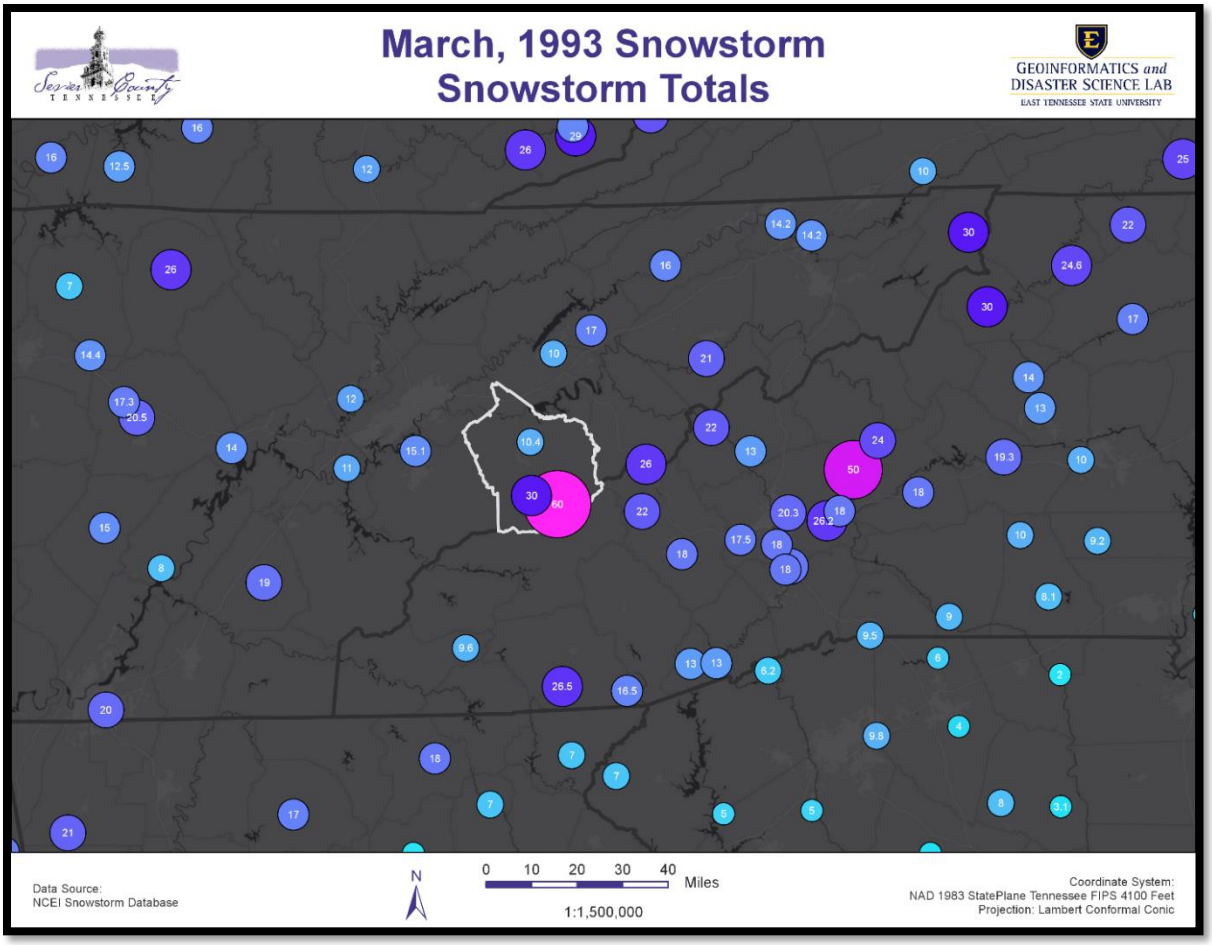

Figure 9-20: Station reported snowfall totals from the March 1993 snowstorm. This event resulted in the highest single day snowfall total for Gatlinburg, TN.

Previous Occurrences

Historically, there have been 102 winter storm events in the unincorporated area of Sevier County and Sevierville from 1996 to 2018. There have been no injuries or fatalities due to winter storm events in the Sevier County planning area. The following table briefly outlines the winter storm events that have occurred in the unincorporated area of Sevier County and Sevierville.

Table 9-10: Winter Storm Incidents from 1996 to 2018 with Total Losses.
(Source: NCEI Storm Events Database)

Date	Location	Injuries	Fatalities	Property Damage	Crop Damage
1/6/1996	GATLINBURG	0	0	$0	$0
1/6/1996	SOUTHWEST PART	0	0	$0	$0
1/11/1996	SEVIERVILLE	0	0	$0	$0
1/11/1996	GATLINBURG	0	0	$0	$0
2/2/1996	EXTREME N PART OF CO	0	0	$0	$0
2/2/1996	SEVIERVILLE	0	0	$0	$0
3/19/1996	SEYMOUR	0	0	$5,000	$0

Date	Location	Injuries	Fatalities	Property Damage	Crop Damage
3/19/1996	COUNTYWIDE	0	0	$0	$0
12/18/1996	COUNTYWIDE	0	0	$0	$0
12/18/1996	SEVIERVILLE	0	0	$0	$0
1/10/1997	COUNTYWIDE	0	0	$0	$0
1/10/1997	PIGEON FORGE	0	0	$0	$0
12/30/1997	GATLINBURG	0	0	$0	$0
12/30/1997	KODAK	0	0	$0	$0
1/27/1998	GATLINBURG	0	0	$0	$0
1/27/1998	SEVIERVILLE	0	0	$0	$0
1/6/1999	SEVIERVILLE	0	0	$0	$0
1/6/1999	SEVIERVILLE	0	0	$0	$0
3/3/1999	PIGEON FORGE	0	0	$0	$0
3/3/1999	SEVIERVILLE	0	0	$0	$0
3/13/1999	KODAK	0	0	$0	$0
3/13/1999	KODAK	0	0	$0	$0
3/26/1999	BEECH SPGS	0	0	$0	$0
3/26/1999	KODAK	0	0	$0	$0
1/22/2000	PIGEON FORGE	0	0	$0	$0
1/22/2000	SEYMOUR	0	0	$0	$0
12/2/2000	PIGEON FORGE	0	0	$0	$0
12/2/2000	PIGEON FORGE	0	0	$0	$0
12/18/2000	COUNTYWIDE	0	0	$0	$0
12/18/2000	COUNTYWIDE	0	0	$5,000	$0
1/1/2001	GATLINBURG	0	0	$0	$0
1/1/2001	GATLINBURG	0	0	$0	$0
1/20/2001	SEVIERVILLE	0	0	$0	$0
1/20/2001	KODAK	0	0	$0	$0
3/20/2001	HATCHERTOWN	0	0	$0	$0
3/20/2001	SEVIERVILLE	0	0	$0	$0
1/5/2002	KODAK	0	0	$2,000	$0
1/5/2002	SEYMOUR	0	0	$0	$0
12/4/2002	CEDAR BLUFF	0	0	$0	$0
1/5/2003	PIGEON FORGE	0	0	$0	$0
1/16/2003	PITTMAN CENTER	0	0	$0	$0
1/16/2003	COUNTYWIDE	0	0	$0	$0
1/22/2003	COUNTYWIDE	0	0	$0	$0
1/22/2003	SEVIERVILLE	0	0	$0	$0
2/7/2003	SEYMOUR	0	0	$0	$0
2/9/2003	COUNTYWIDE	0	0	$0	$0
4/10/2003	GATLINBURG	0	0	$0	$0
12/18/2003	COUNTYWIDE	0	0	$0	$0

Date	Location	Injuries	Fatalities	Property Damage	Crop Damage
12/19/2003	GATLINBURG	0	0	$0	$0
1/9/2004	GATLINBURG	0	0	$0	$0
1/9/2004	BOYDS CREEK	0	0	$0	$0
2/7/2004	WALDEN CREEK	0	0	$0	$0
12/11/2004	KODAK	0	0	$0	$0
12/19/2004	GATLINBURG	0	0	$0	$0
2/10/2005	SEVIERVILLE	0	0	$0	$0
2/28/2005	KODAK	0	0	$0	$0
11/21/2005	KODAK	0	0	$0	$0
1/14/2006	COUNTYWIDE	0	0	$0	$0
2/11/2006	SEYMOUR	0	0	$0	$0
2/18/2007	COUNTYWIDE	0	0	$0	$0
1/16/2008	PIGEON FORGE	0	0	$0	$0
2/27/2008	PIGEON FORGE	0	0	$0	$0
2/3/2009	COUNTYWIDE	0	0	$0	$0
4/7/2009	KODAK	0	0	$0	$0
12/18/2009	SEVIERVILLE	0	0	$0	$0
1/29/2010	SEYMOUR	0	0	$0	$0
1/29/2010	SEVIERVILLE	0	0	$0	$0
2/9/2010	SEYMOUR	0	0	$0	$0
2/24/2010	KODAK	0	0	$0	$0
12/6/2010	PIGEON FORGE	0	0	$0	$0
12/6/2010	KODAK	0	0	$0	$0
12/12/2010	SEVIERVILLE	0	0	$0	$0
12/12/2010	SEVIERVILLE	0	0	$0	$0
12/12/2010	COUNTYWIDE	0	0	$0	$0
12/12/2010	SEVIERVILLE	0	0	$0	$0
12/25/2010	SEVIERVILLE	0	0	$0	$0
12/26/2010	COUNTYWIDE	0	0	$0	$0
12/26/2010	GATLINBURG	0	0	$0	$0
12/26/2010	SEVIERVILLE	0	0	$0	$0
10/28/2012	SEVIERVILLE	0	0	$0	$0
10/28/2012	KODAK	0	0	$0	$0
10/28/2012	SEYMOUR	0	0	$0	$0
10/28/2012	SEVIERVILLE	0	0	$0	$0
1/17/2013	SEVIERVILLE	0	0	$0	$0
3/5/2013	PITTMAN CENTER	0	0	$0	$0
3/25/2013	GATLINBURG	0	0	$0	$0
11/26/2013	GATLINBURG	0	0	$0	$0
2/12/2014	KODAK	0	0	$0	$0
2/13/2014	COUNTYWIDE	0	0	$0	$0

Date	Location	Injuries	Fatalities	Property Damage	Crop Damage
3/29/2014	GATLINBURG	0	0	$0	$0
11/1/2014	COUNTYWIDE	0	0	$0	$0
2/17/2015	WALDEN CREEK	0	0	$1,000	$0
2/25/2015	KODAK	0	0	$0	$0
2/26/2015	CATLETTSBURG	0	0	$0	$0
1/20/2016	PITTMAN CENTER	0	0	$0	$0
1/22/2016	SEVIERVILLE	0	0	$0	$0
2/8/2016	SEVIERVILLE	0	0	$0	$0
1/6/2017	PIGEON FORGE	0	0	$0	$0
12/8/2017	GATLINBURG	0	0	$0	$0
1/29/2018	SEVIERVILLE	0	0	$0	$0
12/9/2018	BOYDS CREEK	0	0	$0	$0
12/21/2018	CATLETTSBURG	0	0	$0	$0

Since the last plan update, there have been 23 winter storm events that have occurred within the unincorporated areas of Sevier County and Sevierville.

Incidents/Probability

The NCEI Storm Events Database reports 102 winter storm events within the boundaries of Sevier County between the years 1996 and 2018. With 102 events, the annual return rate (frequency) for winter storm events in the unincorporated area of Sevier County and Sevierville is eight to nine events every year. This equates to an annual probability of approximately 100%.

9.1.14 Dam Failure

Location & Extent

Dams have been an important part of Sevier County's water infrastructure. In addition to the historic economic benefits provided by dams, they are used for flood control, water supply, power generation, recreation, and for mitigating the impact of increased runoff typically caused by land use changes associated with property development. The United Sates Army Corps of Engineers maintains a national inventory of dams in Sevier County.

In addition to proximity, the level of failure and meteorological conditions during a dam failure will greatly contribute to the extent of an incident. A minor failure will have lesser impacts than a total dam failure. Weather conditions also affect extent, as a dam failure without rainy conditions will have lesser extent, but the population will likely receive less warning. Conversely, rainy conditions exacerbate impacts, but allow for more warning due to expected failure.

According to the Federal Guidelines for Dam Safety, two (2) factors influence the severity of a dam failure: the amount of water impounded and the density, type, and value of development and infrastructure located downstream. Most dam failures are described by their potential point of inundation; the hazard potential levels of low, significant and high are further defined in the table below, while the figure on the following page provides a map of the locations of significant- and high-hazard dams. The magnitude and

severity of dam failures may also be assessed in terms of damage, including loss of life and injury, damage to infrastructure, loss of services or utilities, debris, and economic damage. The following figure shows dams in Sevier County and their hazard level.

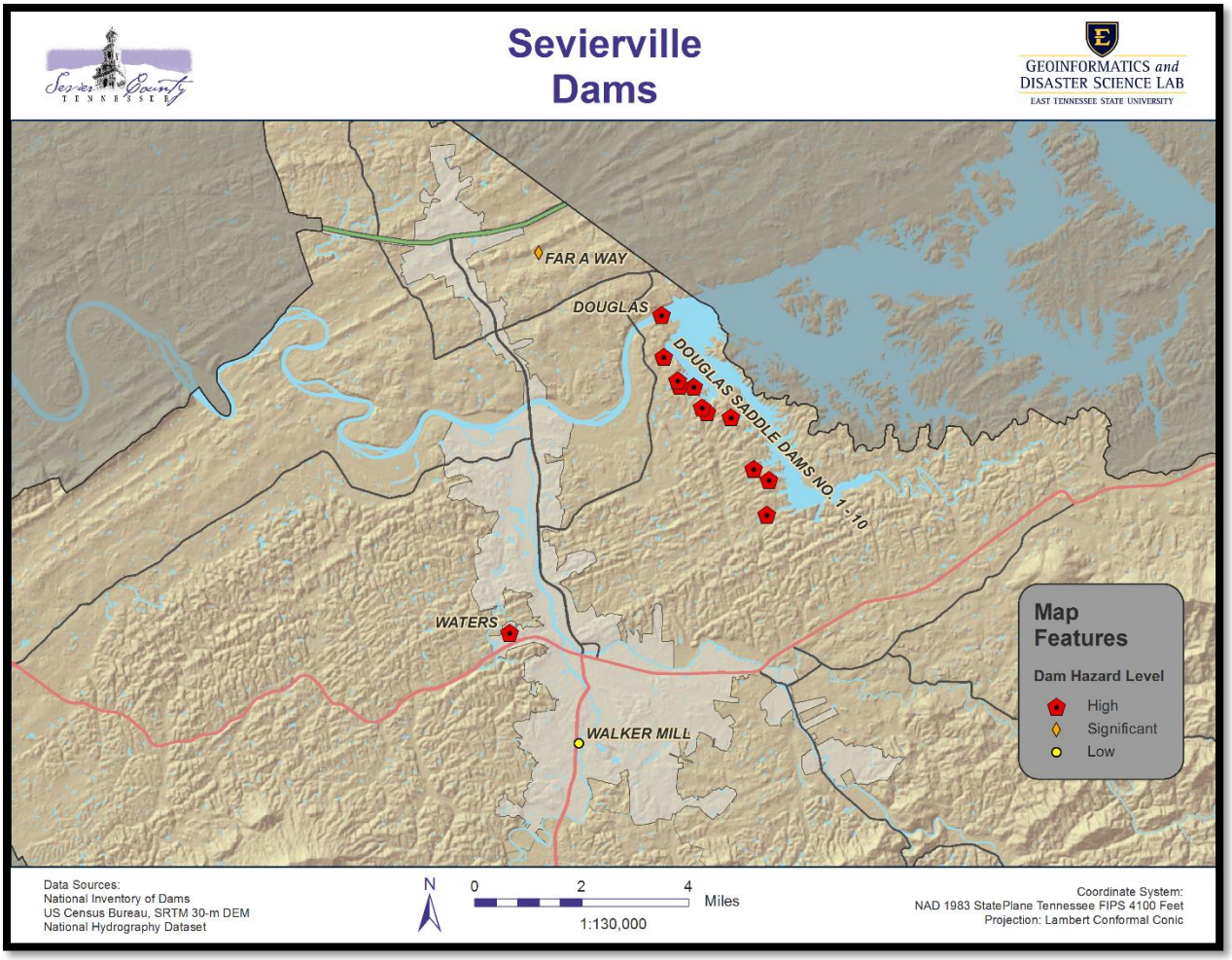

Figure 9-21: Dam Locations with Hazard Level in and around Sevierville.

Previous Occurrences

Sevier County and Sevierville have experienced no dam failures from 1989 to 2018 nor since the last update of the county hazard mitigation plan.

Incidents/Probability

Based on historical records, the annual chance of occurrence for a dam failure is calculated at less than 1%.

9.1.15 Infrastructure Failure

Location & Extent

Critical infrastructure is located throughout the county. Predicting the precise location of the next infrastructure failure is often difficult and generally dependent on the quality, upkeep, and maintenance

of each piece of infrastructure as well as any protective actions that can mitigate or prevent sources of failure.

The failure of these structures could have potentially devastating impacts, including significant disruption to essential facilities, economic and financial impacts, and physical damage to infrastructure. The reliance of virtually all industries on transportation networks is of key importance. A significant event could have cascading effects on other infrastructure.

Previous Occurrences

Oftentimes, smaller scale infrastructure failures occur as a secondary impact from a natural disaster, such as a temporary closure of a road due to a mass wasting event. Sevier County and Sevierville experience these disruptions occasionally and manages them through coordination across agencies. When infrastructure does fail, the county responds quickly to repair the infrastructure.

Incidents/Probability

In general, the county has not experienced any direct, prolonged catastrophic infrastructure failures. However, a significant failure of infrastructure could result in severe disruptions to public life and overall response efforts. Overall, Sevier County and Sevierville are vulnerable to infrastructure failure; however, the probability of occurrence is calculated at less than 1% based on previous occurrences.

9.1.16 Civil Disobedience/Terrorism

Location & Extent

Because of their often-spontaneous nature, it is difficult to pinpoint a location for the occurrence of a civil disturbance or terrorism event. However, monitoring social trends and social media can often inform responders about where potential demonstrations or acts of violence may take place. In addition, information gathered in advance may warn officials and provide locations of sites of potential future disturbances or acts of terrorism. Oftentimes, demonstrations and large, crowded gatherings begin peacefully and escalate to instances of sometimes-violent civil disturbance.

Instances of civil disobedience may originate from a number of different public gatherings, including political rallies, sporting events, and peaceful protests. Civil disturbance and acts of terrorism are typically seen in larger urban areas rather than rural unincorporated areas.

The severity of a civil disturbance incident depends on the nature of the disturbance. Significant disturbances can result in mass arrests, civilian curfews, intensive response efforts, property damage, injuries, and deaths. In general, civil disturbance impacts can range from low to high depending on the severity of the incident.

Police dispatched to control traffic corridors or intrusion on private property is considered a low severity civil disturbance. Disruption of businesses and potential property damage are assessed as a moderate civil disturbance. In these cases, police intervention would be required to restore order without employing chemical agents or physical force. A severe civil disturbance incident would involve rioting, arson, looting, assault, and death, where aggressive police action (tear gas, curfews, and mass arrests) may be required.

Civil disturbances may take on different characteristics depending on the severity of an incident. Each level of severity—low, medium, or high—poses risk to property. A low severity rating may be given to a

localized event that results in minimal to no property damage, minimal police action, and no physical harm to the participants, bystanders, or police. While low severity disturbances may simply disrupt usual business activity due to large crowds and inability to access businesses and possibly residences, they have the potential to become incidents of medium or even high severity due to the amount of people involved and the sometimes emotionally-charged atmosphere that can result. A localized event that results in damage to property, police action, and physical harm to people involved, such as police or protestors, may be considered moderately severe. A moderately severe event may cause some damage to businesses and residences but overall the damage is limited.

Civil disturbances involving emotionally-charged and highly contentious business, police, or political action, or unrest based on the outrage of a segment of the population, could be considered high severity. The results and extent of severe civil disturbances are expected to range from financially burdensome on businesses facing considerable damage and possibly looting to potential destruction of public and private property as well as fire and subsequent smoke damage.

Previous Occurrences

Sevier County and its jurisdictions recently experienced what could be considered an act of terrorism – the only such event of note from 1996 to 2019, and since the last plan update

Tanger Outlet Shooting

A gunman opened fire at the Tanger Outlet Mall in Sevierville on April 16, 2019, killing one person and wounded another before killing himself. The shooting appeared to be random, confirming that such events could happen anywhere and anytime, but most often in event areas or high population areas.

Incidents/Probability

Civil disturbances and acts of terrorism have a low probability of occurring in Sevierville. Based on previous occurrences and location, there is less than a 5% annual chance of occurrence for civil disturbances and acts of terrorism in the unincorporated areas of Sevier County and Sevierville.

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9.2 Vulnerability Assessment

9.2.1 Communicable Diseases Vulnerability

Estimated Impact and Potential Loss

Communicable disease does not have the potential to impact property and crops; however, livestock operations throughout Sevier County and Sevierville are subject to disease outbreaks.

Vulnerable Population

Many communicable diseases are transmitted by vectors, such as mosquitoes, ticks, and fleas. Vectors can transmit an array of pathogens, such as viruses, bacteria, and protozoa, which can cause illness in humans (or humans and animals). While everyone in Sevier County and Sevierville are susceptible to communicable disease, special attention should be paid to highly vulnerable populations such as those who are socioeconomically disadvantaged, young children, and the elderly.

Vulnerability Score

Table 9-11: Communicable Disease Vulnerability Score.

	Communicable Diseases Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	4	2	3	4	2	1.7	**2.6**

9.2.2 Drought Vulnerability

Estimated Impact and Potential Loss

According to the NCEI database, there has been one drought event that has caused some level of crop damage. The total agricultural damage from this event was $2,000. When annualizing the total cost over the 23-year record, total annual losses based on drought is estimated to be $83. The following table presents an analysis of agricultural exposure that is susceptible to drought by major crop type for Sevier County.

Table 9-12: Agricultural Exposure by Crop Type for Drought in Sevier County. (Source: United States Department of Agriculture 2017 Census)

Agricultural Exposure by Crop Type for Drought				
Nursery Plants	Hay	Corn	Dry Peas	Soybeans
$428,000	$1,384,000	$98,000	$135,000	$31,000

Vulnerable Population

Drought typically has a larger impact on the agricultural community, and does not directly affect human life or health. However, drought can exacerbate other hazardous conditions, especially wildfires. There have been no reported injuries or loss of life due to drought in Sevier County and Sevierville.

Vulnerability Score

Table 9-13: Drought Vulnerability Score.

	Drought Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	3	2	4	1	4	1	**2.3**

9.2.3 Earthquake Vulnerability

Estimated Impact and Potential Loss

Sevier County and Sevierville are vulnerable to earthquake hazards; however, the impact is largely unknown since there has yet to be an earthquake that has caused any property or crop damage. The USGS database shows that there is a 6.34% chance of a major earthquake (5.0 or greater) within 50 miles of Sevier County and Sevierville within the next 50 years.

Vulnerable Population

There has been no recorded earthquake event that has caused loss of life or injuries in the state of Tennessee per the Tennessee Hazard Mitigation Plan, so the impact on population is largely unknown in Sevier County and Sevierville.

Vulnerability Score

Table 9-14: Earthquake Vulnerability Score.

	Earthquake Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	1	1	4	4	1	1	**1.7**

9.2.4 Extreme Temperature Vulnerability

Estimated Impact and Potential Loss

All of the Sevier County planning area is vulnerable to extreme temperatures. Extreme heat occurrences often transpire in conjunction with drought occurrences, which leaves the soil susceptible to desiccation. Extreme cold occurrences impact all utilities in the area such as exposed pipes that can freeze and burst. Based on historical data, there has been no property damage as a result of extreme temperatures; however, extreme temperatures have the potential to cause thousands of dollars in property damage.

Vulnerable Population

Residents of Sevier County and Sevierville who are elderly or in poor health are at acute risk along with residents who work outside in the extreme conditions.

Vulnerability Score

Table 9-15: Extreme Temperatures Vulnerability Score.

	Extreme Temperatures Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	4	3	4	1	3	1.55	**2.8**

9.2.5 Flood Including Extreme Precipitation Vulnerability

Estimated Impact and Potential Loss

Using the Hazus 4.2 Flood Model, along with the Sevier County and Sevierville Digital Flood Insurance Rate Maps, the 100-year flood scenario was analyzed to determine losses for the scenario. The following table displays the total economic losses that would result from a 100-year flood scenario.

Table 9-16: Estimated Losses for 100-Year Flood Scenario in Sevier County and its Jurisdictions.

Jurisdiction	Estimated Total Losses
Sevier County (Unincorporated)	$634,000
Gatlinburg	$784,000
Pigeon Forge	$880,000
Pittman Center	$51,000
Sevierville	$960,000
Total	**$3,309,000**

The Hazus 4.2 Flood Model also provided a breakdown by jurisdiction for seven primary sectors throughout Sevierville. The losses for Sevierville are listed in the following table.

Table 9-17: Estimated Losses for 100-Year Flood Scenario in Sevierville by Sector.

Sevierville	Estimated Total Losses
Agricultural	$0
Commercial	$496,000
Government	$16,000
Industrial	$38,000
Religious/Non-Profit	$6,000
Residential	$399,000
Education	$5,000
Total	**$960,000**

Vulnerable Population

The total population within the county that is susceptible to a flood hazard is shown in the table below:

Table 9-18: Vulnerable Populations Susceptible to a 100-Year Flood Event for Sevier County and Sevierville.

Number of People Exposed to Flood Hazards			
Jurisdiction	**# in Community**	**# in Hazard Area**	**% in Hazard Area**
Sevier County (Unincorporated)	64,761	6,848	10.6%
Gatlinburg	3,944	977	24.8%
Pigeon Forge	5,875	1,433	24.4%
Pittman Center	502	74	14.7%
Sevierville	14,807	3,144	21.2%
Total	**89,889**	**12,476**	**13.9%**

The Hazus 4.2 Flood Model was also extrapolated to provide an overview of vulnerable populations throughout Sevier County and Sevierville. The following table identifies the vulnerable population to floods in Sevierville.

Table 9-19: Vulnerable Populates Susceptible to a 100-Year Flood Event in Sevierville.

Sevierville		
Category	**Total Numbers**	**% of People in Hazard Area**
Number in Hazard Area	3,144	21.2%
Persons Under 5 Years	218	6.9%
Persons Under 18 Years	697	22.2%
Persons 65 Year and Over	560	17.8%
Caucasian	2,795	88.9%
Minority	349	11.1%

Vulnerability Score

Table 9-20: Flooding including Extreme Precipitation Vulnerability Score.

	Flooding including Extreme Precipitation Vulnerability Score						
	Probability	**Impact**	**Spatial Extent**	**Warning Time**	**Duration**	**Vulnerability**	**Risk Factor**
Risk Level	4	3	3	3	2	2.15	**2.9**

9.2.6 Mass Wasting

Estimated Impact and Potential Loss

The entire planning area within Sevier County is susceptible to the effects of mass wasting events. Mass wasting events can cause serious damage to highways, buildings, homes, and other structures that support a wide range of economies and activities. Mass wasting events commonly coincide with other natural disasters such as extreme precipitation events. Expansion of urban development contributes to greater risk of damage by mass wasting.

The USGS recognizes six major impacts caused by mass wasting events:

1. Causes damage in all 50 states, Puerto Rico, and the U.S. Virgin Islands
2. Costs $3.5 billion per year in damage repair
3. Causes between 25 and 50 deaths in the United States annually
4. Reduces real estate values and tourist revenue
5. Leads to lost human, industrial, agricultural, and forest productivity
6. Causes damage to the natural environment

Vulnerable Population

Mass wasting events typically impact motorists and those living in the vicinity of a vulnerable area. This is demonstrated in a mass wasting event which occurred on August 1, 2019 in Gatlinburg when a tree fell from a slope and fatally injured a 73-year old man. The lack of a detailed mass wasting inventory makes research on the vulnerability of people to mass wasting events highly limited.

Vulnerability Score

Table 9-21: Mass Wasting Vulnerability Score.

	Mass Wasting Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	3	2	2	4	4	1	**2.3**

9.2.7 Severe Wind Vulnerability

Estimated Impact and Potential Loss

Since 1996, there have been two reported severe wind events that have occurred within the boundaries of Sevier County and Sevierville. The total property damages associated with these events have totaled $22,000. To estimate the potential losses of a severe wind event on an annual basis, the total damage recorded for severe wind events was divided by the total number of years of available severe wind data (1996 - 2018). This provides an annual estimated potential loss of $957. To assess potential losses to the participating jurisdictions, the 2010 Census population was used to assign the estimated potential losses proportionally across the jurisdictions. The following table provides an estimate of potential property losses for Sevier County and its jurisdictions based on the 2010 Census data:

Table 9-22: Estimated Annual Losses for Severe Wind Events in Sevier County and its Jurisdictions.

Unincorporated Sevier County (72.0% of Population)	Gatlinburg (4.4 % of Population)	Pigeon Forge (6.5% of Population)	Pittman Center (0.6% of Population)	Sevierville (16.5% of Population)
$689	$42	$63	$5	$158

Vulnerable Population

There have been no recorded severe wind event that has caused loss of life or injuries in Sevier County and Sevierville; however, these events have the potential to significantly impact the aviation community in these areas.

Vulnerability Score

Table 9-23: Severe Wind Vulnerability Score.

	Severe Wind Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	2	2	2	4	1	1	**1.8**

9.2.8 Sinkhole Vulnerability

Estimated Impact and Potential Loss

The entire Sevier County planning area is susceptible to subsidence and sinkholes based on the karst topography of the region. While sinkholes have a higher risk of forming in the northern portions of the county, the southern portion is also susceptible to sinkholes.

Vulnerable Population

There are no reported fatalities or injuries associated with sinkhole events.

Vulnerability Score

Table 9-24: Sinkhole Vulnerability Score.

	Sinkhole Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	4	2	1	4	1	1	**2.1**

9.2.9 Thunderstorm Vulnerability

Hail

Estimated Impact and Potential Loss

Since 1996, there have been 25 reported hail events that have occurred within the boundaries of Sevier County and Sevierville. The total property damages associated with these events have totaled $13,700. To estimate the potential losses of a hail event on an annual basis, the total damage recorded for hail events was divided by the total number of years of available hail data (1996 - 2018). This provides an annual estimated potential loss of $596. To assess potential losses to the participating jurisdictions, the 2010 Census population was used to assign the estimated potential losses proportionally across the jurisdictions. The following table provides an estimate of potential property losses for Sevier County and its jurisdictions based on the 2010 Census data:

Table 9-25: Estimated Annual Losses for Hail Events in Sevier County and its Jurisdictions.

Unincorporated Sevier County (72.0% of Population)	Gatlinburg (4.4 % of Population)	Pigeon Forge (6.5% of Population)	Pittman Center (0.6% of Population)	Sevierville (16.5% of Population)
$429	$26	$39	$3	$98

Vulnerable Population

There have been no reported injuries or fatalities associated with hail events in Sevier County and Sevierville.

Hail Vulnerability Score

Table 9-26: Hail Vulnerability Score.

	Hail Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	4	2	4	3	1	1.45	**2.6**

Lightning

Estimated Impact and Potential Loss

Since 1996, there have been two reported lightning events that have occurred within the boundaries of Sevier County and Sevierville. There has been no reported property or crop damage associated with lightning within the boundaries of Sevier County.

Vulnerable Population

There has been one reported fatality from lightning that has occurred within the boundaries of Sevier County and Sevierville. On July 10, 2004, a man was struck by lightning while he was fishing on Douglas Lake. The boat was several hundred yards from Douglas Dam when the incident occurred. He was rendered unconscious and fell into the water.

Lightning Vulnerability Score

Table 9-27: Lightning Vulnerability Score.

	Lightning Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	2	1	2	3	1	1.9	**1.7**

Wind

Estimated Impact and Potential Loss

Since 1996, there have been 189 reported thunderstorm wind events that have occurred within the boundaries of Sevier County and Sevierville. The total property damages associated with these events have totaled $3,089,000. To estimate the potential losses of a thunderstorm wind event on an annual basis, the total damage recorded for thunderstorm wind events was divided by the total number of years of available thunderstorm wind data (1996 - 2018). This provides an annual estimated potential loss of $134,304. To assess potential losses to the participating jurisdictions, the 2010 Census population was used to assign the estimated potential losses proportionally across the jurisdictions. The following table provides an estimate of potential property losses for Sevier County and its jurisdictions based on the 2010 Census data:

Table 9-28: Estimated Annual Losses for Thunderstorm Wind Events in Sevier County and its Jurisdictions.

Unincorporated Sevier County (72.0% of Population)	Gatlinburg (4.4 % of Population)	Pigeon Forge (6.5% of Population)	Pittman Center (0.6% of Population)	Sevierville (16.5% of Population)
$96,760	$5,893	$8,778	$750	$22,123

Vulnerable Population

There have been no reported injuries or fatalities associated with thunderstorm wind events in Sevier County and Sevierville.

Wind Vulnerability Score

Table 9-29: Wind Vulnerability Score.

	Wind Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	4	2	4	3	1	1	**2.5**

9.2.10 Tornado Vulnerability

Estimated Impact and Potential Loss

Since 1996, there have been three reported tornadoes that have occurred within the boundaries of Sevier County and Sevierville. The total property damages associated with these tornadoes have totaled $58,000. To estimate the potential losses of a tornado on an annual basis, the total damage recorded for thunderstorm wind events was divided by the total number of years of available thunderstorm wind data (1996 - 2018). This provides an annual estimated potential loss of $2,522. To assess potential losses to the participating jurisdictions, the 2010 Census population was used to assign the estimated potential losses proportionally across the jurisdictions. The following table provides an estimate of potential property losses for Sevier County and its jurisdictions based on the 2010 Census data:

Table 9-30: Estimated Annual Losses for Tornado Events in Sevier County and its Jurisdictions.

Unincorporated Sevier County (72.0% of Population)	Gatlinburg (4.4 % of Population)	Pigeon Forge (6.5% of Population)	Pittman Center (0.6% of Population)	Sevierville (16.5% of Population)
$1,817	$111	$165	$14	$415

Vulnerable Population

There have been no reported injuries or fatalities associated with tornadoes; however, residents living in manufactured housing are more vulnerable to tornadoes and are more likely to sustain higher damage totals due to the construction materials. Approximately 22% of all buildings in Sevier County and Sevierville are manufactured housing. The following table presents an analysis of building exposure that is susceptible to tornadoes by general occupancy type for Sevier County, along with the percentage of building stock that are manufactured homes.

Table 9-31: Building Exposure by General Occupancy Type for Tornadoes in Sevier County ($1,000).

Residential	Commercial	Industrial	Agricultural	Religion	Government	Education	Manufactured Homes
9,332,162	1,574,531	333,255	31,641	201,848	47,906	95,279	22%

Vulnerability Score

Table 9-32: Tornado Vulnerability Score.

	Tornado Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	3	2	2	4	3	1	**2.2**

9.2.11 Tropical Cyclone (Hurricane) Vulnerability

Estimated Impact and Potential Loss

There has been no reported property or crop damage associated with tropical cyclones within the boundaries of Sevier County and Sevierville.

Vulnerable Population

There have been no reported injuries or deaths associated with tropical cyclone within the boundaries of Sevier County and Sevierville.

Vulnerability Score

Table 9-33: Tropical Cyclone Vulnerability Score.

	Tropical Cyclone Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	1	1	4	1	2	1	**1.5**

9.2.12 Wildfires/Conflagration Vulnerability

Estimated Impact and Potential Loss

The entire Sevier County planning area is located near areas of wildland-urban interface and intermix or other susceptible land use/land cover types, which makes them vulnerable to wildfires. Southern areas of Sevier County are particularly vulnerable since they are located within the Great Smoky Mountain National Park. In November of 2016, a wildfire in Sevier County turned into the largest interface fire to affect the state of Tennessee in 100 years, resulting in $911 million in property and content loss.

Vulnerable Population

Sevier County and its jurisdiction residents near areas of wildland-urban interface and intermix and other wooded land cover types are vulnerable to the effects of wildfire. Fourteen fatalities and 221 people were treated for fire-related injuries in November 2016 when the largest interface fire to affect the state of Tennessee in 100 years occurred in Sevier County.

Vulnerability Score

Table 9-34: Wildfires/Conflagration Vulnerability Score.

	Wildfires/Conflagration Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	2	4	2	2	4	1	**2.4**

9.2.13 Winter Storm Vulnerability

Estimated Impact and Potential Loss

Since 1996, there have been 102 reported winter storm events which have occurred within the boundaries of Sevier County and Sevierville. The total property damages associated with these storms have totaled $13,000. To estimate the potential losses of a winter weather event on an annual basis, the total damage recorded for winter storm events was divided by the total number of years of available winter storm data (1996 - 2018). This provides an annual estimated potential loss of $565. To assess potential losses to the participating jurisdictions, the 2010 Census population was used to assign the estimated potential losses proportionally across the jurisdictions. The following table provides an estimate of potential property losses for Sevier County and its jurisdictions based on the 2010 Census data:

Table 9-35: Estimated Annual Losses for Winter Storm Events in Sevier County and its Jurisdictions.

Unincorporated Sevier County (72.0% of Population)	Gatlinburg (4.4 % of Population)	Pigeon Forge (6.5% of Population)	Pittman Center (0.6% of Population)	Sevierville (16.5% of Population)
$407	$25	$37	$3	$93

There have been no injuries or fatalities due to winter storm events in the Sevier County planning area.

Vulnerable Population

All of Sevier County and its jurisdiction residents are vulnerable to the effects of winter weather.

Vulnerability Score

Table 9-36: Winter Storm Vulnerability Score.

	Winter Storm Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	4	3	4	2	4	1.6	**3.0**

9.2.14 Dam Failure Vulnerability

Estimated Impact and Potential Loss

Sevier County and Sevierville are vulnerable to dam failures; however, the impact is largely unknown since there has yet to be a dam failure in the planning area.

Vulnerable Population

There have been no fatalities or injuries associated with dam failure in Sevier County and Sevierville; however, homes and businesses in immediate vicinity downstream of a dam location are vulnerable to the impacts of a dam failure.

Vulnerability Score

Table 9-37: Dam Failure Vulnerability Score.

	Dam Failure Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	1	3	2	4	4	2.9	**2.6**

9.2.15 Infrastructure Failure Vulnerability

Estimated Impact and Potential Loss

In general, Sevierville has not experienced any direct, prolonged catastrophic infrastructure failures. However, a significant failure of infrastructure could result in severe disruptions to public life and overall response efforts.

Vulnerable Population

There are no recorded fatalities or injuries associated with infrastructure failure in Sevierville.

Vulnerability Score

Table 9-38: Infrastructure Failure Vulnerability Score.

	Infrastructure Failure Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	1	3	2	4	3	2.85	**2.5**

9.2.16 Civil Disobedience/Terrorism Vulnerability

Estimated Impact and Potential Loss

The Sevier County planning area experienced one civil disobedience/terrorism event since 1996 (Tanger Outlet Shooting in April 2019) and this event did occur in Sevierville.

Vulnerable Population

There were two fatalities and one injury associated with civil disobedience/terrorism events.

Vulnerability Score

Table 9-39: Civil Disobedience/Terrorism Vulnerability Score.

	Civil Disobedience Terrorism Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Risk Factor
Risk Level	1	4	4	4	1	2.4	**2.8**

9.3 Capability Assessment

This section summarizes the results of the Sevier County Hazard Mitigation Planning Committee and other agency efforts to develop policies, programs, and activities that directly or indirectly support hazard mitigation. It also provides information on resources and gaps in the county's infrastructure, as well as relevant changes in its laws since the last Plan Update, in order to suggest a mitigation strategy. Through this assessment, Sevier County is able to identify strengths that could be used to reduce losses and reduce risk throughout the community. It also identifies areas where mitigation actions might be used to supplement current capabilities and create a more resilient community before, during, and after a hazard event.

Policies, Plans, and Programs

Sevier County and Sevierville capabilities are unique to the county as a whole, including planning, regulatory, administrative, technical, financial, education, and outreach resources. There are a number of mitigation-specific acts, plans, executive orders, and policies that address specific goals, objectives, and policy statements which already support or could support pre- and post-disaster hazard mitigation. Many of the ongoing plans and policies hold significant promise for hazard mitigation, and take an integrated and strategic look holistically at hazard mitigation in all jurisdictions to continually propose ways to improve it. These tools are valuable instruments in pre- and post-disaster mitigation as they facilitate the implementation of mitigation activities through the current legal and regulatory framework. Some examples of these types of planning and regulatory efforts for Sevier County and each jurisdiction are the following:

- Comprehensive/Master Plan
- Transportation Plan
- Local Emergency Operations Plan
- Community Wildfire Protection Plan
- Building Codes
- Flood Insurance Rate Maps
- Zoning Ordinance

Some programs and policies, such as the ones just described, might use complementary tools to achieve a common end, but fail to coordinate with or support each other. Thus, coordination among local mitigation policies and programs is essential to hazard mitigation.

Administration, Technical, and Financial

As a community, Sevier County and Sevierville have administrative and technical capabilities in place that may be utilized in reducing hazard impacts or implementing hazard mitigation activities. Such capabilities include staff, skillset, and tools available in the community that may be accessed to implement mitigation activities and to effectively coordinate resources. The following are resources in place for Sevier County and its incorporated jurisdictions:

- Maintenance programs to reduce risk (tree trimming, clearing drainage systems)
- Mutual Aid Agreements
- Emergency Manager
- Community Planner

- GIS Data
- Warning Systems/Services (Reverse 911, outdoor warning systems)
- Hazard Data & Information

Financial capabilities are the resources that Sevier County and its incorporated jurisdictions have access to or are eligible to use to fund mitigation actions. The following resources are available to fund mitigation actions in Sevier County and its incorporated jurisdictions:

- Capital Improvements Project Funding
- Authority to levy taxes for specific purposes
- Fees for water, sewer, gas, or electric services

Sevier County and its incorporated jurisdictions have existing programs to implement mitigation activities as well as communicate risk. The existing programs are as follows:

- Local citizen groups or non-profits focused on environmental protection, emergency preparedness, access and functional needs populations, etc.
- Ongoing public education or information programs (responsible water use, fire safety, household preparedness, wildfire preparedness)
- Storm Ready certification
- Firewise Communities certification

The following jurisdictions and entities are recognized by Sevier County under the Hazard Mitigation Plan allowing them to apply for available hazard mitigation funding for as long as these jurisdictions notify the county of their intentions and the county concurs:

- City of Gatlinburg
- City of Pigeon Forge
- Town of Pittman Center
- City of Sevierville
- Unincorporated Areas of Sevier County

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9.4 Summary

Table 9-40: Risk Assessment for the City of Sevierville.

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	Vulnerability	Overall Risk
Winter Storms	4	3	4	2	4	1.6	**3.0**
Floods Including Extreme Precipitation	4	3	3	3	2	2.2	**2.9**
Extreme Temperatures	4	3	4	1	3	1.6	**2.8**
Civil Disobedience/ Terrorism	1	4	4	4	1	2.4	**2.8**
Communicable Disease	4	2	3	4	2	1.7	**2.6**
Dam Failure	1	3	2	4	4	2.9	**2.6**
Thunderstorms (Hail)	4	2	4	3	1	1.5	**2.6**
Infrastructure	1	3	2	4	3	2.9	**2.5**
Thunderstorms (Wind)	4	2	4	3	1	1.0	**2.5**
Wildfires/ Conflagration	2	4	2	2	4	1.0	**2.4**
Drought	3	2	4	1	4	1.0	**2.3**
Mass Wasting	3	2	2	4	4	1.0	**2.3**
Tornadoes	3	2	2	4	3	1.0	**2.2**
Sinkholes	4	2	1	4	1	1.0	**2.1**
Severe Wind	2	2	2	4	1	1.0	**1.8**
Thunderstorms (Lightning)	2	1	2	3	1	1.9	**1.7**
Earthquakes	1	1	4	4	1	1.0	**1.7**
Tropical Cyclones	1	1	4	1	2	1.0	**1.5**

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10. Mitigation Strategies

10.1 Planning Process

A hazard mitigation strategy is the demonstration of Sevier County and its jurisdictions' long-term commitment to reducing risks from hazards. The strategy also serves as a guide for decision makers as they commit resources to reducing the effects of hazards. The mitigation goals and actions are the product of analysis and review by the planning team, stakeholders, steering committee, and county/jurisdiction personnel.

10.2 Strategies, Actions, and Goals

The goals represent the guidelines that Sevier County and its jurisdictions want to achieve through mitigation actions. By articulating strategies, actions, and goals based on the risk assessment results, and intending to address those results, this sets the stage for identifying, evaluating, and prioritizing feasible, cost effective, and environmentally sound actions to be promoted and undertaken by Sevier County and its jurisdictions.

For the purpose of this plan, goals and action items are defined as follows:

- **Goals** are general guidelines that explain what Sevier County wants to achieve. Goals are expressed as broad policy statements representing desired long-term results.
- **Action Items** are the specific steps (projects, policies, and programs) that advance a given goal. They are highly focused, specific, and measurable.

Goals

The following goals were determined by Sevier County and its jurisdictions to reflect the current and future desired state of mitigation as of the year 2020:

Goal 1: Protect the lives and health of citizens and visitors from the effects of hazards.

Goal 2: Emphasize mitigation planning to decrease vulnerability of existing and new structures.

Goal 3: Encourage public support and commitment to hazard mitigation by communicating mitigation benefits.

Goal 4: Facilitate sound building practices in the county and jurisdictions so as to reduce or eliminate the potential impact of hazards.

Goal 5: Improve the ability of the county and jurisdictions to rapidly recover and restore facilities and services to the public.

Mitigation Actions

The action plan includes how identified action items will be implemented and administered, implementation timeline, and sectors each mitigation action impacts. The seven sectors mitigation actions may impact are identified as the following:

1. Public
2. Responders
3. Continuity of operations including continued delivery of services
4. Property, facilities, and infrastructure
5. Environment
6. Economic condition of the jurisdiction
7. Public confidence in the jurisdiction's governance

Additionally, a cost-benefit review for each action was performed on a qualitative basis. The review considered each activity's benefit (Table 10-1) as a function of its ability to permanently eliminate or reduce risk (i.e., Very High, High, Medium, and Low). The prioritization table (Table 10-2) was used as a determination of the benefits that would be experienced as a result of implementing the action. The higher the action's priority, the more cost beneficial the action was determined to be for the county. The costs to implement each activity were also examined qualitatively using a similar method. The result produced a generalized approach for assessing relative benefits to cost.

Table 10-1: Mitigation Benefit Scale.

Ranking	Description
Very High	Projects or activities which **permanently eliminate** damages or deaths across Sevier County from any hazard.
High	Projects or activities which **reduce the probability** of damages, deaths, and injuries across Sevier County from any hazard.
Medium	Projects or activities which **warn** the public to the approach of a natural hazard threat across Sevier County and/or **improves** the county's response capabilities.
Low	Public outreach projects or activities meant to **educate** the public on the subject of hazard mitigation including studies and research on best practices for disaster preparedness, or improve data acquisition and compilation analysis.

Table 10-2: Cost-Benefit Scale for Mitigation Action Priority.

		Benefit			
		Low	**Medium**	**High**	**Very High**
Cost	**Very High**	Low	Low	Medium	Medium
	High	Low	Medium	High	High
	Medium	Medium	High	High	Very High
	Low	Medium	High	Very High	Very High

A timeframe for implementing each action was assigned based on priority and stakeholder recommendations. Categories for the timeframe are defined as the following:

- **Ongoing**: Currently implemented by Sevier County and its jurisdictions
- **Short-Term**: Less than 2 years
- **Medium-Term**: 2 to 4 years
- **Long-Term**: Greater than 4 years

Funding sources for these actions include federal programs such as the Hazard Mitigation Assistance (HMA) grant programs, which currently include the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance Program (FMA), and Pre-Disaster Mitigation (PDM) program. A new form of assistance, called the Building Resilient Infrastructure and Community (BRIC) program, will soon replace the PDM program and could be an excellent source of funding for a variety of projects listed in the following table. At the state level, some projects may be funded via 'capital project funding requests' which constitute state government funding allocations directly to a jurisdiction, or via Community Block Development Grants (CBDG). Additionally, local sources of funding may be provided via annual budget allocations, or Capital Improvement Budgeting.

Mitigation actions for Sevier County and each of its jurisdictions are below:

Action ID	Description	Priority	Time-frame	Hazards Addressed	Office/Agency Responsible	Mitigation Considerations
1	Educate new staff on local hazards, protection actions, and evacuation procedures during orientation	Medium	Ongoing & Short-Term	All-Hazards	All Depts (w/Sevier County EMA leading)	1
2	Educate citizens on local hazards, protective actions, and evacuation procedures	Medium	Ongoing & Short-Term	All-Hazards	Sevier County EMA, Law Enforcement, Fire Department, PIO	1
3	Enhance public outreach programs to improve community preparedness in county and jurisdiction response to hazards	Medium	Medium -Term	All-Hazards	Sevier County EMA, Law Enforcement, Fire Department, PIO	1,2,3,7
4	Post the public version of the hazard mitigation plan online	Medium	Short-Term	All-Hazards	Sevier County EMA, PIO	1,2,7

Action ID	Description	Priority	Time-frame	Hazards Addressed	Office/Agency Responsible	Mitigation Considerations
5	Continue to develop infrastructure database to improve GIS data applications, mapping, and Hazus Modeling efforts	High	Ongoing	All-Hazards	Sevier County GIS Group, Public Works, Planning, IT	1,2,3,4,5,6
6	Conduct exercises for hazard response capabilities in accordance with reference plans	Medium	Ongoing	All-Hazards	Sevier County EMA, Law Enforcement, Fire Department	1,2,7
7	Enhance and expand reach of voice/aural alert capabilities & emergency warning systems (i.e., siren system, message boards, AM broadcast system and road signs)	Medium	Ongoing & Long-Term	All-Hazards	Sevier County EMA, Law Enforcement, Fire Department, PIO	1,2,7
8	Expand/increase emergency communications capabilities (e.g., towers, repeaters, generators)	Medium	Ongoing & Long-Term	All-Hazards	Sevier County EMA, Law Enforcement, Fire Department, 911/EMG Comm. Dist.	1,2,3,4,5,7
9	Add generators for utilities and install components to connect to critical infrastructure	Medium	Long-Term	All-Hazards	Public Works, Utilities	1,2,3,4

Action ID	Description	Priority	Time-frame	Hazards Addressed	Office/Agency Responsible	Mitigation Considerations
10	Expand camera systems for improved situational awareness	Medium	Ongoing & Long-Term	All-Hazards	Sevier County EMA, Law Enforcement, Fire Department, Public Works, Planning, IT	2,3,4,7
11	Develop a navigation system and signage for event-specific evacuation routing	High	Ongoing	All-Hazards	Sevier County EMA, Law Enforcement, Fire Department, Public Works, GIS, Planning	1,2,3,7
12	Identify major event spaces and enhance multi-department/agency and multi-jurisdiction collaborative response agreements for human-caused hazards	High	Ongoing & Medium-Term	Civil Disobedience / Terrorism , Communicable Diseases, Infrastructure Failure	Sevier County EMA, Law Enforcement, Fire Department, Health Dept, Planning, GIS	1,2,3,4,6,7
13	Evaluate and/or implement possible bollard and other built environment (environmental design) alterations to reduce impact of incidents in high traffic (incl. pedestrian) areas	High	Ongoing & Long-Term	Civil Disobedience / Terrorism, Infrastructure Failure	Sevier County EMA, Law Enforcement, Fire Department, Public Works, Planning	1,2,4,5

Action ID	Description	Priority	Time-frame	Hazards Addressed	Office/Agency Responsible	Mitigation Considerations
14	Development of a local Fusion Center or Program/ Information Sharing System	Medium	Long-Term	Civil Disobedience / Terrorism, Infrastructure Failure	Sevier County EMA Sevier County EMA, Law Enforcement, Fire Department, GIS	2,3,6,7
15	Provide timely and accurate health alerts, advisories, and updates on public health issues	Very High	Ongoing	Communicable Diseases	Sevier County EMA & East Tennessee Regional Health Dept	1,2,7
16	Monitor local onset of flu seasons and prepare health services for vaccination	Very High	Ongoing	Communicable Diseases	Sevier County EMA & East Tennessee Regional Health Dept	1,2,3,7
17	Hydrology studies (updating previous studies and conducting new studies in new areas)	Medium	Ongoing & Long-Term	Dam Failure and Floods	Sevier County EMA, NWS-Morristown, Planning, GIS, TVA, Fire Dept	2,4,5
18	Addition of stream gauges and rain gauges; integrate real time flood modeling system; install static and electronic gauges	High	Ongoing & Long-Term	Dam Failure, Drought, and Floods	Sevier County EMA, NWS-Morristown, Planning, GIS, TVA, Fire Dept	1,2,3,4,5
19	Adopt county-specific policies requiring water-saving measures in time of drought	High	Long-Term	Drought	Sevier County EMA, Dept of Agriculture, Local Gov Jurisdictions	1,3,4,5,6

Action ID	Description	Priority	Time-frame	Hazards Addressed	Office/Agency Responsible	Mitigation Considerations
20	Conduct studies to reduce the effects of drought on critical operations	High	Long-Term	Drought	Ag Extension Office, TN Climate Office, Planning	1,2,7
21	Identify and/or construct safe rooms in buildings with insufficient shelter areas	Medium	Long-Term	Earthquake, Tornado, Tropical Cyclone, and Wildfire/ Conflagration	Sevier County EMA, School System Planning, LE, Fire Dept, Building Inspection	1,2,4,7
22	Develop and implement a plan for extreme heat and cold situations	Medium	Medium -Term	Extreme Temperatures	Sevier County EMA & TN Climate Office, Fire Dept, LE	1,2,7
23	Enhance insulation of exposed pipes and other features to prevent damage during cold temperatures	High	Long-Term	Extreme Temperatures and Winter Storms	Local Gov Jurisdictions, Planning, Building Inspection	3,4,6
24	Evaluate insulation standards for remodels and new construction	Medium	Short-Term	Extreme Temperatures and Winter Storms	Building Inspection, Planning, Codes Enforcement	3,4,5,6
25	Build brick barriers around or elevate critical utility infrastructure in flood-prone areas	High	Long-Term	Flood	Public Works, Local Gov Jurisdiction, Planning, Storm Water	3,4,6

Action ID	Description	Priority	Time-frame	Hazards Addressed	Office/Agency Responsible	Mitigation Considerations
26	Move River Divide Road	Medium	Ongoing & Long-Term	Flood	Storm Water, Planning, Public Works, Hwy Dept	1,2,3,4,5
27	Bank stabilization project at Baskin's Creek	High	Ongoing	Flood	Public Works, Hwy Dept, Planning	4,5
28	Residential buyout project	High	Ongoing	Flood	Planning, Local Gov Jurisdiction	1,4,5,6
29	Assist in improving properties with repetitive loss	High	Ongoing	Flood	Planning	1,4,5,6
30	Increase and improve drainage capacity in areas of existing and new construction (incl. increasing tile size where necessary)	High	Long-Term	Flood, Thunderstorm, and Tropical Cyclone	Public Works, Storm Water, Planning, Hwy Dept.	3,4,5,6
31	Maintain storm water systems (e.g., clean drainage areas/tiles, replace damaged tiles)	High	Ongoing & Long-Term	Flood, Thunderstorm, and Tropical Cyclone	Public Works, Storm Water, Hwy Dept, Planning	1,2,3,4,5,6,7
32	Implement flood risk management principles into planning, including emergency protocol changes for flash flood warnings	High	Long-Term	Flood, Thunderstorm, and Tropical Cyclone	Sevier County EMA, Law Enforcement, Fire Department, Planning	2,3,4,5,6

Action ID	Description	Priority	Time-frame	Hazards Addressed	Office/Agency Responsible	Mitigation Considerations
33	Implement access restriction strategies (e.g., place barriers and signs in area) for frequently flooded roadways	High	Short-Term	Flood, Thunderstorm, and Tropical Cyclone	Sevier County EMA, Law Enforcement, Fire Department, Public Works, Storm Water, Planning, Highway Dept	1,2,4,5
34	Site critical infrastructure (especially electrical) above/out of low-lying areas for new construction	Very High	Short-Term	Flood, Thunderstorm, and Tropical Cyclone	Building Inspection, Planning, Utilities	2,3,4,5,6
35	Harden electrical systems to include surge protection mechanisms	High	Long-Term	Flood, Thunderstorm, and Tropical Cyclone	Utilities	3,4,5,6
36	Harden underground electrical transmission infrastructure	High	Long-Term	Flood, Thunderstorm, and Tropical Cyclone	Utilities	3,4,5,6
37	Add surge protection mechanisms specific to fire alarms for all buildings	High	Ongoing & Short-Term	Flood, Thunderstorm, and Tropical Cyclone	Building Inspections, Planning, Codes Enforcement	3,4,5,6
38	Provide and maintain additional signage and road markings for pedestrians and vehicles at crosswalks, as allowed by municipal code	High	Medium-Term	Infrastructure Failure	Public Works, Hwy Dept.	1,2,7

Action ID	Description	Priority	Time-frame	Hazards Addressed	Office/Agency Responsible	Mitigation Considerations
39	Study the impact of mass/public transportation and other incidents in the county	High	Medium -Term	Infrastructure Failure	Public Works, Hwy Dept, Planning	1,2,3,4,5,6,7
40	Retrofit water supply systems	Medium	Medium & Long-Term	Infrastructure Failure and Wildfires/ Conflagration	Utilities, Public Works	1,2,3,4,5
41	Assess and implement erosion control measures	High	Medium -Term	Mass Wasting	Planning, Storm Water, Public Works, Hwy Dept	1,2,4,5
42	Assess and implement soil/ slope stabilization measures	Medium	Long-Term	Mass Wasting	Planning, Storm Water, Public Works, Hwy Dept	1,2,4,5
43	Identify and assess impacts of invasive plant species and how these species may increase risk for various hazards	High	Short-Term	Mass Wasting and Wildfires/ Conflagration	Fire Dept, Dept of Agriculture	4,5
44	Relocate some utilities underground	Medium	Long-Term	Severe Wind, Thunderstorms, Tornadoes, Tropical Cyclones, and Winter Storms	Public Works, Utilities	1,2,3,4,5
45	Perform a detailed building assessment for retrofitting buildings to withstand hazard incidents	Medium	Ongoing & Long-Term	Severe Wind, Thunderstorm, Tornado, Tropical Cyclone, and Winter Storms	Fire, Codes Enforcement, Planning, Building Inspection	3,4,5,6

Action ID	Description	Priority	Time-frame	Hazards Addressed	Office/Agency Responsible	Mitigation Considerations
46	Map, analyze, and assess known sinkhole locations and impacts on infrastructure	High	Long-Term	Sinkholes	GIS Group, Public Works, Storm Water, Planning	3,4,5
47	Utilize risk assessment information to inform future policies and codes regarding construction in sinkhole-prone areas	High	Medium-Term	Sinkholes	Sevier County EMA, Planning, GIS	4,5,6
48	Evaluate and provide lightning protection for all buildings	High	Long-Term	Thunderstorm and Tropical Cyclone	Codes Enforcement, Building Inspection, Local Gov Jurisdictions	3,4,5,6
49	Expand lightning detection sensors or systems	High	Medium-Term	Thunderstorm and Tropical Cyclone	Sevier County EMA, Fire Dept, Local Gov Jurisdictions	1,2,4,5
50	Identify wildland fire safe zones and increase fire rating signage	Very High	Short-Term	Wildfires/ Conflagration	Sevier County EMA, Planning, Fire Dept, Dept of Agriculture, GIS, LE	1,2,3,4,5,7

Action ID	Description	Priority	Time-frame	Hazards Addressed	Office/Agency Responsible	Mitigation Considerations
51	Increase water supply and structure-specific hydration systems (install sprinklers, provide dedicated power sources and cisterns, increase pump capacity, construct dry hydrants)	Medium	Medium & Long-Term	Wildfires/ Conflagration	Fire Dept, Codes Enforcement, Planning, Utilities, Local Gov Jurisdiction, Public Works	1,2,3,4,5,7
52	Develop a comprehensive plan to ensure wildfire mitigation (incl. protection of external fuel sources) and removal of fire fuels both on & off private property	High	Medium -Term	Wildfires/ Conflagration	Sevier County EMA, Fire Dept., Planning	1,2,3,4,5,7
53	Develop and maintain a database to track community vulnerability to wildfire	Very High	Medium -Term	Wildfires/ Conflagration	Sevier County EMA & GIS Group, Fire Dept., Planning	1,2,4,5,7
54	Implement fuels management program	High	Medium & Long-Term	Wildfires/ Conflagration	Sevier County EMA, Fire Dept, Dept. of Agriculture, Public Works	3,4,5

Action ID	Description	Priority	Time-frame	Hazards Addressed	Office/Agency Responsible	Mitigation Considerations
55	Maintain and update fire detection and suppression systems in all buildings at and above code	High	Ongoing & Medium -Term	Wildfires/ Conflagration	Codes Enforcement, Building Inspection	1,2,3,4,7
56	Train personnel to effectively react to wildfires	High	Ongoing	Wildfires/ Conflagration	Sevier County EMA, Fire Dept	1,2,7
57	Develop process for holistic assessment of spaces with high hazards (incl. safety protocols and land-use) for risk-informed sitings	High	Medium -Term	Wildfires/ Conflagration	Sevier County EMA, Fire Dept., GIS	1,2,7
58	Maintain and improve snow and ice mitigation measures to clear roads	High	Ongoing	Winter Storms	Public Works, Hwy Dept.	1,2,7
59	Obtain cat-track conversion systems for ATV's to improve search and rescue efforts	High	Medium -Term	Winter Storms	Sevier County EMA, Fire Dept, LE	1,2,7

10.3 Progress in Local Mitigation Efforts and Changes in Priorities

A total of four (4) mitigation strategies from the 2011 Sevier County Hazard Mitigation Plan were carried forward in this hazard mitigation plan update. These include the following:

- "Move River Divide Road" – currently Mitigation Strategy #26 (note: gates have been added to close the road during flooding events)
- "Bank stabilization at Baskin's Creek" – currently Mitigation Strategy #27

- "Residential buyout project" – currently Mitigation Strategy #28
- "Assist in improving properties with repetitive loss" – currently Mitigation Strategy #29

A total of six (6) mitigation strategies from the 2011 Sevier County Hazard Mitigation Plan were carried forward and amended in this hazard mitigation plan update. These include the following:

- "Expand early flood warning equipment and detection" – now reflected in Mitigation Strategy #18
- "All hazards warning system" – now reflected in Mitigation Strategies #7 and #8
- "Establish an evacuation route" – now reflected in Mitigation Strategy #11
- "Public storm room/safe room" & "Public storm room/safe room (Schools)" – now reflected in Mitigation Strategy #21
- "Improve/elevate portions of city streets subject to flooding" – now reflected in Mitigation Strategies #30 and #31

For mitigation strategies carried forward and amended from the 2011 Sevier County Hazard Mitigation Plan, the Cost-Benefit Scale for Mitigation Action Priority represents a change or update in prioritization method. The "Priority" column in the Mitigation Strategies list indicates these changes.

The following mitigation strategies from the 2011 Sevier County Hazard Mitigation Plan have either been completed or are no longer deemed necessary:

- Snyder Road bridge was replaced, well above the identified level that was needed to prevent flooding
- Two bridges on Old Birds Creek Road did not warrant elevation based on a lack on known flooding issues by the Highway Department.

11. Plan Maintenance

11.1 Purpose

The section of the Code of Federal Regulations (CFR) pertaining to Local Mitigation Plans lists five required components for each plan: a description of the planning process; Risk Assessments; mitigation strategies; a method and system for plan maintenance; and documentation of plan adoption. This section details the method and system for plan maintenance, following the CFR's guidelines that the Plan Update must include (1) "a section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle," (2) "a process by which local governments incorporated the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans" and (3) "discussion on how the community will continue public participation in the plan maintenance process."

11.2 Monitoring, Evaluation, and Updated Plan

By law, the Hazard Mitigation Plan must be updated every five years prior to re-submittal to the Federal Emergency Management Agency (FEMA) for re-approval. The first part of this subsection describes the complete update process, including the following:

- Responsible parties
- Methods to be used
- Evaluation criteria to be applied
- Scheduling for monitoring and evaluating the plan

These descriptions are followed by an explanation of how and when the plan will be periodically updated.

11.3 Responsible Parties

Sevier County has developed a plan maintenance process to ensure that regular review and update of the Hazard Mitigation Plan occurs. The county has formed a Hazard Mitigation Plan Evaluation Committee that consists of selected members from jurisdictions, local agencies, and the Hazard Mitigation Plan Update (HMPU) Committee. The HMPU Evaluation Committee will consist of the following representation:

1. Sevier County Emergency Management Agency Director (responsible for overall coordination of HMP maintenance activities)
2. Mayors and/or Town Administrators of each of the jurisdictions or their representative

The Sevier County Emergency Management Agency Director will be responsible for contacting each of the committee members during January of every year. Members will have a one-month period in which to respond to initiate a meeting if any one member feels that issues must be addressed. However, should a hazard event occur and the need for updates and/or analysis surfaces, a meeting can be called by the Sevier County Emergency Management Agency Director or requested by a committee member.

The Sevier County Emergency Management Agency Director will also be responsible for maintaining plan review comments. Members of the evaluation committee will monitor the plan on an ongoing basis using phone calls and emails to contact those responsible for implementing the plan's action items and bring

the project status reports to the yearly evaluation meetings. Ideas to be discussed will include, but are not limited to, the following:

- Does the committee membership need to be updated?
- Have any new hazard events occurred?
- Has new funding been allotted?
- Have any projects been implemented?
- Have the project priorities changed?
- Are there any new projects to discuss?

11.4 Methods for Monitoring and Evaluating the Plan

On an annual basis (and as warranted by circumstances such as a major disaster declaration), the Sevier County Emergency Management Agency Director will monitor the plan to assess the degree to which assumptions and underlying information contained in the plan may have changed. For example, the Sevier County Emergency Management Agency Director will look for the following:

- Changes in the information available to perform vulnerability assessments and loss estimates. For example: as the county and jurisdictional Risk Assessments and plans are integrated into this Plan Update, the Sevier County Emergency Management Agency Director will be soliciting feedback from county and jurisdiction officials about any changes in their real or perceived risks.
- Changes in laws, policies, and regulations. Changes in county or jurisdictional departments and/or their procedures, including the Sevier County Emergency Management Agency and the administration of grant programs.

The results of these monitoring efforts will be made available to the Sevier County Hazard Mitigation Evaluation Committee as they are produced. Using the compiled results of ongoing monitoring efforts, the plan will be evaluated annually, generally starting in the month of January (unless circumstances indicate otherwise). The Sevier County Emergency Management Agency Director will initiate the evaluations by contacting each of the committee members, who will in turn have a one-month period to respond by initiating a meeting or addressing an issue. Should a hazard event occur and the need for update surface, a meeting may be called by the Sevier County Emergency Management Agency Director or requested by a committee member through the Sevier County Emergency Management Agency Director.

The initial contacts will be made no later than December of each year for the first four years and in August in the fifth year (in anticipation of the required Plan Update for FEMA re-approval). The initial contact will advise the appropriate agencies/organizations that the plan will be re-evaluated in the coming months, and request their participation in the process.

The Sevier County Emergency Management Agency also has the authority to evaluate and update the plan at times other than those identified in this section under the following general conditions:

- After a major disaster declaration;
- At the request of the Tennessee Emergency Management Agency; or
- When significant new information regarding risks or vulnerabilities is identified.

11.5 Plan Evaluation Criteria

The evaluations will consider several basic factors which are similar to those addressed in the monitoring process, and any additional review indicated by the Tennessee Emergency Management Agency or the Sevier County Hazard Mitigation Evaluation Committee. The factors that will be taken into consideration during these periodic evaluations of the plan include the following:

1. Changes in vulnerability assessments and loss estimations. Evaluation will include an examination of the analyses conducted for hazards identified in the plan and determine if there have been changes in the level of risk to the state and its citizens to the extent that the plan (in particular the strategies and prioritized actions the county/jurisdiction is considering) should be modified.
2. Changes in laws, policies, ordinances, or regulations. The evaluation will include an assessment of the impact of changes in relevant laws, policies, ordinances, and regulations pertaining to elements of the plan.
3. Changes in county/jurisdiction departments or their procedures (in particular the Sevier County Emergency Management Agency, which is responsible for maintaining the plan) that will affect how mitigation programs or funds are administered.
4. Significant changes in funding sources or capabilities.
5. Progress on mitigation actions (including project closeouts) or new mitigation actions that the county/jurisdiction is considering.

11.6 Updating the Plan

Updates will follow the original planning process outlined in Section 2. The update process will entail a detailed and structured re-examination of all aspects of the original plan, followed by recommended updates. The update process will be initiated by the Sevier County Emergency Management Agency and assisted and tracked by the Sevier County Hazard Mitigation Evaluation Committee. The recommendations will be presented to the Sevier County Hazard Mitigation Evaluation Committee for consideration and approval. It is expected that the county and each jurisdiction's administration will issue a letter of adoption for each update of the plan. At a minimum, the plan will be updated and re-submitted to FEMA for re-approval every five years, as required by the Disaster Mitigation Act of 2000. The five-year update for FEMA re-approval requires that all original steps outlined in Section 2 be revisited to make sure the plan assumptions and results remain valid as a basis for further decision-making and priority-setting. The Sevier County Emergency Management Agency will initiate, coordinate, and lead all plan updates. The following paragraphs describe the procedures for interim and five-year updates, respectively.

The nature of plan amendment will be determined by the evaluation process described above. In general, the Sevier County Emergency Management Agency will notify the Sevier County Hazard Mitigation Evaluation Committee that the county is initiating an interim amendment, and describe the circumstances that created the need for the amendment (per the list in the Plan Evaluation Criteria section above). The Sevier County Emergency Management Agency Director will determine if the Sevier County Hazard Mitigation Evaluation Committee should be consulted regarding potential changes. If it is determined that the Sevier County Hazard Mitigation Evaluation Committee should be involved, the nature of the involvement will be at the discretion of the Sevier County Emergency Management Agency Director. When amendments are completed absent the involvement of the Sevier County Hazard Mitigation Evaluation Committee, the Sevier County Emergency Management Agency Director will advise all

committee members via email that the plan has been amended, and describe the nature of the amendment. In addition, the Sevier County Emergency Management Agency Director will provide TEMA with a copy. As required by the Disaster Mitigation Act of 2000, the plan will be updated every five years and re-submitted to FEMA for re-approval. In those years, the evaluation process will be more rigorous, and will examine all aspects of the plan in detail. It is anticipated that several meetings of the Sevier County Hazard Mitigation Evaluation Committee will be required and that the county and each jurisdiction will formally re-approve the plan prior to its submission to FEMA. Based on the five-year renewal requirements for Plan Updates, the Sevier County Emergency Management Agency Director anticipates that the submission date for the required update will be in 2025. Prior to that time, the Sevier County Emergency Management Director will contact the committee members and other appropriate agencies/organizations to confirm a schedule for the Plan Update.

11.6 2020 Plan Version Method and Schedule Evaluation

For the current plan update, the previously approved plan's method and schedule were evaluated to determine if the elements and processes were involved in the 2020 update. Based on this analysis, the method and schedule were deemed to be acceptable, and nothing was changed for this update.

11.7 Incorporation into Existing Planning Programs

When appropriate, local governments, by way of the individuals who served on the Sevier County Hazard Mitigation Evaluation Committee, will address the need to incorporate requirements of the mitigation plan into their respective zoning ordinances, comprehensive plans, and/or capital improvement plans if deemed necessary and if not previously included. An effort will be made by all Hazard Mitigation Evaluation Committee members to ensure consistency in all future planning efforts with the mitigation goals and risk assessments presented in this plan. Consistency between all planning efforts will ensure a decrease in losses related to hazard events within future and existing developments. During the life of the plan since the previous update process, the Hazard Mitigation Evaluation Committee was not incorporated into other formal planning mechanisms as none occurred during that time period. However, goals and action items were frequently discussed at both county and jurisdictional council meetings. If amendments to existing ordinances or new ordinances are required, each political jurisdiction will be responsible for its respective updates. However, based upon the findings of this plan, little need exists for creating new ordinances or revising existing ordinances.

On behalf of the jurisdictions of the City of Gatlinburg, City of Pigeon Forge, Town of Pittman Center, and the City of Sevierville, Sevier County has the authority to incorporate contents of the Hazard Mitigation Plan into the county's existing regulatory mechanisms.

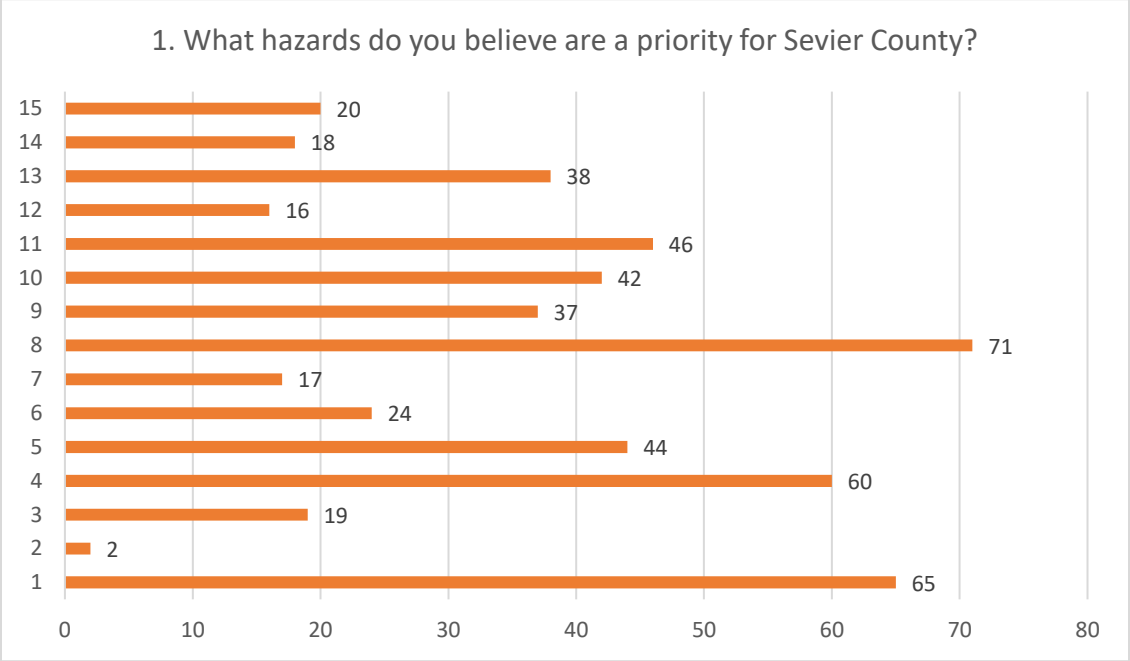
11.8 Continued Public Participation

Responsibility for continued public participation will be that of the Sevier County Emergency Management Director. Copies of the plan will be kept on file at the Sevier County Emergency Management Agency Office and with each jurisdiction. Contained in the plan is a list of the Planning Team members, which are assumed to be part of the Hazard Mitigation Evaluation Committee and can be contacted when needed. In addition, copies of the plan and any proposed changes will be posted on the county government website. This website will also have an email address and phone number where the public can direct their comments or concerns.

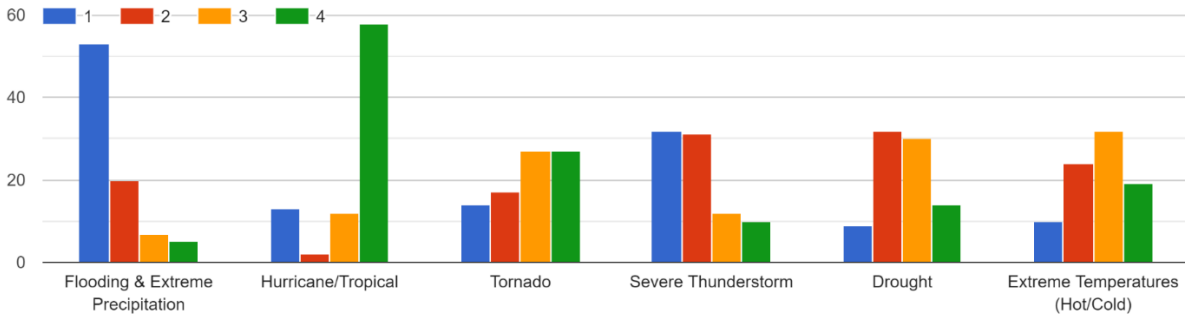
Appendix A: List of Abbreviations

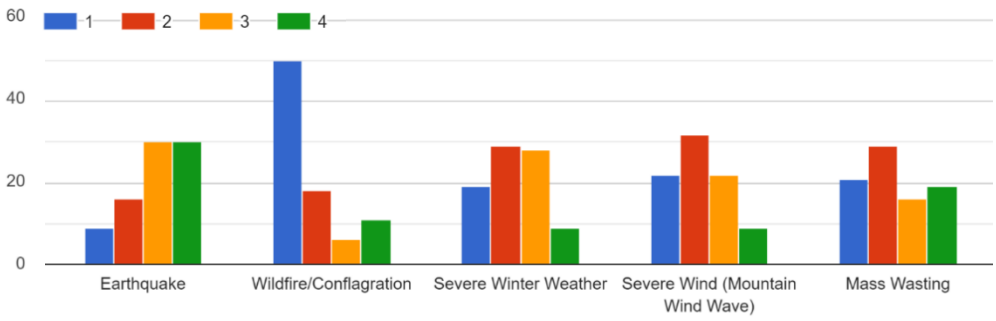
44 CFR	44 Code of Federal Regulations
CDC	Center for Disease Control and Prevention
DMA 2000	Disaster Mitigation Act of 2000
DFIRM	Digital Flood Insurance Rate Map
EOP	Emergency Operation Plan
FEMA	Federal Emergency Management Agency
GIS	Geographic Information Systems
Hazus-MH	U.S. Multi Hazard Loss Estimation Software
HMGP	Hazard Mitigation Grant Program
TEMA	Tennessee Emergency Management Agency
NCEI	National Centers for Environmental Information
NOAA	National Oceanic and Atmospheric Administration
NFIP	National Flood Insurance Program
NWS	National Weather Service

Appendix B: Results of Public Survey

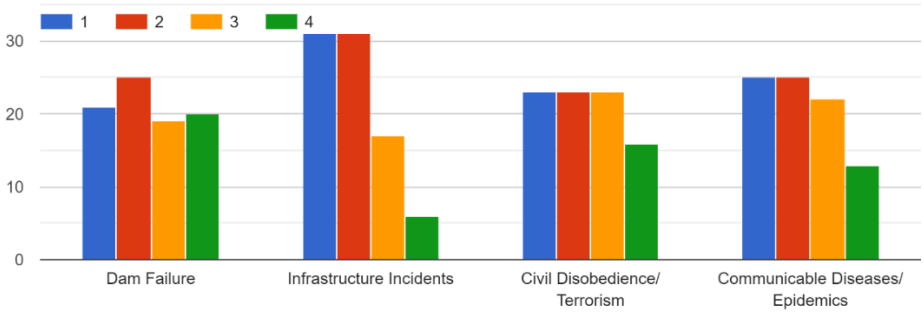


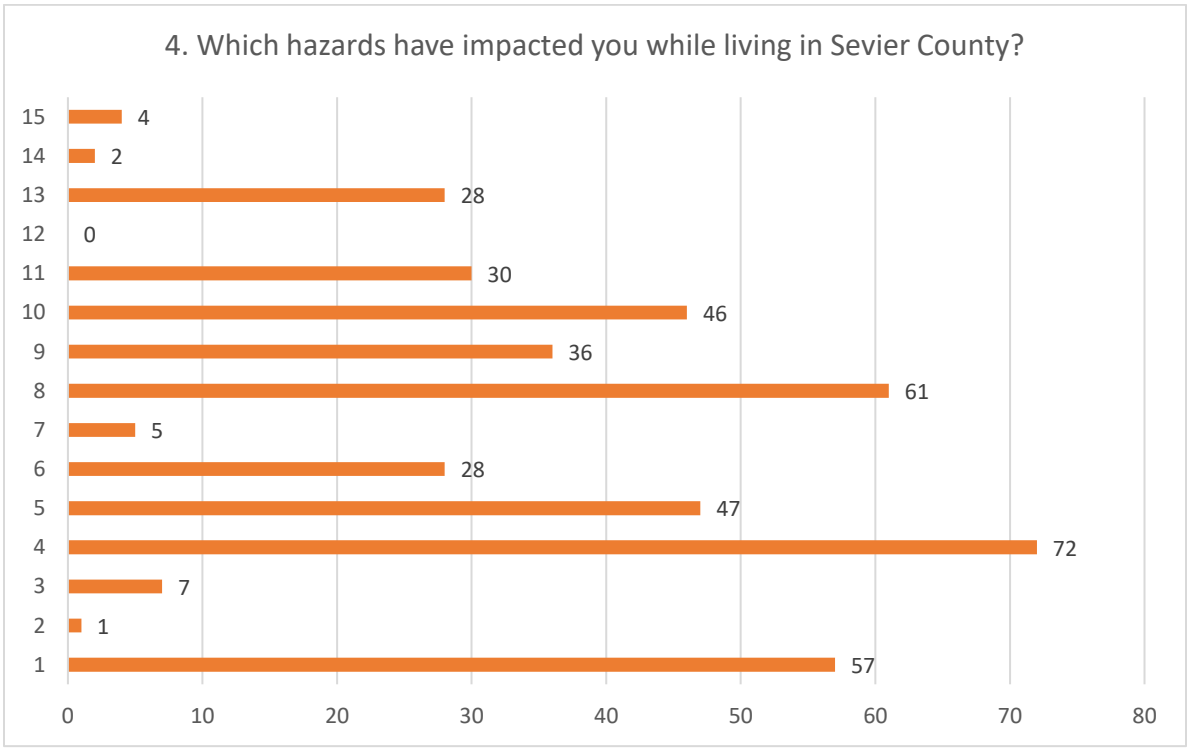
2. Please rank the following natural hazards in order of importance with the rank of 1 being the most important and 4 as the least important.





3. Please rank the following man-made hazards in order of importance with the rank of 1 being the most important and 4 as the least important.

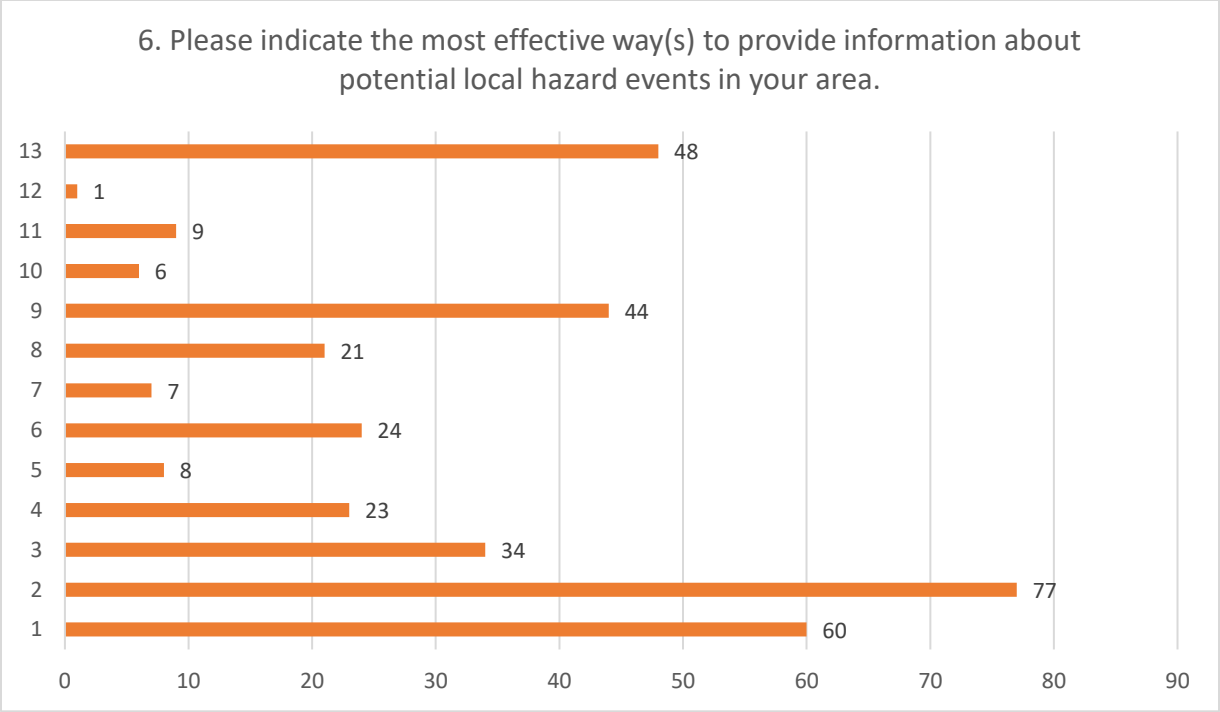


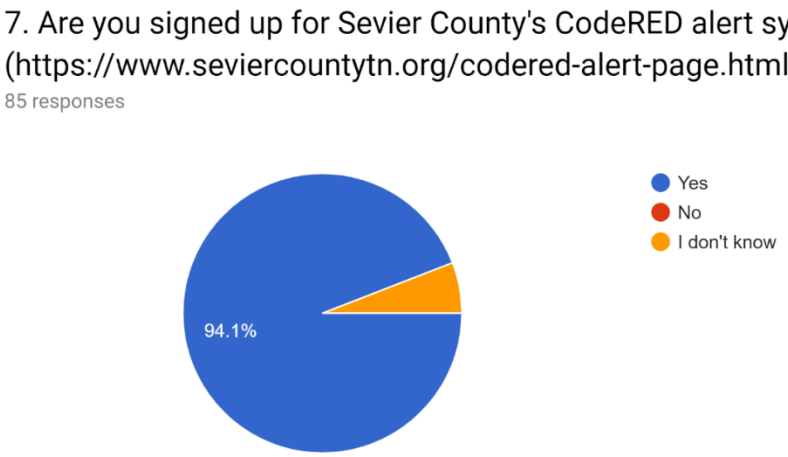


5. Would you like to describe hazardous events in Sevier County that impacted you (including dates of rece...r other media to gads.etsu@gmail.com

85 responses

Many responses – e.g., wildfire impacts, recent flooding (including locations and some pictures), winter weather events, severe storms, high wind, rockslides, traffic/trees falling on the Spur





Many very helpful comments at the end of the survey were also provided, e.g., query about development of robust communications plan, preference for text/phone over social media alerts, more information about tire storage facility (Wears Valley), use of local knowledge, etc.

Appendix C: Critical Infrastructure

Critical infrastructure located within the boundaries of Sevier County and its jurisdictions were identified and categorized according the community lifelines above. Below are locations of the critical infrastructure located within the boundaries of Sevier County and its jurisdictions.

Sevier County Critical Infrastructure

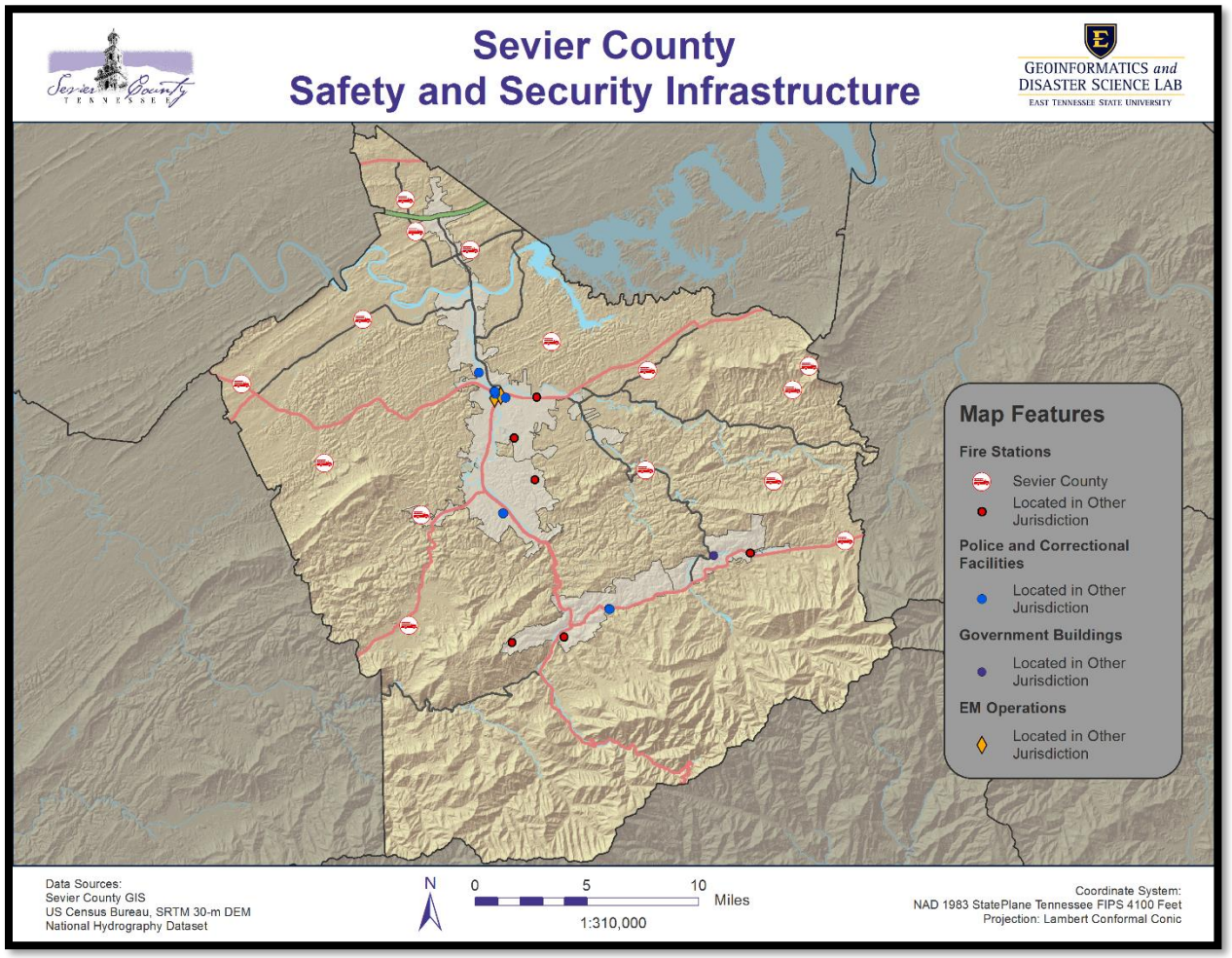


Figure C-0-1: Safety and Security Critical Infrastructure Located in Sevier County.

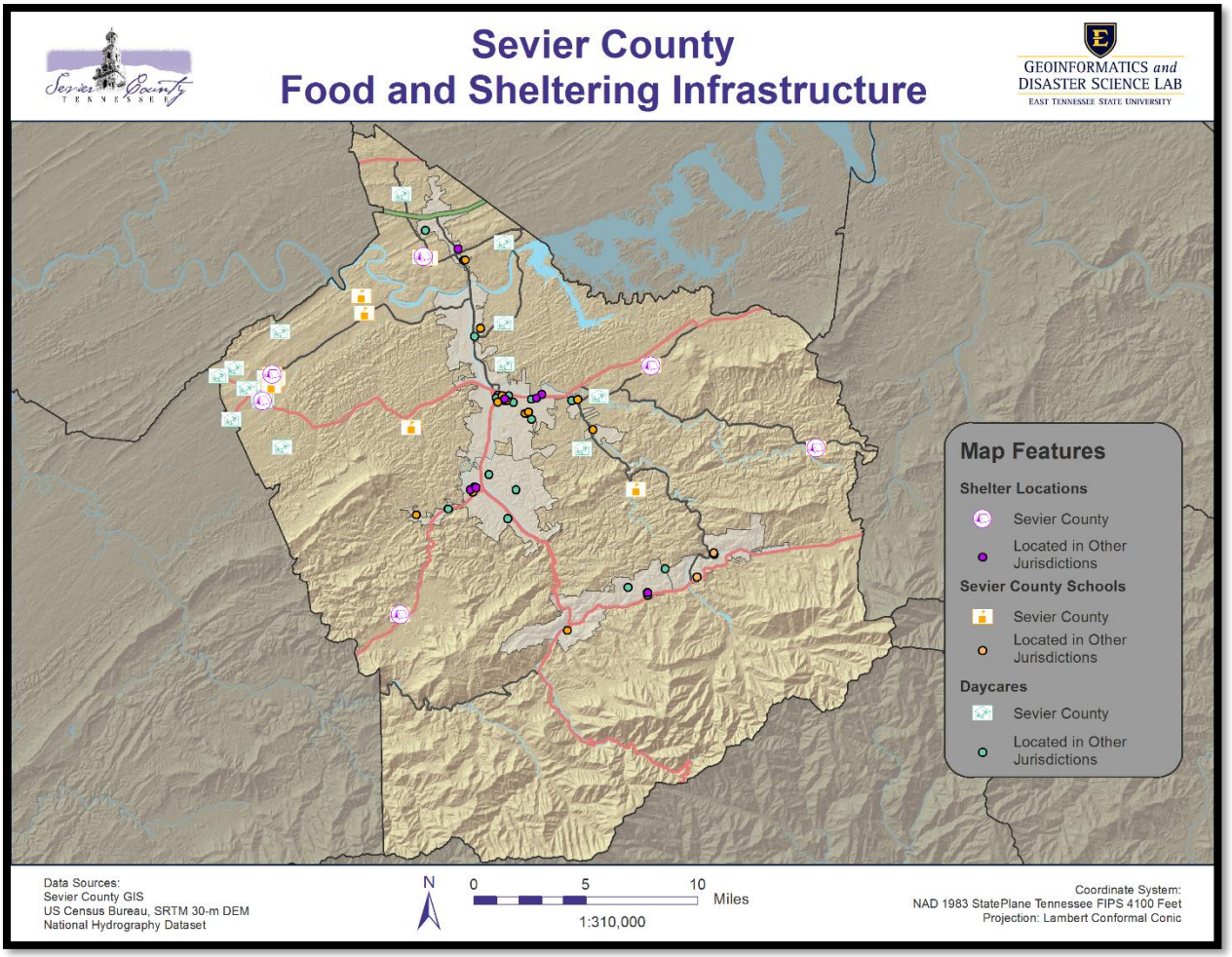


Figure C-0-2: Food and Sheltering Critical Infrastructure Located in Sevier County.

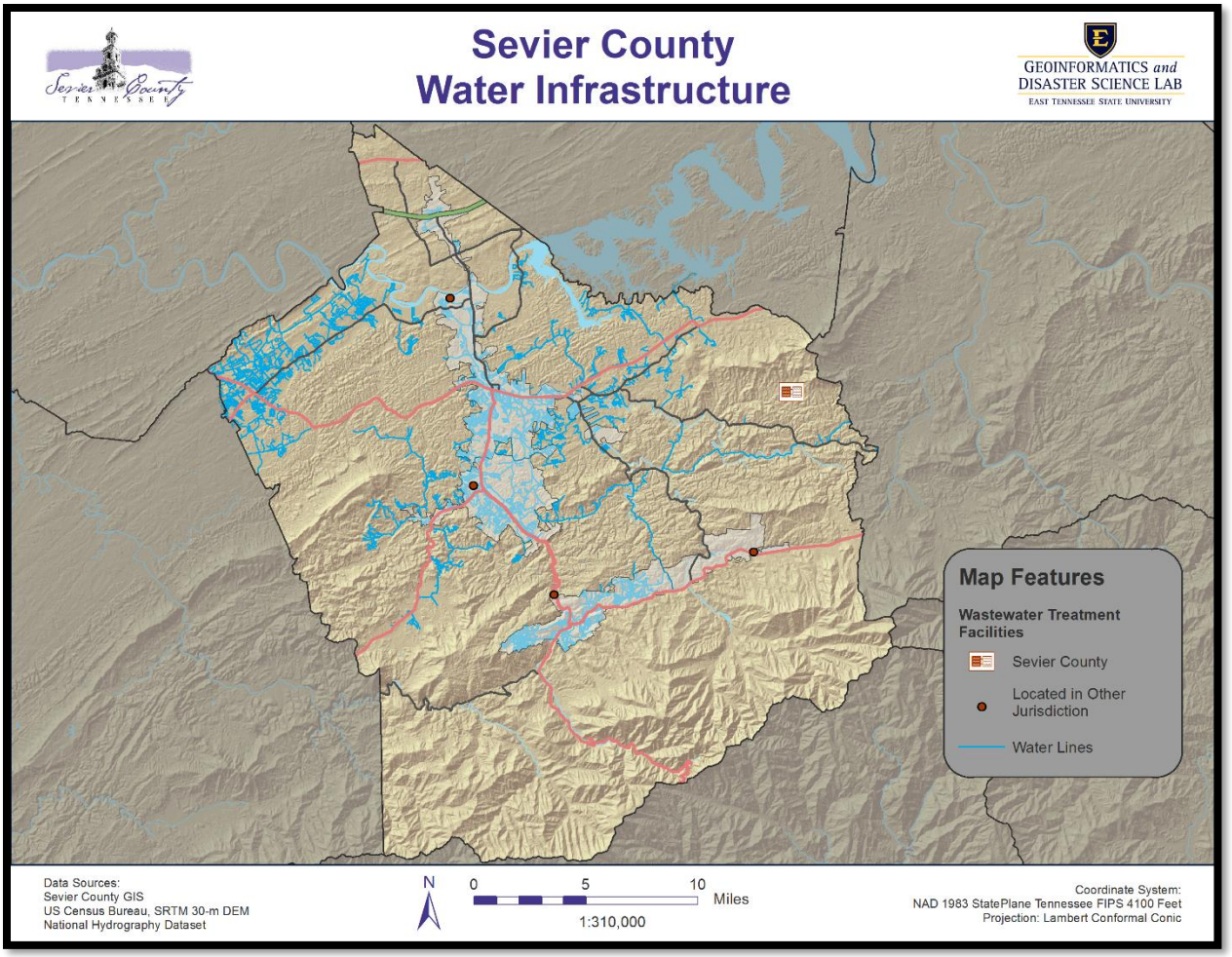


Figure C-0-3: Water Critical Infrastructure Located in Sevier County.

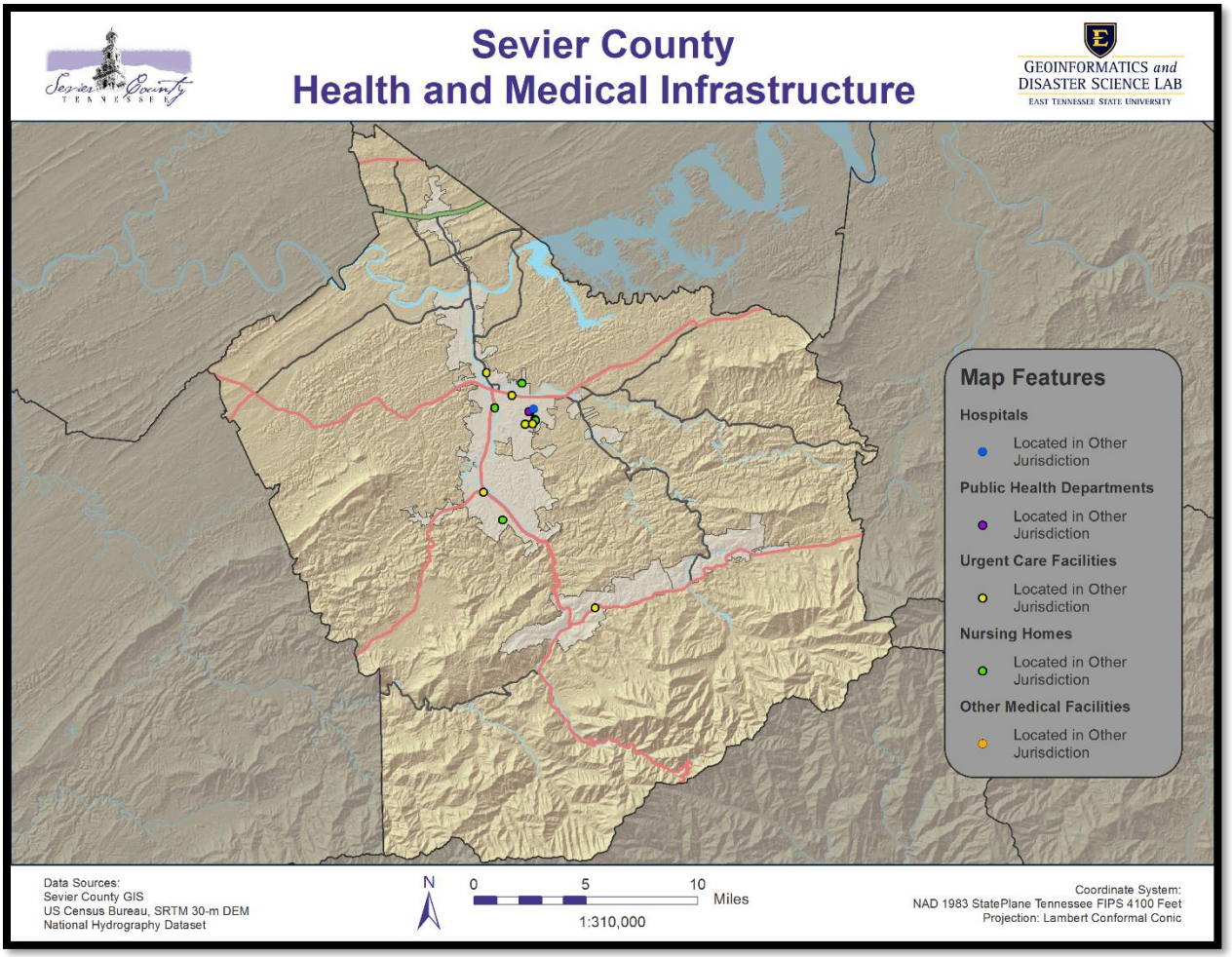


Figure C-0-4: Health and Medical Critical Infrastructure Located in Sevier County.

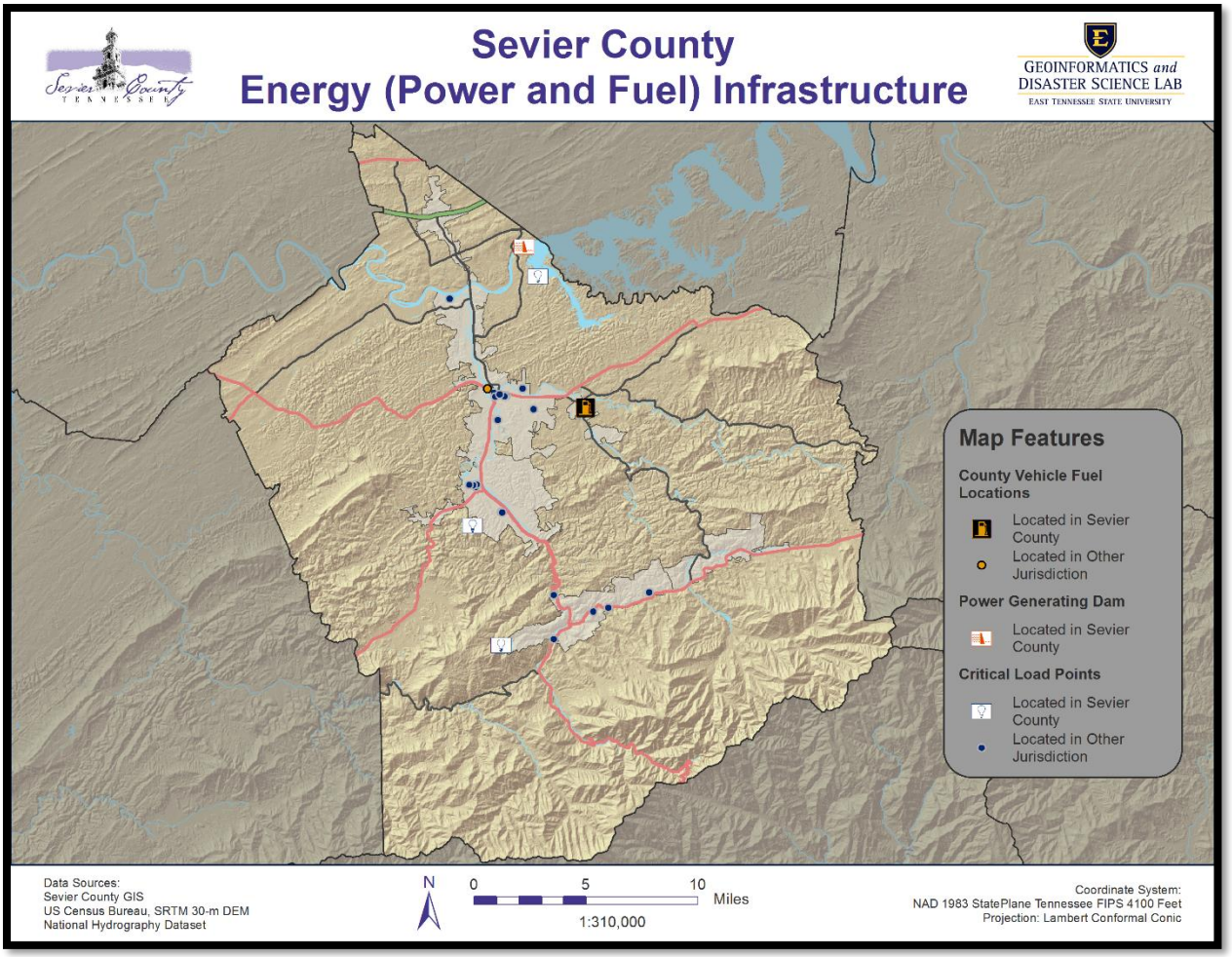


Figure C-0-5: Energy Critical Infrastructure Located in Sevier County.

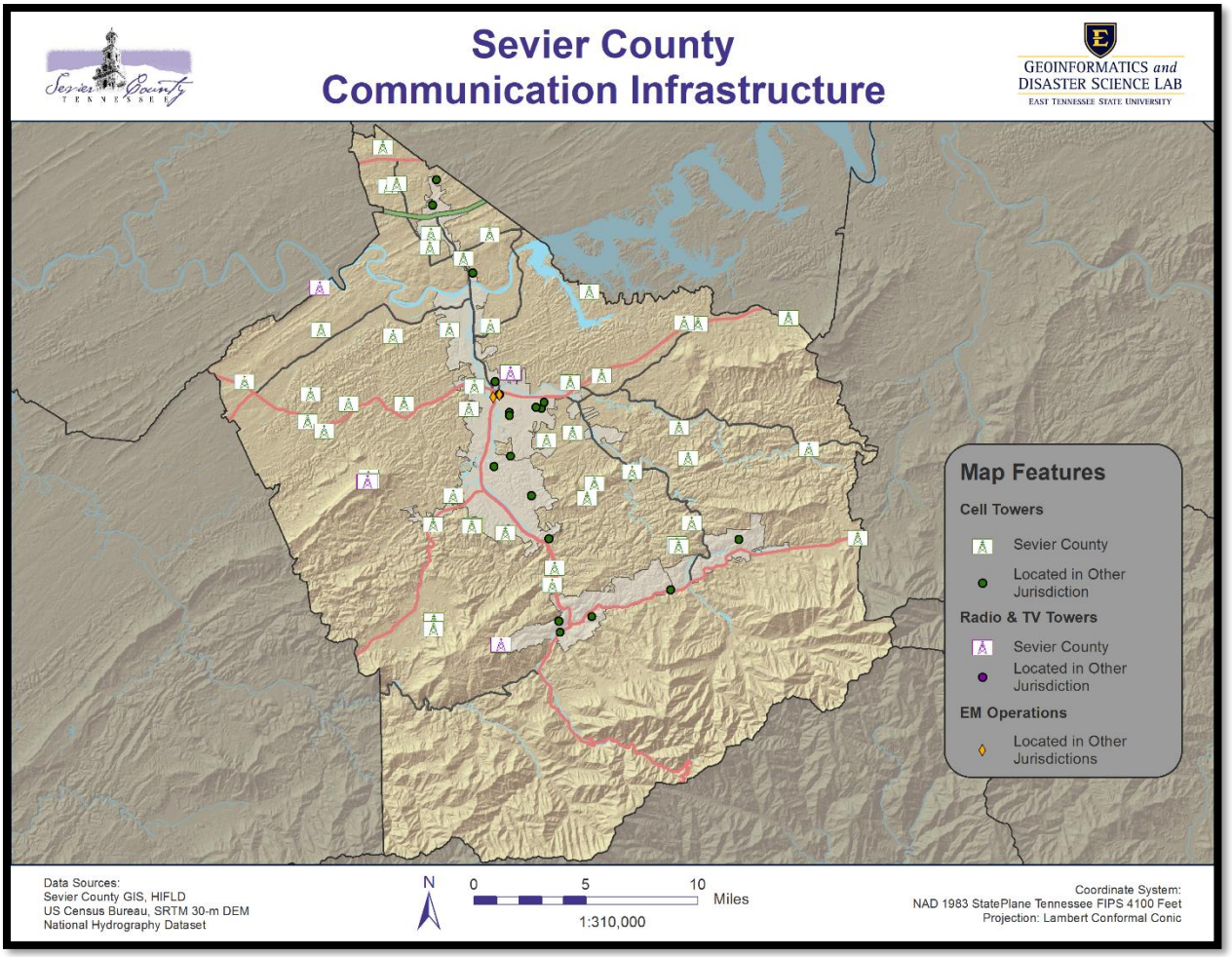


Figure C-0-6: Communications Critical Infrastructure Located in Sevier County.

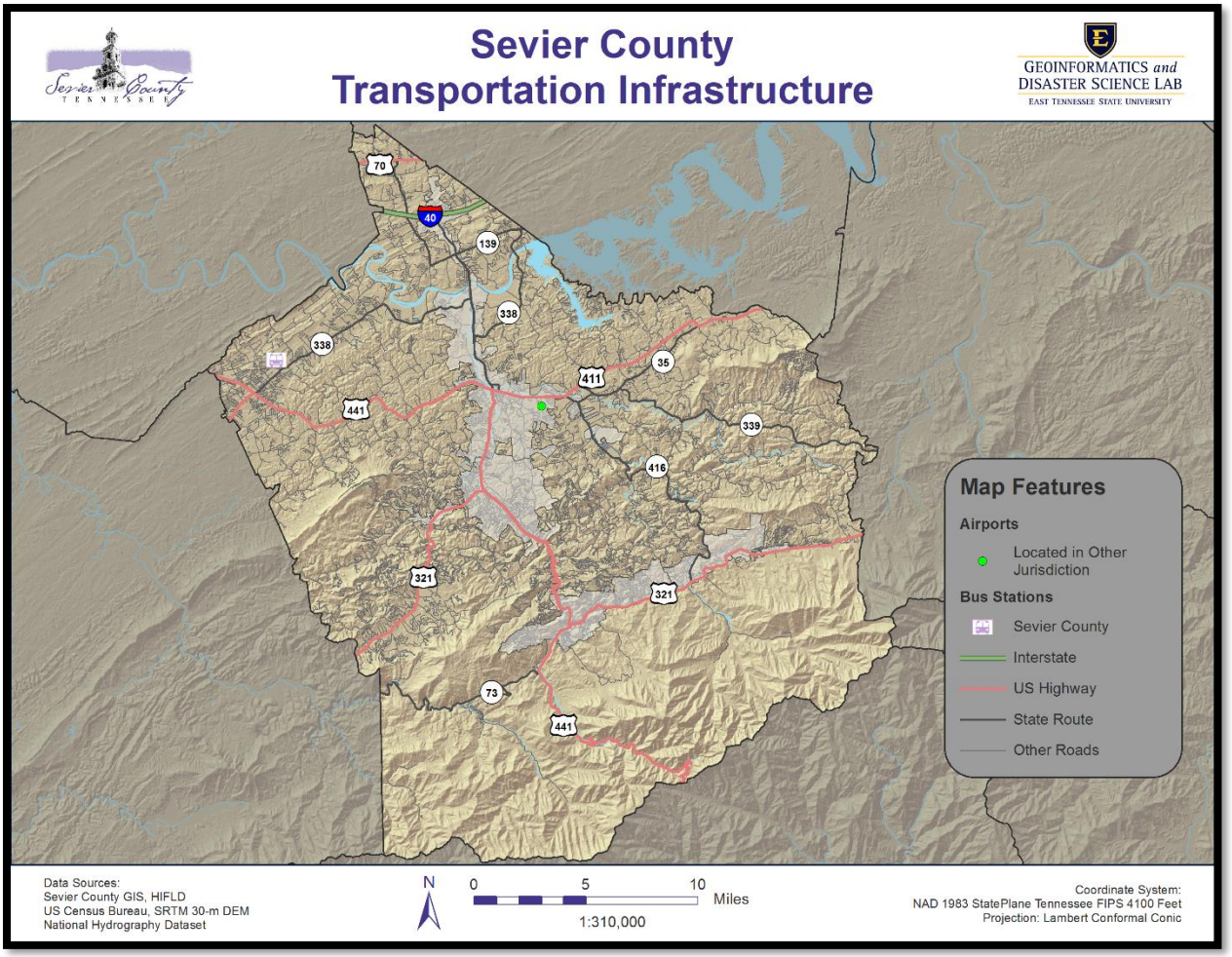


Figure C-0-7: Transportation Critical Infrastructure Located in Sevier County.

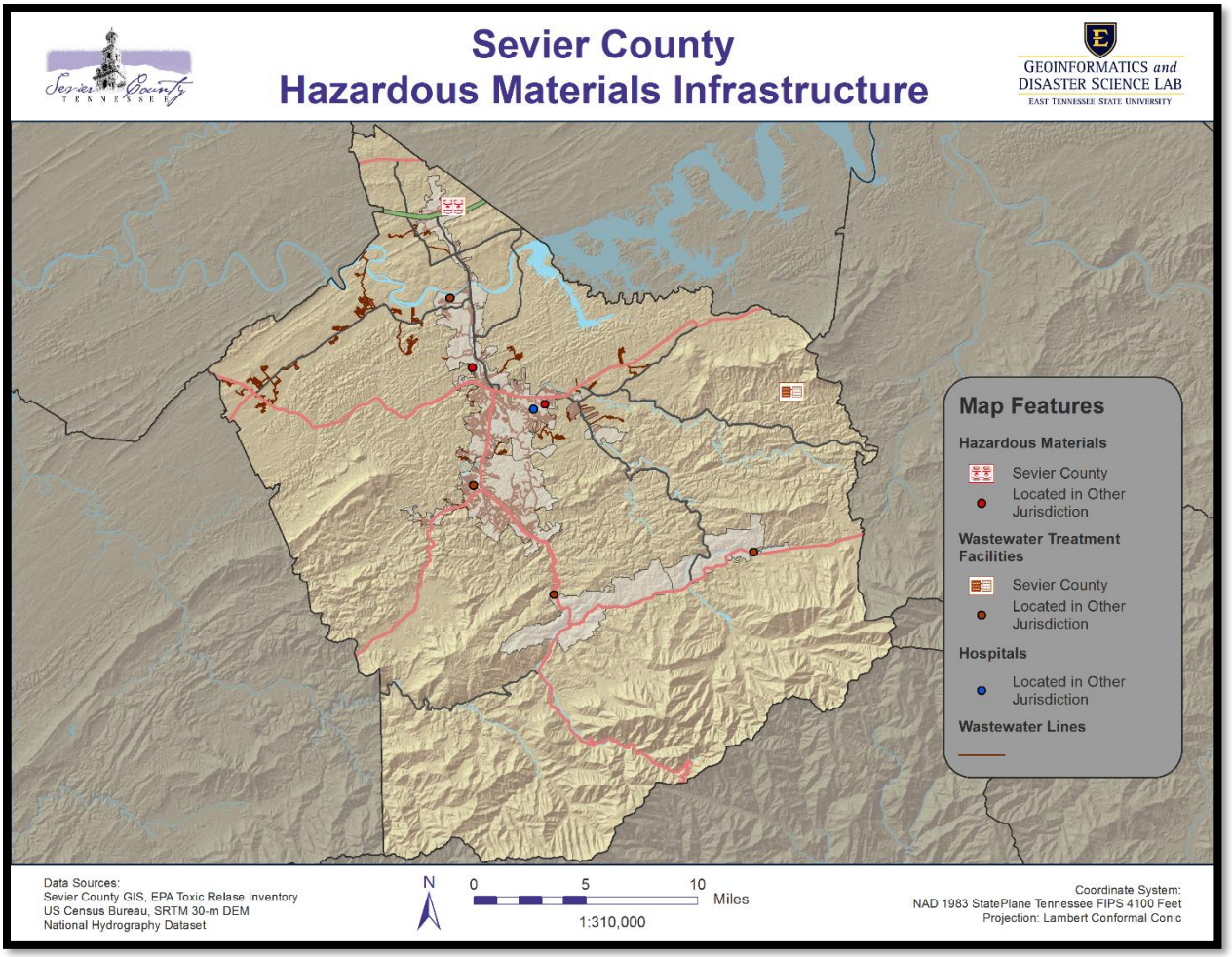


Figure C-0-8: Hazardous Material Critical Infrastructure Located in Sevier County.

Gatlinburg Critical Infrastructure

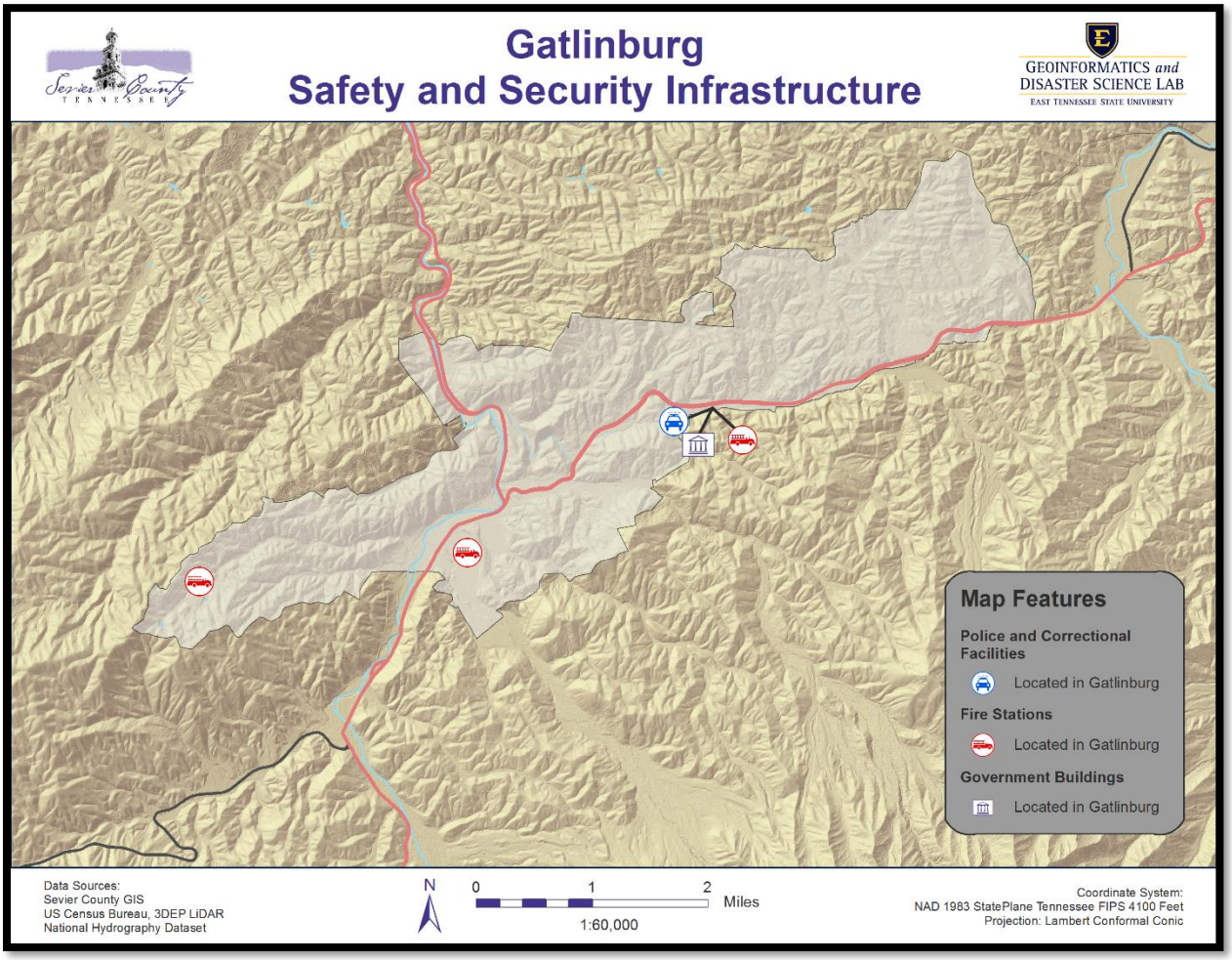


Figure C-0-9: Safety and Security Critical Infrastructure Located in Gatlinburg.

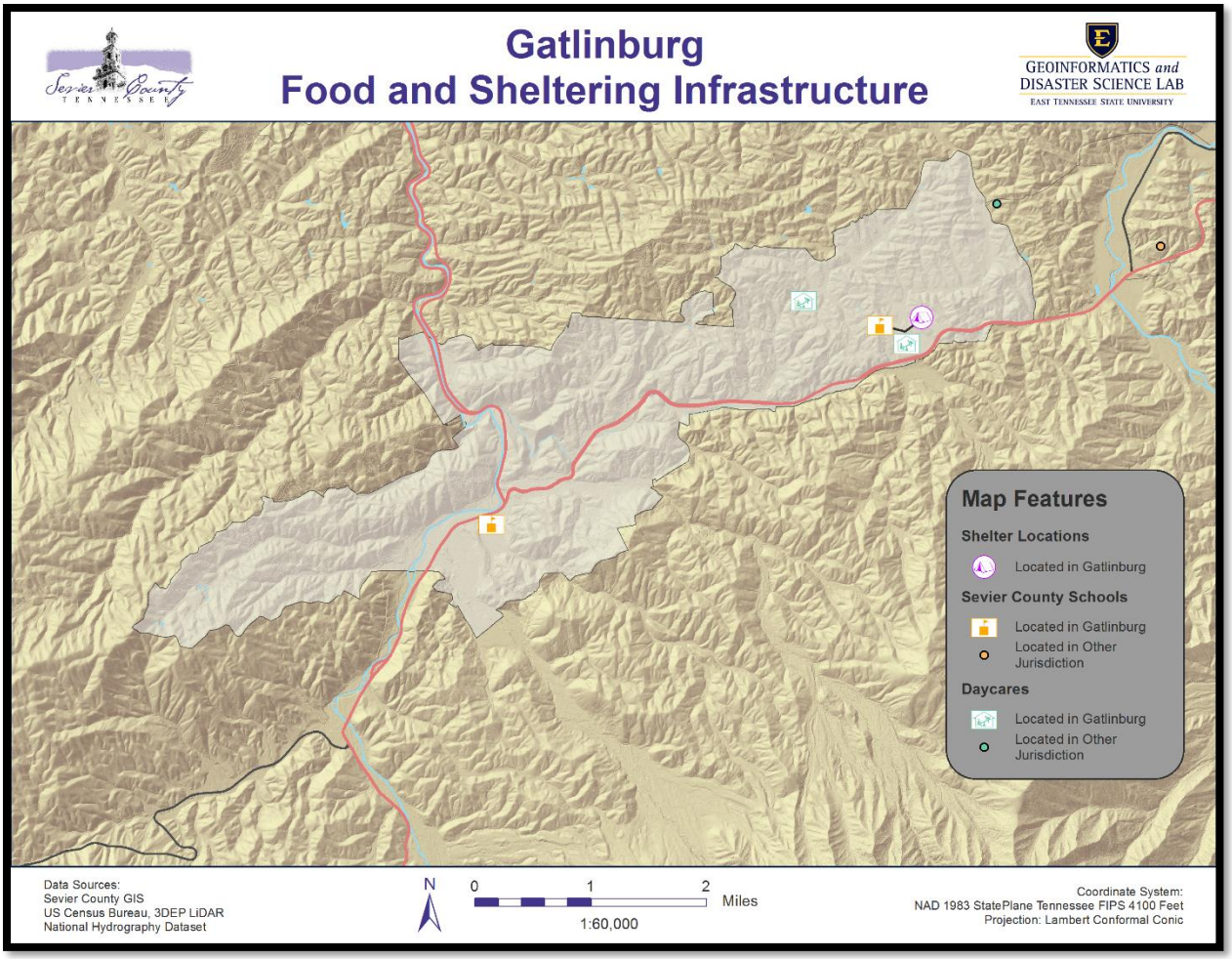


Figure C-0-10: Food and Sheltering Critical Infrastructure Located in Gatlinburg.

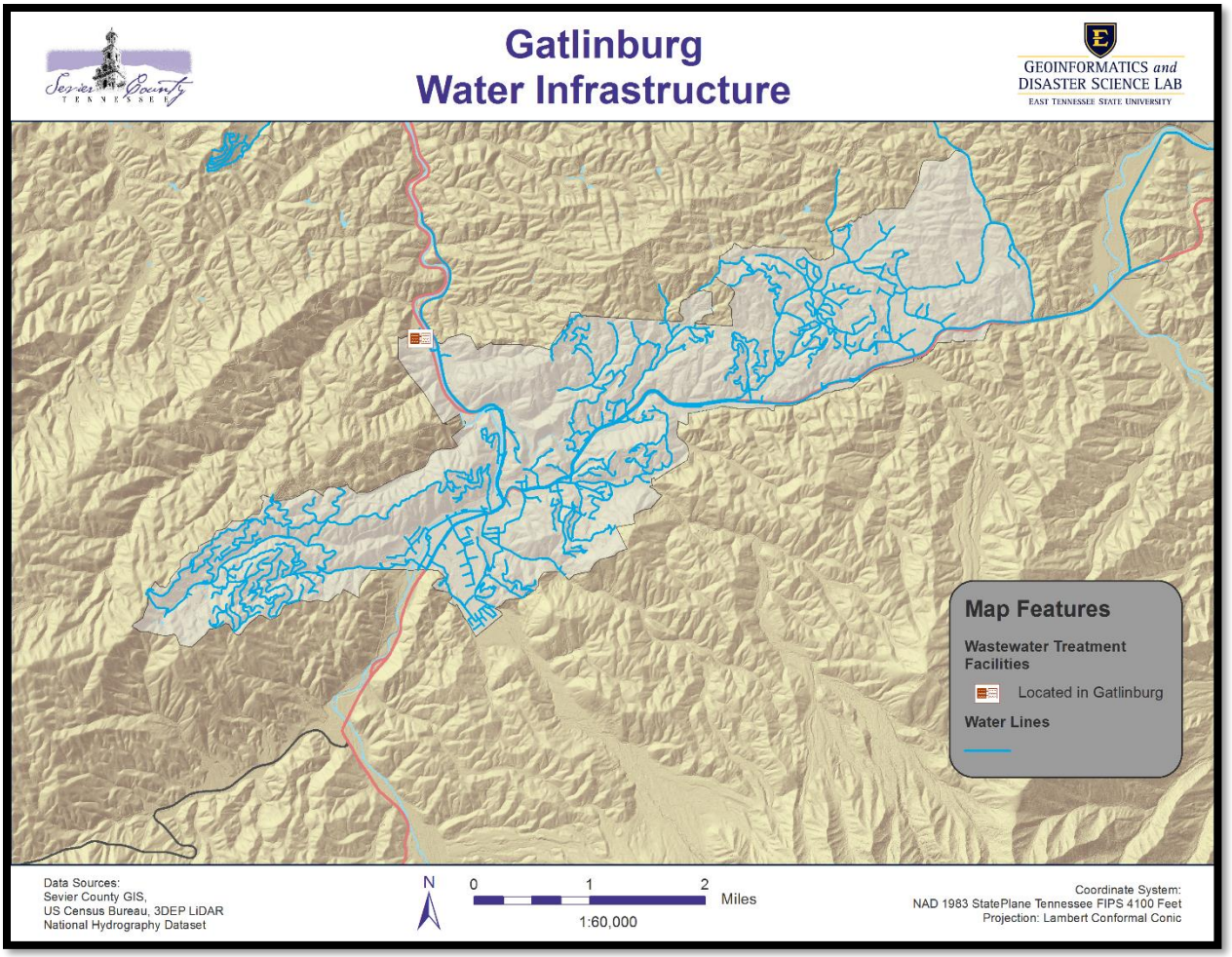


Figure C-0-11: Water Critical Infrastructure Located in Gatlinburg.

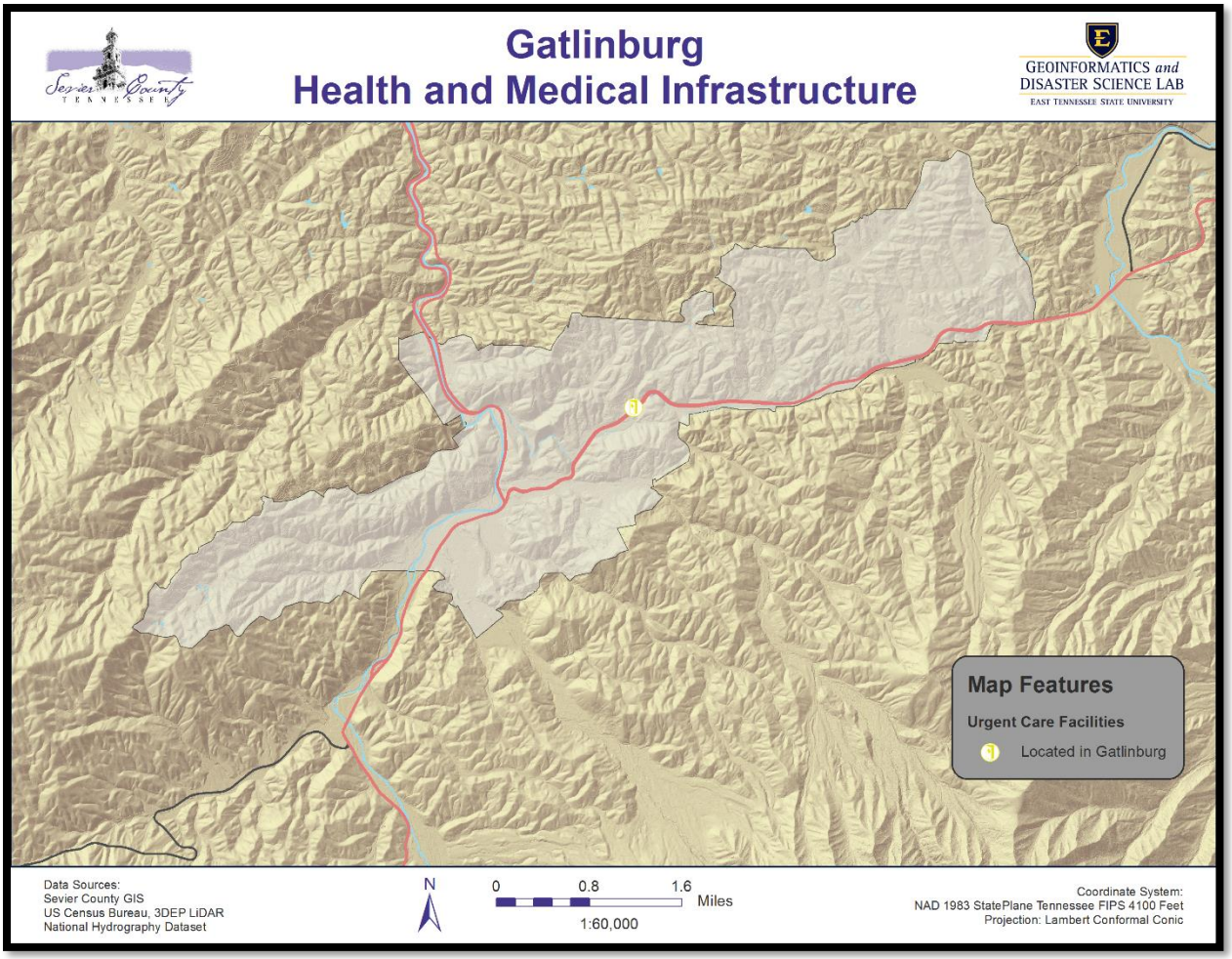


Figure C-0-12: Water Critical Infrastructure Located in Gatlinburg.

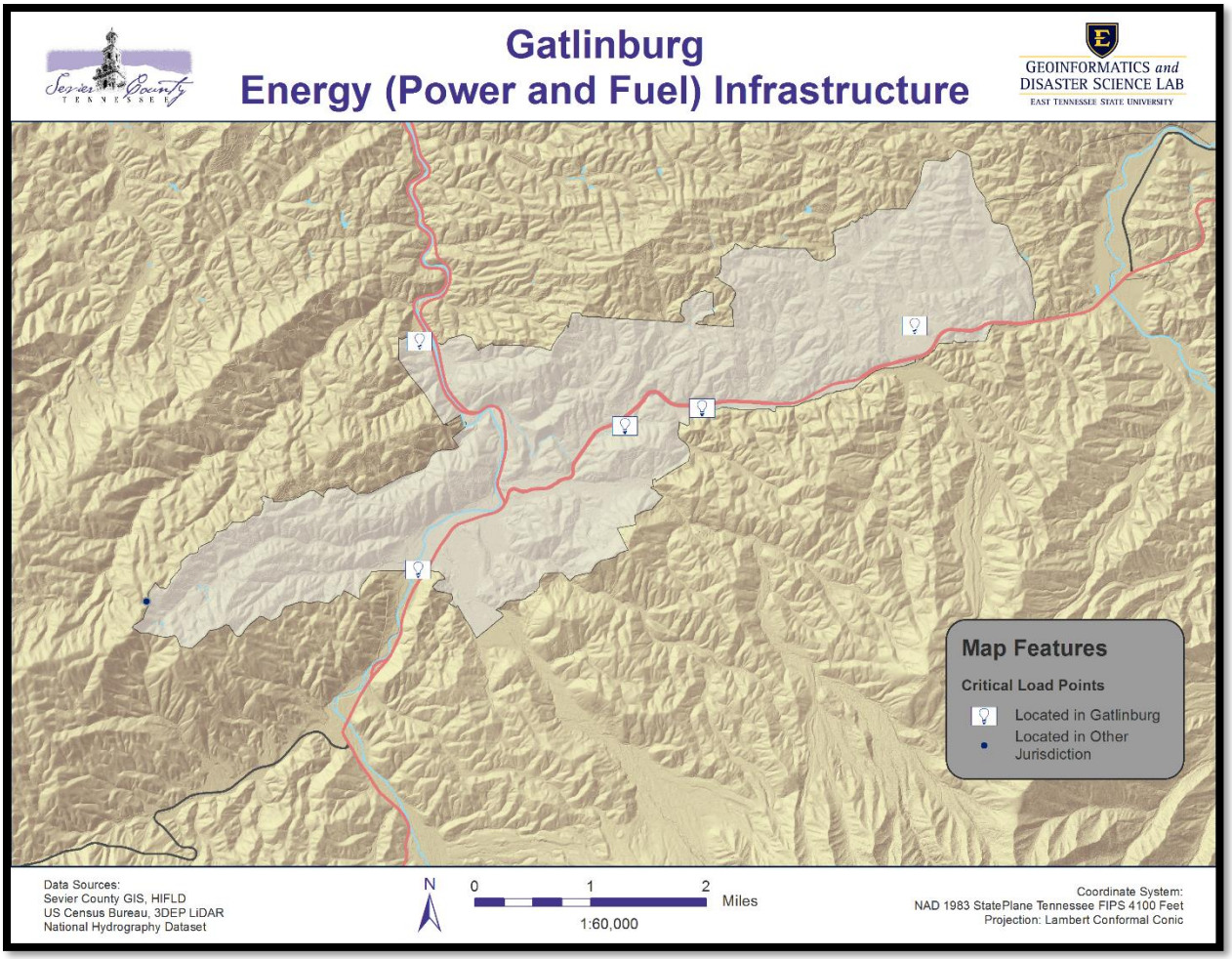


Figure C-0-13: Energy Critical Infrastructure Located in Gatlinburg.

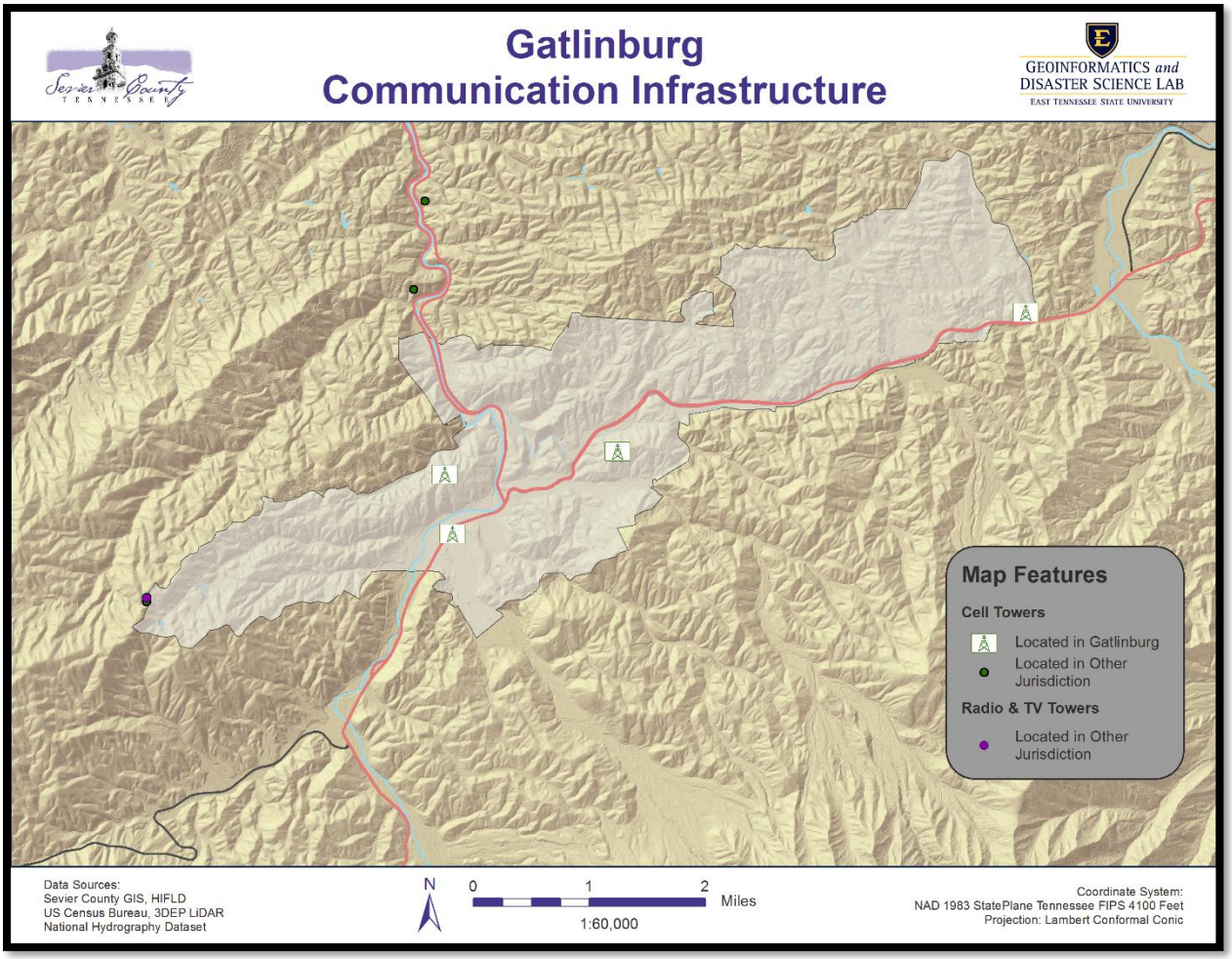


Figure C-0-14: Communications Critical Infrastructure Located in Gatlinburg.

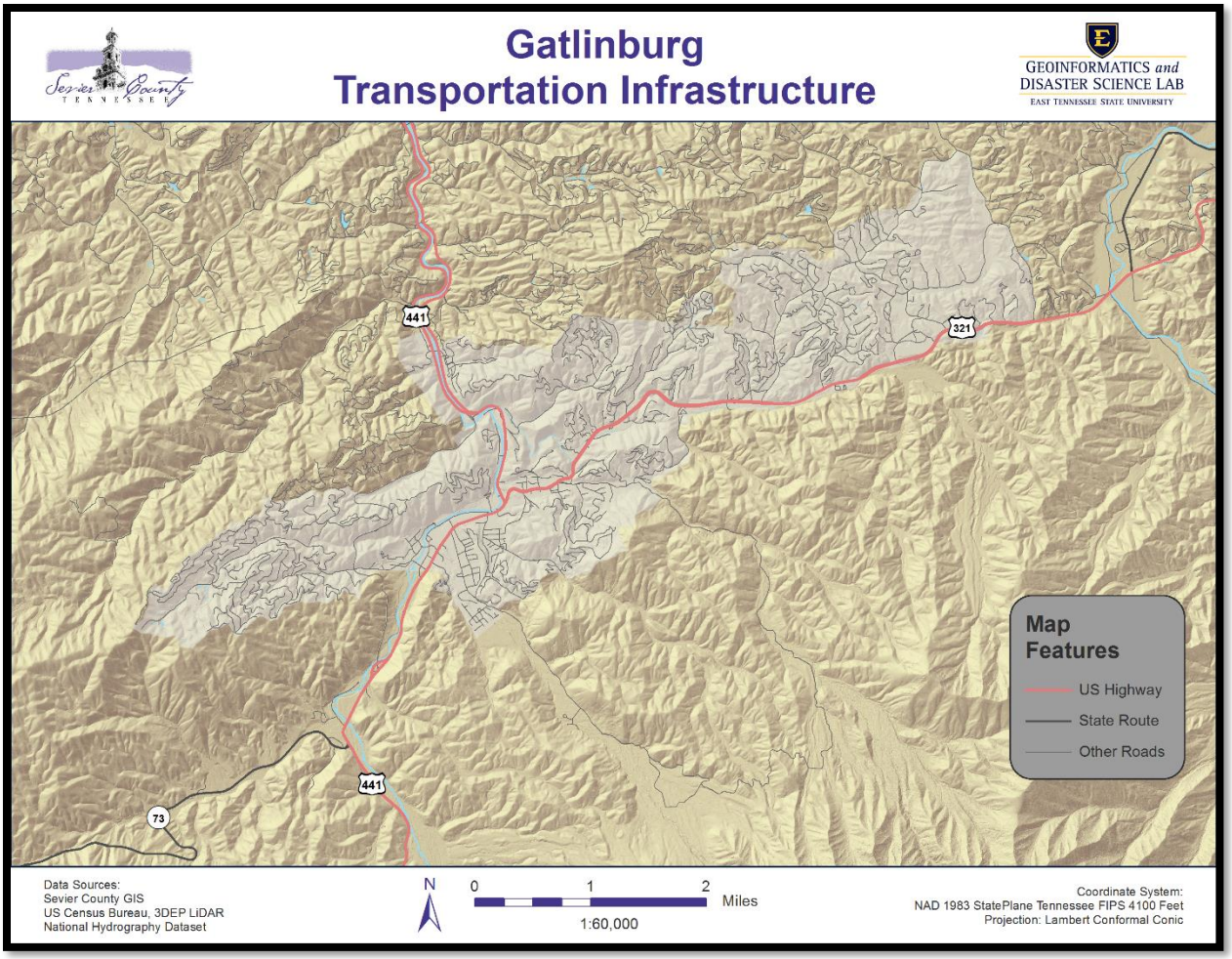


Figure C-0-15: Transportation Critical Infrastructure Located in Gatlinburg.

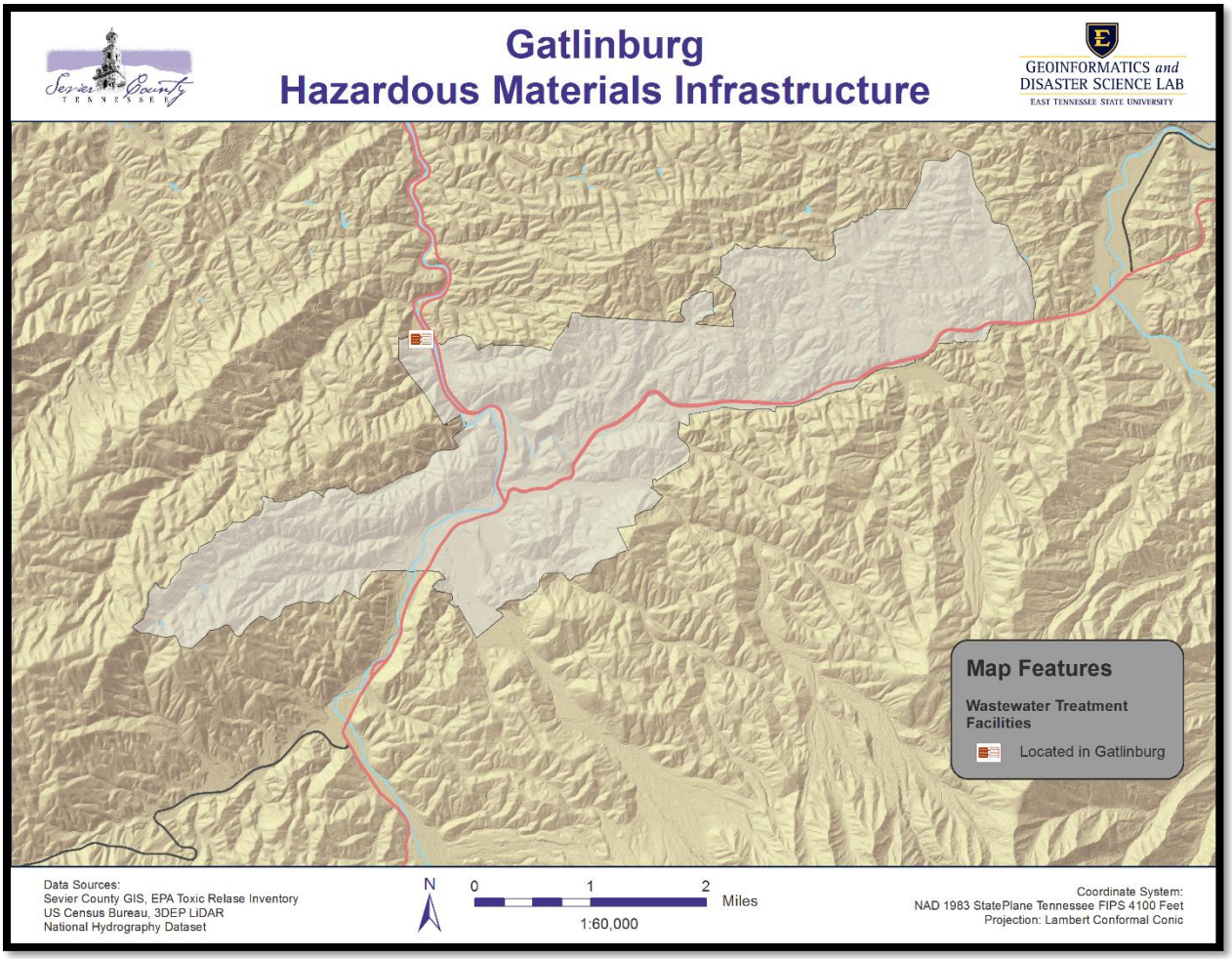


Figure C-0-16: Hazardous Material Critical Infrastructure Located in Gatlinburg.

Pigeon Forge Critical Infrastructure

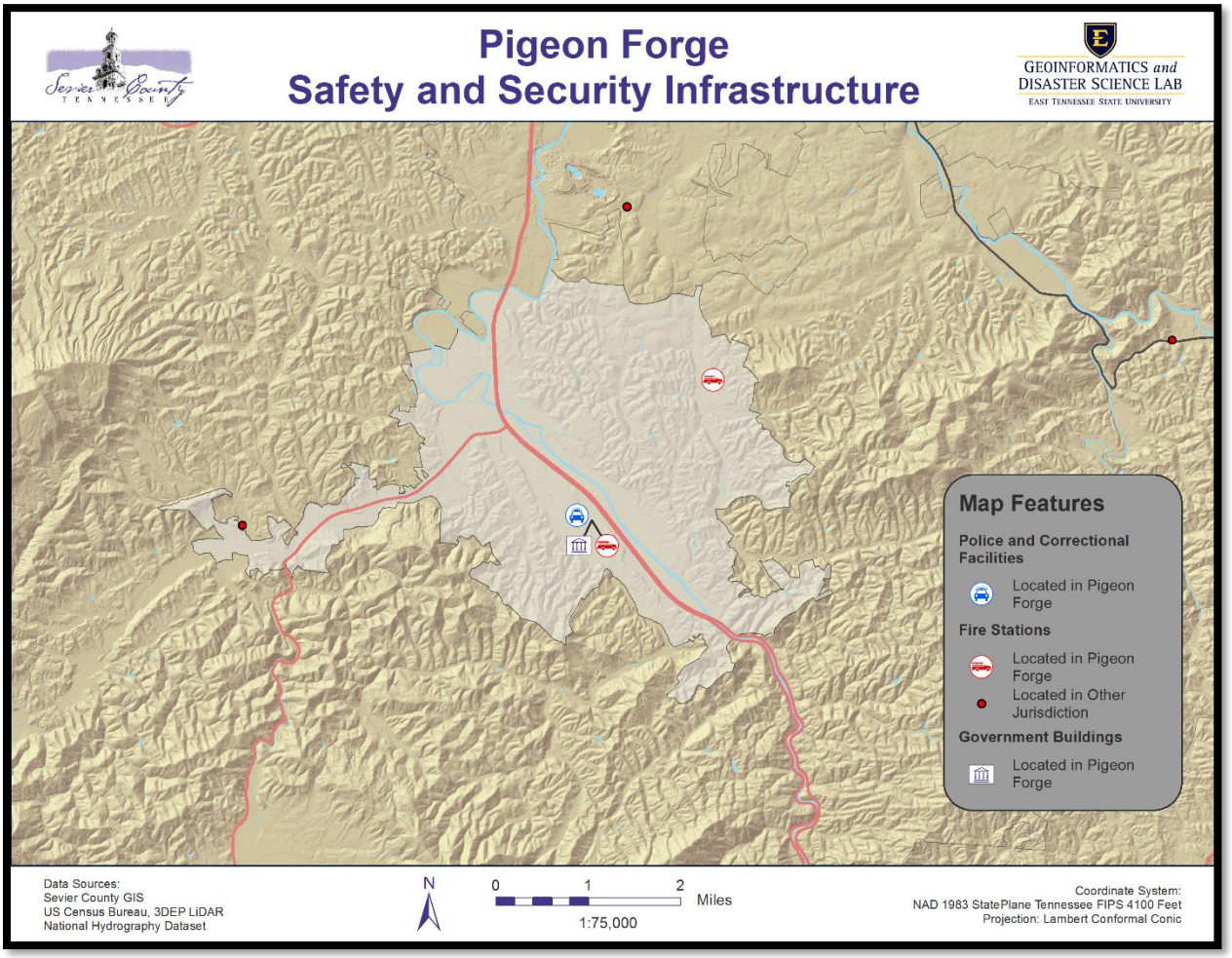


Figure C-0-17: Safety and Security Critical Infrastructure Located in Pigeon Forge.

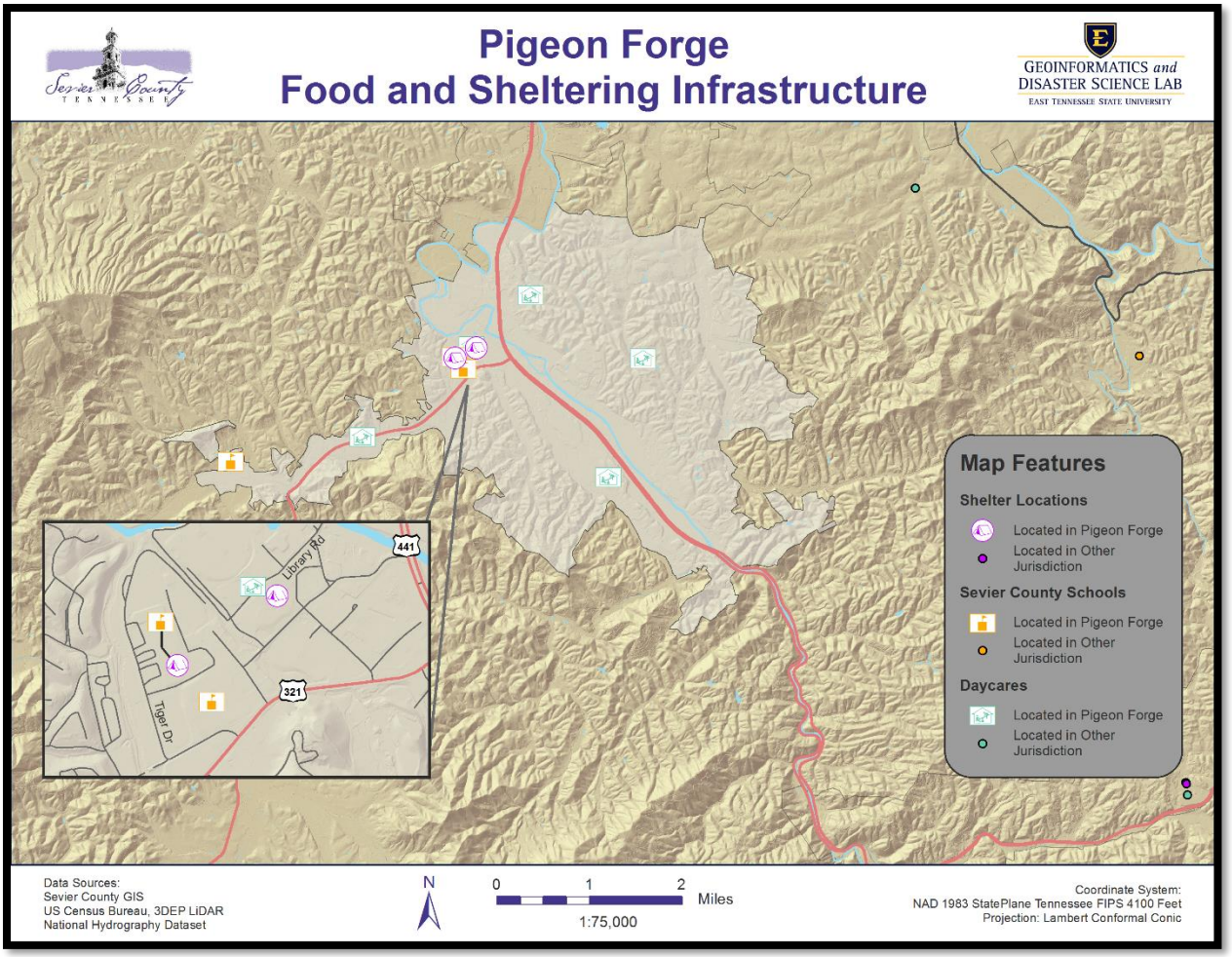


Figure C-0-18: Food and Sheltering Critical Infrastructure Located in Pigeon Forge.

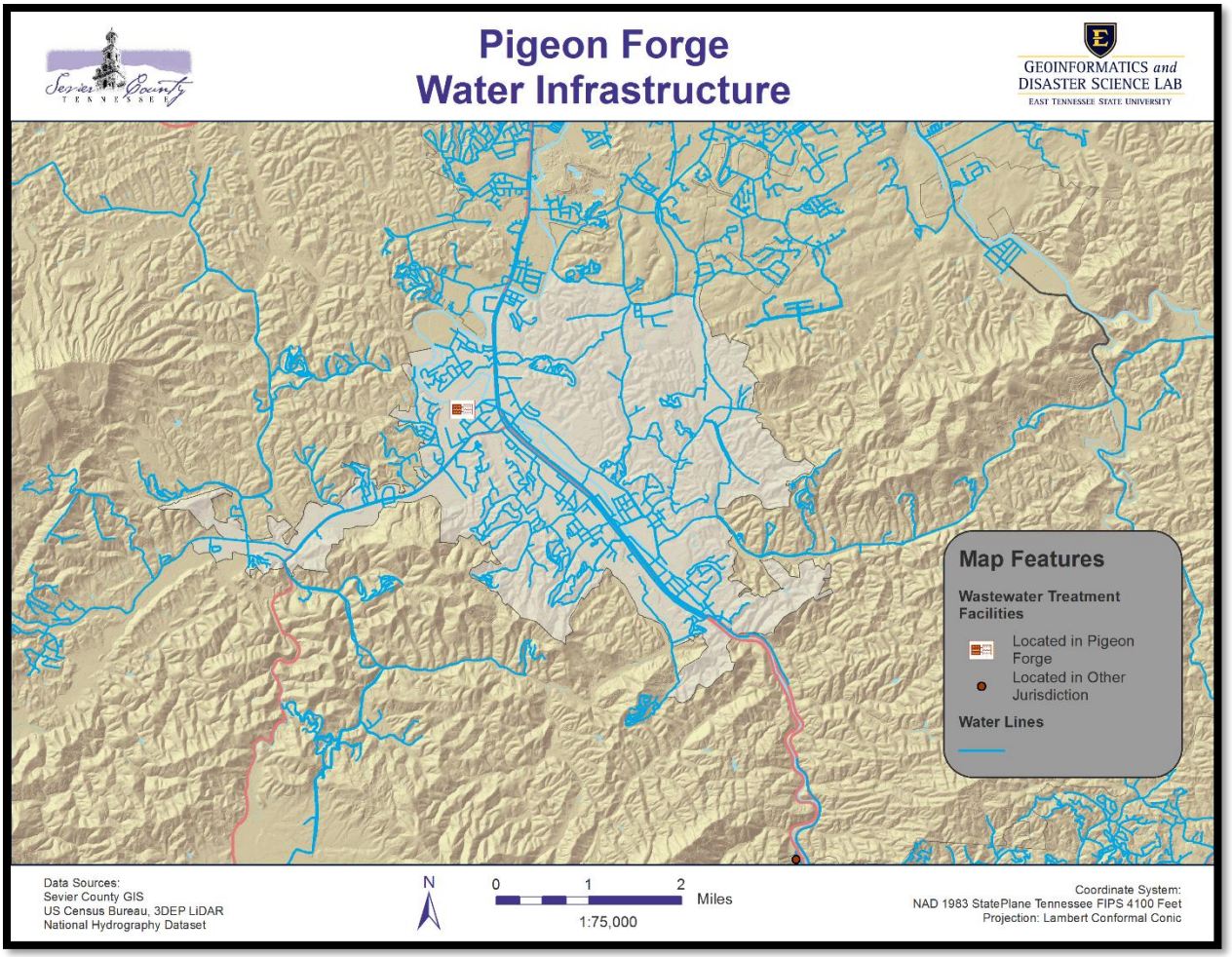


Figure C-0-19: Water Critical Infrastructure Located in Pigeon Forge.

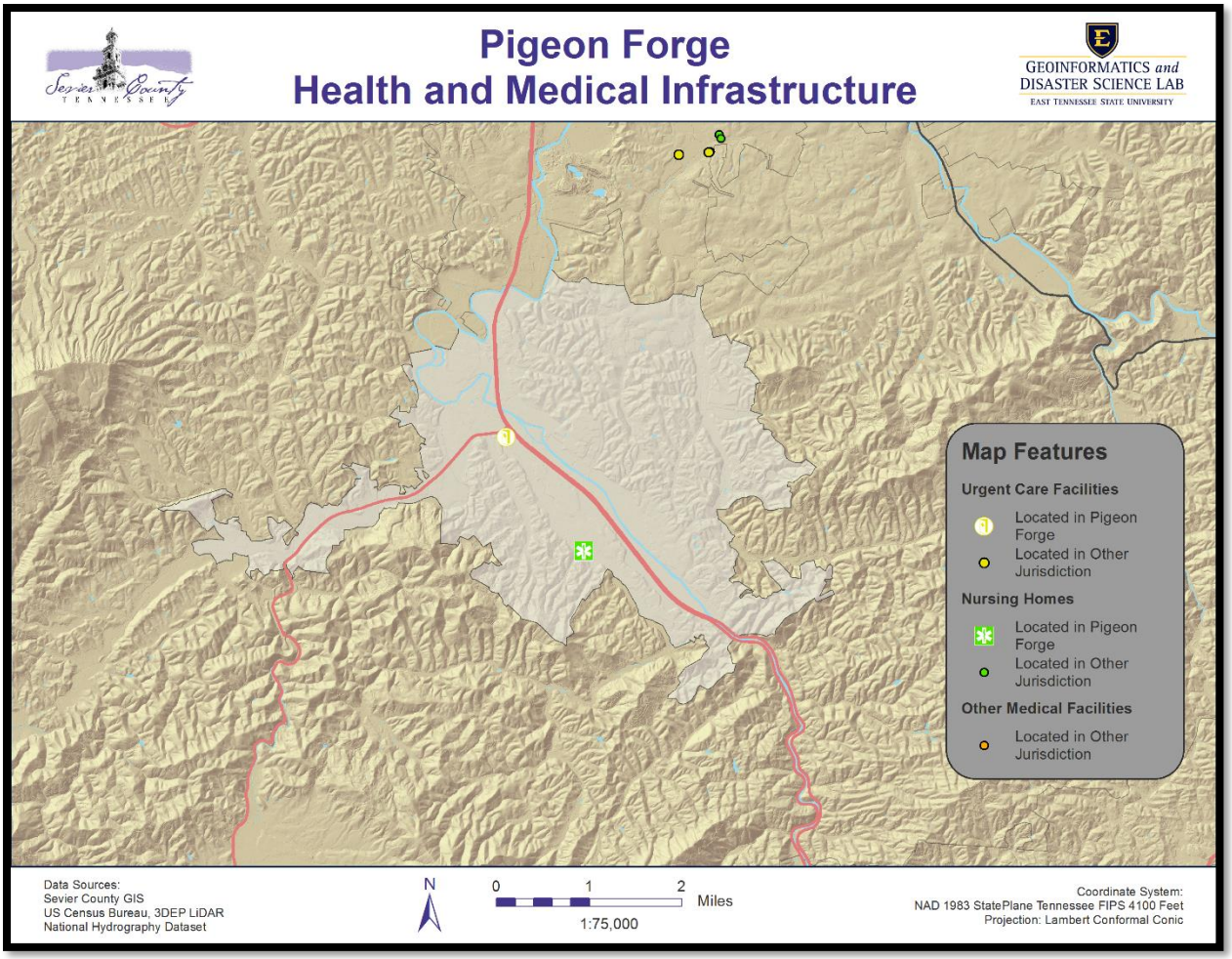


Figure C-0-20: Health and Medical Critical Infrastructure Located in Pigeon Forge.

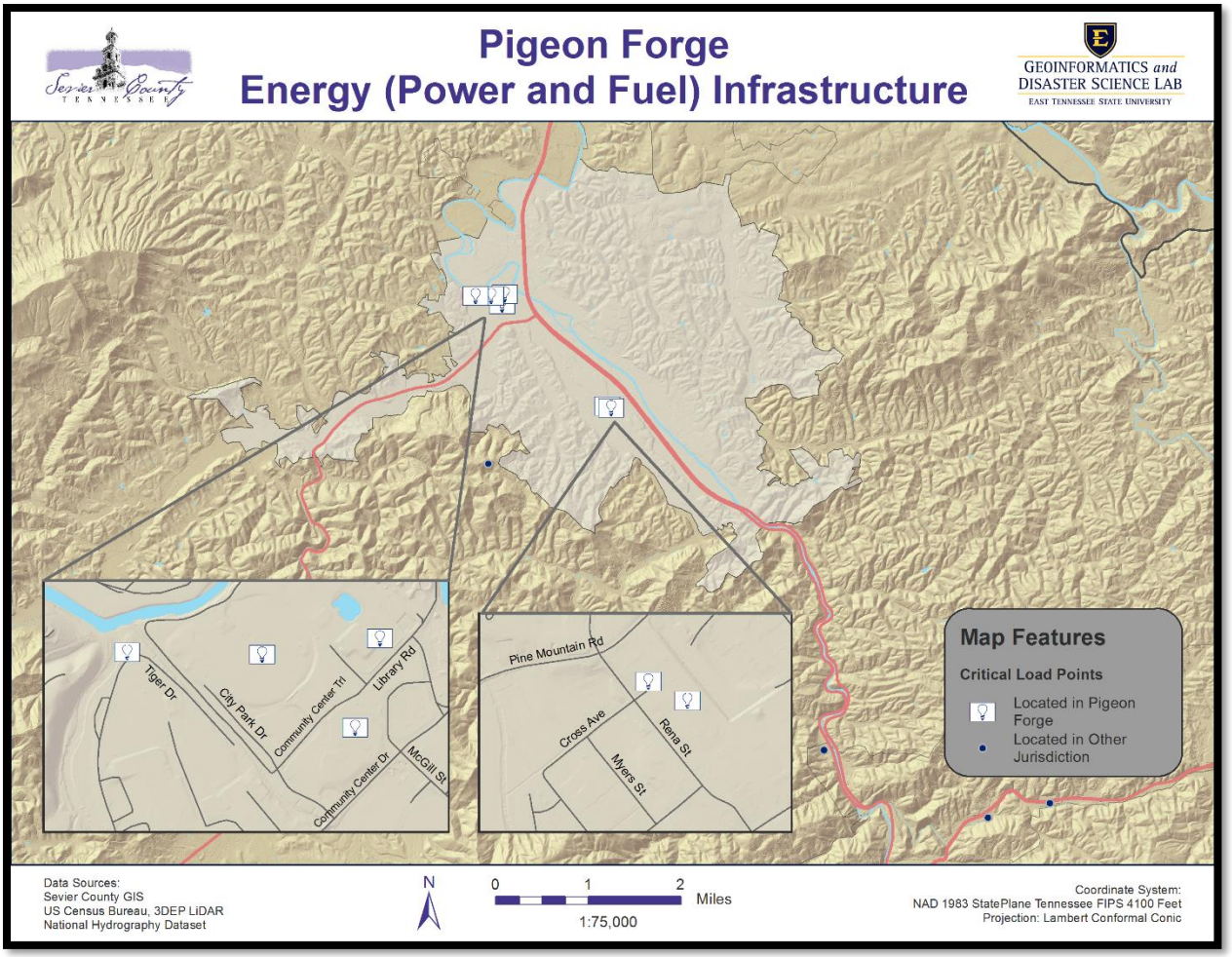


Figure C-0-21: Energy Critical Infrastructure Located in Pigeon Forge.

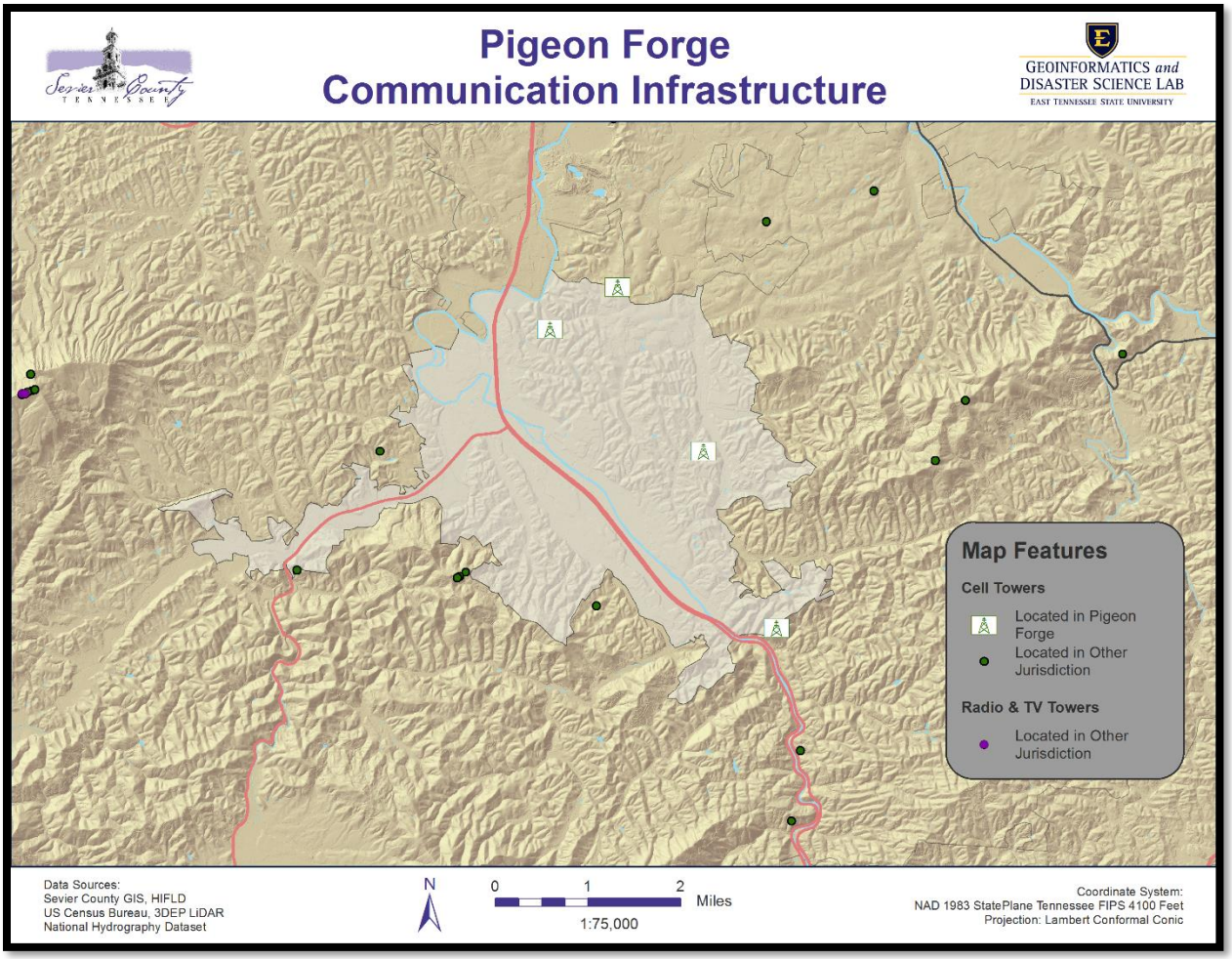


Figure C-0-22: Communications Critical Infrastructure Located in Pigeon Forge.

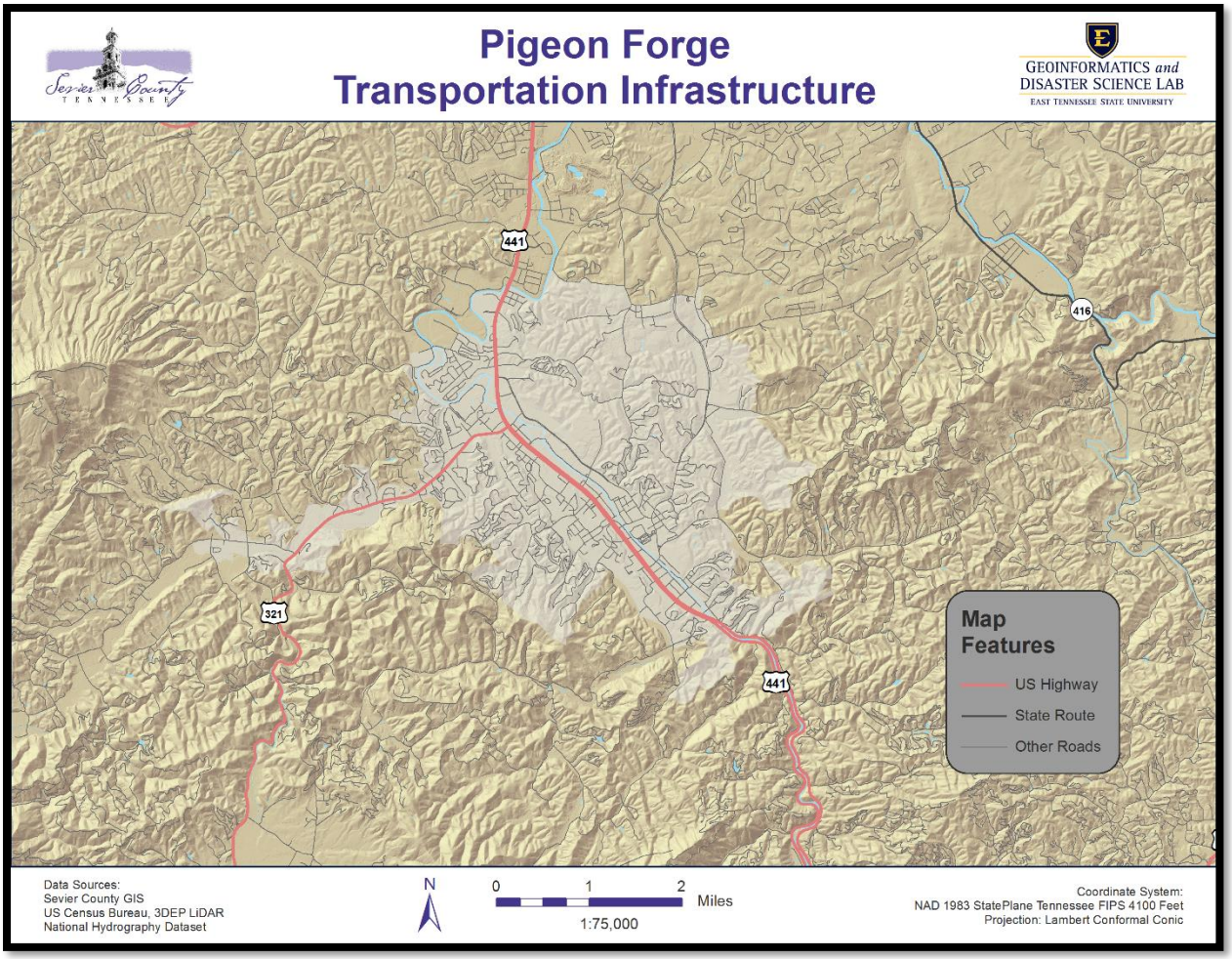


Figure C-0-23: Transportation Critical Infrastructure Located in Pigeon Forge.

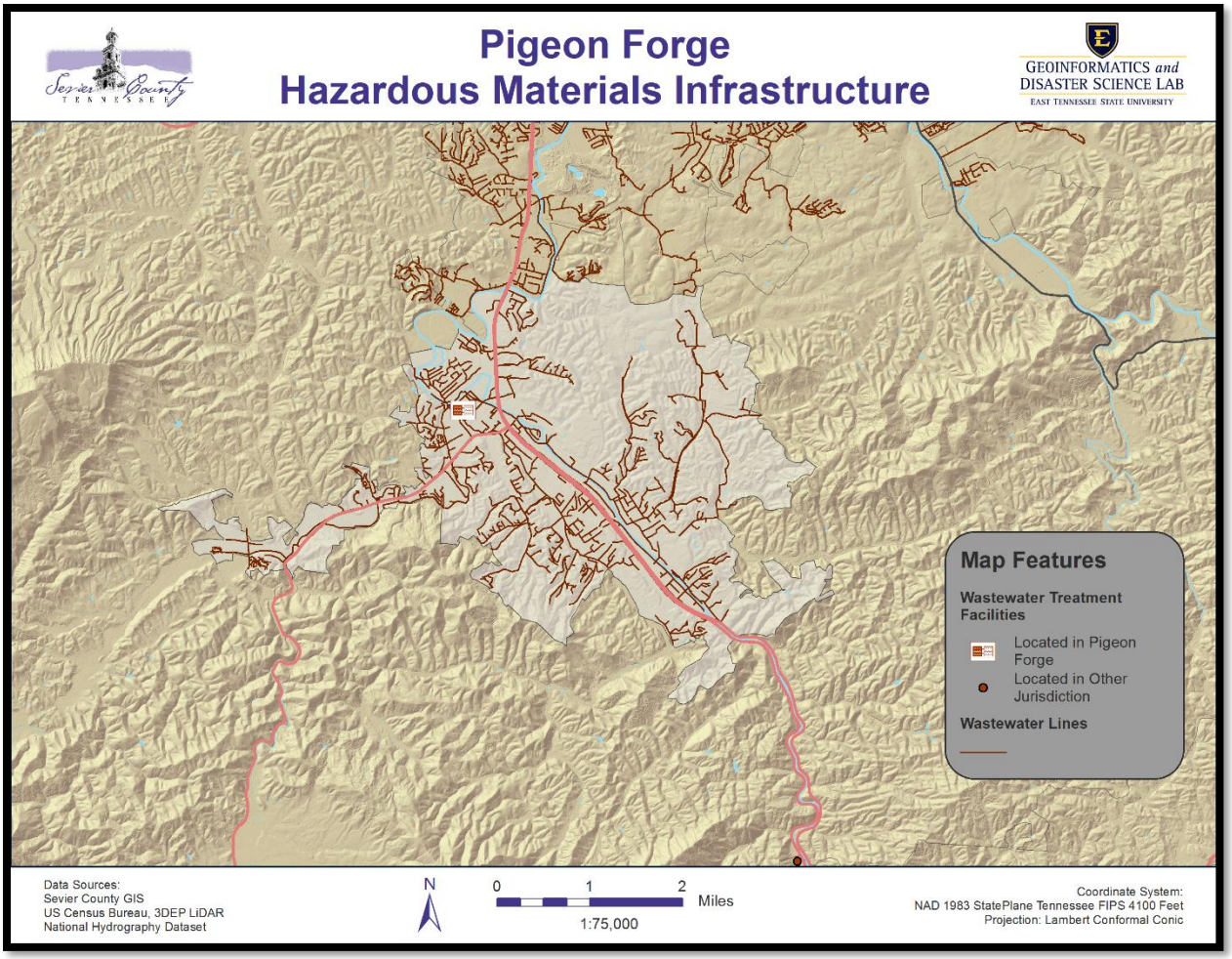


Figure C-0-24: Hazardous Material Critical Infrastructure Located in Pigeon Forge.

Pittman Center Critical Infrastructure

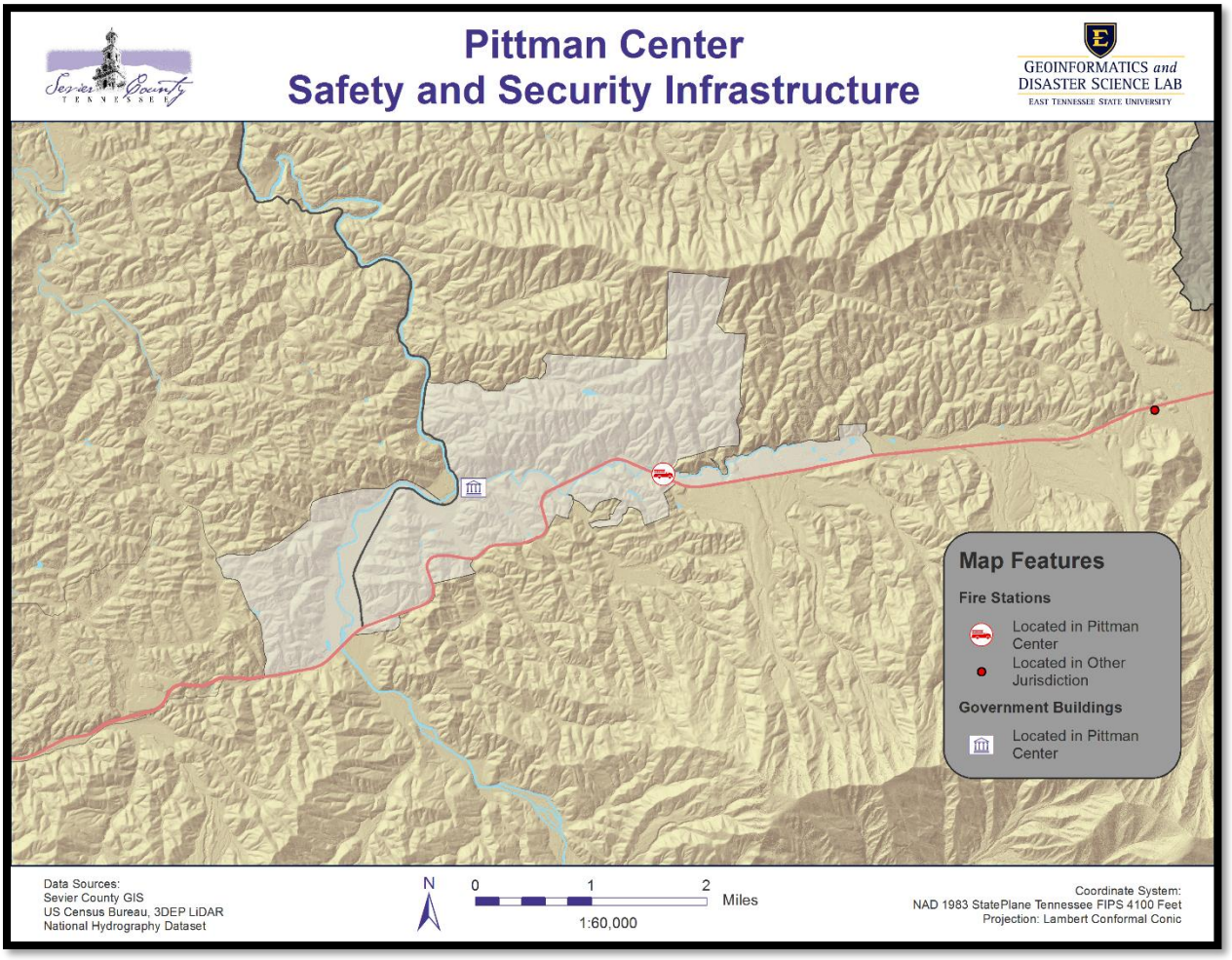


Figure C-0-25: Safety and Security Critical Infrastructure Located in Pittman Center.

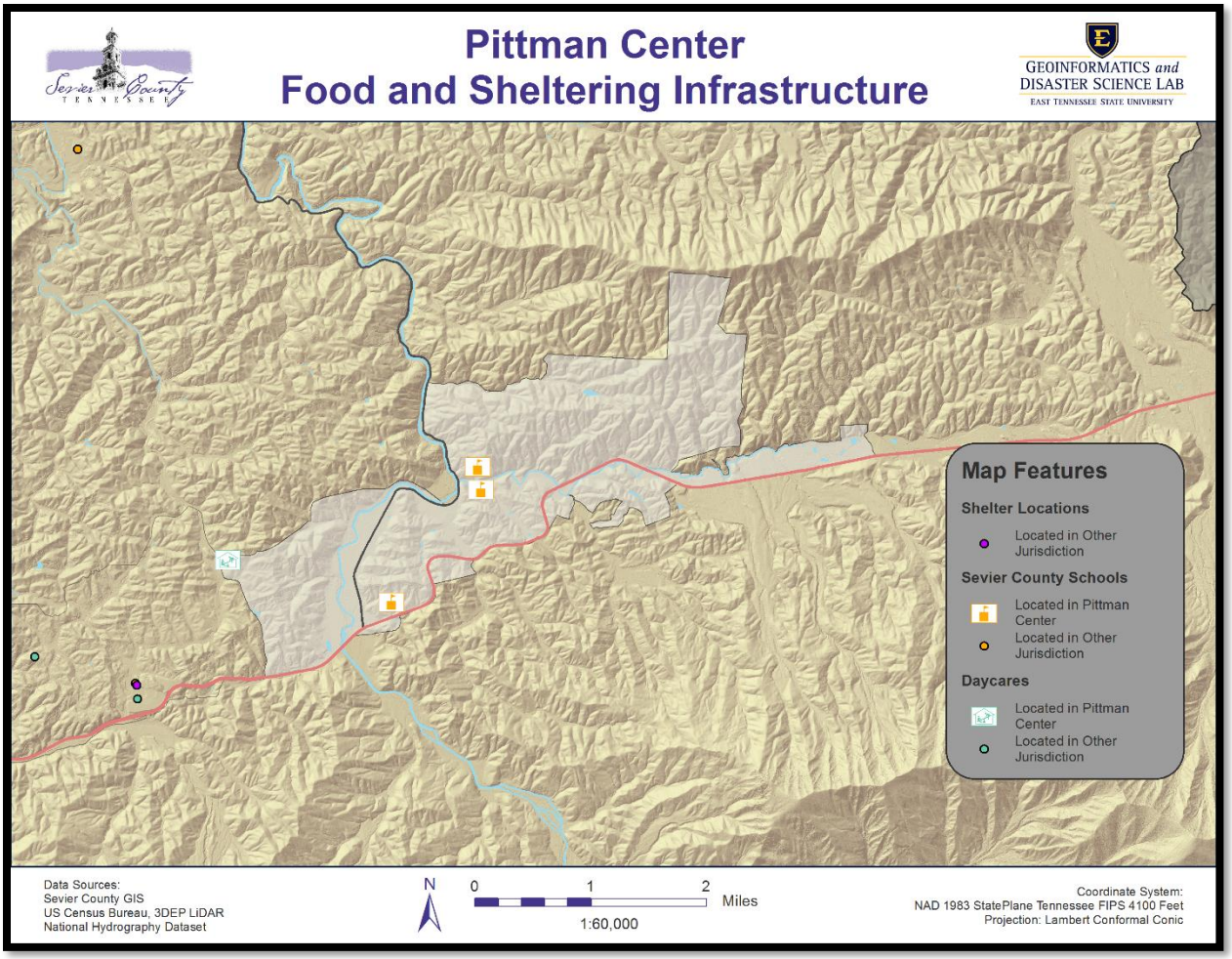


Figure C-0-26: Food and Sheltering Critical Infrastructure Located in Pittman Center.

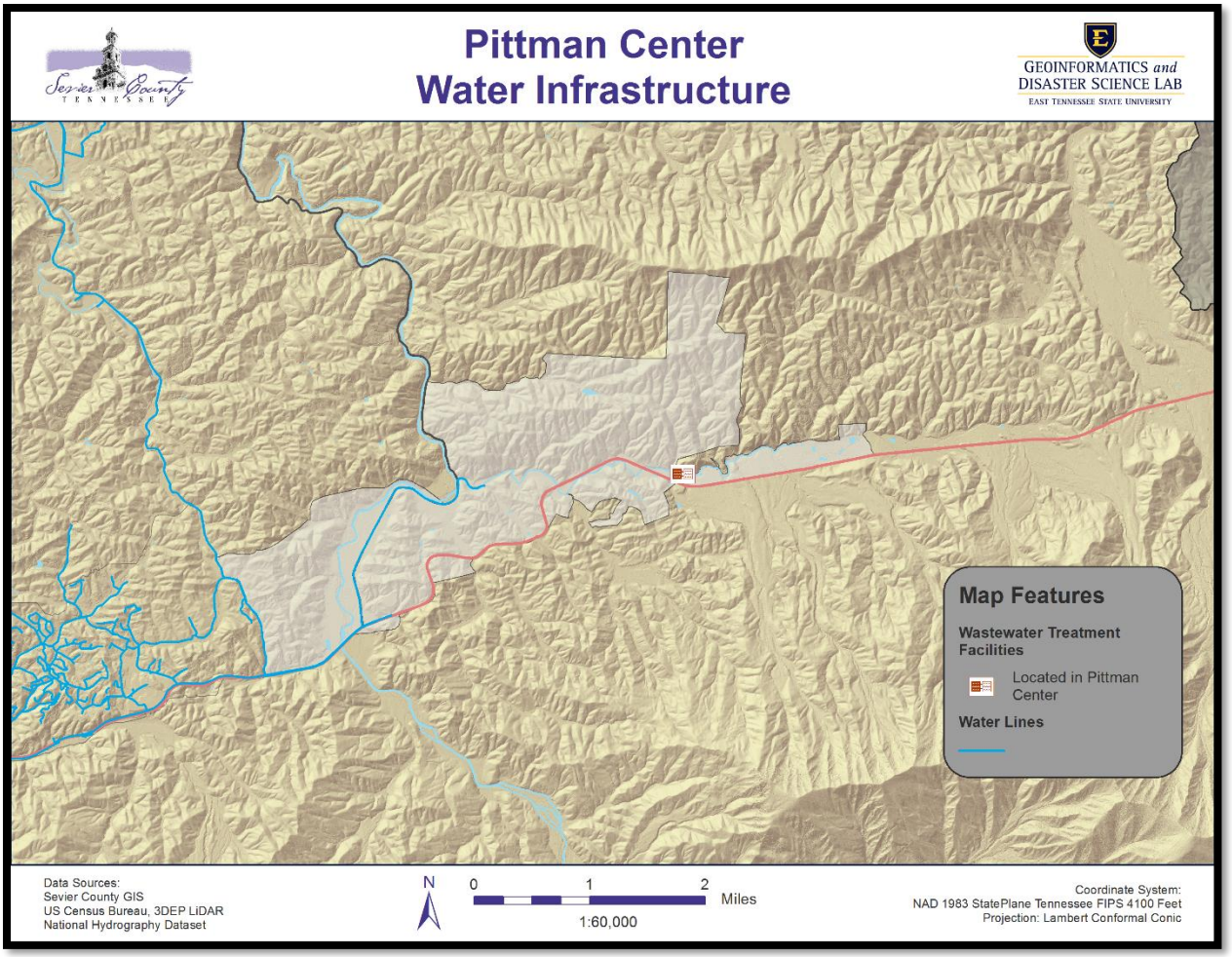


Figure C-0-27: Water Critical Infrastructure Located in Pittman Center.

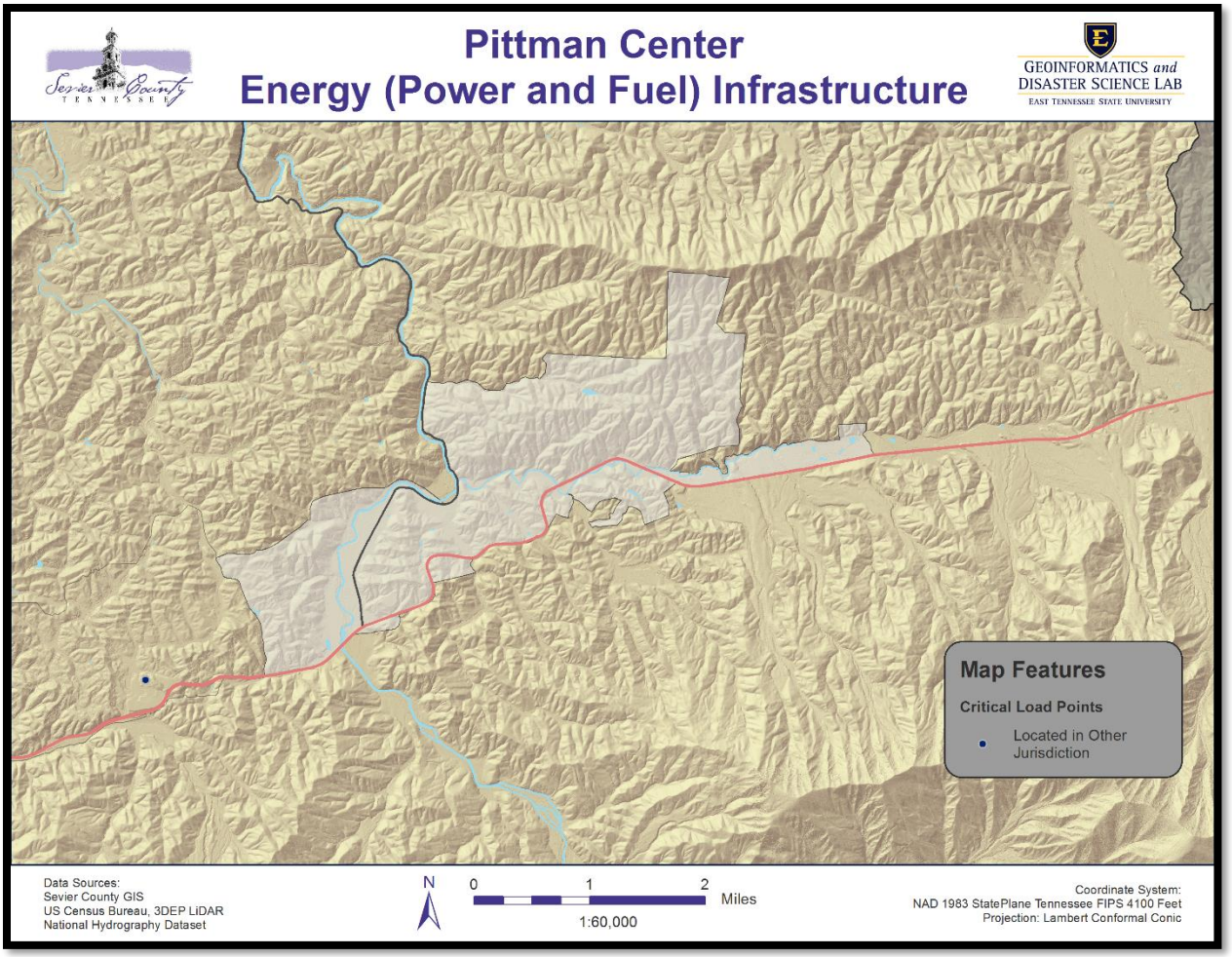


Figure C-0-28: Energy Critical Infrastructure Located in Pittman Center.

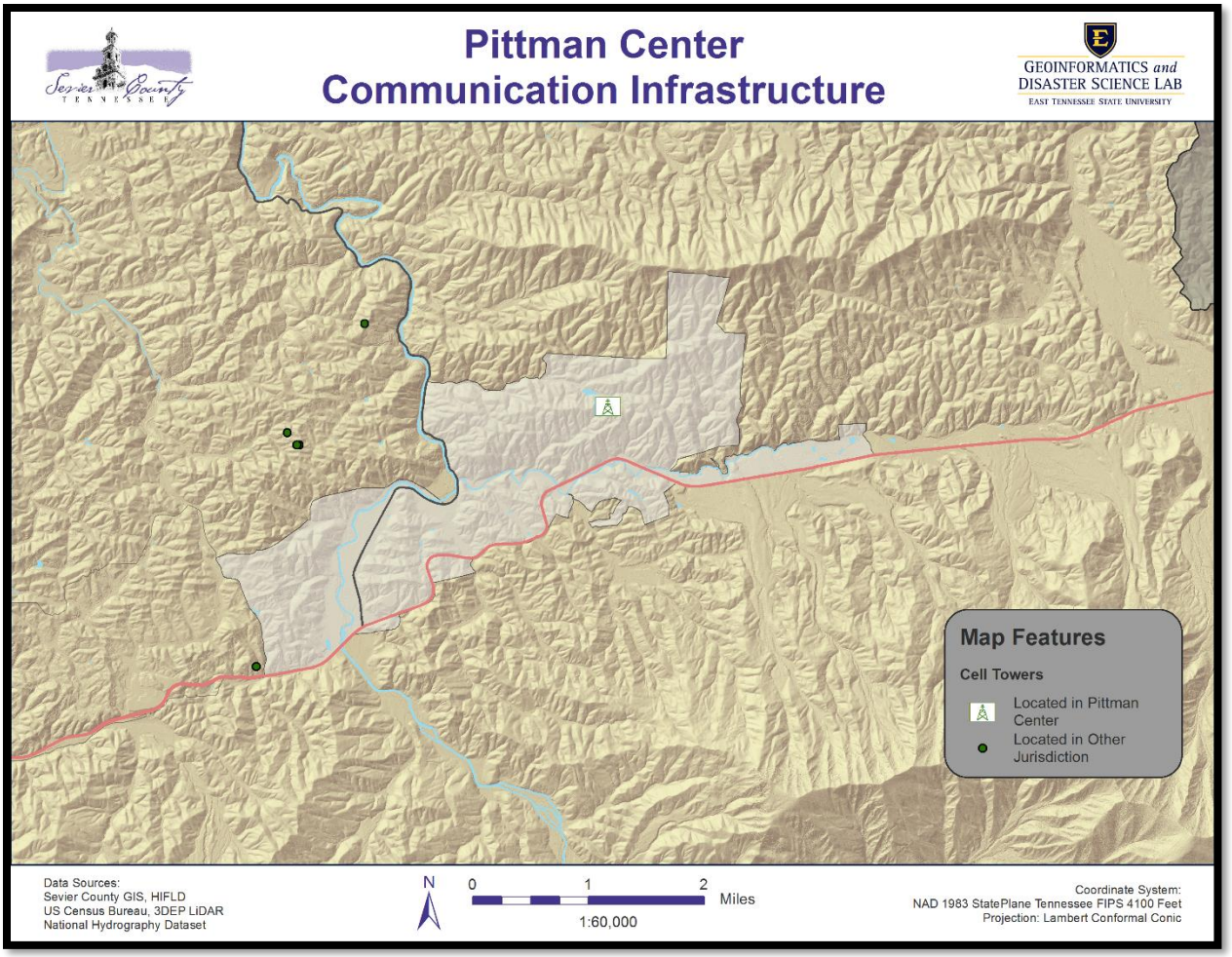


Figure C-0-29: Communications Critical Infrastructure Located in Pittman Center.

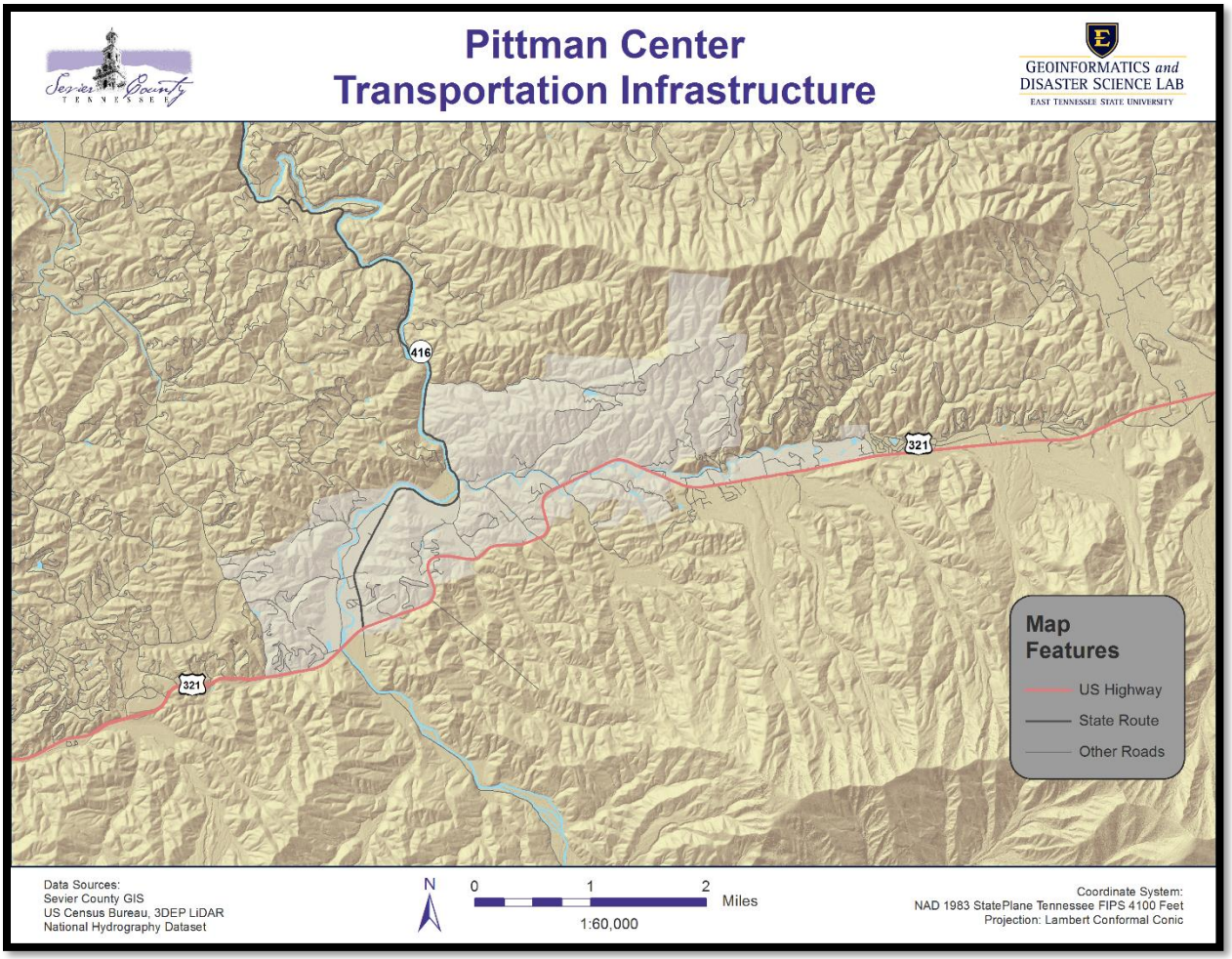


Figure C-0-30: Transportation Critical Infrastructure Located in Pittman Center.

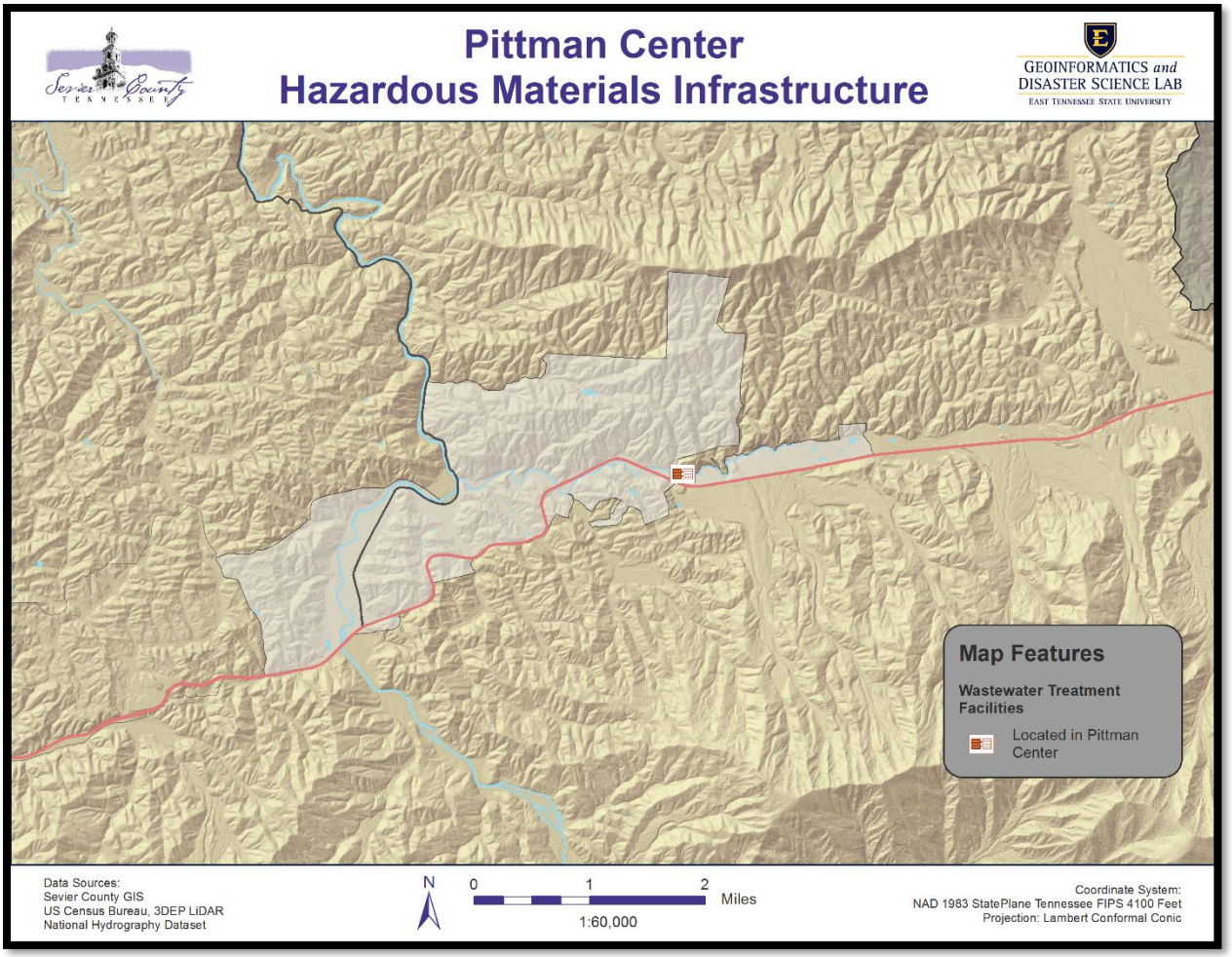


Figure C-0-31: Hazardous Material Critical Infrastructure Located in Pittman Center.

Sevierville Critical Infrastructure

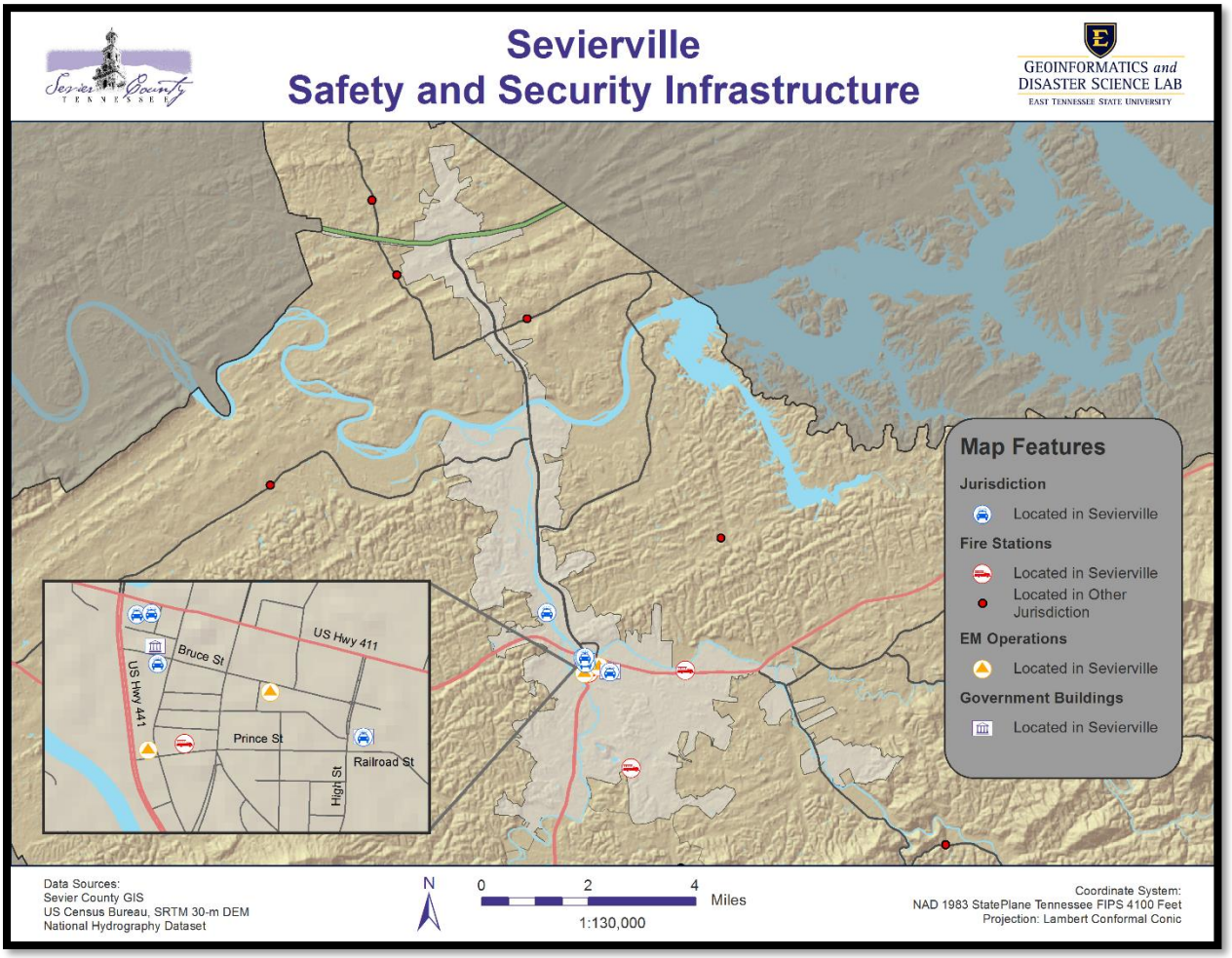


Figure C-0-32: Safety and Security Critical Infrastructure Located in Sevierville.

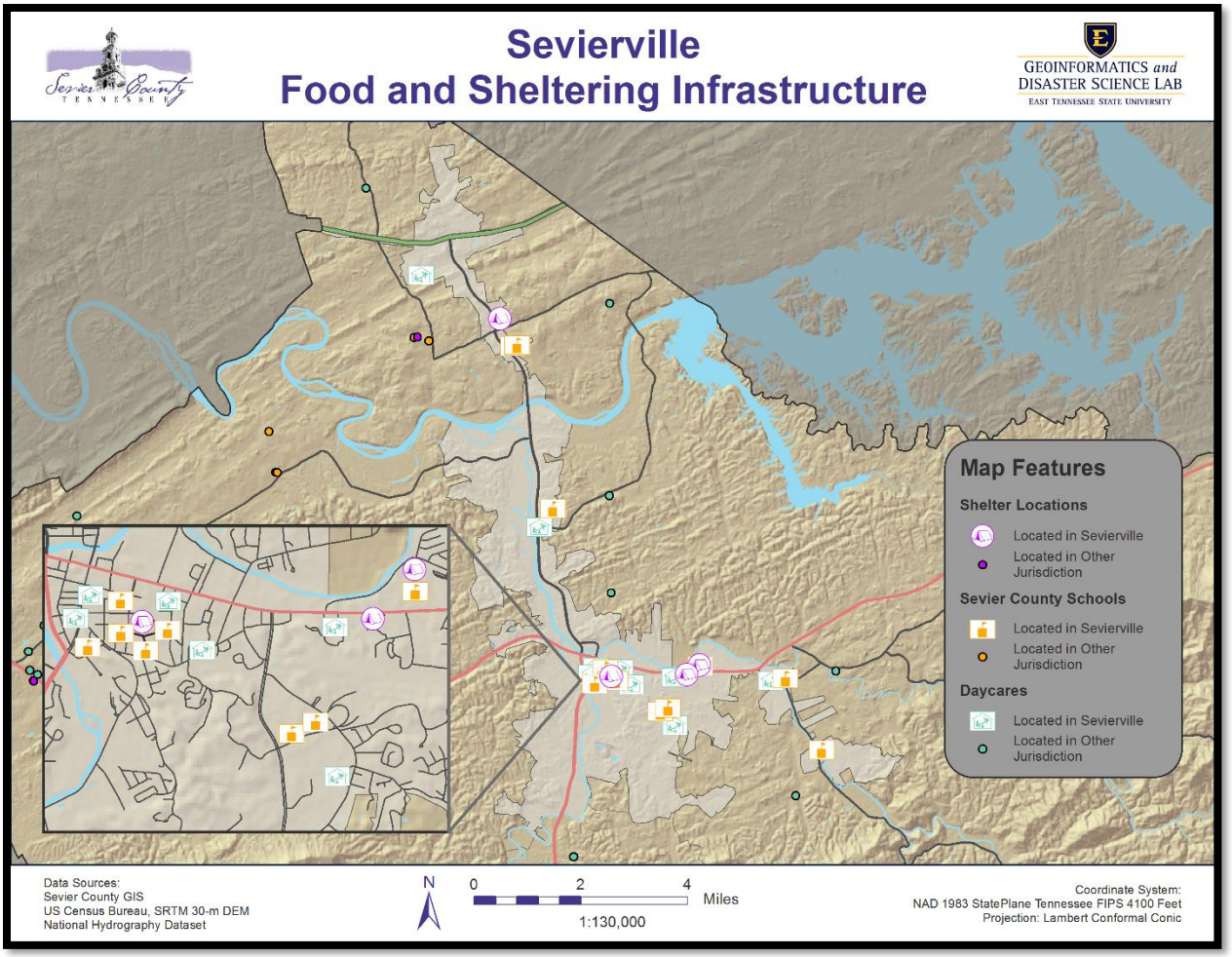


Figure C-0-33: Food and Sheltering Critical Infrastructure Located in Sevierville.

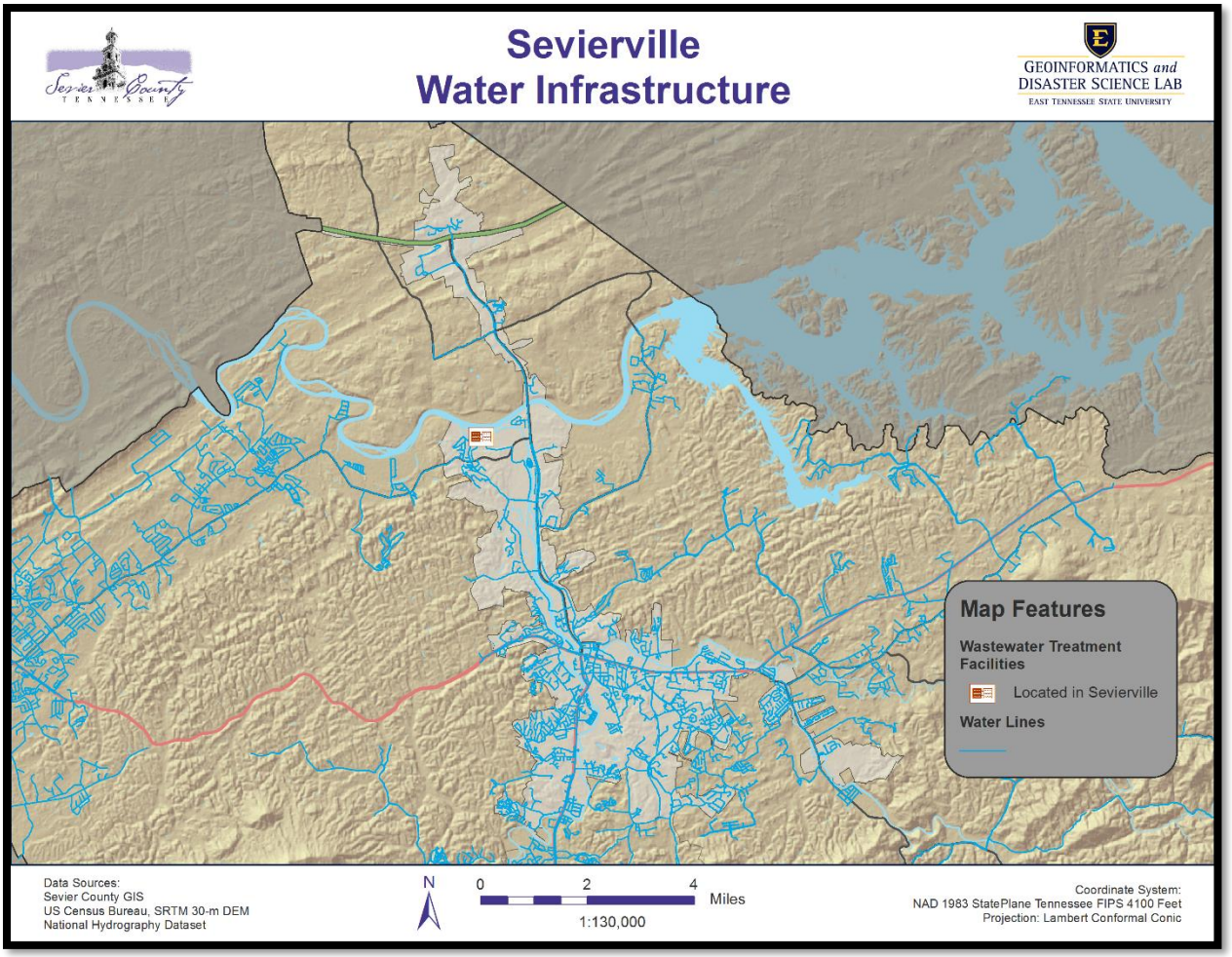


Figure C-0-34: Water Critical Infrastructure Located in Sevierville.

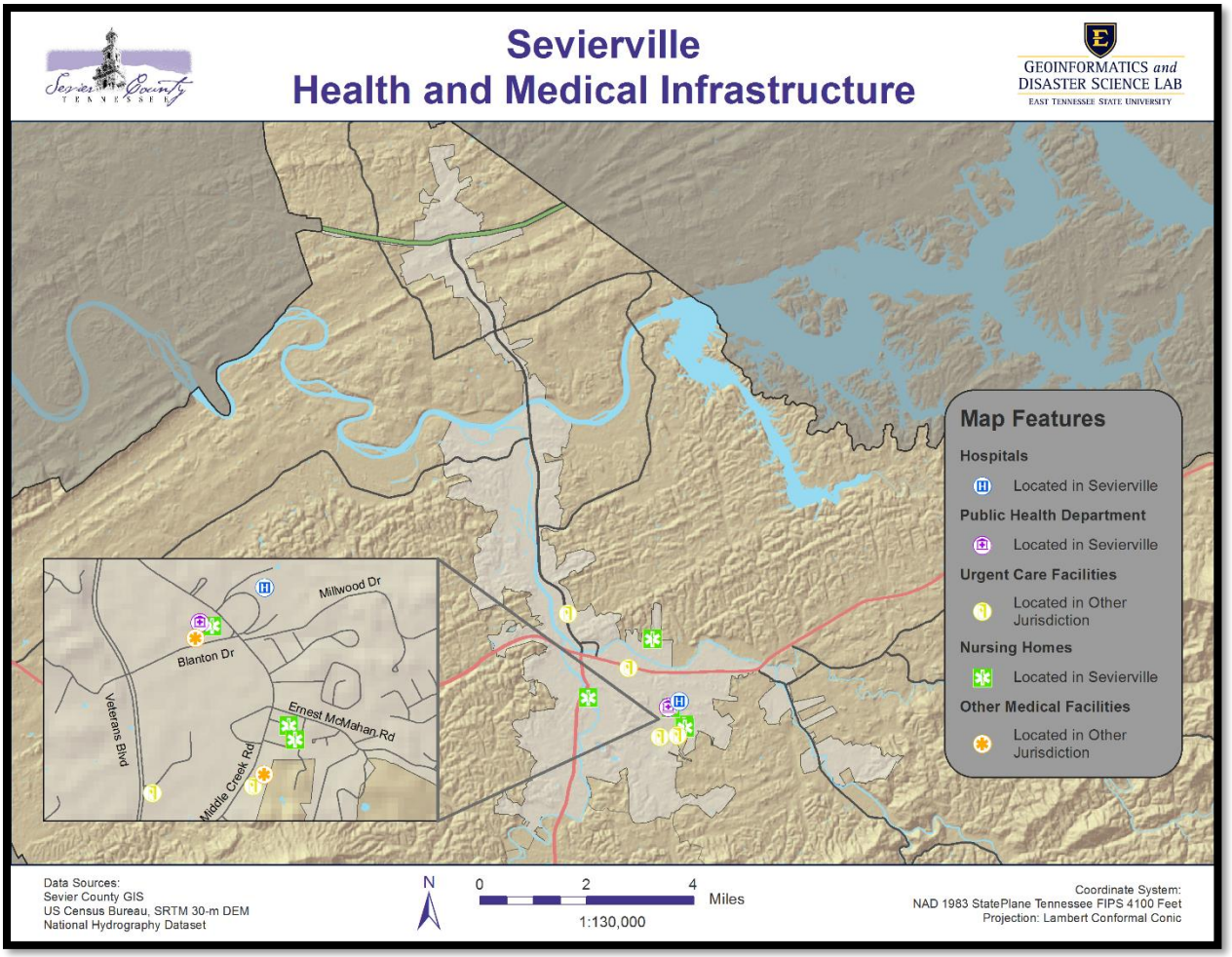


Figure C-0-35: Health and Medical Critical Infrastructure Located in Sevierville.

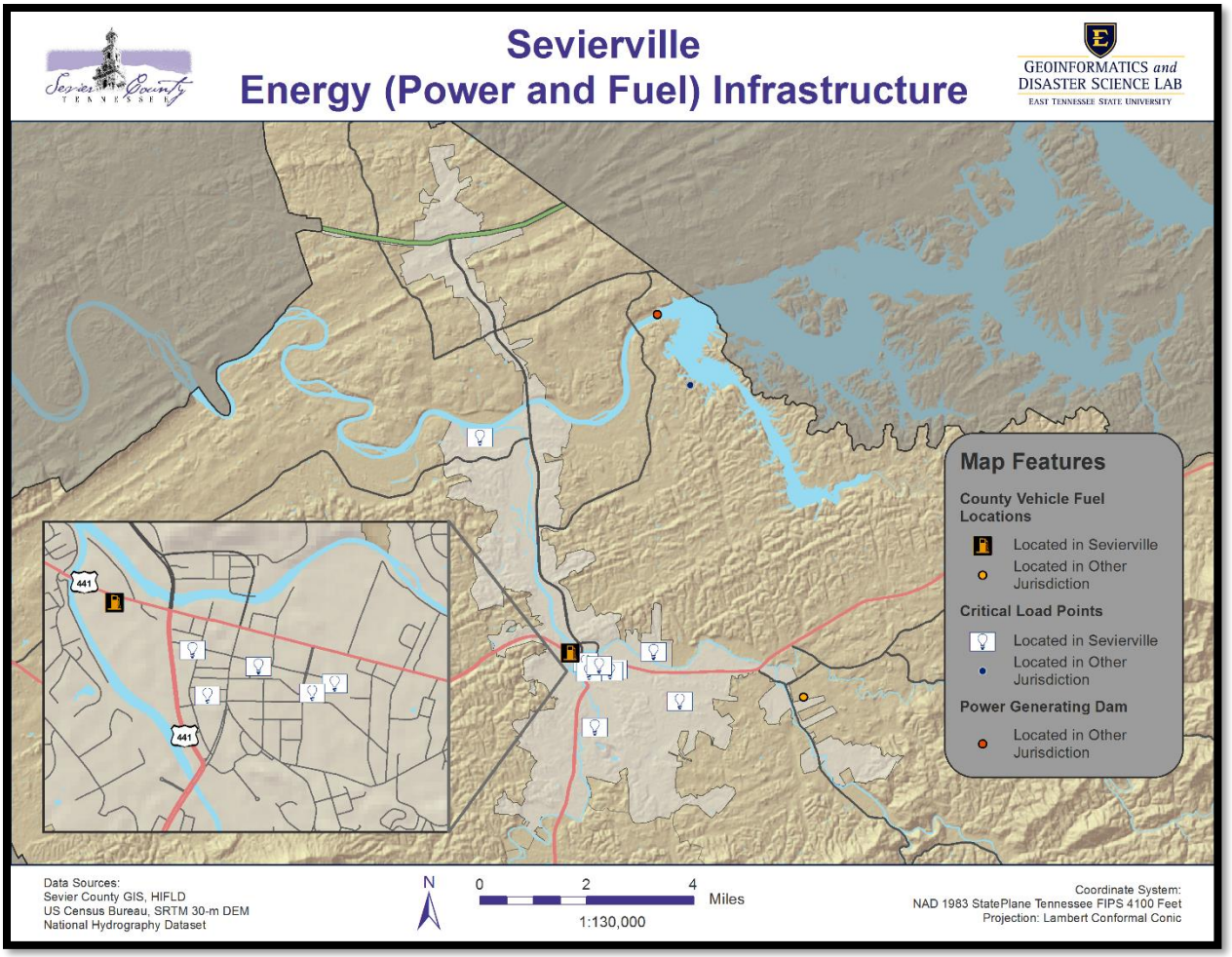


Figure C-0-36: Energy Critical Infrastructure Located in Sevierville.

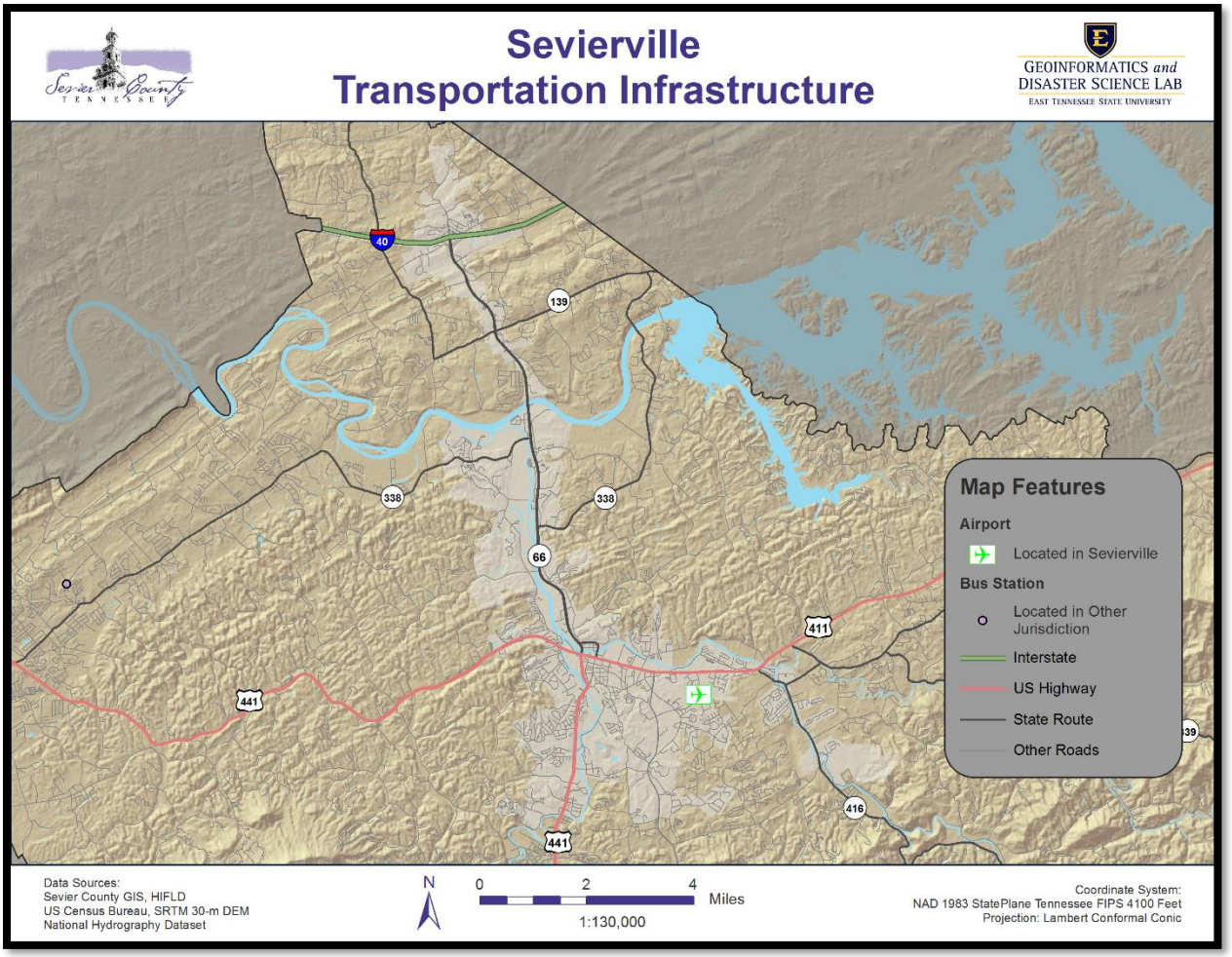


Figure C-0-37: Transportation Critical Infrastructure Located in Sevierville.

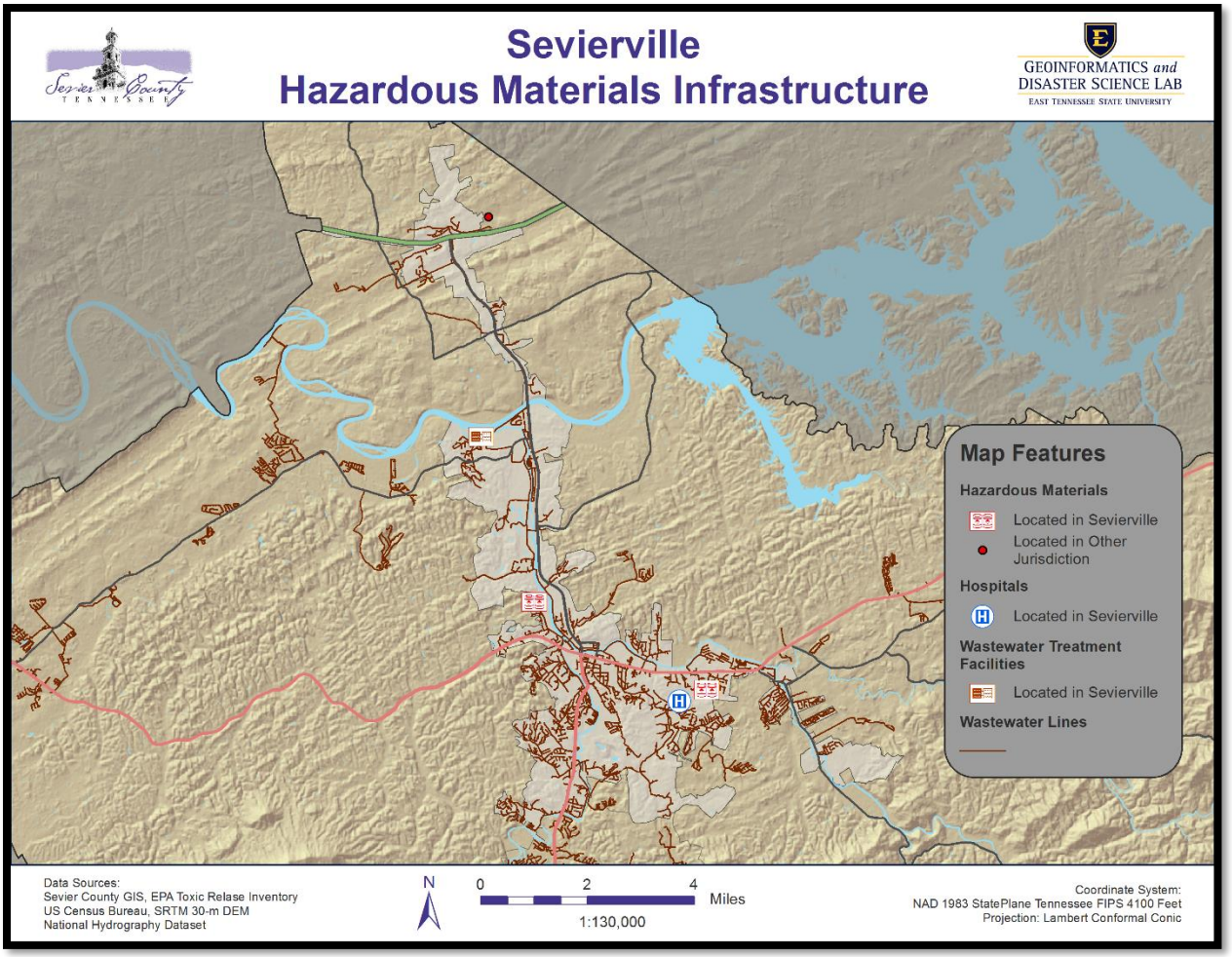


Figure C-0-38: Hazardous Material Critical Infrastructure Located in Sevierville.

Appendix D: News/Media Links for Previous Occurrences

Date	Hazard	Brief Description	Link
07/27/10	Sinkhole	TDOT reports reopening of State Route 66 after leak in water line helps cause a sinkhole under the road.	https://www.tn.gov/news/2010/7/27/sinkhole-repaired-on-state-route-66-in-sevier-county.html
11/24/12	Earthquake	3.0 earthquake with epicenter in Sevier County.	https://www.wrcbtv.com/story/20175623/light-earthquake-rumbles-areas-of-e-tenn-nc
11/30/16	Wildfire/Flooding /Mass Wasting	Article discussing rain finally helping to control Chimney Tops 2 fire and the resulting storms that came with the rain.	https://www.latimes.com/nation/la-na-tennessee-wildfires-20161130-story.html
12/16/16	Mass Wasting	Low landslide risk after Chimney Tops 2 fire according to USGS.	https://www.usgs.gov/news/low-landslide-risk-after-tragic-smokies-fires
12/22/16	Wildfire	Summary by National Park Service of Chimney Tops 2 fire.	https://www.nps.gov/grsm/learn/chimney-tops-2-fire.htm
03/15/17	Mass Wasting	Concern for landslide risk after Chimney Top fire.	https://www.wbir.com/article/news/local/landslide-risk-present-in-sevier-co-expert-says/422923928
05/09/17	Severe Wind	Mountain wave winds contribution to Chimney Tops 2 fire	https://www.usatoday.com/story/news/nation-now/2017/05/09/gatlinburg-wildfires-mountain-wave-winds/314209001/
08/03/17	Earthquake	Small earthquake near Sevierville (2.7)	https://www.wbir.com/article/news/local/small-earthquake-hits-near-sevierville/461824739
08/31/17	Wildfire	Full individual fire report of Chimney Tops 2 fire by the NPS.	https://wildfiretoday.com/documents/ChimneyTops2Report.pdf

Date	Hazard	Brief Description	Link
11/01/17	Wildfire	National Fire Protection Association report on large loss fires in the United States in 2016; Gatlinburg fire was the largest in terms of loss	https://www.nfpa.org/News-and-Research/Publications-and-media/NFPA-Journal/2017/November-December-2017/Features/Large-Loss-Fires-2016
11/22/17	Wildfire	Account of Chimney Tops 2 fire.	https://www.knoxnews.com/story/news/2017/11/22/gatlinburg-wildfire-one-year-later-chimney-tops-trail/856267001/
11/22/17	Severe Wind	Mountain wave winds contribution to Chimney Tops 2 fire	https://www.knoxnews.com/story/news/local/tennessee/gatlinburg/2017/11/22/gatlinburg-fire-how-fast-did-winds-blow/850944001/
12/21/17	Sinkhole	USGS claims local quarry is to blame for sinkholes along Middle Creek in Sevierville.	https://www.aggman.com/usgs-report-blames-quarry-for-sinkholes-by-bridge-in-tennessee/
04/30/18	Earthquake	A 2.1M quake occurred in the Cherokee National Forest in Sevier County, near the Tennessee-North Carolina state line on April 23	https://www.citizentribune.com/news/local/whole-lotta-shakin-sixth-april-earthquake-hits-region/article_34ff3fba-4c96-11e8-9449-db6c8ff6c6e6.html
12/29/18	Flooding	Flooding causes road closures in Sevier County.	https://themountainpress.com/news/1821/flooding-closes-multiple-roads-in-sevier-county/
02/23/19	Flooding	Pictures from social media depicting flood damage and flood levels for Sevier and Knox counties.	https://www.knoxnews.com/story/news/2019/02/23/east-tennessee-flooding-residents-share-photos-videos-perspective/2962462002/
02/23/19	Flooding	Level three state of emergency for eastern Tennessee.	https://www.wbir.com/article/weather/severe-weather/tennessee-is-under-a-level-3-state-of-emergency-what-does-that-mean/51-0f9835b0-5b76-48de-8992-cc4307e6ff0f

Date	Hazard	Brief Description	Link
02/24/19	Flooding	Video of Old Mill River flooding in Sevier county.	https://www.youtube.com/watch?v=JulLOOX-8Hk
03/06/19	Flooding	Article discussing damages over $10 million from flooding over the entirety of Sevier county.	https://www.wvlt.tv/content/news/Sevier-damage-grows-to-10M-506776491.html
04/16/19	Civil Disobedience/ Terrorism	Tanger mall shooting - 2 dead.	https://www.knoxnews.com/story/news/crime/2019/04/16/sevierville-police-respond-shooting-tanger-outlets/3489057002/
04/18/19	Civil Disobedience/ Terrorism	Tanger mall shooting, article discusses initial news coverage of shooting and motives.	https://www.knoxnews.com/story/news/crime/2019/04/18/tanger-outlets-shooting-prohibited-owning-gun/3508565002/
04/19/19	Flooding	Pigeon forge - Little pigeon river above flood stage causes road closures.	https://www.wate.com/news/local-news/flooding-update-high-water-still-has-roads-closed-in-sevier-county/
05/29/19	Sinkhole	Article discussing the reopening of the Dolly Parton Pkwy after sinkhole shut down eastbound lane.	https://www.wate.com/news/local-news/update-all-lanes-of-dolly-parton-parkway-reopened-after-sinkhole-closed-eastbound-lane/
08/01/19	Mass Wasting	Death on the Spur due to landslide.	https://www.wvlt.tv/content/news/Rock-slide--513505151.html
08/03/19	Flooding/Mass Wasting	Landslide from flooding of the Spur and resulting fatality.	https://themountainpress.com/news/3655/nps-rains-caused-spur-landslides/
08/27/19	Earthquake	Two small earthquakes near Sevierville (2.2/1.7)	https://www.wate.com/news/local-news/earthquakes-2-small-quakes-in-sevier-county-on-tuesday-afternoon/
08/30/19	Sinkhole	State to fund repairs on sinkholes near Sevier county airport.	https://themountainpress.com/news/3884/state-will-fund-95-of-repairs-on-airport-sinkholes/