

# VULNERABILITY ASSESSMENT

Based on the *Hazard Analysis* conducted for Catawba County, the hazards listed below have been chosen for inclusion in a higher-level, detailed vulnerability assessment to help Catawba County and its participating jurisdictions in prioritizing those to address through proposed mitigation actions. This listing differs slightly in terminology and grouping from the *Hazard Identification* and *Hazard Analysis* sections, as those hazards specifically affecting Catawba County are more fully explored.

- **Flood**
- **Hurricanes and Tropical Storms**
- **Severe Thunderstorms and Tornadoes**
- **Wildfire**
- **Drought**
- **Winter Storms**
- **Erosion**
- **Dam/ Levee Failure**
- **Earthquakes, Sinkholes and Landslides**

These hazards were chosen from the previous sections due to the higher level of risk for these hazards compared to others. It is important to note that this risk assessment is based on best available data as collected and updated during the 2009 plan update. Additional work will continue to be done during future plan updates to enhance, expand and further improve the accuracy this assessment for mitigation planning purposes.

#### **44 CFR Requirement**

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

## *Methodologies Used*

To drive the risk assessment effort, two distinct methodologies were applied. The first methodology consists of utilizing HAZUS<sup>®MH</sup> (GIS-based loss estimation software available from the Federal Emergency Management Agency) as well as a GIS-based approach independent of the HAZUS<sup>MH</sup> software. These two GIS-based studies, which together form a quantitative assessment, were then combined with a qualitative element to create a hybrid approach. The quantitative assessment focuses on potential loss estimates, while the qualitative assessment is comprised of a scoring system built around values assigned by the Mitigation Advisory Committee to the likelihood of occurrence, spatial extent and potential impact of each hazard studied here.

It is important to note that the determinations presented in this section with regard to vulnerability were developed using best available data, and the methodologies applied have resulted in an approximation of risk. These estimates should be used to understand relative risk from hazards 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 natural hazards and their effects on the built environment and also from approximations and simplifications that are necessary in order to provide a comprehensive analysis.

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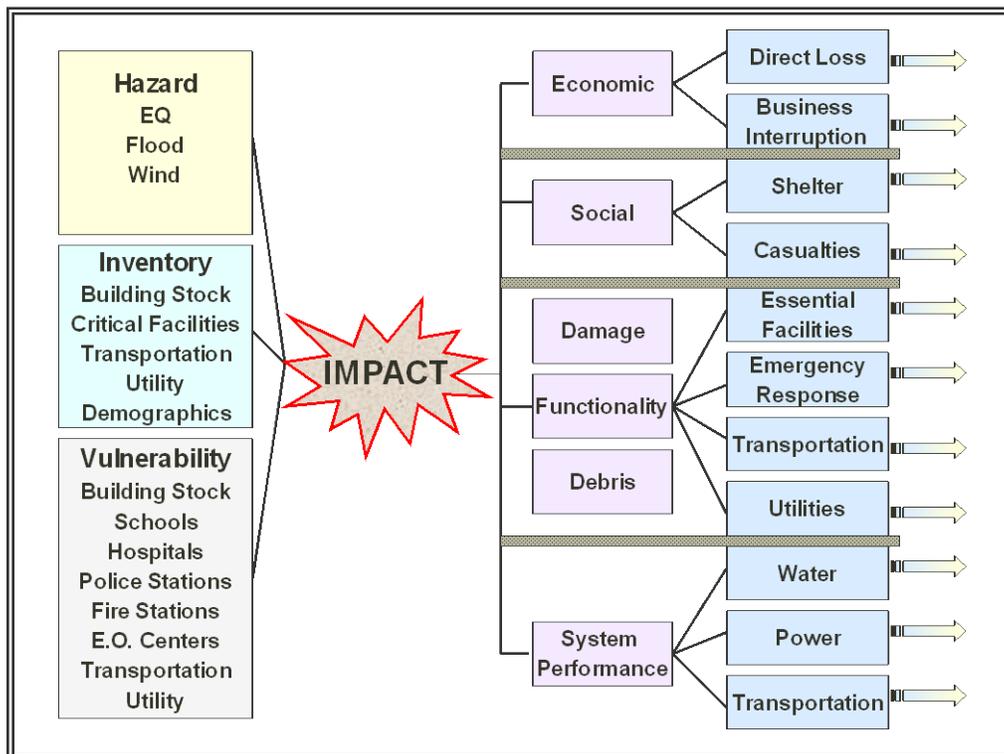
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## Explanation of HAZUS<sup>MH</sup> Risk Assessment Methodology

HAZUS<sup>MH</sup> is FEMA’s nationwide standardized loss estimation software package, built upon an integrated geographic information system (GIS) platform. This risk assessment utilized HAZUS<sup>MH</sup> (Version MR3) to produce regional profiles and estimated losses for three of the hazards addressed in this section: flood, hurricane winds and earthquake. For the flood hazard, a Level 2 analysis was performed using new DFIRM data to generate potential loss estimates to the 100-year flood event. However, annualized losses were generated using the same GIS-based methodology as in 2004 in combination with new DFIRM data (further described below). For the hurricane wind and earthquake hazards, Level 1 analyses were performed to generate potential annualized losses for the County as a whole.

The HAZUS<sup>MH</sup> risk assessment methodology is parametric, in that distinct hazard and inventory parameters — such as wind speed and building type, for example — were modeled using the HAZUS<sup>MH</sup> software to determine the impact (damages and losses) on the built environment. **Figure 6.1** shows a conceptual model of HAZUS<sup>MH</sup> methodology.

**Figure 6.1**  
**Conceptual Model of HAZUS<sup>MH</sup> Methodology**



It is important to note that for those hazards where HAZUS<sup>MH</sup> was used, “worst case scenario” results were produced to show the maximum potential extent of damages for those hazards. It is understood that any smaller events which could occur would likely create fewer losses than those calculated here.

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## Explanation of GIS-based (non-HAZUS) Risk Assessment Methodology

The general steps used in the GIS-based assessment conducted independently of the HAZUS<sup>MH</sup> software are summarized below:

- The first step in conducting this facet of the risk assessment consisted of GIS data collection from local, state and national sources.
- For the flood hazard, ESRI<sup>®</sup> ArcGIS<sup>™</sup> 9.2 was used to assess risk utilizing digital flood hazard data (based on FEMA Flood Insurance Rate Maps) in combination with locally-available GIS data layers. Primary data layers used include local tax records for individual parcels, building footprint data, digital orthophotographic layers, and geo-referenced point locations for critical facilities, hazardous materials sites and infrastructure elements. Using these data layers, flood risk was assessed by calculating the assessed building value for all pre-FIRM<sup>1</sup> structures located in identified flood hazard areas. A contents value of 50 percent was used in determining total potential flood loss.
- For the severe thunderstorm, tornado and winter storm hazards, best available data on historical hazard occurrences (limited to NOAA National Climatic Data Center records) was used to produce an annualized loss estimate of potential damages. Using this data, annualized loss estimates were generated by totaling the amount of property damage over the period of time for which records were available, and calculating the average annual loss. GIS was used to show the correlations between potential future events and residential population distribution throughout the county. Future plan updates may also incorporate place-of-business population distribution to better reflect the vulnerability of human life inherent during traditional working hours. In instances where multiple counties are affected and the value for property damage reflects the total for the affected area, professional judgment was used in extracting a reasonable share for Catawba County to produce an annualized loss estimate of potential damages in Catawba County.
- For the wildfire, drought, erosion and dam/levee failure hazards, meaningful historical data (meaning data which would have included property damages and other essential indicators) was virtually non-existent, and therefore annualized potential losses for these hazards is assumed to be negligible.

## Explanation of Hybrid Approach

As described in the preceding commentary, the quantitative assessment focuses on potential loss estimates, while the qualitative assessment is comprised of a scoring system built around values assigned by the Mitigation Advisory Committee to the likelihood of occurrence, spatial extent and potential impact of each hazard presented here. For likelihood of occurrence, the following four options were available to members of the Mitigation Advisory Committee: Highly Likely, Likely, Possible or Unlikely. For spatial extent, three options were offered to describe the area which might be expected to be affected: Large, Moderate or Small. For potential impact, the choices consisted of: Catastrophic, Critical, Limited or Minor. **Table 6.1** provides the criteria associated with each label.

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<sup>1</sup> The methodology used for determining potential flood loss estimates assumed that pre-FIRM structures would not have been constructed to minimum NFIP standards, and therefore are more likely to be vulnerable to the flood hazard than post-FIRM structures. Pre-FIRM structures were identified by comparing the date of construction for each structure to the NFIP entry date for that jurisdiction.

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**Table 6.1  
Criteria for Qualitative Assessment**

Classification	Assigned Value	Definition
<b>Likelihood of Occurrence</b>		
Highly Likely	3	Near 100% annual probability
Likely	2	Between 10 and 100% annual probability
Possible	1	Between 1 and 10% annual probability
Unlikely	0	Less than 1% annual probability
<b>Spatial Extent</b>		
Large	3	More than 50% of area affected
Moderate	2	Between 10 and 50% of area affected
Small	1	Less than 10% of area affected
<b>Potential Impact</b>		
Catastrophic	4	High number of deaths/injuries possible. More than 50% of property in affected area damaged or destroyed. Complete shutdown of facilities for 30 days or more.
Critical	3	Multiple deaths/injuries possible. More than 25% of property in affected area damaged or destroyed. Complete shutdown of facilities for more than one week.
Limited	2	Minor injuries only. More than 10% of property in affected area damaged or destroyed. Complete shutdown of facilities for more than one day.
Minor	1	Very few injuries, if any. Only minor property damage and minimal disruption on quality of life. Temporary shutdown of facilities.

The values assigned for each option chosen are added together for each hazard to arrive at a total score. For example, in Catawba County the flood hazard is considered Highly Likely (3), with a Moderate reach (2), with a Critical potential impact (3). This gives the flood hazard a total hazard rating of 8 (10 being the highest possible score.) This presents the flood hazard as one of the highest ranking hazards for the planning area.

All conclusions are presented in "Conclusions on Hazard Risk," beginning on page 6-50. Findings for each hazard are detailed in the hazard-by-hazard vulnerability assessment which follows, beginning with an overview of the planning area.

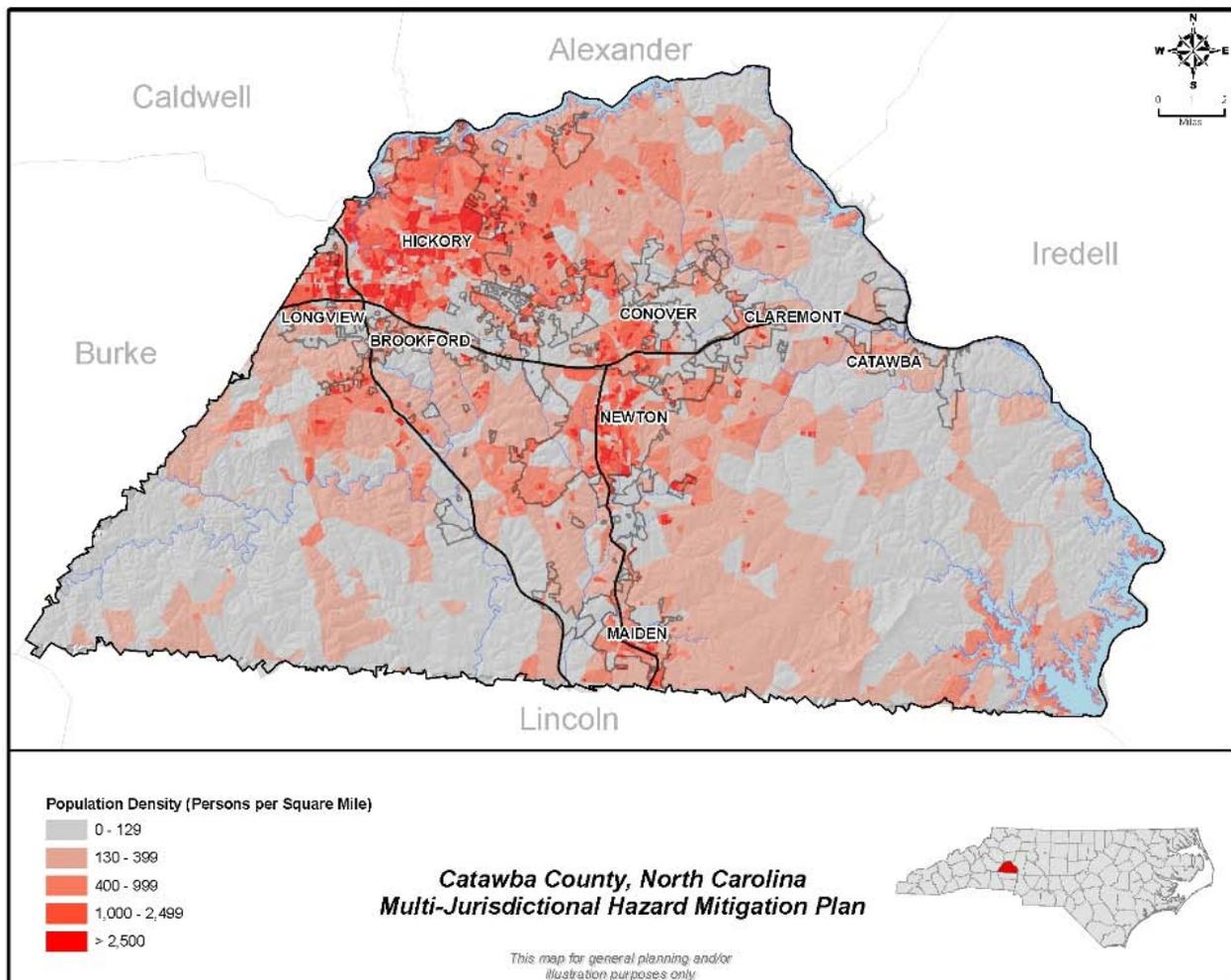
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## Overview of Catawba County Vulnerability

According to the U.S. Census Bureau, the total population of Catawba County in 2000 was 141,685. (The total population in 2000 for the state of North Carolina as a whole was 8,049,313.) **Figure 6.2** shows the distribution of Catawba County's population across the county's geographic area. The map shows the total number of persons within each census block.

**Figure 6.2**  
**Population Density by Census Block (U.S. Census 2000)**



Source: CCGIS, U.S. Census Bureau

The total dollar exposure of buildings within Catawba County is estimated to be approximately \$10.1 billion. This is based on a study of approximately 55,000 residential, commercial and industrial buildings

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located throughout the county, derived from 2009 HAZUS<sup>MH</sup> MR3 data.<sup>2</sup> Total dollar exposure accounts for both the building and building contents, which is based on a percentage of each building's value.

Of the approximately \$10.1 billion in total building exposure, 63% is classified as residential, followed by 19.5% as commercial and 13.6% as industrial property exposure. **Figure 6.3** through **Figure 6.5** shows the distribution of residential, commercial and industrial property throughout the county by census block.

For risk assessment purposes, it is assumed that this entire countywide building stock of approximately 55,000 buildings is equally susceptible to those hazards not located within geographically-defined hazard areas as described this section (such as flood and wildfire, in which more detailed estimates of at-risk structures are provided).

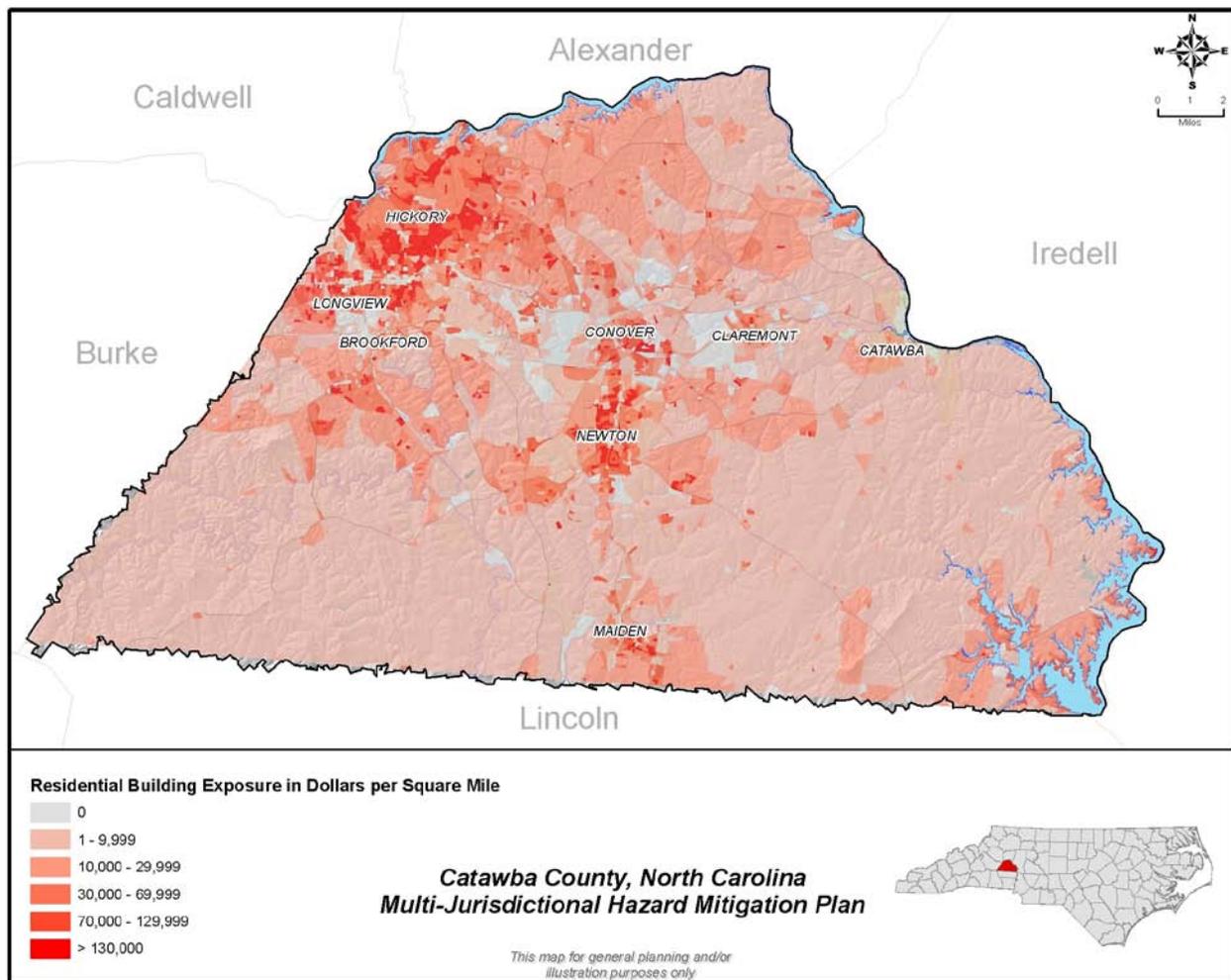
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<sup>2</sup> HAZUS-MH MR-3 uses Census 2000 and Dunn and Bradstreet (2006) data for its default inventories. Any values unavailable in the current version of the HAZUS-MH software are not reflected.

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**Figure 6.3**  
**Residential Dollar Exposure**

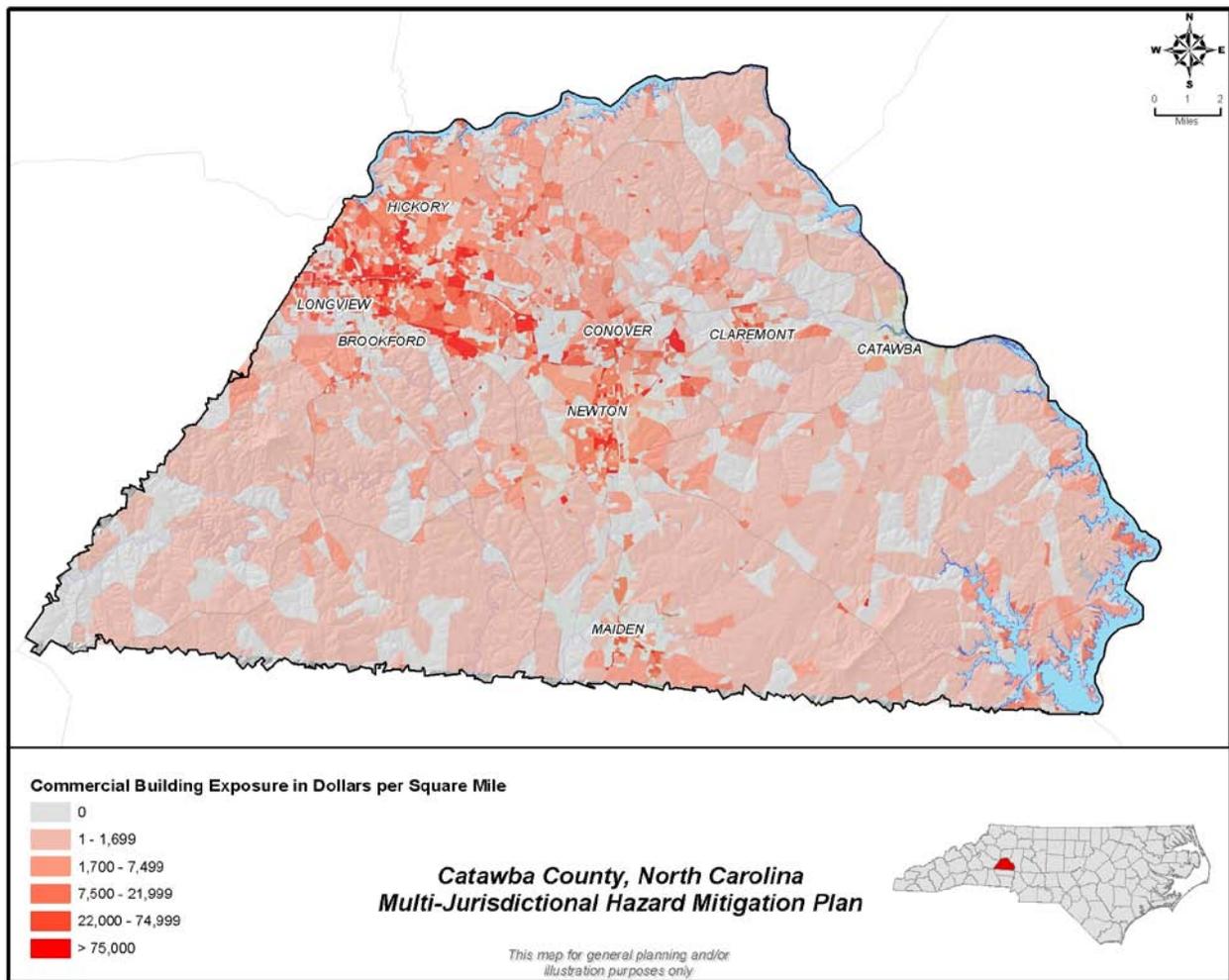


Source: CCGIS, FEMA (HAZUS-MH)

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**Figure 6.4**  
**Commercial Dollar Exposure**

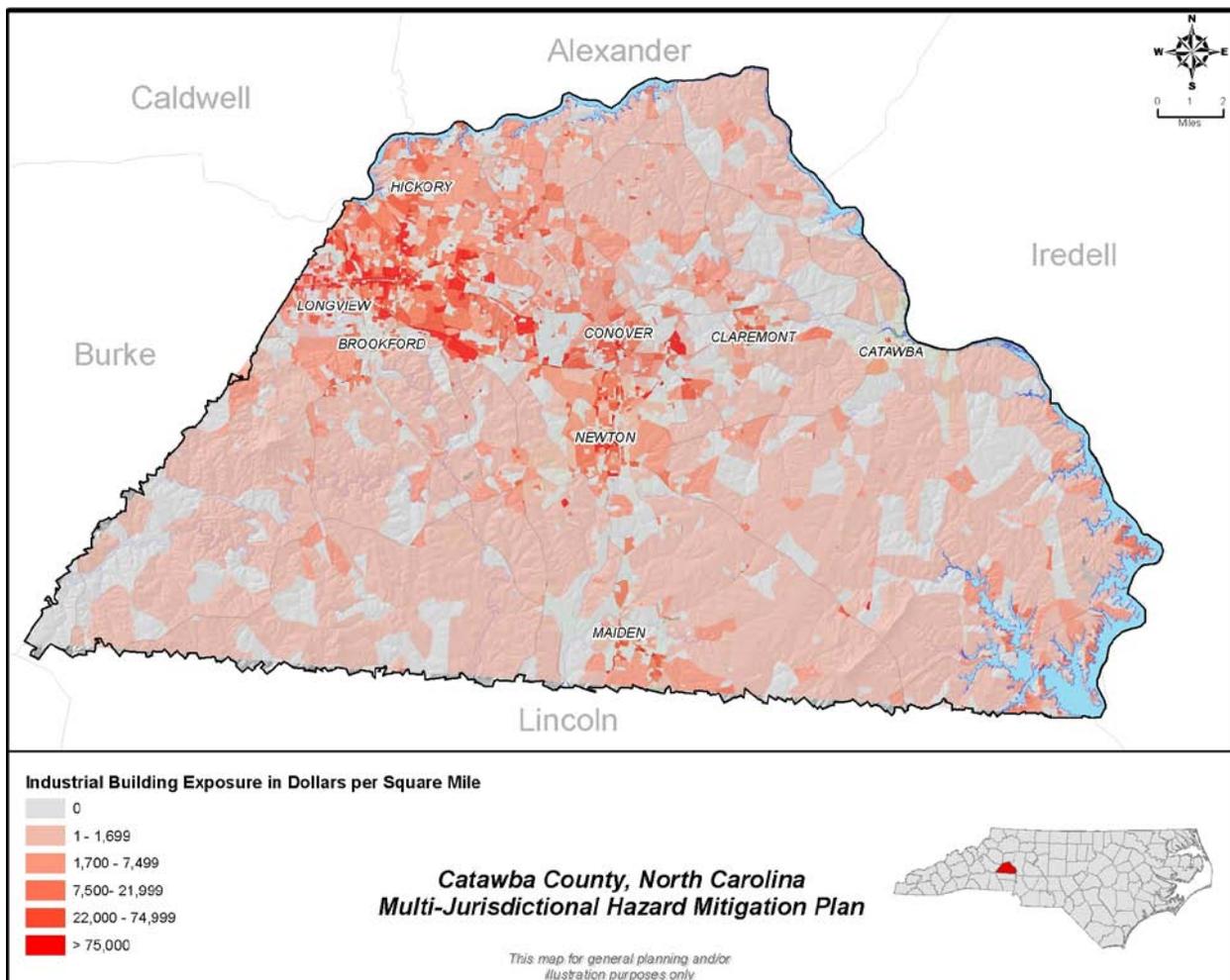


Source: CCGIS, FEMA (HAZUS-MH)

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**Figure 6.5**  
**Industrial Dollar Exposure**



Source: CCGIS, FEMA (HAZUS-MH)

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## **Development Trends**

The rate of population change in Catawba County between 1990 and 2000 was 19.7 percent, only somewhat lower than the state of North Carolina's average population change of 21 percent. Since 2000, the County's population growth has slowed but remains steady with a 10.2 percent increase. One specific aspect of this growth is the expansion of roadways into Catawba County that are opening opportunities for commerce along these new heavily traveled routes. Local officials are aware of these growth trends and are mindful of the need to plan development away from flood and other hazard areas.

The following description of development trends provides more detailed information on recent land use patterns in Catawba County. Additional information on current and future development trends is provided in *Section 3: Community Profile*.

### Trends in the Northeast Planning Area

The Northeast Planning Area, commonly referred to as Oxford, is projected to be one of the fastest growing areas of the County in coming years. Currently, most of this area's industrial and commercial development is along I-40 and Highway 70 from Highway 16 North in Conover to Claremont. The eastern side of Conover consists of perhaps the largest concentration of industry in Catawba County. Portions of Claremont are beginning to emerge as major industrial areas as well. Residential development in this area is mostly concentrated in and around Conover and Claremont with growing developments (mostly along Rock Barn Road) outside of the cities. Extension of water service by the City of Conover along Highway 16 North will help clear the way for continued residential development in this area. The Catawba River serves as the northern and eastern boundary of this area. Many parts of this section of the River are not conducive to the type of water craft activities that parts to the south experience. However, more passive recreational opportunities could abound here. In fact, the County's first Park - Riverbend - is located in this area off Highway 16 along the Catawba River.

### Trends in the North-Central Planning Area

This area is influenced primarily to the south by Conover. Hickory has grown to the very edges of this Planning Area. Conover serves parts of this area with water and/or sewer services thus facilitating much of the extra-urban growth that has occurred here. Outside of Conover, the area includes concentrations of small residential subdivisions along Houston Mill Road, Section House Road and the northern part of Springs Road. Most of the industrial development here is in the western portions of Conover. Like the Northeast Planning Area, the North-Central Area is still largely undeveloped.

### Trends in the St. Stephens Planning Area

This area is comprised of established, primarily middle-class, single-family neighborhoods with a commercial spine (Springs Road) consisting of mostly older business establishments that target the immediate surrounding neighborhoods. Despite the fact that the St. Stephens area includes a significant residential population that is growing, the area has yet to experience the rapid new commercial investment that is found along Highway 127 and Highway 70 in Hickory. Significant parts of this area are served with municipal services and are already incorporated into the City of Hickory. This annexation trend is likely to continue as the growth-driven demand for municipal services continues. Even though this is one of the more densely populated of the County planning areas, plenty of vacant land still exists for continued growth. There is limited industrial development that exists in this Planning Area. Most of it is along and around Highland Avenue.

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### Trends in the Hickory Urban Area

Much of the Hickory Urban Area is near build-out; that is, most of the land is either built upon or is unsuitable for building. The exception to this is found in northwest Hickory (census tract 103) where some land still exists and is available for new development. The land use pattern found in Hickory is one of large scale residential development in both the northeast and northwest quadrants. These residential areas are split by heavy commercial development along Highway 127 (north of downtown) and Highway 70 (east and west) and the Downtown/Catawba Square area. Most of the City's industrial development is located in the southwestern and southeastern portion of the City along Highland Avenue and Tate Boulevard and along US Highway 321 North.

### Trends in the East Newton Planning Area

The East Newton Planning Area is the industrial development side of the City of Newton and its environs. Most of the industrial development has occurred along the east-west railroad tracks and northward towards Conover to Highway 70. Most of the residential development has occurred to the south of the railroad tracks. Like the Hickory Urban Area, much of this planning area is nearly built-out. Highway 16 serves as a mixed-use dividing line between the East and West Newton planning areas. Approximately one-half of this area is incorporated, mostly by Newton and partly by Conover.

### Trends in the West Newton Planning Area

Similar to East Newton, this area is mostly built-out. Highway 16 serves as a spine between the East Newton and West Newton Planning Areas. Highway 16 consists of a mixture of residential, commercial and limited industrial development, none of it large in scale. Highway 321 Business is located here and is mostly commercial on the northern end near Highway 70 and largely office and institutional to the south near Highway 10 (County Government Center, County Justice Center). The majority of the land here is devoted to older, single family residential homes. Most of the land in this Planning Area is incorporated by the City of Newton.

### Trends in the West-Central Planning Area

This area is a relatively small planning area with a high growth center around the northern part of the Mountain View community. The area stretches from Robinson Road in the east to the western County line; and from Highway 70 in the north to Bethel Church Road in the south. The northern portion of the new US 321 Freeway is located here and will have tremendous development influence. This area includes the River Road interchange and the planned Sandy Ford interchange. The I-40/321/127 interchange provides the Mountain View community and surrounding land with good accessibility to all parts of the County and beyond. The southern portions of Hickory and Long View in this Planning Area represent a high growth area for both municipalities: Long View southward to I-40 and Hickory towards the Mountain View community. The Town of Brookford is also located here. This mill town has changed very little over time. However, the new freeway will disrupt portions of the Town and may even bring some limited development pressures that have never been seen before. With the exception of Highway 70, most of the development patterns here are limited to older, established single-family residential neighborhoods with a growing amount of convenience commercial development to serve them. Highway 70 is heavily developed with mostly automobile-oriented strip commercial development.

### Trends in the Southwest Planning Area

This area includes the communities of Propst Crossroads, Cooksville, Plateau and Blackburn. It also includes some of the Mountain View Community south of Bethel Church Road including the neighborhoods of Deerfield and Homestead. The area is largely low density residential or rural with only a small amount of commercial development at some of the crossroad communities. The trend is for

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continued low density residential except in the Mountain View community where future municipal services may facilitate new residential growth. There are no incorporated areas in this Planning Area.

### Trends in the South-Central Planning Area

This area contains all of the new US 321 Freeway south of Sandy Ford Road and contains the Highway 10 and the Startown Road interchanges. These two interchanges represent the most immediate growth potential. Virtually all of the land in the southern half of this planning area, including the Freeway, is undeveloped or is farmland or timberland. The only ongoing significant activity in the southern portion of the area is along Highway 10 and the Rocky Ford area. This includes the City of Newton's target new distribution facility and Catawba County's Eco-Complex (including the Blackburn Landfill). The general areas of influence here involve Newton growing to the west along Highway 10, Maiden growing to the northwest and west towards the Startown Road interchange with US 321 and Hickory growing southward along Startown Road. The Maiden area will likely experience significant growth and development in years to come due to the new data center being constructed by Apple Computer, Inc. in the West Star Mission Critical Data Park near US 321 Business which is projected to create more than 3,000 jobs. Conover is essentially blocked by Hickory and Newton from annexing any of this area. A few years ago, the City of Newton annexed a significant portion of the Startown Community. In recent years, the Town of Maiden has grown northward along Hwy. 321 Business and westward along West Maiden Road to the new 321 Freeway interchange at Startown Rd. The northern portions of the South-Central Planning Area has developed similarly to the Mountain View and St. Stephens communities with older, moderate density residential neighborhoods and a scattering of convenience commercial opportunities. Highway 70 in this Planning Area has a mixture of smaller commercial establishments and large commercial and industrial developments. Many relatively large tracts of land still exist along this stretch of Highway 70.

### Trends in the East-Central Planning Area

The East-Central Planning Area is located to the east of Newton and Conover, south of Highway 70 and north of Highway 16 South. This area is significantly influenced by the City of Newton and to a lesser degree by Conover. However, it is primarily an area that includes the industrial strip along Highway 70 between Conover and Claremont. Claremont's ever increasing tax base is evident in this Planning Area. The residential development is almost exclusively segregated to the northern part of this area (around Highway 10 and north to Highway 70). Murray's Mill is located in this area as are the communities of Balls Creek, Witherspoon Crossroads and parts of Bandys. Also found here are the residential developments of Shangri-La and Shamrock Park. The old County landfill is located in this area.

### Trends in the South Planning Area

Heavily influenced by Maiden in the west, this area lies southwest of Highway 16 South and includes all of the southwest side of Highway 16 South from Highway 150 to the Newton City limits. It is bounded in the west by Highway 321 Business which splits the Town of Maiden in half. The Hwy. 321 Business corridor between Maiden and Newton is home to a number of industrial operations. Highway 16 South includes mostly older residential homes with driveway access to the highway and some commercial nodes at major crossroads. Most of the land in this area is lower density residential (several acres per home). There are virtually no concentrated higher density residential subdivisions in this area. In addition to Maiden, the area includes the communities of Drums Crossroads, Providence Mill, and Olivers Crossroads.

### Trends in the Southeast Planning Area

Far and away the largest of the designated County Planning Areas, the Southeast is also one of the fastest growing, one of the least connected to the rest of the County and the one with the likelihood for the most growth-related issues to be dealt with. This planning area could not be any more diverse. The

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area surrounding the Town of Catawba is very rural in nature but has some development potential along Highway 70 and Highway 10. The rest of the Planning Area (except the land adjacent to Lake Norman) is largely undeveloped. Roads such as Sherrills Ford Road, Little Mountain Road and Hopewell Church Road are virtually untapped for development. Conversely, land around the Lake is becoming very developed at densities similar to some urban areas. The influences of Lake Norman are not to be underestimated. Rapid growth is beginning to occur here, and municipal water service is being expanded to accommodate this growth and public sewer is now under construction. The road network that has been created by land developers along both sides of Highway 150 is extensive. Due to a lack of public sewer service in the past, development here is often limited to half acre lots or greater. However, for an unincorporated place the density is still very high in certain areas around the Lake. The vast majority of the Southeast Planning Area's population likely lives within a mile of Lake Norman or the Catawba River.

Island Point Road is of particular concern when exploring land use issues. This approximately four mile long road has huge development potential. As this area becomes developed with more and more residences, traffic will become more burdensome. With the Southeast area's strong ties to employment and entertainment in Charlotte, peak hour traffic on this four mile dead-end road will likely need to be remedied over time. With this mind, an alternate road was required to be constructed to connect to another State-maintained road. Brawley School Road in Iredell County poses a similar, but much more ominous threat. Density limitations have been placed on that road to address these same issues. While no specific data exists to determine commuting patterns and shopping habits in this area, general discussions with residents suggest that Sherrills Ford/Lake Norman residents shop and are entertained mostly in Mooresville and northern Mecklenburg County and work in and around Charlotte. For good schools, less congestion and somewhat less expensive waterfront living, the 45 minute to one-hour commute appears to be worth it for a growing number of people.

## *Flood*

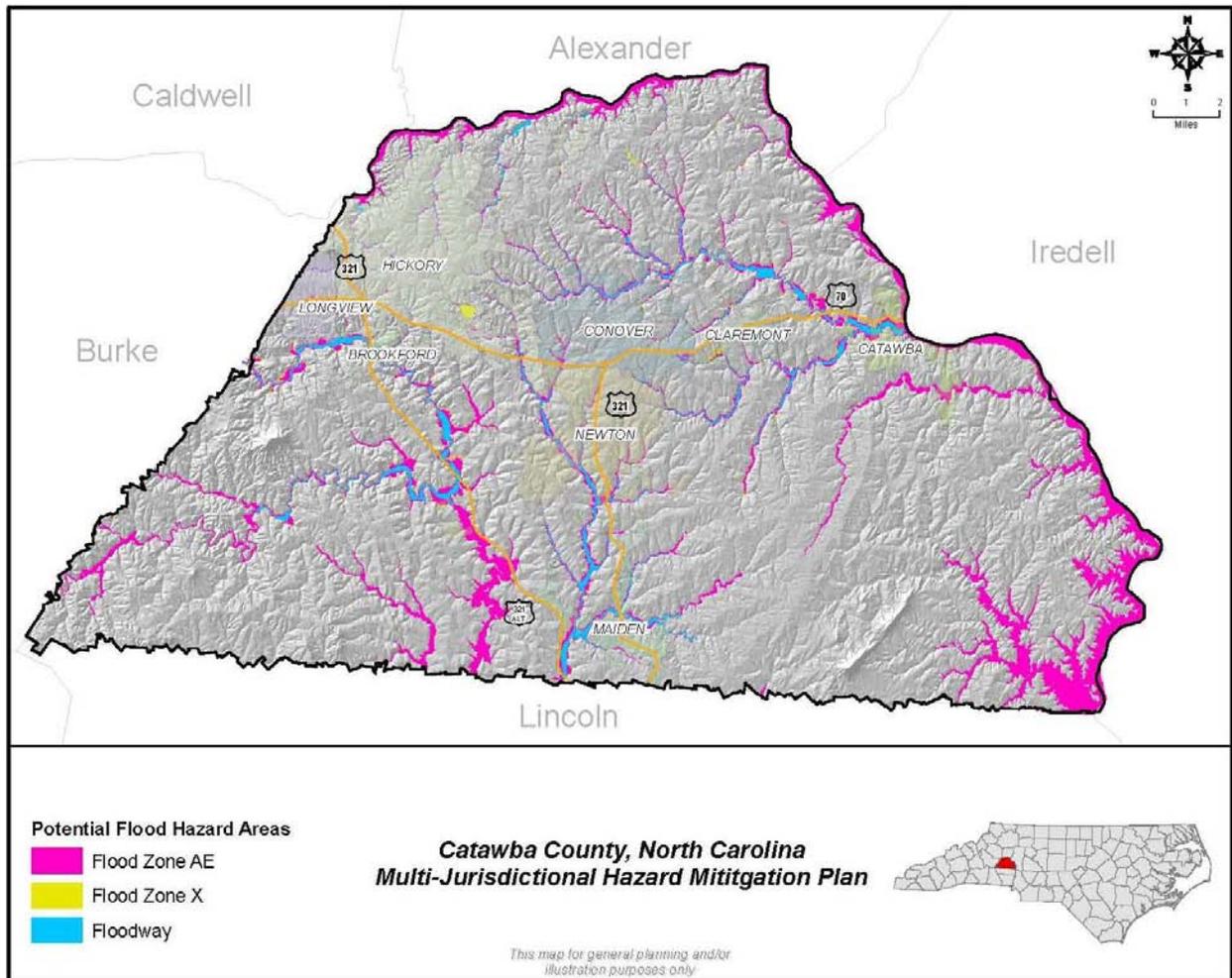
The vulnerability assessment for the flood hazard in Catawba County is based on a detailed GIS analysis utilizing the best data currently available. Much of this information is based on county data, however all digital flood data is based on FEMA Flood Insurance Rate Maps (FIRMs) which in 2004 contained some extreme examples of erroneous floodplain delineations particularly in the Lake Norman area. These errors were highlighted in the 2004 version of this plan. Fortunately, new and improved DFIRM data became available in 2008 through the North Carolina Flood Mapping Program. All jurisdictions in Catawba County have since approved and adopted the new FIRMs, and the vulnerability assessment performed in 2009 relied on the new DFIRM data layers as provided by Catawba County.

**Figure 6.7** shows flood zone AE (one percent annual chance flood event, otherwise known as the "100-year flood) and zone X (.02 percent annual chance flood event, otherwise known as the 500-year flood event) on a countywide scale, based on current digital Flood Insurance Rate Maps. To provide the additional level of detail needed to discern localized flood hazard for the counties individual jurisdictions, **Figure 6.8** through **Figure 6.15** were produced to show flood hazard areas within each municipality along with digital orthophotography, including areas immediately outside the incorporated limits of each. In addition, data tables were created to summarize at-risk structures (**Table 6.2** and **Table 6.3**), estimated losses (**Table 6.4** and **Table 6.5**), repetitive loss properties (**Table 6.6**), high potential loss properties (**Table 6.7**), and critical facilities (**Table 6.8**) based on their intersection with known flood hazard boundaries.

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**Figure 6.7**  
**Flood Zones A, AE and X Countywide**

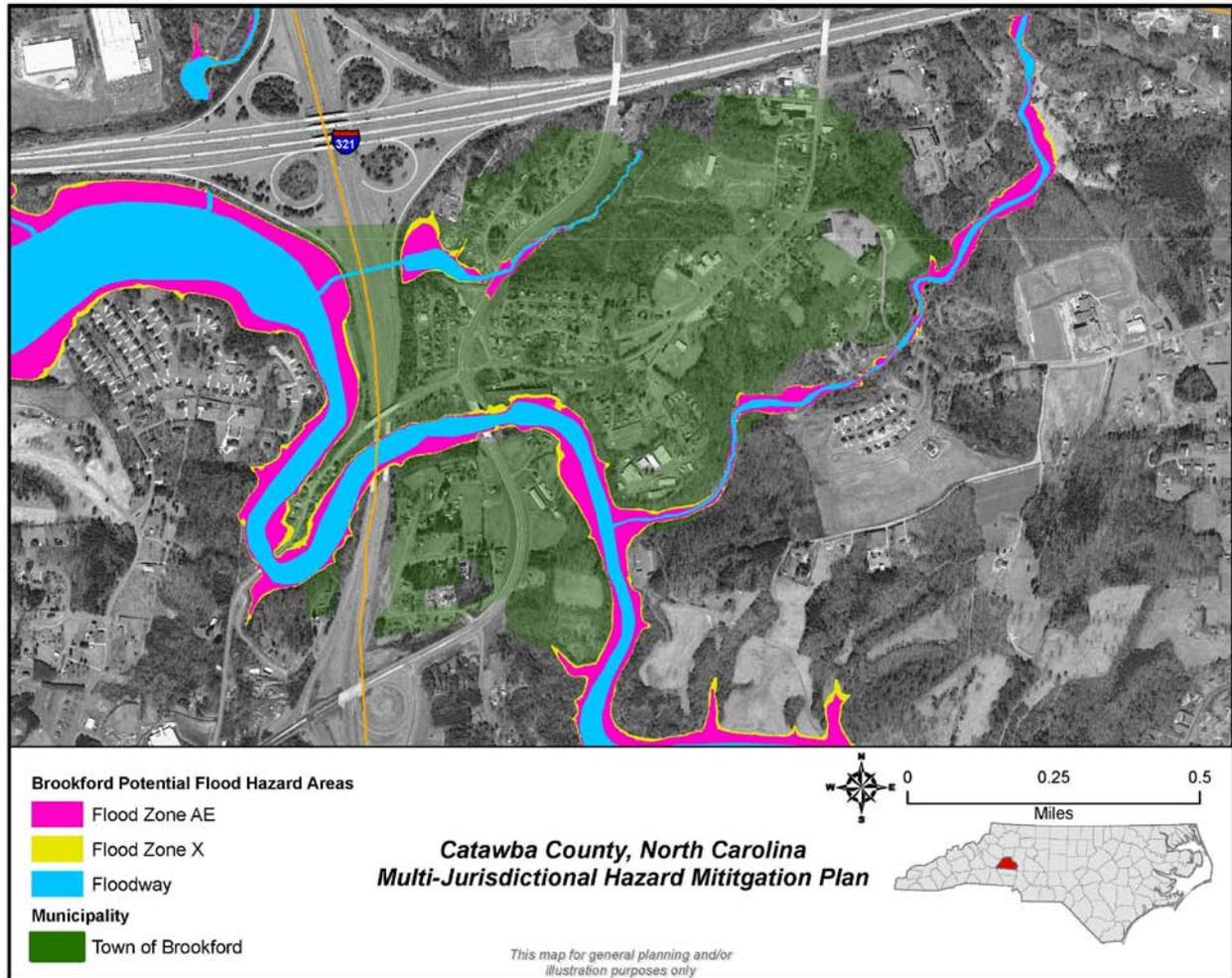


Source: CCGIS, FEMA

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**Figure 6.8**  
**Flood Zones A, AE and X in the Town of Brookford**

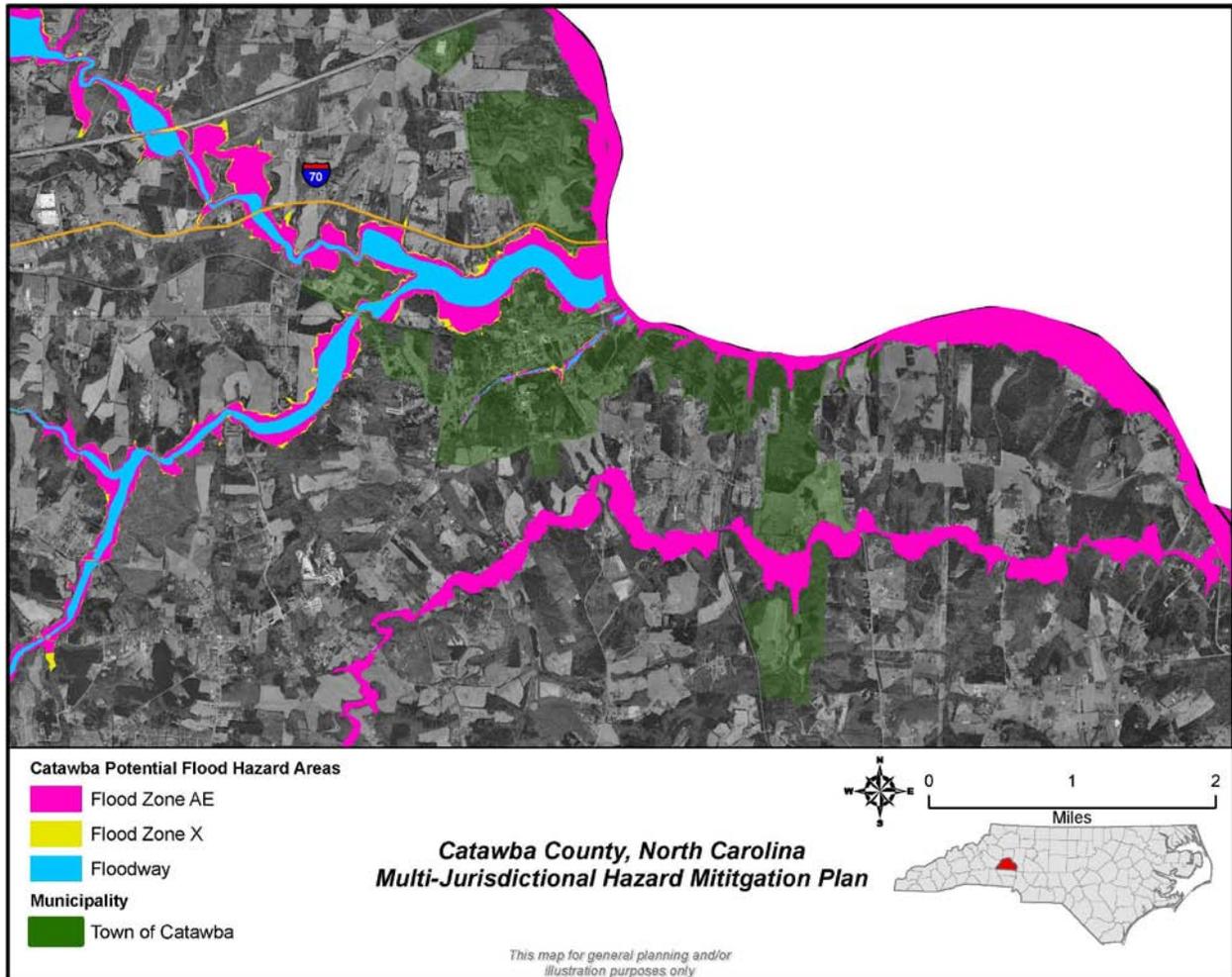


Source: CCGIS, FEMA

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**Figure 6.9**  
**Flood Zones A, AE and X in the Town of Catawba**

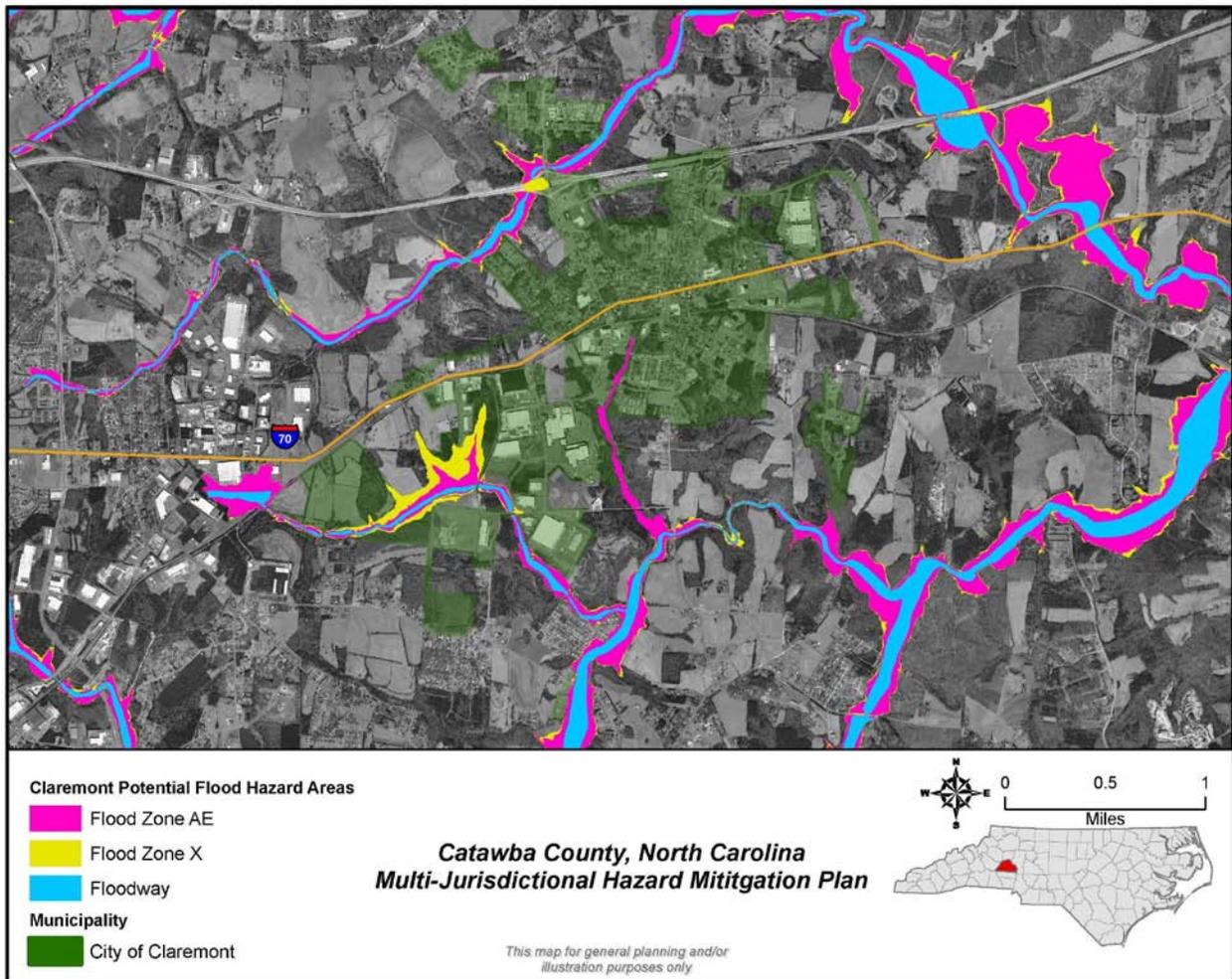


Source: CCGIS, FEMA

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**Figure 6.10**  
**Flood Zones A, AE and X in the City of Claremont**

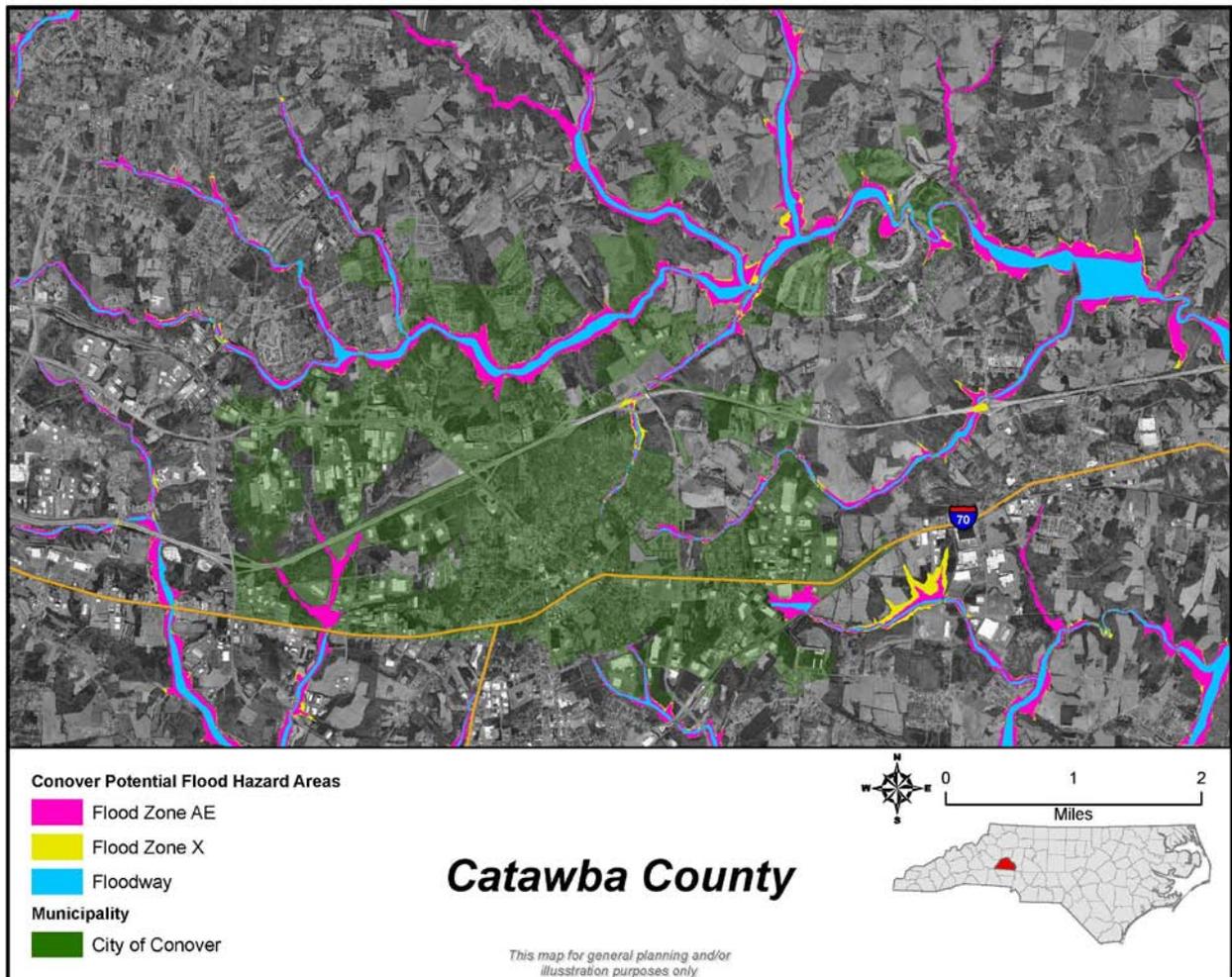


Source: CCGIS, FEMA

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**Figure 6.11**  
**Flood Zones A, AE and X in the City of Conover**

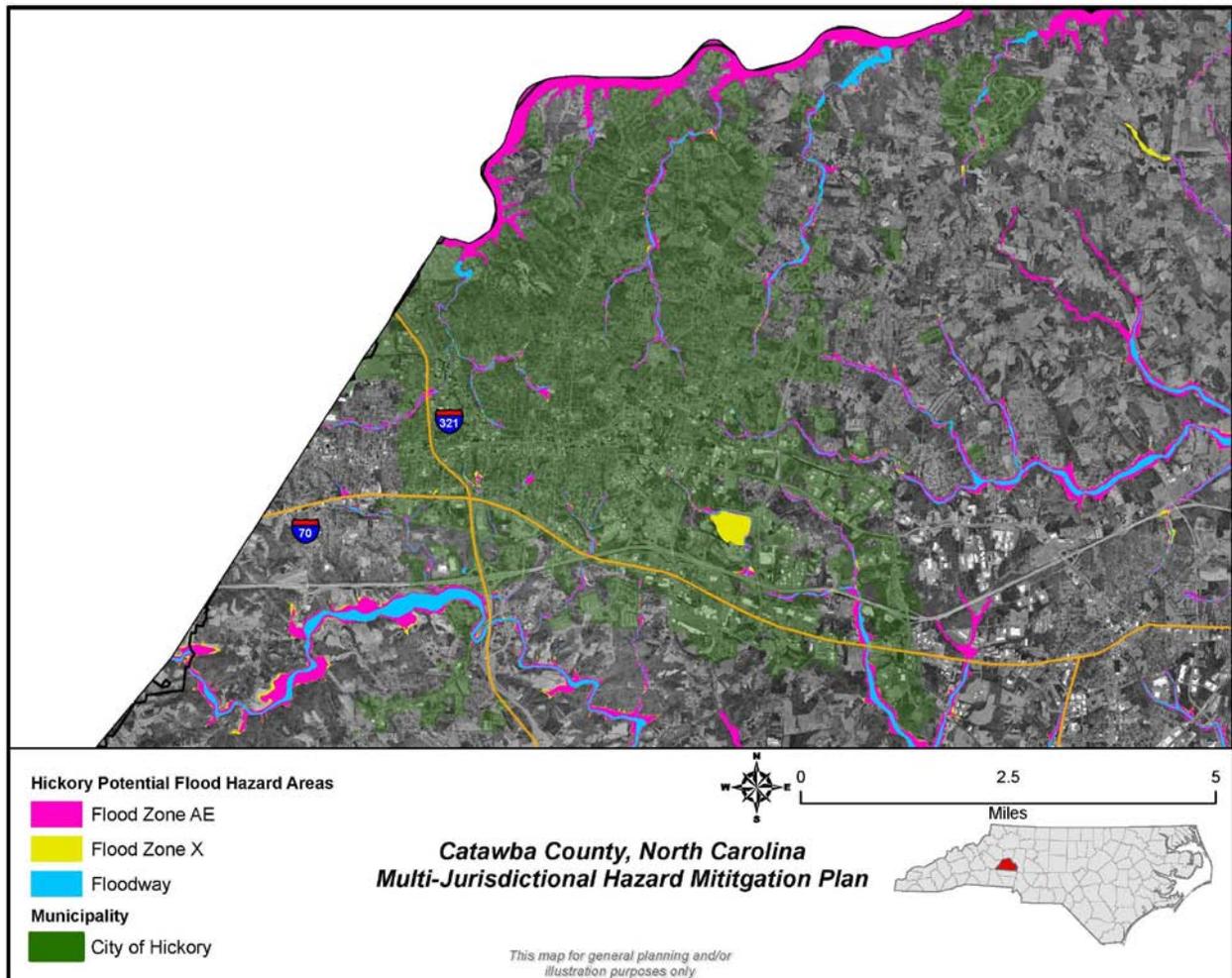


Source: CCGIS, FEMA

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**Figure 6.12**  
**Flood Zones A, AE and X in the City of Hickory**

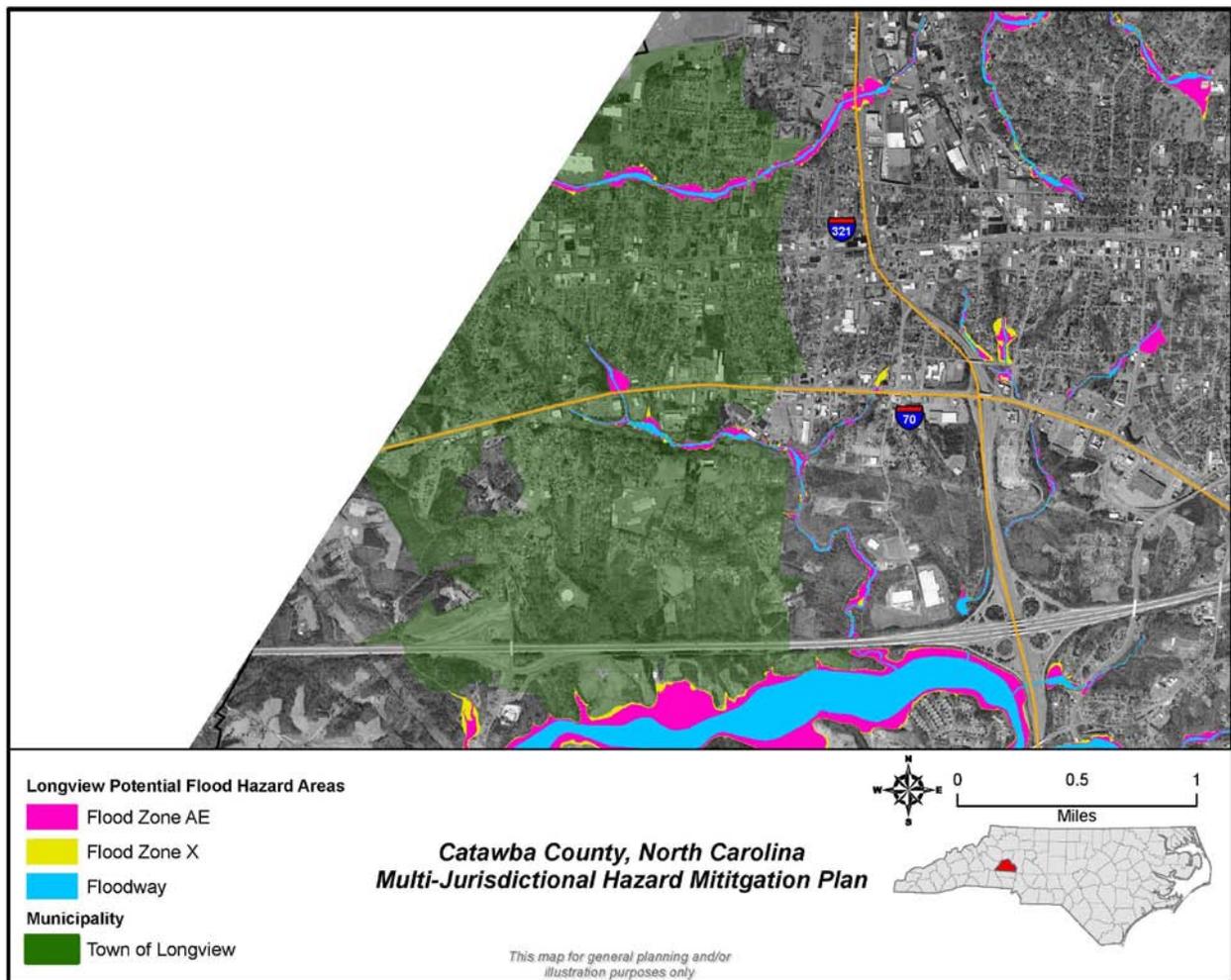


Source: CCGIS, FEMA

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**Figure 6.13**  
**Flood Zones A, AE and X in the Town of Long View**

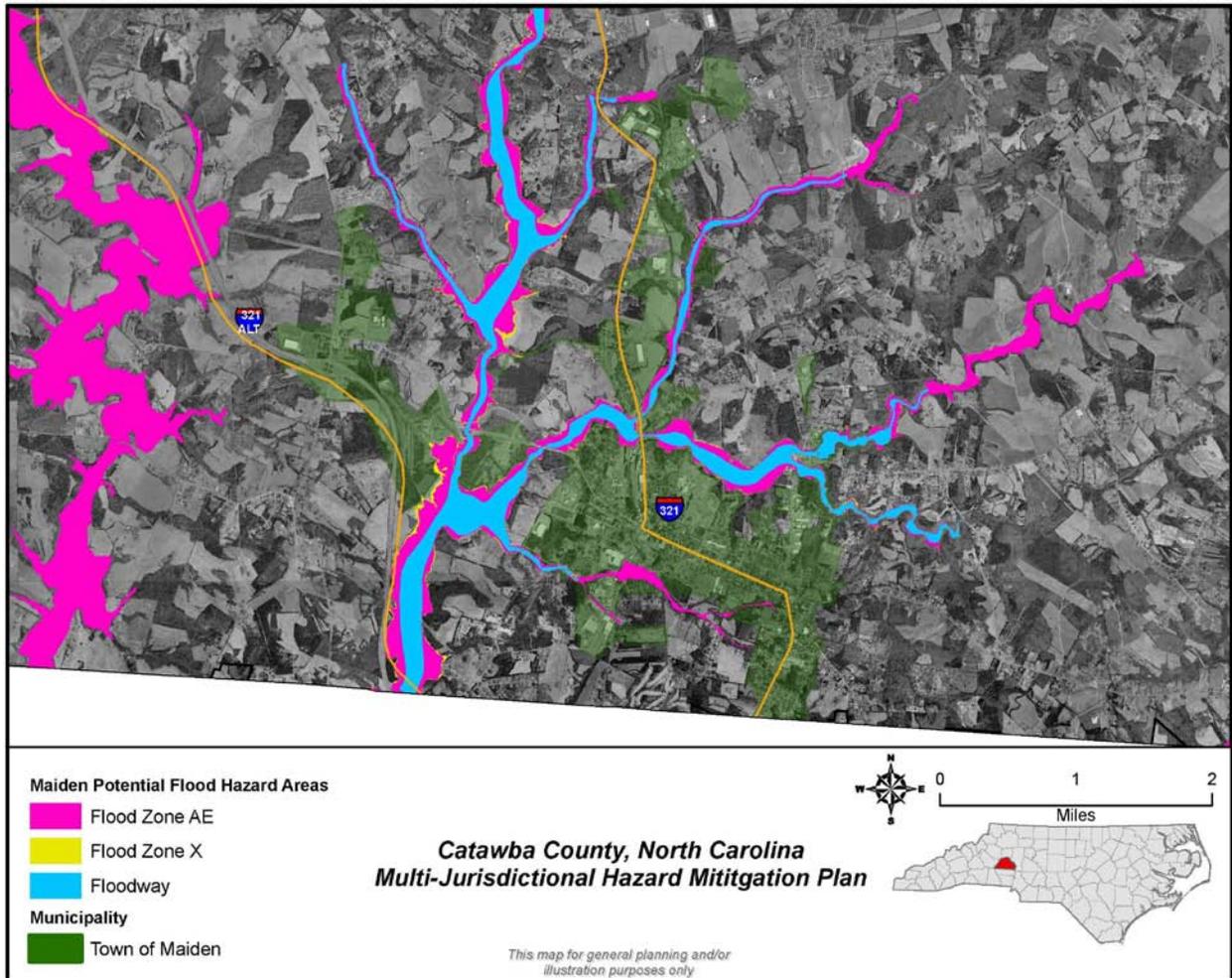


Source: CCGIS, FEMA

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**Figure 6.14**  
**Flood Zones A, AE and X in the Town of Maiden**

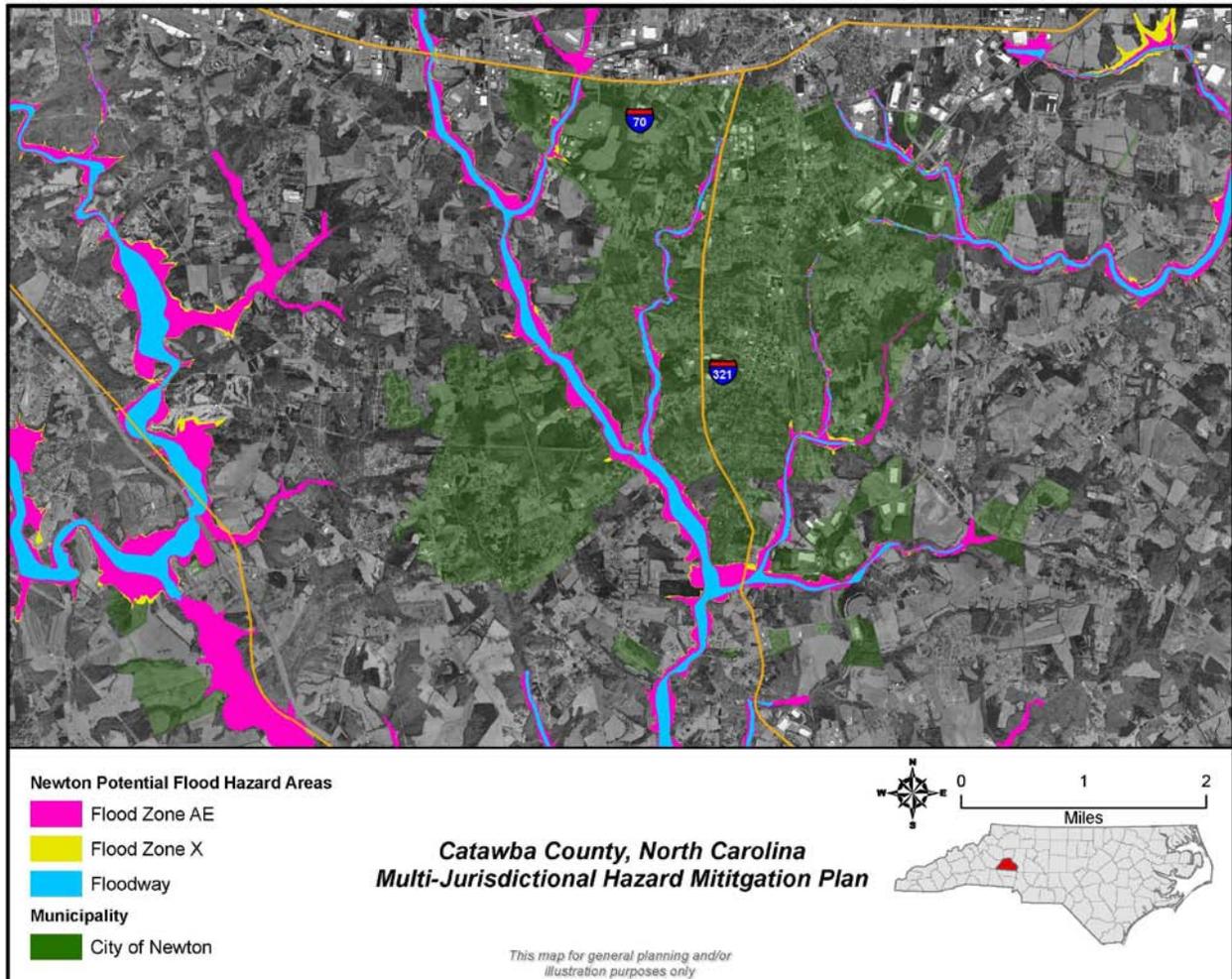


Source: CCGIS, FEMA

# VULNERABILITY ASSESSMENT

CATAWBA COUNTY, NORTH CAROLINA  
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**Figure 6.15**  
**Flood Zones A, AE and X in the City of Newton**



Source: CCGIS, FEMA

# VULNERABILITY ASSESSMENT

CATAWBA COUNTY, NORTH CAROLINA  
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## At-Risk Structures

A total of 2,253 structures within the county have been identified through GIS analysis as being located within the 100-year floodplain. Together, these structures amount to an assessed value of \$271,630,600 (please note that this figure includes the improved building values for all structures located on the given parcel according to local tax records, including accessory structures and other building that are located on the property). Of these, 1,969 structures are pre-FIRM (built prior to the local enforcement of NFIP standards) and are therefore considered to be the “at-risk” structures. The total assessed value of these at-risk structures is \$223,445,200. **Table 6.2** provides an overview of those structures determined to be potentially at risk to the one percent annual chance flood event (100-year flood), while **Table 6.3** does the same for those structures determined to be potentially at risk to the .02 percent annual chance flood event (500-year flood).

**Table 6.2**  
**Overview of At-Risk Structures in Catawba County (100-Year Floodplain)**

Jurisdiction	NFIP Entry Date	Effective FIRM	100-Year Floodplain (Zones A and AE)			
			Number of Structures	Assessed Value	Number of Pre-FIRM Structures	Value of Pre-FIRM Structures
Catawba County	1980	07/07/09	1,862	\$201,634,300	1,655	\$168,292,000
Brookford	1979	07/07/09	15	\$1,019,700	15	\$1,019,700
Catawba	1980	07/07/09	14	\$1,361,300	11	\$541,500
Claremont	2003	07/07/09	4	\$467,000	4	\$467,000
Conover	1980	07/07/09	65	\$6,069,700	49	\$3,383,200
Hickory	1981	07/07/09	170	\$29,865,200	138	\$21,843,100
Long View	1980	07/07/09	23	\$8,576,600	21	\$8,434,300
Maiden	1980	07/07/09	22	\$11,081,100	16	\$10,650,800
Newton	1980	07/07/09	78	\$11,555,700	60	\$8,813,600
<b>COUNTYWIDE TOTALS</b>			<b>2,253</b>	<b>\$271,630,600</b>	<b>1,969</b>	<b>\$223,445,200</b>

# VULNERABILITY ASSESSMENT

CATAWBA COUNTY, NORTH CAROLINA  
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**Table 6.3  
Overview of At-Risk Structures in Catawba County (500-Year Floodplain)**

Jurisdiction	NFIP Entry Date	Effective FIRM	500-Year Floodplain (Zone X)			
			Number of Structures	Assessed Value	Number of Pre-FIRM Structures	Value of Pre-FIRM Structures
Catawba County	1980	07/07/09	85	\$12,253,200	57	\$7,879,000
Brookford	1979	07/07/09	5	\$412,200	4	\$257,000
Catawba	1980	07/07/09	2	\$277,600	2	\$277,600
Claremont	2003	07/07/09	2	\$842,800	2	\$842,800
Conover	1980	07/07/09	9	\$2,003,400	6	\$1,526,700
Hickory	1981	07/07/09	60	\$14,144,500	46	\$8,636,900
Long View	1980	07/07/09	4	\$1,721,100	4	\$1,721,100
Maiden	1980	07/07/09	0	\$0	0	\$0
Newton	1980	07/07/09	33	\$7,968,300	28	\$7,220,400
<b>COUNTYWIDE TOTALS</b>			<b>200</b>	<b>\$39,623,100</b>	<b>149</b>	<b>\$28,361,500</b>

## Loss Estimation

In order to generate annualized loss estimates for Catawba County and each jurisdiction, a similar methodology that was applied in 2004 was used again for the 2009 update. An annualized countywide loss estimate of nearly **\$1.7 million** was generated by assuming an average of a 25 percent loss to all pre-FIRM structures located in the 100-year floodplain during a one percent annual chance flood event. The annualized loss estimate was calculated by adding the estimated total loss (25 percent of the total exposed building value of pre-FIRM structures in the 100-year floodplain) to a content value equal to 50 percent of building value, then dividing that figure by 100. **Table 6.4** provides the annualized loss estimates as generated using this method for each local jurisdiction in Catawba County.

**Table 6.4  
Annualized Loss Estimates for Flood**

Jurisdiction	Number of At-Risk Structures	Annualized Loss Estimate
Catawba County	1,655	\$1,262,190
Brookford	15	\$7,648
Catawba	11	\$4,061
Claremont	4	\$3,503
Conover	49	\$25,374
Hickory	138	\$163,823
Long View	21	\$63,257

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Maiden	16	\$79,881
Newton	60	\$66,102
<b>COUNTYWIDE TOTALS</b>	<b>1,969</b>	<b>\$1,675,839</b>

In order to generate additional information on potential loss estimates for the 100-year flood event, FEMA's loss estimation methodology, HAZUS-MH, was applied in combination with Catawba County's new DFIRM data to provide Level 2 analysis for each individual jurisdiction. Depth grids for Catawba County and each municipality were created using AECOM's Watershed Information System (WISE)® and new FEMA DFIRM data. Those depth grids were then clipped to each jurisdiction's boundaries, and the unincorporated portion of the County. Within HAZUS-MH each jurisdiction had its own HAZUS-MH project, and the depth grids were then imported into HAZUS. Once the depth grids were imported into HAZUS-MH, the program ran its analysis for hydraulics as well as loss estimation. Agricultural losses were not analyzed due to the variable parameters, i.e. time of year of flooding. Following the loss analysis a global summary report was generated providing the loss information. The results of this Level 2 HAZUS-MH analysis are summarized for each jurisdiction in **Table 6.5**.

**Table 6.5**  
**HAZUS-MH Loss Estimates for the 100-Year Flood Event**

Jurisdiction	Total Economic Loss	Displaced Households	Debris (Tons)	Debris (Truckloads)
Catawba County	\$94,240,000	983	18,896	756
Brookford	\$1,310,000	10	537	21
Catawba	\$2,070,000	20	451	18
Claremont	\$3,740,000	6	89	4
Conover	\$10,680,000	66	730	29
Hickory	\$26,160,000	330	2,986	119
Long View	\$2,420,000	29	280	11
Maiden	\$4,590,000	31	977	39
Newton	\$17,430,000	129	1,353	54
<b>COUNTYWIDE TOTALS</b>	<b>\$162,640,000</b>	<b>1,604</b>	<b>26,299</b>	<b>1,051</b>

## Repetitive Loss Properties

The identification of repetitive loss properties is an important element to conducting a local flood risk assessment, as the inherent characteristics of properties with multiple flood losses strongly suggest that they will be threatened by continual losses. Repetitive loss properties are also important to the NFIP, since structures that flood frequently put a strain on the National Flood Insurance Fund. Under the NFIP, FEMA defines a repetitive loss property as "any NFIP-insured property that, since 1978 and regardless of any change(s) of ownership during that period, has experienced: a) four or more paid flood losses; or b) two paid flood losses within a 10-year period that equal or exceed the current value of the insured property; or c) three or more paid losses that equal or

### 44 CFR Requirement

**44 CFR Part 201.6(c)(2)(ii):** *The must also address National Flood Insurance Program (NFIP) insured structures that have been repetitively damaged by floods.*

# VULNERABILITY ASSESSMENT

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## CATAWBA COUNTY, NORTH CAROLINA MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN

exceed the current value of the insured property.” A strong goal of FEMA is to reduce the numbers of structures that meet these criteria, whether through elevation, acquisition, relocation, or a flood control project that lessens the potential for continual losses.

According to FEMA, there are currently seven (7) repetitive loss properties in Catawba County with total NFIP claims payments of approximately \$108,000.<sup>3</sup> As indicated in **Table 6.6**, five of these properties are located in the County’s jurisdiction and two are located in the City of Hickory. Most of the listed repetitive loss properties are located within proximity to identified special flood hazard areas, and two of the seven properties have reportedly already been addressed through mitigation measures. None of Catawba County’s identified repetitive loss properties are classified by FEMA as “Severe Repetitive Loss” properties.

Four of the five repetitive loss properties located in Catawba County are located along Lake Lookout in an area known as Carpenter’s Cove. This is an area that experiences chronic flood problems during periods when lake levels rise due to intense, heavy rains. The area is fully built out and is made up primarily of second homes, including many older cottages constructed in the 1950’s and 1960’s before the County joined the NFIP. No new development or redevelopment is planned for this area.

The other repetitive loss property identified for Catawba County (#0128538) is located along Lake Hickory but in an area outside of the identified special flood hazard area. Similar to the Carpenter’s Cove area, this portion of the County is mostly built out and there is very limited potential for new development or redevelopment projects. Any new development along Lake Lookout and Lake Hickory would have to conform to the County’s Unified Development Ordinance which includes flood damage prevention standards that exceed FEMA’s minimum standards as described in *Section 7: Capability Assessment*.

The two repetitive loss properties located in the City of Hickory are located in areas that have been fully developed and not experiencing new growth or redevelopment projects. The first property (#0102594) is located in an area referred to as “Falling Creek Tributary.” The structure located on the property in question has flooded reportedly due to its location only a few feet away from Falling Creek. The home was built in 1976 and is considered a pre-FIRM structure. The second property (#0072955) is considered “mitigated” as the structure previously occupying the parcel in question has since been demolished (around 2000). The cause of historical flood claims against this property was attributed to poor building design of the structure, according to City engineers. There are no new development plans for this location.

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<sup>3</sup> FEMA data provided to Catawba County by the North Carolina Division of Emergency Management on September 4, 2009. Data was last updated on May 31, 2009.

# VULNERABILITY ASSESSMENT

CATAWBA COUNTY, NORTH CAROLINA  
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**Table 6.6  
NFIP Repetitive Loss Properties in Catawba County**

Property Locator	Jurisdiction	General Location	Occupancy	Number of Insured Losses	NFIP Claims Paid	Comments
0038359	Catawba County	Lake Lookout	Single Family	3	\$16,552	Mitigated. No additional information available.
0102594	City of Hickory	Falling Creek Tributary	Multi-Family	3	\$14,926	Insured, but not yet mitigated. Located in SFHA, near floodway. Cause of flooding is attributed to structure's extreme proximity to Falling Creek and lack of building elevation.
0072955	City of Hickory	9th Street, NE	Non-residential	2	\$93,259	Mitigated through acquisition/relocation. Not located in SFHA. Past flooding attributed to poor building design.
0133367	Catawba County (Catawba Address)	Carpenter's Cove on Lake Lookout	Single Family	2	\$46,753	Insured, but not yet mitigated. Located in SFHA. Cause of flooding is attributed to high lake levels behind Lake Lookout Dam following significant long-term precipitation.
0136754	Catawba County	Carpenter's Cove on Lake Lookout++	Single Family	2	\$33,593	Not insured; not mitigated. Located in SFHA. Cause of flooding is attributed to high lake levels behind Lake Lookout Dam following significant long-term precipitation.
0131113	Catawba County (Claremont Address)	Carpenter's Cove on Lake Lookout	Single Family	2	\$27,339	Insured, but not yet mitigated. Located in SFHA. Cause of flooding is attributed to high lake levels behind Lake Lookout Dam following significant long-term precipitation.
0128538	Catawba County (Conover Address)	Lake Hickory	Single Family	2	\$2,621	Not insured; not mitigated. Not located in SFHA. Cause of flooding is likely attributed to high lake levels following significant long-term precipitation or tropical storm events.

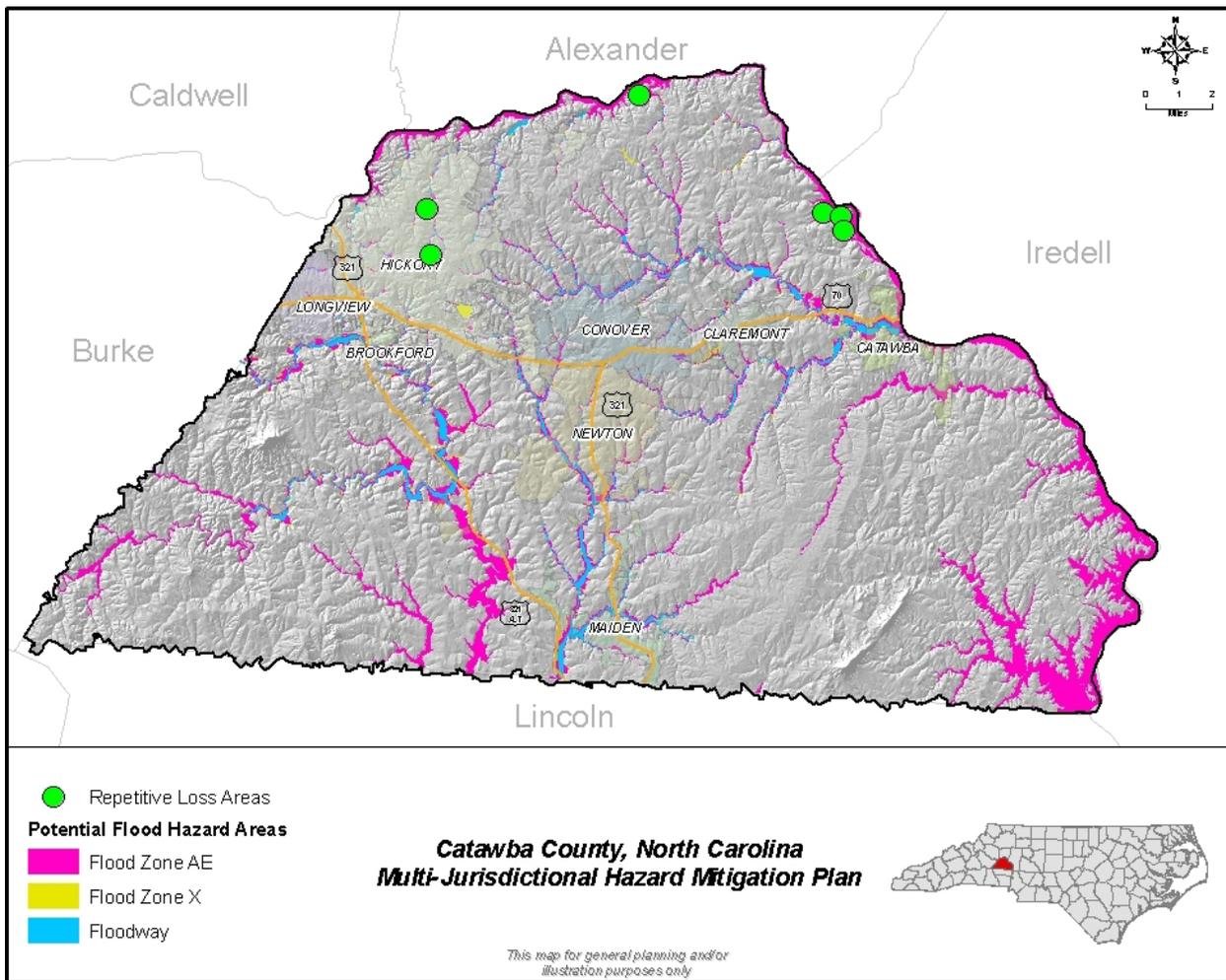
Source: FEMA

# VULNERABILITY ASSESSMENT

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The specific addresses of repetitive loss properties is maintained by Catawba County but deliberately not included in the Plan as required by law.<sup>4</sup> However, the general locations of these properties in Catawba County are shown **Figure 6.16** (classified as “repetitive loss areas”).

**Figure 6.16**  
**Repetitive Loss Areas in Catawba County**



Source: CCGIS, FEMA

<sup>4</sup> NFIP repetitive loss data is protected under the federal Privacy Act of 1974 (5 U.S.C. 552a) which prohibits personal identifiers (i.e., owner names, addresses, etc.) from being published in local mitigation plans.

# VULNERABILITY ASSESSMENT

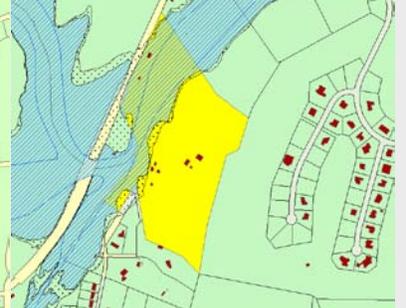
CATAWBA COUNTY, NORTH CAROLINA  
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## At-Risk High Potential Loss Properties

In 2004, there were 671 properties within Catawba County determined to have an assessed value greater than \$1 million. Initially, 33 of these properties were identified through GIS analysis as having at least one structure located (in whole or in part) in a flood hazard area. Upon further analysis it was determined that only six appeared to be legitimately at-risk. In most cases involving the 27 parcels that were ruled out, the flood hazard boundary was determined to intersect with a building of negligible value in relation to the other buildings in the same parcel not intersecting with the flood hazard area.

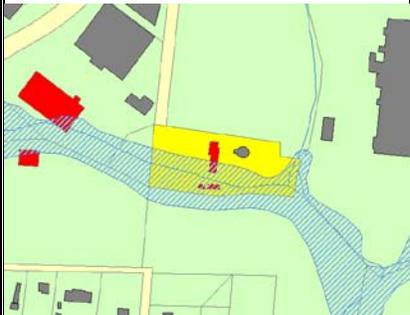
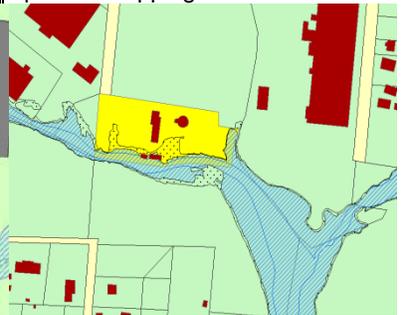
**Table 6.7** helps illustrate the flood risk for each of the six properties of concern according to the 2004 and the 2009 data for special flood hazard areas. In the maps provided in the table, the parcel in question is highlighted in yellow and buildings that appeared to intersect with the flood hazard area in 2004 highlighted in red. The status of each structure's vulnerability as determined through the 2004 and the 2009 assessments is noted in the accompanying comments provided for each property. As can be seen in the table, many of the properties determined in 2004 to be potentially at risk are no longer considered vulnerable to flood hazards per the County's new digital flood hazard layer.

**Table 6.7**  
**Overview of High Potential Loss Properties in Catawba County**

High Potential Loss Property	Relationship to the Flood Hazard Area (2004)	Relationship to the Flood Hazard Area (2009)
<p>6692 Valwood Road (Catawba County)</p> <p>Owner: Baptist State Convention of North Carolina, Inc.</p>	<p>Approximately seven (7) buildings are located (in whole or in part) in a flood hazard area.</p> 	<p>Buildings are no longer located in flood hazard area with updated mapping.</p> 
<p>3680 Hillview Drive NE (City of Conover)</p> <p>Owner: City of Conover</p>	<p>Several small buildings appear to be in a flood hazard area.</p> 	<p>Three buildings remain in flood hazard area with updated mapping.</p> 

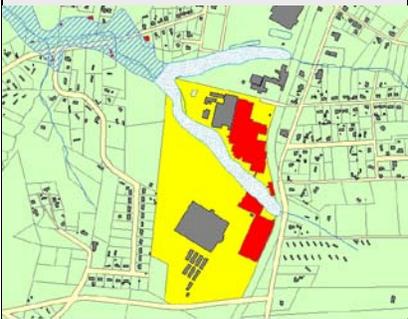
# VULNERABILITY ASSESSMENT

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High Potential Loss Property	Relationship to the Flood Hazard Area (2004)	Relationship to the Flood Hazard Area (2009)
<p>1187 18th Street SW (City of Hickory) Owner: Town of Long View</p>	<p>Three (3) buildings appear to be located (in whole or in part) in a flood hazard area.</p> 	<p>Two small buildings remain in flood hazard area; large building is no longer in flood hazard area with updated mapping.</p> 
<p>1950 13th Avenue SE (City of Hickory) Owner: Fairfield Inn Hickory, LLC</p>	<p>The majority of this complex appears to be within a flood hazard area.</p> 	<p>Building complex is now completely outside of flood hazard area.</p> 
<p>1227 10th Street NW (City of Hickory) Owner: Associated Apartment Investors/ Creekside Limited Partnership</p>	<p>Four (4) structures appear to intersect with a flood hazard area.</p> 	<p>Buildings are now completely outside of flood hazard area.</p> 

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High Potential Loss Property	Relationship to the Flood Hazard Area (2004)	Relationship to the Flood Hazard Area (2009)
<p>700 South Main Avenue (Town of Maiden) Owner: Ethan Allen, Inc.</p>	<p>The flood hazard area appears to cross through the middle of this complex intersecting with several buildings.</p> 	<p>One small building remains in the flood hazard area; all others are now outside of it with updated mapping.</p> 

# VULNERABILITY ASSESSMENT

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## At-Risk Critical Facilities, Infrastructure and Hazardous Material Sites

Beyond the wastewater treatment plants addressed under high potential loss properties, only one critical facility was identified in 2004 as being in a flood hazard area. This was the Catawba EMS/Rescue base located at 300 2<sup>nd</sup> Street SW in Catawba<sup>5</sup>. Although no building footprint was available for further GIS analysis, it was initially determined that the entire parcel was located in the 100-year floodplain. Upon further analysis using the new digital flood hazard data for the 2009 plan update in addition to consultation with local officials, it was determined that the EMS/Rescue base structure is not located in an identified special flood hazard area,



*Members of the public aided in the planning process by pointing out specific areas within the county known to have repetitive flood issues. (PBS&J Project Photo)*

No other critical facilities such as medical centers, schools and fire stations were found to be located in identified flood hazard areas and none are known to be at-risk. This excludes facilities that by their nature are intentionally constructed in and appropriately designed for flood hazard areas such as water and sewer systems.

According to input obtained through a public meeting and information derived from North Carolina Department of Transportation records, sections of 13 secondary roads including at least two bridges are prone to flooding. This information was determined to not have changed during the 2009 plan update process. **Figure 6.17** and **Table 6.8** document the location of these flood-prone infrastructure elements.

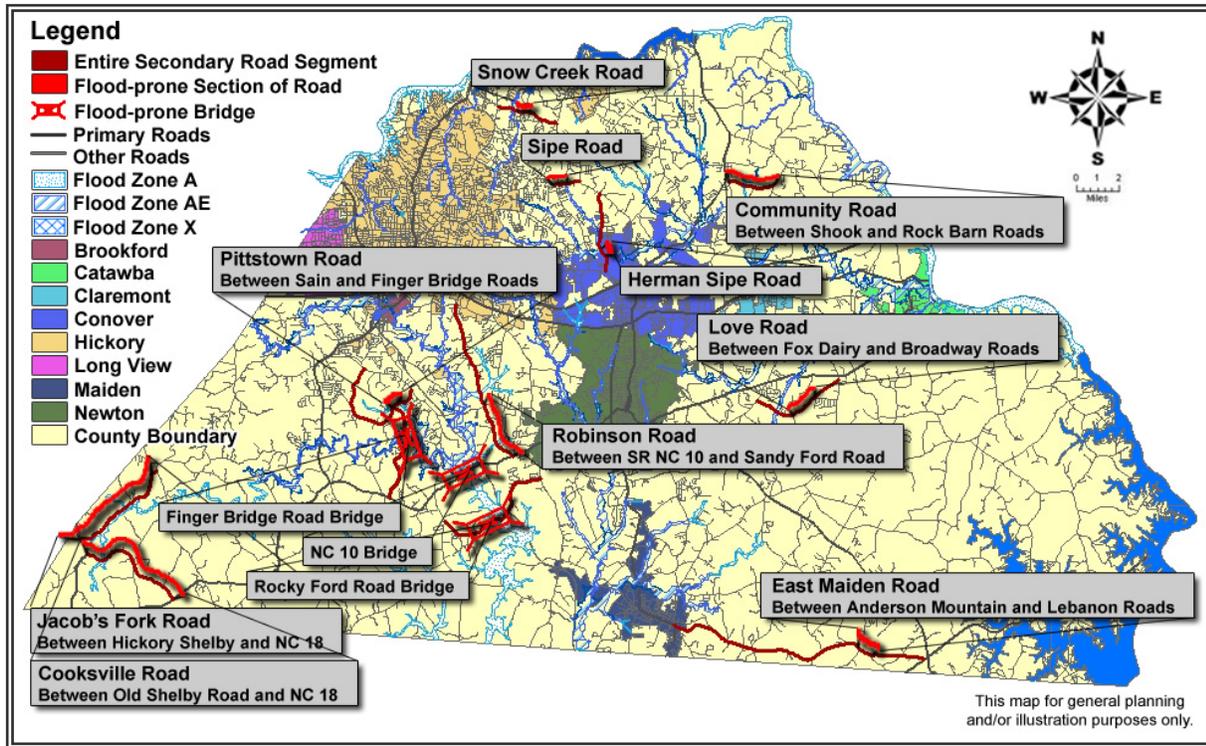
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<sup>5</sup> A more-detailed site assessment will be performed on this facility to determine its vulnerability to the flood hazard and the need for hazard mitigation measures (per the Catawba Mitigation Action Plan).

# VULNERABILITY ASSESSMENT

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**Figure 6.17**  
**Flood-prone Road and Bridge Segments in Catawba County**



**Table 6.8**  
**Flood-prone Road and Bridge Segments in Catawba County**

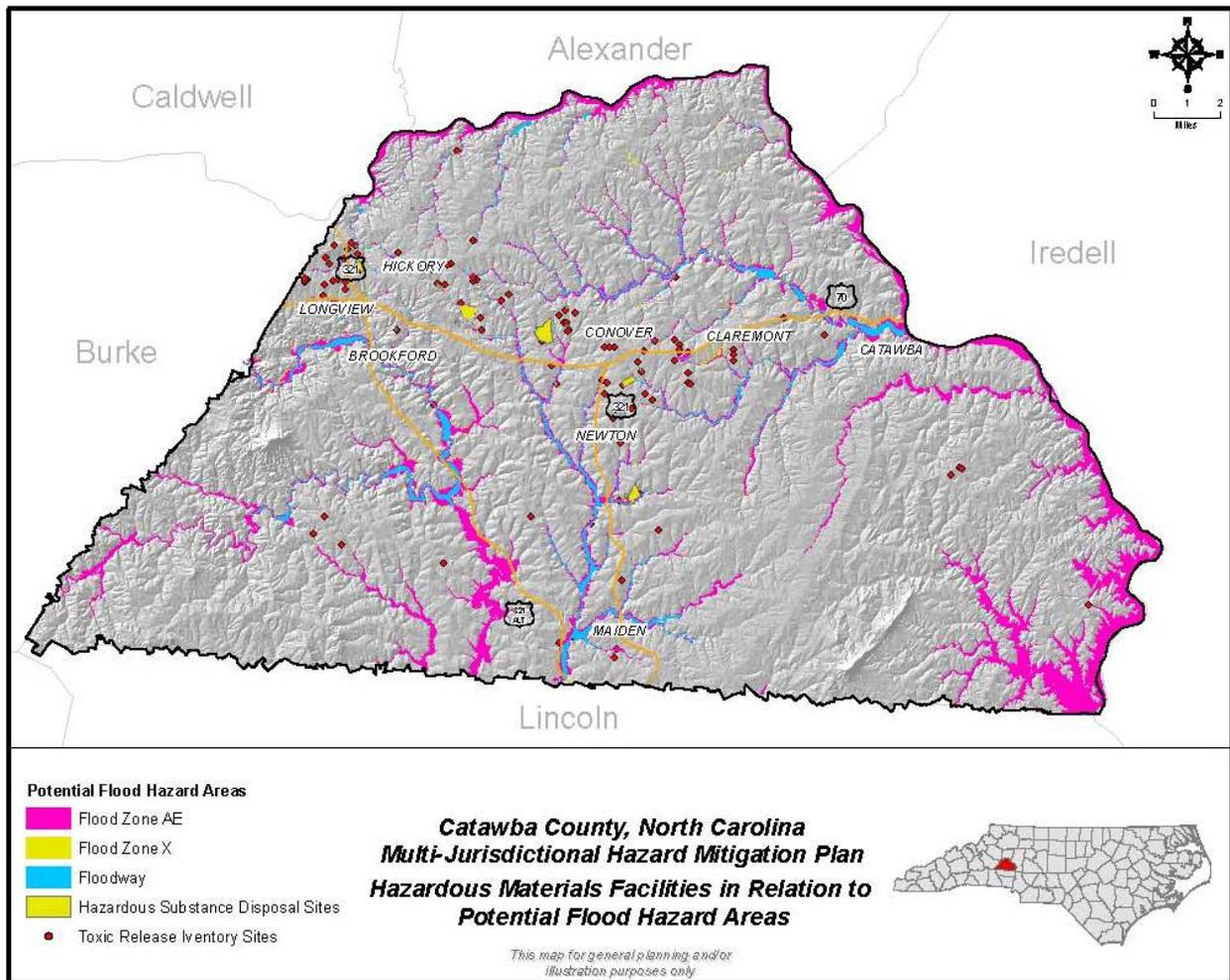
Flood-prone Road	Secondary Road (SR) Designation	Location of Known Flooding
Community Road	SR 1710	Between Shook Road (SR 1711) and Rock Barn Road (SR 1709)
Cooksville Road	SR 1105	Between Old Shelby Road (SR 1104) and NC 18
East Maiden Road	SR 1855	Between Anderson Mountain Rd (SR 1857) and Lebanon Rd (SR 1856)
Finger Bridge Road	SR 1139	At concrete bridge
Herman Sipe Road	SR 1490	Between Wall Street and Lilly Hill Road
Hickory Shelby Road	SR 1002	Below the junkyard
Jacob's Fork River Road	SR 1111	Between Hickory Shelby Road (SR 1002) and NC 18
Love Road	SR 1809	Between Fox Dairy Road (SR 1807) and Broadway Lane (SR 2635)
Pittstown Road	SR 1131	Between Sain Road (SR 1133) and Finger Bridge Road (SR 1139)
Robinson Road	SR 1146	Between NC 10 and Sandy Ford Road (SR 1143)
Rocky Ford Road	SR 2019	At the one-lane bridge (dirt section)
Sipe Road	SR 1492	Between Pioneer Drive and Summit Circle
Snow Creek Road	SR 1507	Between 22nd Street NE (SR 1680) and 25th Street NE (SR 1574)

# VULNERABILITY ASSESSMENT

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Using GIS analysis, it was also determined that 8 of the 127 hazardous materials (HAZMAT) sites are located within the 100-year floodplain. The location of all recorded HAZMAT sites in Catawba County are illustrated in **Figure 6.18**.

**Figure 6.18**  
**HAZMAT Sites Intersecting 100-year Floodplain**



Source: CCGIS, U.S. EPA, NC OneMap

## Hurricanes and Tropical Storms

Historical evidence shows that Catawba County is vulnerable to damaging hurricane and tropical storm-force winds.<sup>6</sup> Loss estimates for wind were developed based on probabilistic scenarios using HAZUS<sup>MH</sup>

<sup>6</sup> Refer to the *Hazard Analysis* section of this risk assessment for detailed historical information.

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(Level 1 analysis).<sup>7</sup> **Table 6.9** shows number of structures damaged and estimated losses for 50, 100 and 500-year return periods. In order to provide a summary of potential wind-related losses, an annualized loss estimate of **\$452,000** was derived from the HAZUS<sup>MH</sup> assessment (property-related damages only). The overwhelming majority (77 percent) of property losses are attributed to residential buildings. HAZUS-MH results also indicated that Catawba County may suffer an annualized loss estimate of an additional \$69,000 in losses due to business interruption from hurricane events.

**Table 6.9**  
**Estimates of Potential Losses for Hurricane-force Winds**

Level of Event	Approximate Number of Structures Damaged	Estimated Losses
50-year Storm (60 MPH peak sustained winds)	20	\$700,000
100-year Storm (70 MPH peak sustained winds)	91	\$4,400,000
500-year Storm (88 MPH peak sustained winds)	2,352	\$36,800,000

## *Severe Thunderstorms and Tornadoes*

Historical evidence shows that most of the state is vulnerable to thunderstorm and tornado activity. These particular hazards are often associated with one another, as tornadoes often result from severe thunderstorm activity. Tornadoes may also occur during a tropical storm or hurricane. Because it cannot be predicted where thunderstorm and tornado damage may occur, the total dollar exposure figure of \$10.1 billion for buildings and facilities within the county is considered to be exposed and could potentially be affected. Based on historic property damages, an annualized loss estimate of **\$688,000** was generated for severe thunderstorms and tornadoes.

## *Wildfire*

In an effort to show the vulnerability of Catawba County to the wildfire hazard, wildfire potential in the county is compared with population density in **Figure 6.19**. Overall, in terms of annualized loss estimates, the monetary impact of wildfires is considered to be **negligible**. This is in large part due to the fact that most wildfires reported for Catawba County are rapidly contained and suppressed by state and local firefighting efforts. **Table 6.10** shows the total estimated number of structures and assessed building value potentially at risk in the high and moderate wildfire hazard zones for each jurisdiction.

<sup>7</sup> A Level 1 analysis yields a baseline estimate built upon national databases and is considered by FEMA to be a solid way in which to begin the risk assessment process and prioritize high-risk areas within a community or county (FEMA public Web site).

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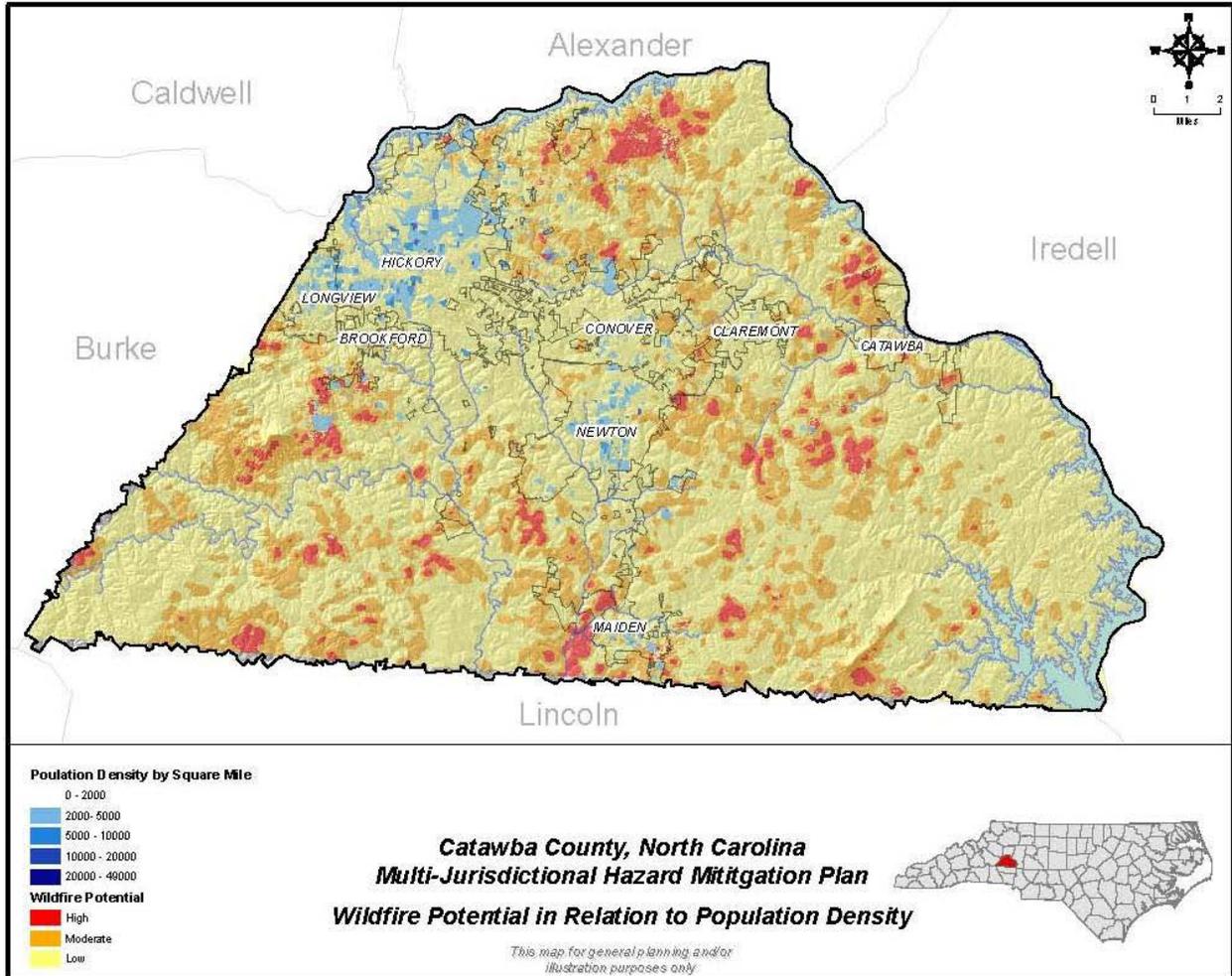
**Table 6.10**  
**Estimates of Potential Losses for Wildfire**

Jurisdiction	High Wildfire Hazard Zone		Moderate Wildfire Hazard Zone	
	Number of Structures	Assessed Value	Number of Structures	Assessed Value
Catawba County	4,880	\$271,152,700	25,475	\$1,333,983,100
Brookford	0	\$0	34	\$953,100
Catawba	4	\$5,952,900	186	\$14,605,600
Claremont	9	\$15,900	48	\$14,761,000
Conover	37	\$9,441,800	606	\$130,719,800
Hickory	67	\$18,469,000	1,003	\$225,405,300
Long View	0	\$0	99	\$7,851,800
Maiden	208	\$17,674,600	696	\$62,291,100
Newton	71	\$8,187,800	702	\$78,143,200
<b>COUNTYWIDE TOTALS</b>	<b>5,276</b>	<b>\$330,894,700</b>	<b>28,849</b>	<b>\$1,868,714,000</b>

# VULNERABILITY ASSESSMENT

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**Figure 6.19**  
**Wildfire Potential in Relation to Population Density<sup>8</sup>**



Source: CCGIS, North Carolina Division of Forest Resources

<sup>8</sup> For additional information with regard to the maps in Figure 6.21, refer to the Wildfire portion of the *Hazard Analysis* and the Overview of Catawba County Vulnerability portion of the *Vulnerability Assessment*.

# VULNERABILITY ASSESSMENT

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## *Drought*

Although the State of North Carolina as a whole is vulnerable to drought, estimated potential losses are difficult to calculate because drought causes little damage to the built environment. One exception for Catawba County is reportedly the replacement of wells that dry up during sustained drought conditions, as described in Section 5: Hazard Analysis. The total cost of well replacement in Catawba County is estimated at approximately \$4,000 per replacement. Using this cost figure in combination with the County's historical permit data for replacement wells (indicating approximately 425 permits per year during peak drought conditions), along with the determination that Catawba County experiences severe drought conditions on average of 7.5 percent of the time (per the PDSI described in Section 5), the annualized loss estimate for the drought hazard in Catawba County is **\$128,000**.

Potential damages to agricultural products were researched further with state and local sources during the 2009 plan update process; however no documented data on historical crop losses were found to be available.

## *Winter Storms*

Unlike hazards such as tornadoes that typically impact a specific location, winter storms most often affect large geographic areas and often impact multiple counties. Based on estimated historical property damages for Catawba County due to winter storms, an annualized loss estimate of **\$298,000** for this hazard was calculated. This estimate was calculated using data made available through NOAA's National Climatic Data Center on property-related damages.<sup>9</sup> Potential losses may be further inflated by additional factors not represented in this estimate, such as removal of snow from roadways, debris clean-up, some secondary indirect losses from power outages (a significant impact of concern for Catawba County), etc.

A qualitative facet of vulnerability in Catawba County is the lack of awareness on the part of county residents in preparing for and responding to winter storm conditions in a manner that will minimize the danger to themselves and others.

## *Erosion*

As discussed in the Section 5: Hazard Analysis, Catawba County has not been mapped to show erosion hazard risk and no specific areas of erosion concern have been identified by the Mitigation Advisory Committee. Further, no structures in Catawba County have been identified as being vulnerable to erosion. Due to the lack of any known problem areas, vulnerable structures or historical losses, future potential property losses to the erosion hazard are assumed to be negligible for Catawba County and its participating jurisdictions without conducting further vulnerability assessment studies. This determination, coupled with the fact that existing local erosion and sediment control regulations are in place to minimize the potential negative impacts of future development as it relates erosion hazards, suggests that Catawba County and its municipalities need not focus on preparing specific mitigation actions to address erosion at this time. However the erosion hazard will remain as a hazard of possible future concern and continue to be reevaluated during future plan updates.

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<sup>9</sup> Further information on the methodology used to calculate annualized losses is provided on Page 3 of this Section.

# VULNERABILITY ASSESSMENT

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CATAWBA COUNTY, NORTH CAROLINA  
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## *Dam/Levee Failure*

**Figure 6.20** shows the location of dams in and around<sup>10</sup> Catawba County in relation to population density. Whereas this may not support any conclusive correlation between dam breaches or failures and affected populations, it does aid the planning process by visually placing all known state-regulated dams in direct relationship to population distribution.

Catawba County also maintains inundation maps that were prepared based on a computer-simulated dam failure by Duke Energy, which maintains a number of hydropower dams in Catawba County for generating electricity. These maps are still currently not digitally referenced and were therefore not included in the GIS-based risk assessment for Catawba County, but it is expected that they may be provided in digital format for use in future Plan updates.

As described in Section 4: Hazard Analysis, there are no historical dam failure events reported for Catawba County and they are considered very low probability events. Therefore the annualized loss estimate for property damages caused by dam failure is considered to be negligible.

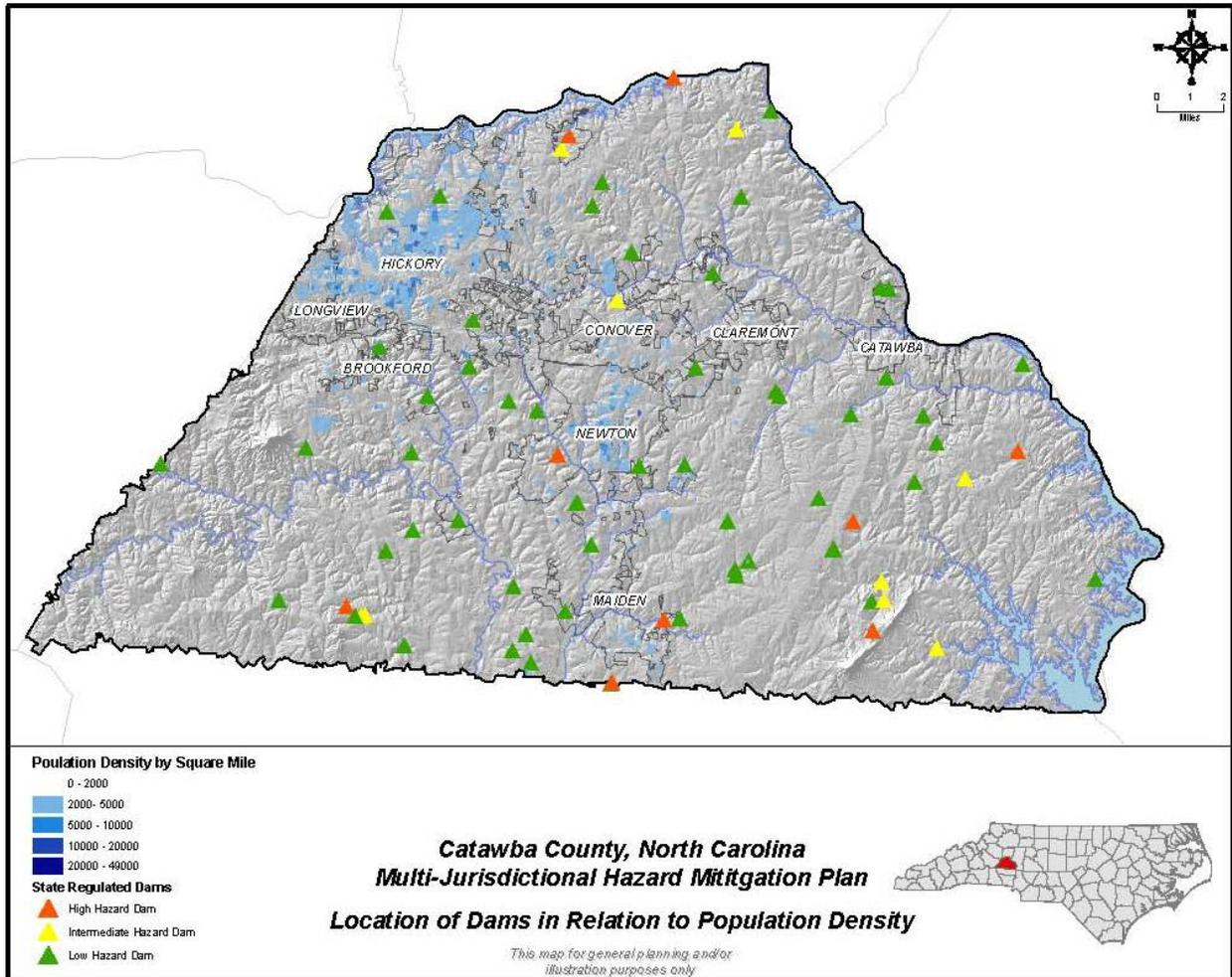
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<sup>10</sup> Dams in the immediate vicinity of Catawba County were included in this figure if a dam breach or failure at that dam's location could potentially impact the population of Catawba County.

# VULNERABILITY ASSESSMENT

CATAWBA COUNTY, NORTH CAROLINA  
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**Figure 6.20**  
**Location of Dams in Relation to Population Density**



Source: CCGIS, North Carolina Division of Land Resources, Dam Safety Program

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## *Earthquakes, Sinkholes and Landslides*

### Earthquakes

Risk for earthquake for the area, as well as potential losses due to earthquake impact, is considered to be moderate. **Table 6.11** provides building-related loss estimates for 100 through 2,500-year return periods based on HAZUS<sup>MH</sup> probabilistic scenarios.

**Table 6.11**  
**Estimates of Potential Losses for Earthquake**

Level of Event	Approximate Number of Structures Damaged	Estimated Losses
100-year Event	251	\$1,970,000
500-year Event	4,903	\$75,270,000
1,000-year Event	10,321	\$210,680,000
2,500-year Event	21,315	\$619,790,000

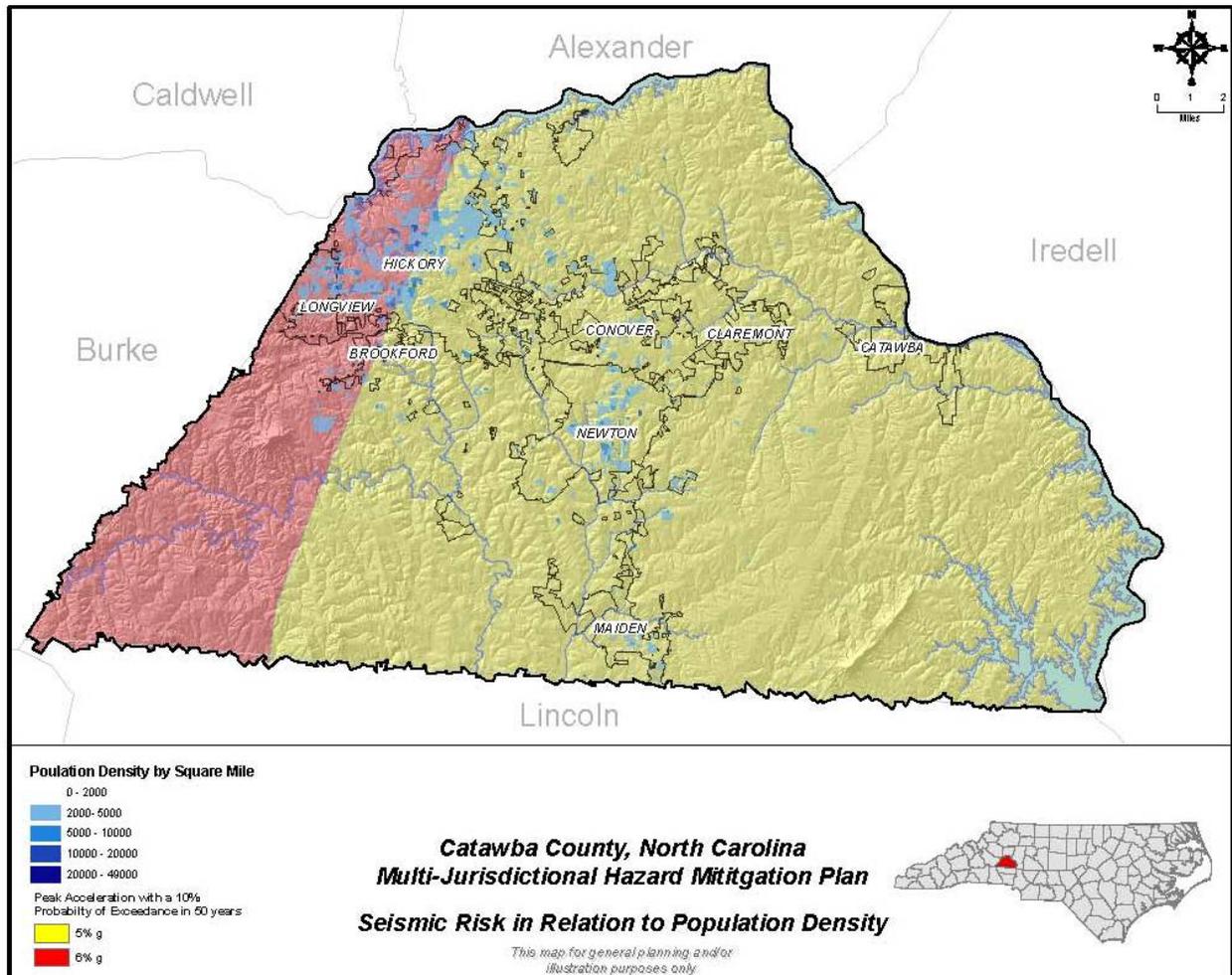
The annualized loss estimate for earthquake is **\$745,000**. The largest percentage (38 percent) of property losses are attributed to residential occupancies. HAZUS-MH results also indicated that Catawba County may suffer an annualized loss estimate of an additional \$175,000 in losses due to business interruption from earthquake events.

**Figure 6.21** shows seismic risk based on peak ground acceleration values (as described in Section 5: Hazard Analysis) in relation to population distribution.

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**Figure 6.21**  
**Seismic Risk in Relation to Population Distribution**



Source: CCGIS, FEMA

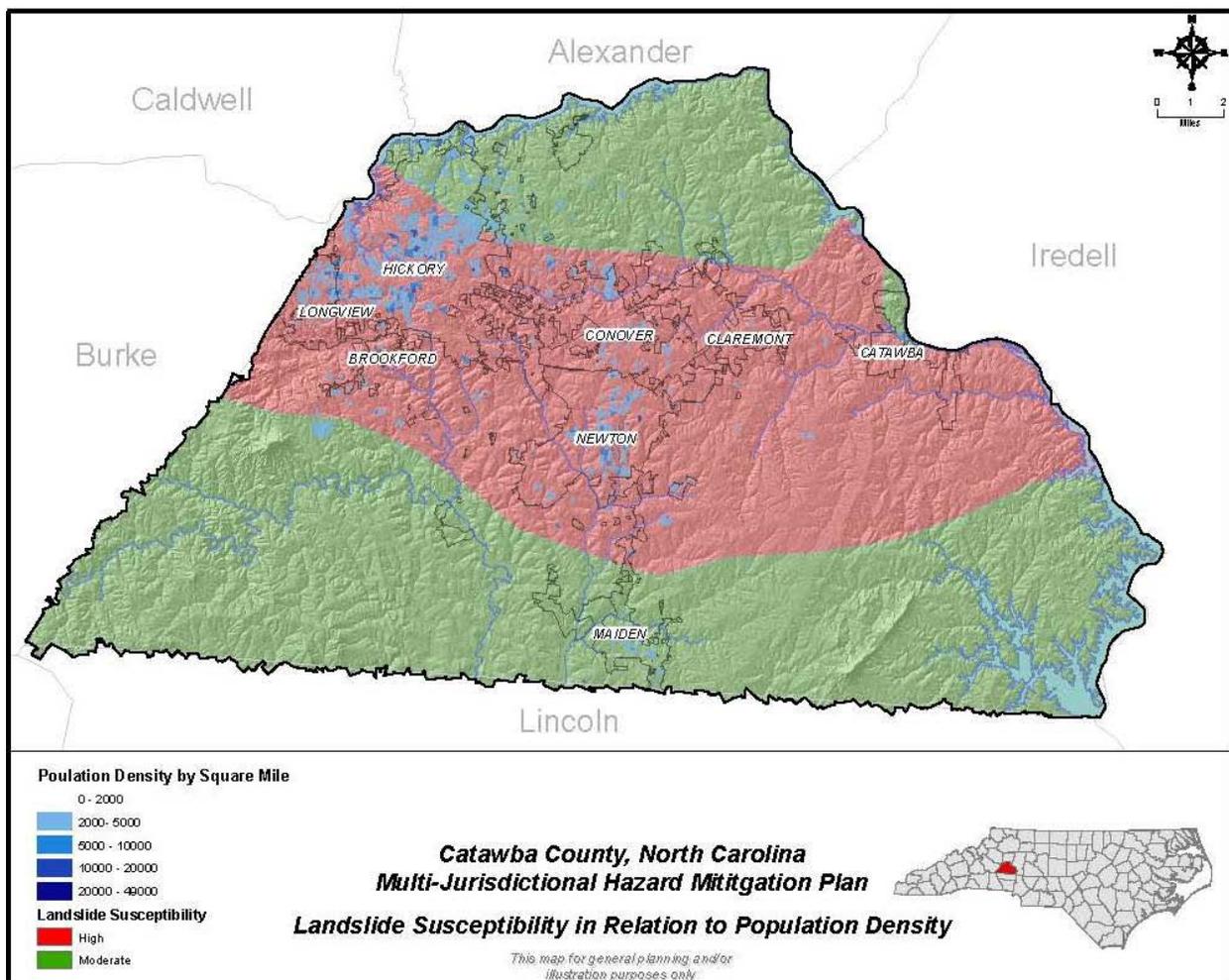
# VULNERABILITY ASSESSMENT

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## Sinkholes and Landslides

Figure 6.22 shows landslide potential in relation to population distribution. Based on available historical records, annualized losses for both the sinkhole and landslide hazards are considered to be negligible.

**Figure 6.22**  
**Landslide Risk in Relation to Population Distribution**



Source: CCGIS, USGS

## Other Hazards

Though Catawba County recognizes that North Carolina is vulnerable to other hazards, a detailed risk assessment was not completed for other hazards due to the low level of risk and/ or vulnerability for these hazards within the area as a whole as compared with the hazards included in this section. This

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determination was made following a review of the most current State Hazard Mitigation Plan (2007) and is consistent with the hazard classifications for Catawba County as described therein.

### *High Potential Loss Properties, Critical Facilities and HAZMAT Sites*

Catawba County has inventoried high potential loss properties within the county (buildings with an assessed building value greater than \$1 million) along with critical facilities such as fire and police stations, hospitals and schools, and hazardous materials sites which include only those sites listed in the U.S. Environmental Protection Agency's Toxic Release Inventory (TRI) database or State of North Carolina's Hazardous Substance Disposal Sites<sup>11</sup>. These facilities are considered to be of special value and/or significance, and are considered as a default to be uniformly at-risk to such hazards as tornadoes, winter storms, severe wind damage, hailstorms, etc. **Table 6.12** lists these types of facilities along with a total number in the County's inventory, those that are potentially at-risk to the flood and wildfire hazards (where building footprints intersect with known hazard areas), and those that are assumed to be at-risk from other hazards.<sup>12</sup> **Figure 6.23** illustrates the location of 127 hazardous materials sites in relation to population density.

**Table 6.12**  
**High Potential Loss Properties, Critical Facilities and HAZMAT Sites**

Type	Total Number in Inventory	At-risk from Flood Hazard	At-risk from Wildfire Hazard <sup>13</sup>	At-risk from Other Hazards
High Potential Loss Properties	753	128	34	753
Hospitals	2	0	0	2
Fire Stations	31	0	1	31
EMS/ Rescue Bases	15	0	0	15
Schools	40	0	3	40
Daycare Centers	140	0	6	140
Historical Sites	41	1 <sup>14</sup>	2	41
Toxic Release Inventory (TRI)	109	4	2	109
Hazardous Substance Disposal Sites	18	4	0	18
<b>TOTAL:</b>	<b>1,149</b>	<b>140</b>	<b>48</b>	<b>1,149</b>

Source: CCGIS, U.S. EPA, NC OneMap

<sup>11</sup>Includes sites on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Information System (CERCLIS), the National Priorities List, the State Inactive Hazardous Sites List, the Sites Priority List, and some Department of Defense sites.

<sup>12</sup> Because hazards such as thunderstorms, tornadoes and winter storms that have no discernable hazard boundary and present approximately uniform risk to Catawba County, the column indicating risk from other hazards tends to be all inclusive by default. Local knowledge will continue to be leveraged against national and regional databases for further analysis in future Plan updates.

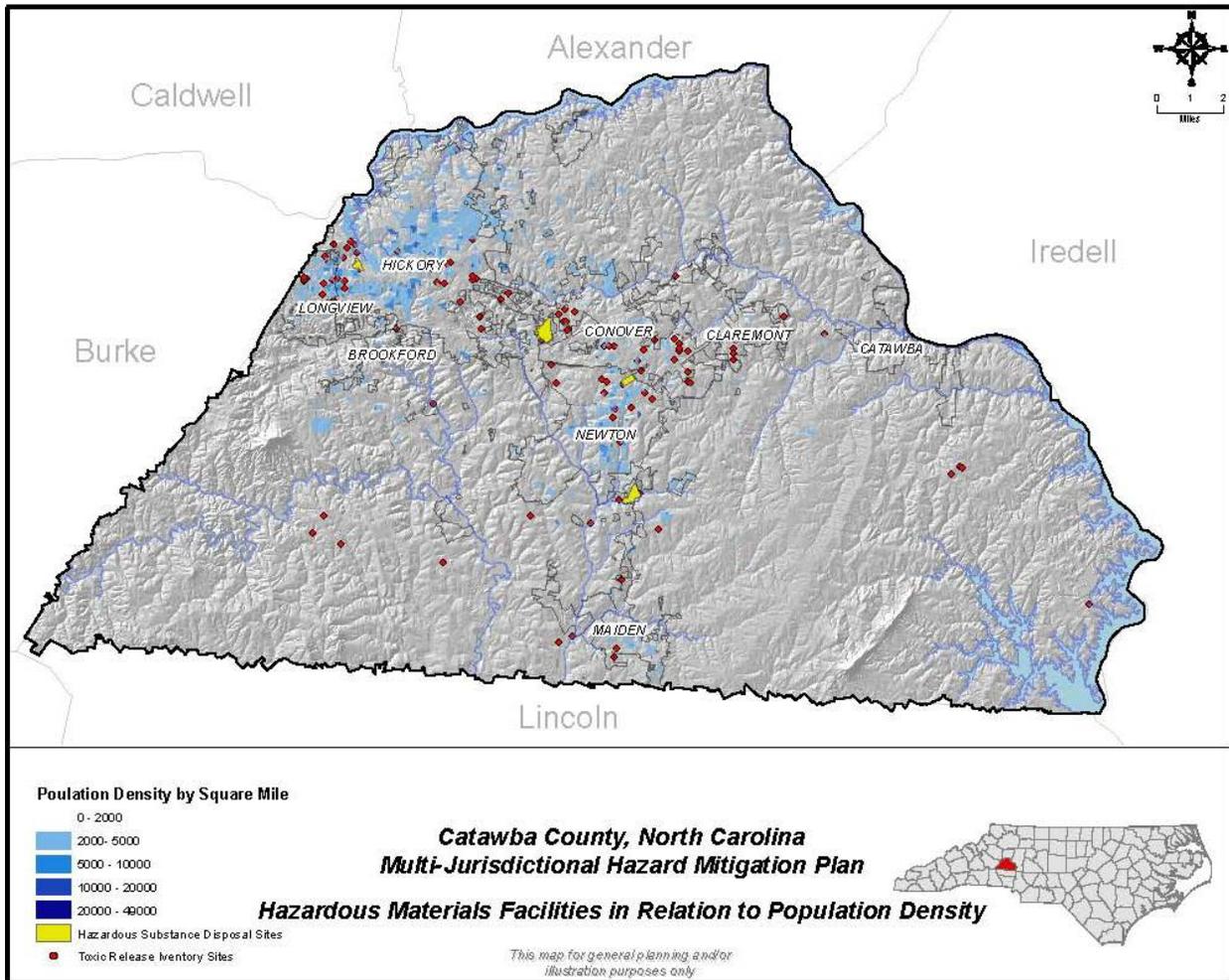
<sup>13</sup> Includes properties, facilities and sites located within areas of high wildfire potential.

<sup>14</sup> The only historic site determined to be potentially at risk to flooding is the Bunker Hill Covered Bridge. However, according to historical reports the bridge has survived large flood events in the past (1916, 1940 and 1973), and therefore the risk is not considered severe or requiring hazard mitigation measures at this time.

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CATAWBA COUNTY, NORTH CAROLINA  
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**Figure 6.23**  
**HAZMAT Sites in Relation to Population Density**



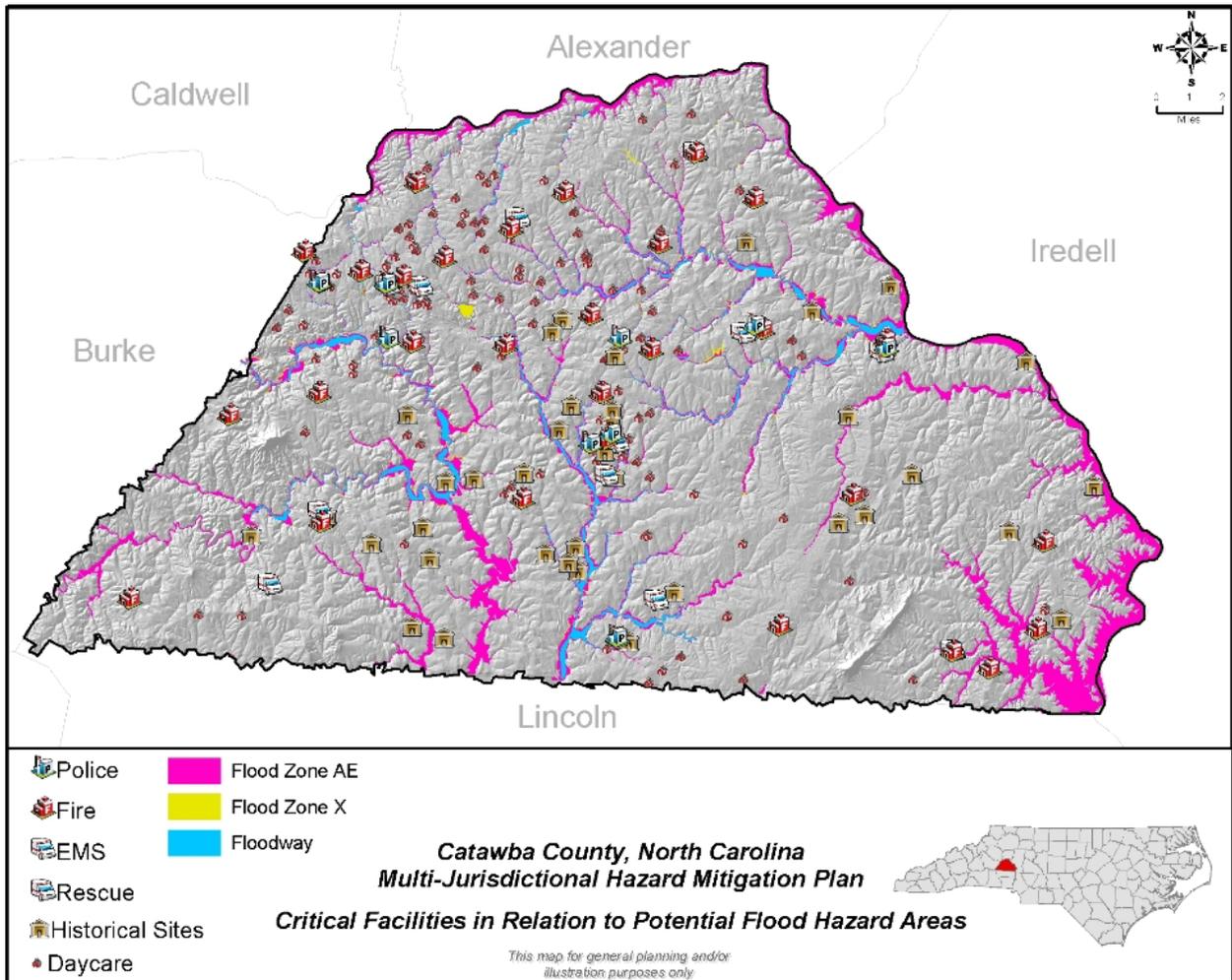
Source: CCGIS, U.S. EPA, NC OneMap

**Figure 6.24** shows a countywide map of critical facilities and flood hazard areas. **Figure 6.25** shows a countywide map of critical facilities and wildfire hazard areas. The maps become more meaningful when substantially enlarged or zoomed in upon using GIS software and as data is withdrawn through further analysis (as shown in Table 6.12).

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CATAWBA COUNTY, NORTH CAROLINA  
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**Figure 6.24**  
**Critical Facilities and Flood Hazard Areas**

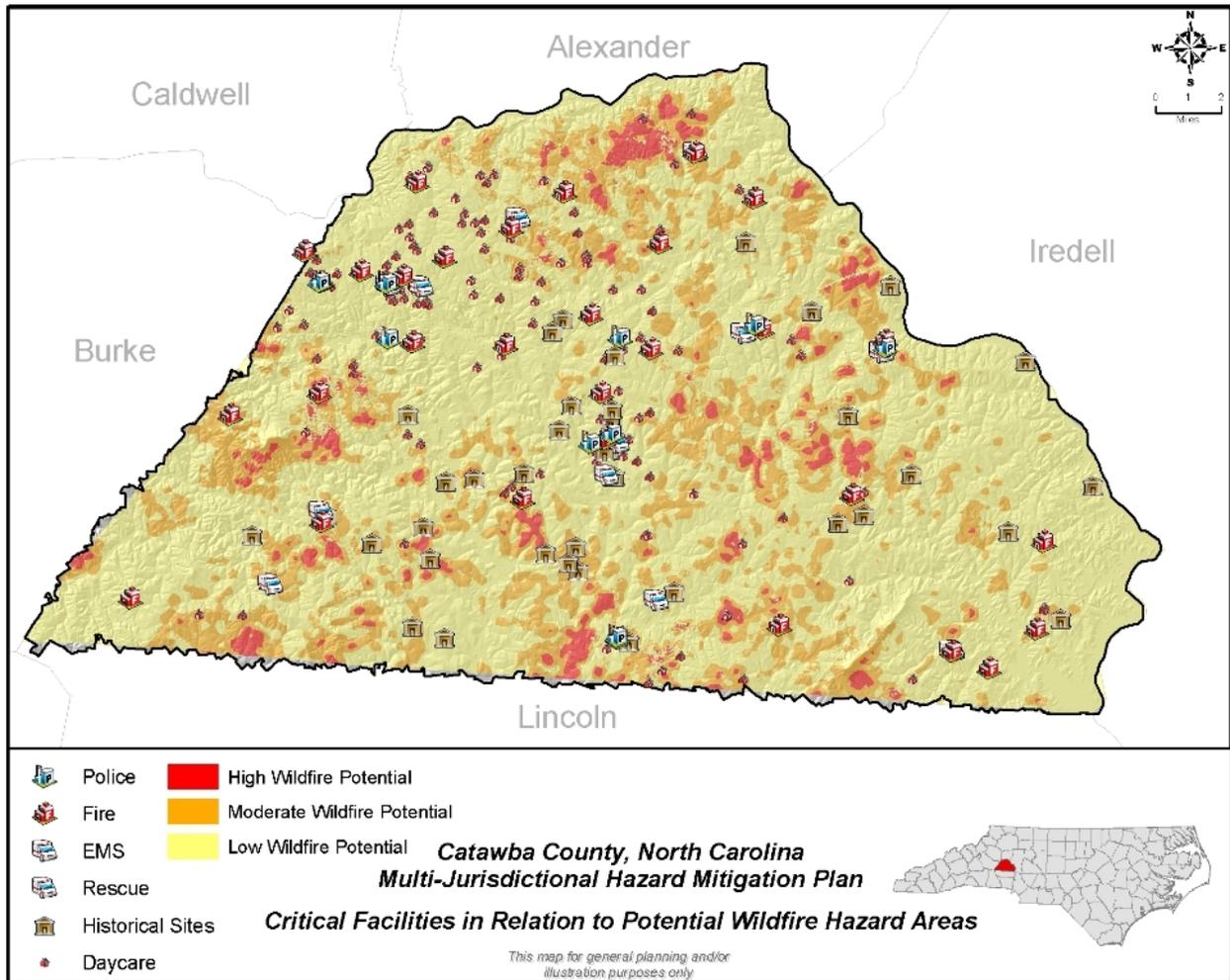


Source: CCGIS, FEMA

# VULNERABILITY ASSESSMENT

CATAWBA COUNTY, NORTH CAROLINA  
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**Figure 6.25  
Critical Facilities and Wildfire Hazard Areas**



Source: CCGIS, North Carolina Division of Forest Resources

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CATAWBA COUNTY, NORTH CAROLINA  
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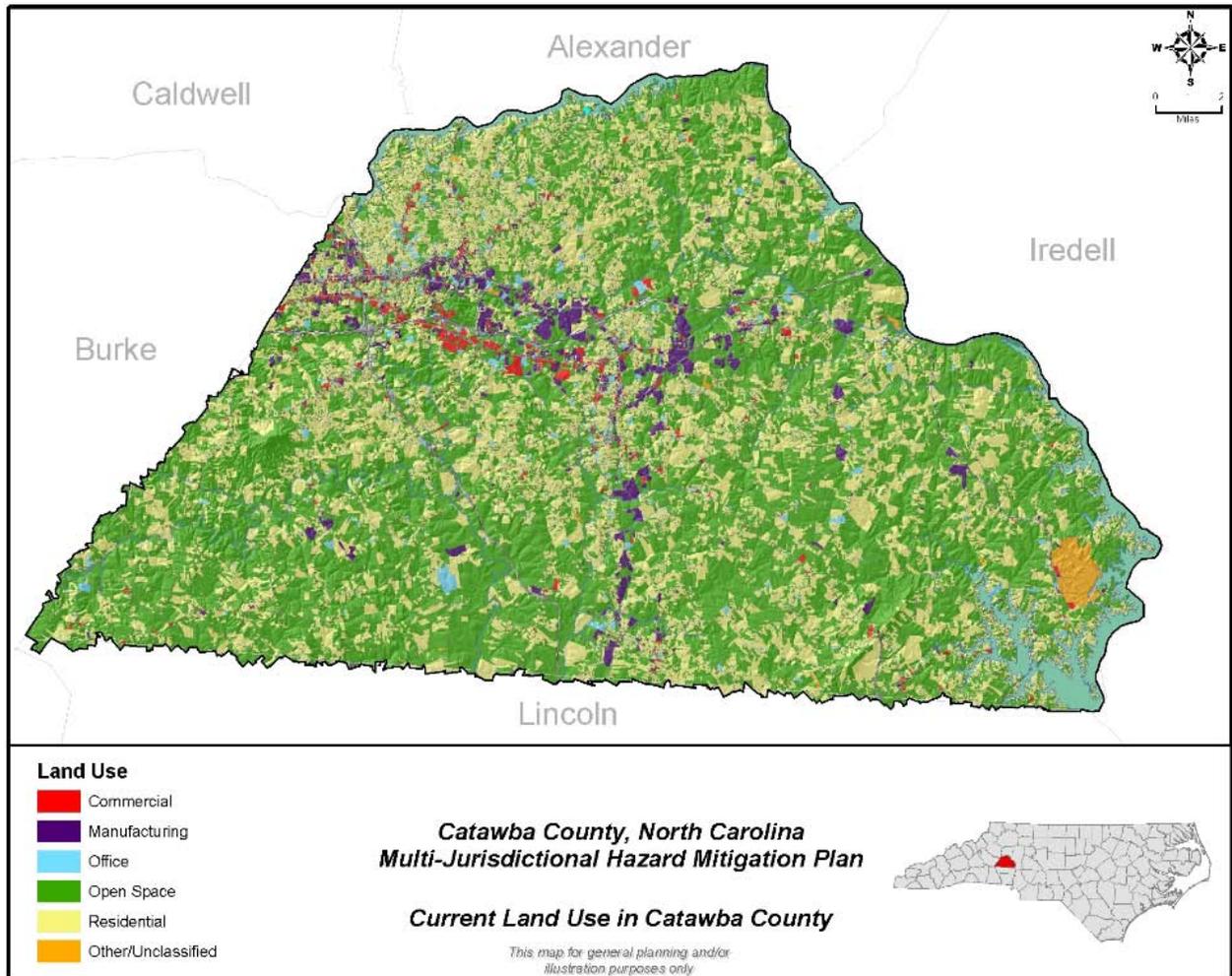
## *Land Use and Known Hazard Areas*

An important consideration for local mitigation planning is how current land use patterns are guiding development in relation to known hazard areas that have distinct geographic boundaries. In Catawba County, these hazards include the flood and wildfire hazards. **Figure 6.26** illustrates current land use in Catawba County according to the following general land use types: commercial; manufacturing; office; office space; residential; and other/unclassified. **Figure 6.27** and **Figure 6.28** show countywide land use along with potential flood and wildfire hazard areas, respectively. As with the critical facilities maps, these figures become more meaningful when substantially enlarged or zoomed in upon using GIS software and as data is withdrawn through further analysis. Catawba County developed future land use maps as part of its small area planning process (further described *Section 3: Community Profile*) in which natural hazards were considered. These maps are considered important tools for the County to use in terms of risk communication and future land use development decisions, and will continue to be considered during future Plan enhancements.

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**Figure 6.26**  
**Current Land Use in Catawba County**

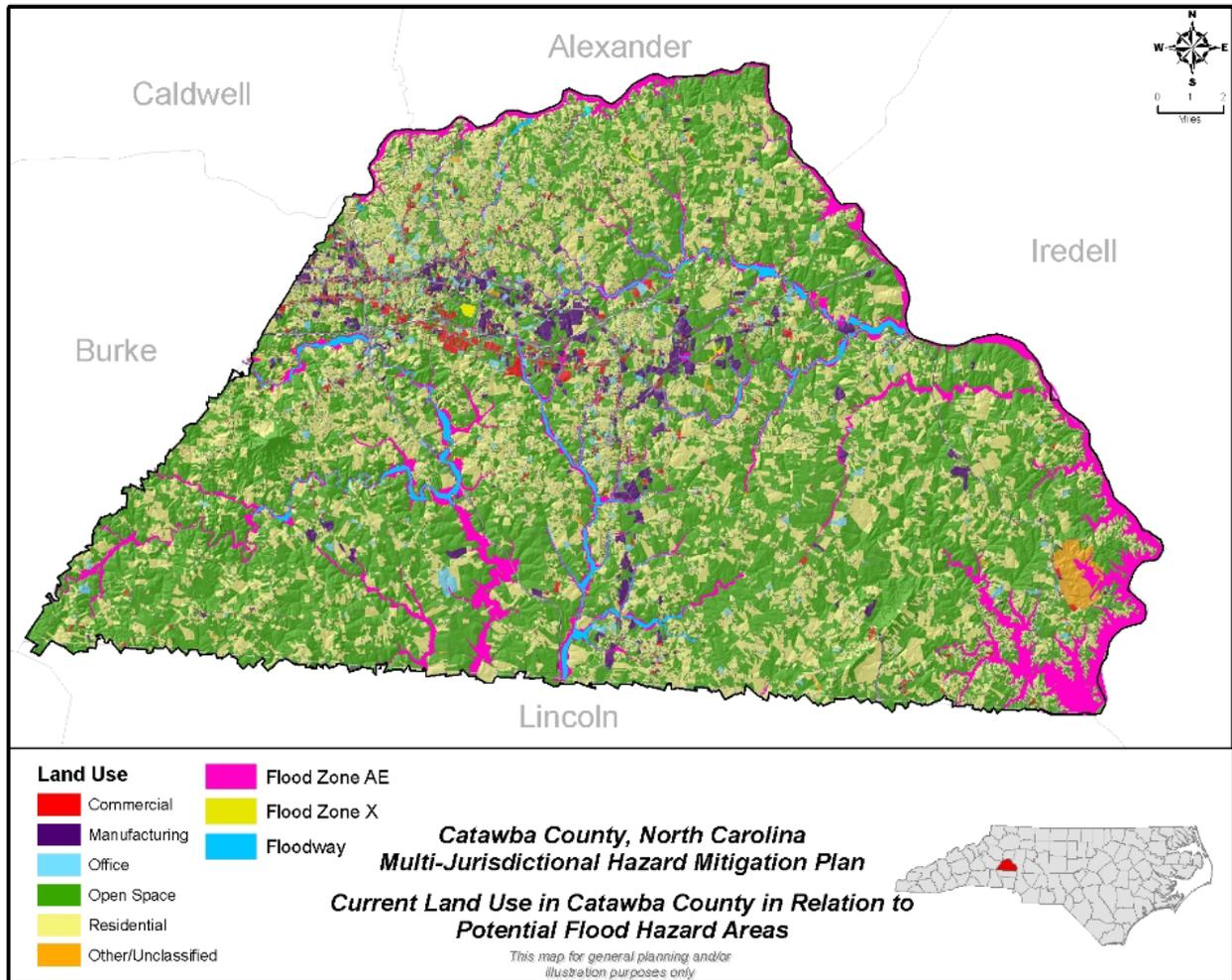


Source: CCGIS

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CATAWBA COUNTY, NORTH CAROLINA  
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**Figure 6.27**  
**Current Land Use and Flood Hazard Areas**

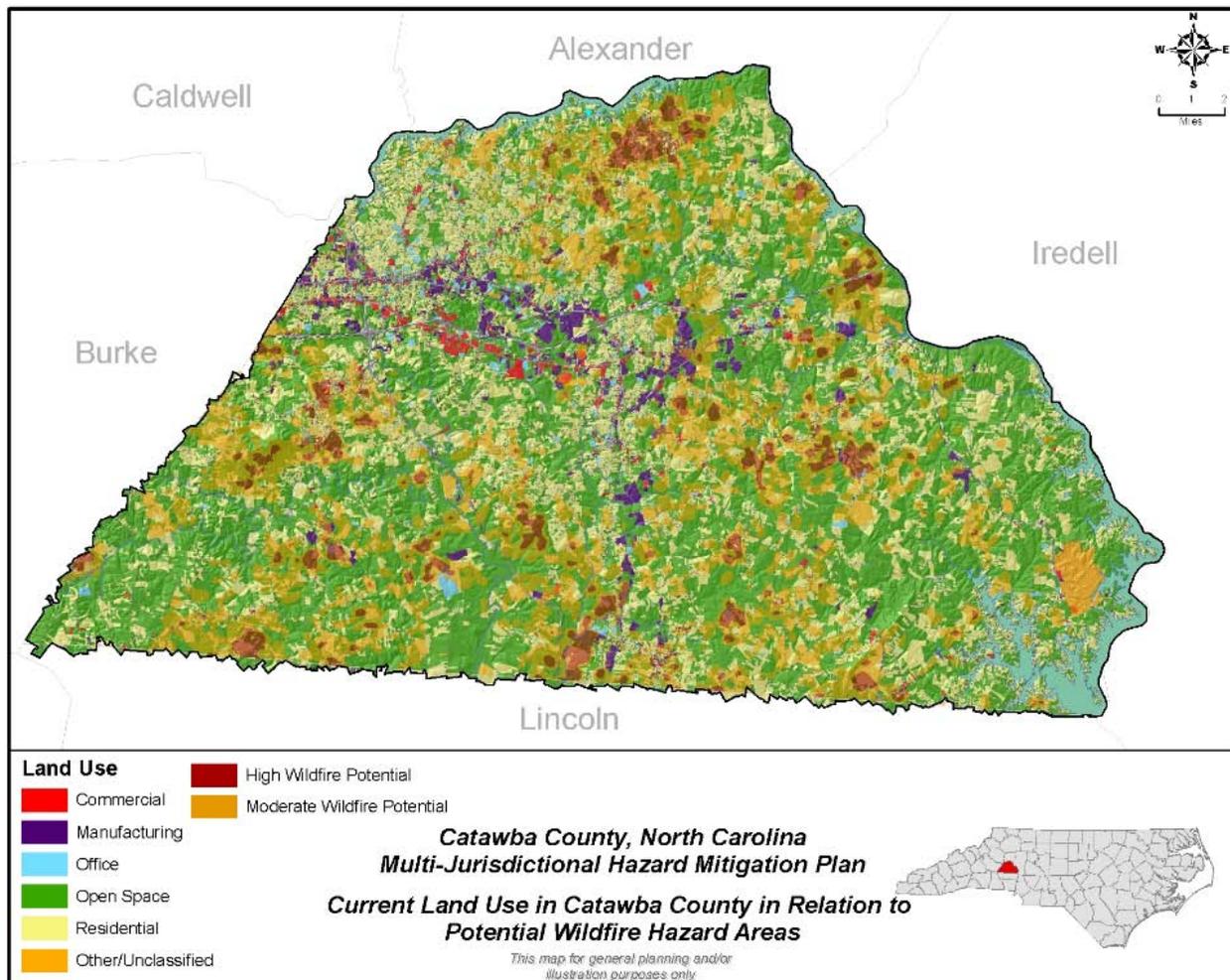


Source: CCGIS, FEMA

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CATAWBA COUNTY, NORTH CAROLINA  
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**Figure 6.28**  
**Current Land Use and Wildfire Hazard Areas**



Source: CCGIS, North Carolina Division of Forest Resources

## *Unique Risks for Local Jurisdictions*

As part of this risk assessment process, the Catawba County Mitigation Advisory Committee was asked to identify any hazard vulnerabilities that may be unique to local jurisdictions within the county beyond those already addressed. Essentially, the representatives of each community was asked to provide information as to the nature of any hazards not addressed in the countywide risk assessment, whether or not the hazard(s) are confined to a distinct geographic boundary, and what the consequences of the hazard event occurring would be on lives and property within the localized area. During the 2009 plan update, no unique risks were reported by participating jurisdictions beyond those already addressed.

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CATAWBA COUNTY, NORTH CAROLINA  
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## *Conclusions on Hazard Risk*

As explained in “Methodologies Used,” a hybrid approach was employed to reconcile findings from both a quantitative assessment (based on HAZUS<sup>MH</sup> and GIS analysis) and a qualitative assessment (based on a scoring and ranking system agreed upon by the Mitigation Advisory Committee). **Table 6.13** summarizes the annualized expected losses for each hazard which are a culmination of the quantitative assessment (sorted by estimated annualized losses). In comparison to the initial 2004 assessment, the annualized potential losses for all hazards decreased (with the exception of earthquake which increased, and drought which went from negligible to an estimated figure of \$128,000). These differences in annualized loss estimates can be attributed to better data (as in the case of flood, severe thunderstorms and tornadoes, and winter storms), or enhancements to loss estimation software (HAZUS-MH for hurricane and earthquake) or other methods used to generate the loss estimates (as described earlier in this section). The top four hazards identified through the 2009 plan update process are the flood hazard, the earthquake hazard, the severe thunderstorm and tornado hazard, and the hurricane and tropical storm hazard.

**Table 6.13**  
**Summary of Potential Annualized Losses**  
**(From Quantitative Assessment)**

Hazard	Estimated Annualized Losses
Flood	\$1,676,000
Earthquake	\$745,000
Severe Thunderstorms and Tornadoes	\$688,000
Hurricanes and Tropical Storms	\$452,000
Winter Storms	\$298,000
Drought	\$128,000
Wildfire	Negligible
Erosion	Negligible
Dam/ Levee Failure	Negligible
Sinkholes and Landslides	Negligible

Based upon the qualitative approach defined in detail under Methodologies Used, the risks from natural hazards in Catawba County were weighed by the Mitigation Advisory Committee and criteria was used to assign values to the likelihood of occurrence, spatial extent affected, and potential impact of each hazard based upon its estimated maximum severity level<sup>15</sup> as indicated in **Table 6.14**. While Catawba County is potentially vulnerable to each of the hazards identified in this Plan, estimated maximum severity levels helps assign values for potential impact (answering the question of “how bad can it be?”) based on available scientific data and previous hazard occurrences as described in Section 5: Hazard Analysis.

<sup>15</sup> Estimated maximum severity levels (i.e., magnitude or extent) were classified according to scientific scales such as the Saffir-Simpson Scale for hurricanes, Palmer Drought Severity Index for drought, Modified Mercalli Intensity Scale for earthquakes and Enhanced Fujita Scale for tornadoes (more thoroughly described in Section 4: Hazard Identification). For hazards with no scientific scale applied, only concise qualitative descriptions of severity are provided based on the results of the hazard analysis as summarized in Section 5.

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**Table 6.14  
Estimated Maximum Severity Levels for Catawba County Hazards**

Hazard	Estimated Maximum Severity Level
Flood	500-Year Flood (0.2% annual chance flood elevations)
Hurricanes and Tropical Storms	Category 2 Hurricane (96-110mph winds)
Severe Thunderstorms and Tornadoes	F4 Tornado (166-200mph winds)
Wildfire	20 acres burned along urban/wildland interface
Drought	PDSI -4.0 (Extreme Drought)
Winter Storms	Severe Winter Storm (50mph winds, snow accumulations of greater than one foot and/or ice accumulations of greater than 1 inch)
Erosion	Only minor stream bank erosion in isolated, undeveloped areas
Dam/ Levee Failure	Complete failure of high-hazard dam
Earthquakes	MMI VI Earthquake
Sinkholes and Landslides	Only minor naturally occurring events in isolated, undeveloped areas

The cumulative sum of all assigned values for each hazard resulted in the calculation of a total hazard risk rating for each hazard, as shown in **Table 6.15** (sorted by hazard risk rating). The top four hazards identified through this process are the hurricane and tropical storm hazard, the winter storm hazard, the flood hazard, and the severe thunderstorm and tornado hazard.

**Table 6.15  
Hazard Risk Ratings (From Qualitative Assessment)**

Hazard	Likelihood	Spatial Extent	Potential Impact	Hazard Risk Rating
Hurricanes and Tropical Storms	Likely (2)	Large (3)	Critical (3)	<b>8</b>
Winter Storms	Highly Likely (3)	Large (3)	Limited (2)	<b>8</b>
Flood	Highly Likely (3)	Moderate (2)	Critical (3)	<b>8</b>
Severe Thunderstorms and Tornadoes	Highly Likely (3)	Small (1)	Critical (3)	<b>7</b>
Earthquakes	Unlikely (0)	Large (3)	Critical (3)	<b>6</b>
Wildfire	Highly Likely (3)	Small (1)	Minor (1)	<b>5</b>
Drought/ Extreme Heat	Possible (1)	Moderate (2)	Minor (1)	<b>4</b>
Dam/ Levee Failure	Unlikely (0)	Small (1)	Critical (3)	<b>4</b>
Erosion	Likely (2)	Small (1)	Minor (1)	<b>4</b>
Sinkholes and Landslides	Unlikely (0)	Small (1)	Minor (1)	<b>2</b>

The conclusions drawn from the qualitative and quantitative assessments, combined with final determinations from the Mitigation Advisory Committee, were fitted into three categories for a final summary of hazard risk based on High, Moderate or Low designations (**Table 6.16**). The three high risk hazards identified through this process are the hurricane and tropical storm hazard, the winter storm hazard, and the flood hazard. The three moderate risk hazards identified are the severe thunderstorm

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CATAWBA COUNTY, NORTH CAROLINA  
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and tornado hazard, the earthquake hazard, and the wildfire hazard.

**Table 6.16**  
**Estimated Risk Levels (Combination of Qualitative and Qualitative Assessments)**

<b>HIGH RISK HAZARDS</b>	Hurricanes and Tropical Storms Winter Storms Flood
<b>MODERATE RISK HAZARDS</b>	Severe Thunderstorms and Tornadoes Earthquake Wildfire
<b>LOW RISK HAZARDS</b>	Drought/ Extreme Heat Erosion Dam/ Levee Failure Sinkholes and Landslides

It should be noted that although some hazards may show Moderate or Low risk, hazard occurrence is still possible. Also, any hazard occurrence could potentially cause a sizable impact and losses could be extremely high (e.g. an F5 tornado or a Category 5 hurricane). It is also important to recognize that the future likelihood and intensity of many natural hazards identified for Catawba County are predicted to increase due to the effects of climate change, as discussed earlier in Section 5: Hazard Analysis. These implications were considered and discussed by the Mitigation Advisory Committee and will continue to be so during future plan updates as more scientific data and information becomes available.

In conclusion, while Catawba County is susceptible to a wide range of natural hazards to varying degrees, the hazards of hurricane and tropical storm, winter storm, and flood are of the utmost, immediate concern to the county and its municipalities with regard to hazard mitigation practices and policies. This is further reflected in the *Mitigation Strategy* section of the Plan.