HAZARD ANALYSIS

The *Hazard Analysis* section provides information on historical hazard occurrences in Catawba County for the hazards listed below. This includes an assessment of the location and spatial extent of the event as well as best available data regarding the impact on the county.

- **Flood**
- **Hurricanes, Tropical Storms and Nor'easters**
- **Severe Thunderstorms and Tornadoes**
- **Wildfire**
- **Drought/ Extreme Heat**
- **Winter Storms and Freezes**
- **Erosion**
- **Dam/ Levee Failure**
- **Earthquakes, Sinkholes and Landslides**
- **Effects of Climate Change on Natural Hazards**

CFR Requirement

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

Historical records are used to identify the level of risk, with the methodological assumption that the data sources cited are reliable and accurate. This section also provides maps that illustrate the location and spatial extent for those hazards within Catawba County that have a recognizable geographic boundary (i.e., hazards that are known to occur in particular areas of Catawba County, such as the 100-year floodplain). For those hazards not confined to a particular geographic area (such as tornadoes and hailstorms), general information on their applicable intensity across the entire jurisdiction is provided.

Flood

There are numerous rivers and streams flowing through Catawba County. When heavy or prolonged rainfall events occur, these rivers and streams are susceptible to some degree of flooding. Catawba County, due to its geographic location, is not susceptible to coastal flooding or storm surge.[1] There have been a number of past flooding events throughout Catawba County, ranging widely in terms of location, magnitude and impact. The most frequent flooding events are quite localized in nature, resulting from heavy rains in a short period of time over urbanized areas that are not able to appropriately handle stormwater runoff. These events typically do not threaten lives or property and won't result in emergency or disaster declarations, thus historical data is difficult to come by. **Table 5.1** describes recently recorded flood events which have caused a notable impact on Catawba County. The most significant property damage reported for these five events was $3 million on August 17, 2002 when flooding affected the Hickory area. **Table 5.2** lists the number of insured losses and total claims payments for historical flood damages in each jurisdiction as recorded under the National Flood Insurance Program (NFIP).[2] **Figure 5.1** shows potential flood hazard areas throughout the county in relation to incorporated municipalities.

Table 5.1
Recent Flood Events in Catawba County (2002-2008)

Location	Date of Occurrence	Type of Event	Deaths/ Injuries	Property Damage	Details
Hickory	08/17/2002	Flash Flood	0/0	$3,000,000	A serious urban flash flood developed when five to six inches of rain fell within a two-hour period. Sinkholes developed that continued to grow for weeks after the flood. Some flat-roofed businesses collapsed. Water was reported to have accumulated to depths of 17 feet in portions of the downtown area. Rapidly flooding streets caused numerous people to become trapped in vehicles, requiring rescue. Water entered numerous homes and businesses. Numerous large trees were downed from a combination of the excessive rain and wind gusts up to 50 miles per hour.
Countywide	03/20/2003	Flash Flood	0/0	0	Flooding developed quickly across the county after the onset of heavy early morning rain. Although flooding was largely described as minor, some livestock required rescue due to flooding along the Jacobs Fork River.
Claremont	05/02/2003	Flash Flood	0/0	0	Some creeks in the Claremont area overflowed their banks and flooded a portion of Interstate 40.
Conover	05/03/2003	Flash Flood	0/0	0	Several creeks overflowed their banks in the Conover area, resulting in some flooded roads, including County Home Road. Creekside Mobile Home Park was also flooded.
Hickory	06/16/2003	Flash Flood	0/0	$60,000	Several roads were covered with water. A culvert on River Bend Road collapsed, causing part of the road to wash away.
Long View	08/06/2003	Flash Flood	0/0	$5,000	Several streets were closed due to flooding. At least one vehicle was trapped by flood waters.

[1] Refer to the *Community Profile* section (Section 3 of this Plan) for details regarding Catawba County's geographic position within North Carolina.
[2] NFIP claims statistics provided by the Federal Emergency Management Agency (as of 4/30/2009).

Location	Date of Occurrence	Type of Event	Deaths/ Injuries	Property Damage	Details
Countywide	09/08/2004	Flood	0/0	$130,000	After an extended period of moderate to heavy rainfall, rises along the Catawba River resulted in significant road flooding across the county during mid-morning. Water releases from upstream dams contributed to the flooding along the river. Evacuations became necessary by late morning. Numerous homes and a few farm ponds were damaged.
Longview	05/19/2005	Flash Flood	0/0	$5,000	Water up to the windows of a car.
Hickory	07/07/2005	Flash Flood	0/0	$0	Severe urban flooding in Hickory and Conover, with a bridge washed out in Conover. Also, a sinkhole that developed in 2002 in a restaurant parking lot in Hickory during a significant flash flood event reopened, while a second sinkhole developed in another restaurant parking lot.
Countywide	10/07/2005	Flood	0/0	$30,000	County reported a portion of highway 70 was closed. Several bridges were underwater in the southwest part of the county. Water entered the basements of several homes, while at least 1 home was evacuated. In addition, the 3rd major sinkhole in 3 years opened up in Hickory at the intersection of Highway 321 and Old Lenoir Road. Portions of the county received as much as 8.7 inches of rain in the 48-hour period ending on the morning of the 8th.
Maiden	08/17/2008	Flash Flood	0/0	$50,000	A vigorous upper low and easterly upslope flow into the North Carolina foothills resulted in slow moving storms that produced some flash flooding despite the ongoing drought across the region. A few roads were flooded in the Maiden area, including Mays Chapel Church Road near highway 321. Several structures and at least one vehicle were also flooded due to urban flooding in Maiden. Flooded roads were also reported further east, including highway 16 about 6 miles east northeast of Maiden and Sherrills Ford Road about 12 miles east northeast of town.
Startown	08/27/2008	Flash Flood	0/0	0	The remnants of Tropical Storm Fay stalled just west of the Appalachian mountains, resulting in a prolonged, moist south to southeasterly flow over western North Carolina. A 25 foot section of East 1st Street in Newton was washed out by water from Snow Hill Creek. Also, Rocky Ford Road was closed due to flooding along the South Fork River. A section of Little Road was washed out near the intersection of Albert Drive. Storm total rainfall in this area averaged 8 to 10 inches, with locally higher amounts, resulting in significant urban and stream flooding.
TOTALS:			**0/0**	**$3,280,000**	

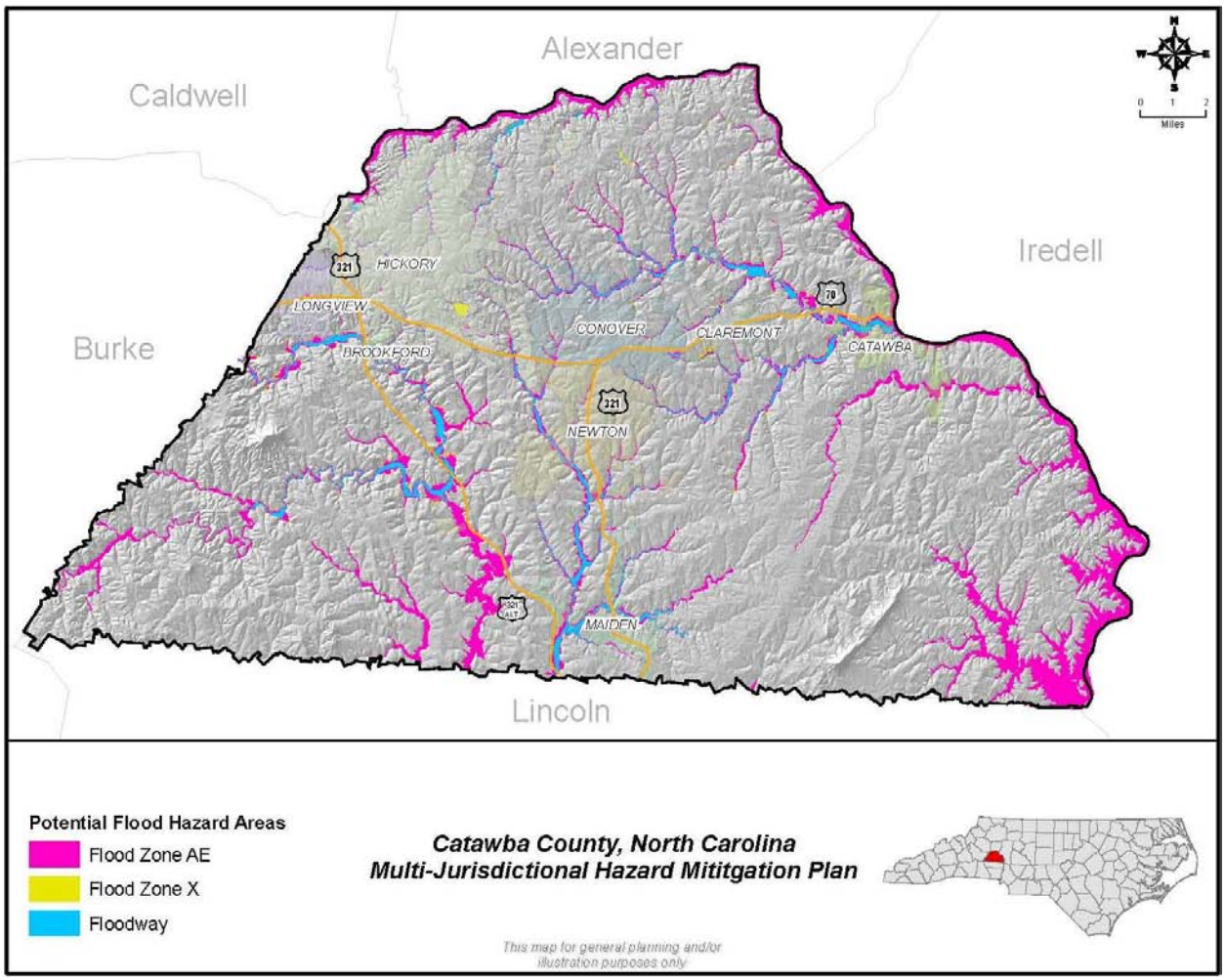
Source: NOAA, National Climatic Data Center

Table 5.2
NFIP Statistics for Historical Flood Losses and Claims Payments

Jurisdiction	Total Number of Losses	Total Payments
Catawba County	57	$467,618
Brookford	0	$0
Catawba	0	$0
Claremont	0	$0
Conover	2	$2,747
Hickory	11	$117,932
Long View	0	$0
Maiden	1	$2,379
Newton	0	$0
TOTAL	**71**	**$590,676**

Source: FEMA

Figure 5.1
Potential Flood Hazard Areas Countywide[3]



Source: CCGIS, FEMA

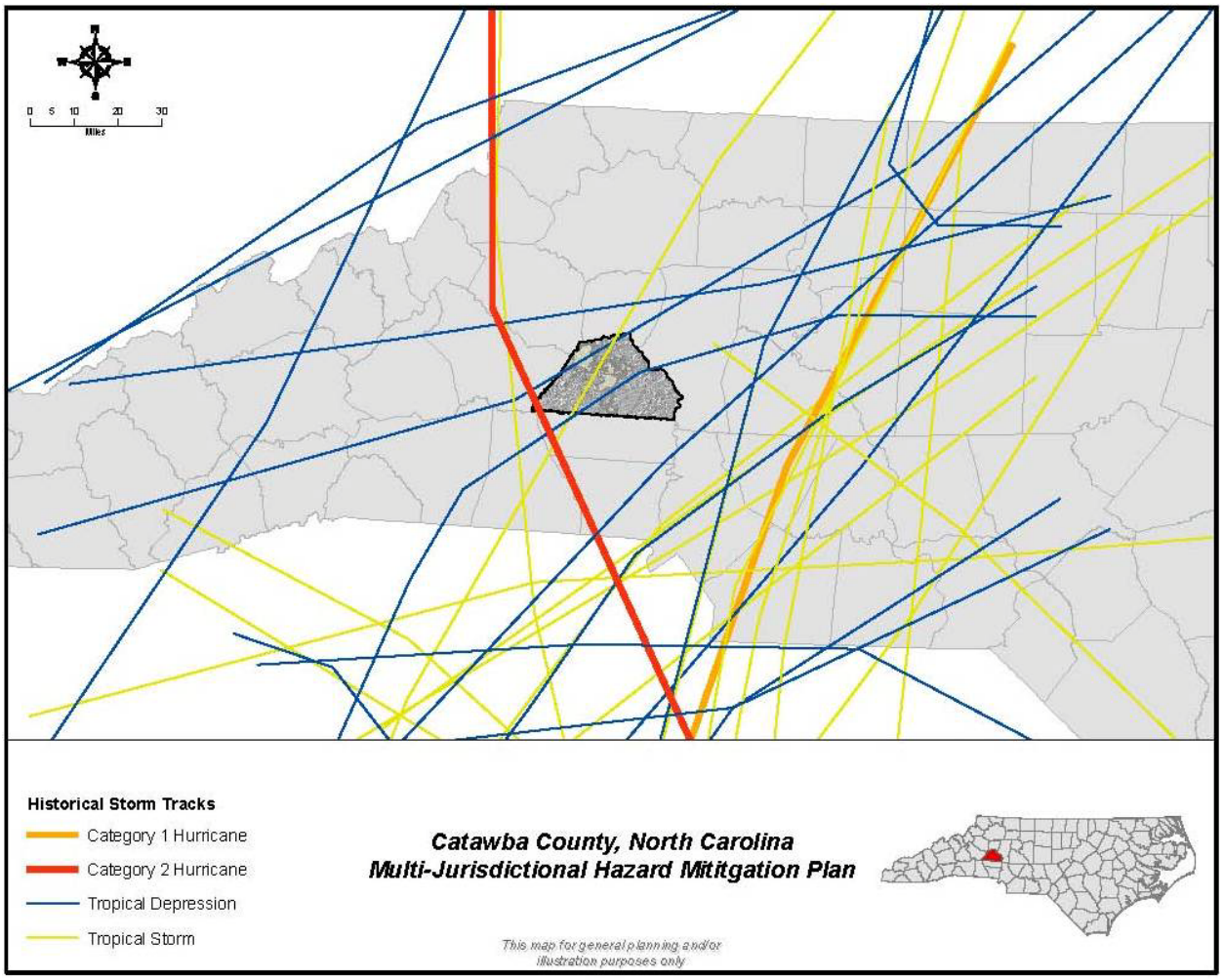
Hurricanes, Tropical Storms and Nor'easters

On average, North Carolina experiences a hurricane approximately once every two years. Substantial hurricane damage is typically most likely to be expected in the easternmost counties of the state; however, hurricane and tropical storm-force winds have significantly impacted areas far inland, including Catawba County. In fact, 34 such storms have passed within 75 miles of Catawba County since 1851, four of which crossed directly through the county (**Figure 5.2** and **Table 5.3**). This includes a Category 1 and Category 2 hurricane, 16 were tropical storms, and 16 were tropical depressions.. Of the four that passed through the county, one was a Category 2 hurricane (Hurricane Hugo in 1989), one was an

[4] For comparison, there are three counties in North Carolina which have had no recorded tornado events, and one county has reported as many as 46.

unnamed tropical storm in 1949, and two were tropical depressions (1939 and 1968). No nor'easters are known to have significantly impacted Catawba County in recent history.

Figure 5.2
Historical Storm Tracks within 75 Miles of Catawba County (Since 1851)



Source: CCGIS, NOAA

Table 5.3
Historical Storm Tracks within 75 Miles of Catawba County (Since 1851)

Name of Storm	Date of Occurrence	Storm Category	Maximum Recorded Wind Speed (Miles Per Hour)
Not named	09/17/1859	Tropical Storm	45
Not named	9/12/1878	Tropical Storm	70
Not named	9/11/1882	Tropical Storm	45
Not named	10/12/1885	Tropical Storm	45
Not named	6/22/1886	Tropical Storm	45
Not named	9/24/1889	Tropical Storm	50
Not named	8/28/1893	Category 1	85
Not named	7/19/1901	Tropical Depression	35
Not named	9/18/1906	Tropical Storm	45
Not named	9/3/1913	Tropical Storm	45
Not named	8/3/1915	Tropical Depression	35
Not named	7/15/1916	Tropical Storm	60
Not named	9/23/1920	Tropical Storm	65
Not named	10/3/1927	Tropical Storm	45
Not named	5/30/1934	Tropical Depression	35
Not named	8/18/1939	Tropical Depression	30
Not named	10/9/1946	Tropical Depression	35
Not named	8/28/1949	Tropical Storm	45
Able	8/31/1952	Tropical Storm	50
Gracie	9/30/1959	Tropical Storm	70
Cleo	8/30/1964	Tropical Depression	30
Abby	6/8/1968	Tropical Depression	30
Babe	9/8/1977	Tropical Depression	30
David	9/5/1979	Tropical Storm	65
Bob	7/25/1985	Tropical Storm	65
Danny	8/18/1985	Tropical Depression	30
Chris	8/29/1988	Tropical Depression	30
Hugo	9/22/1989	Category 2	100
Beryl	8/17/1994	Tropical Depression	15
Danny	7/24/1997	Tropical Depression	25
Dennis	9/6/1999	Tropical Depression	30
Bill	7/2/2003	Tropical Depression	25
Ivan	9/17/2004	Tropical Depression	25
Jeanne	9/28/2004	Tropical Depression	25

Source: NOAA, National Hurricane Center

There is very little reliable information on the historical impacts of past hurricane and tropical storm events in Catawba County. No official historical records or damage statistics specific to the area are available through Catawba County, the North Carolina Division of Emergency Management or the Federal Emergency Management Agency. However, the following anecdotal information on Hurricane Hugo in

1989 (Catawba County's most powerful storm event to date) was provided through the Catawba County Emergency Services:

> *"The winds from Hurricane Hugo started really picking up around 2:00 in the morning. About this same time the first reports of damages started coming into the Communications Center. It was also about this time that EOC was activated to full force. From what can be remembered from that time, the rain bands started moving in about 4:00 a.m. The heaviest damage that Catawba County experienced occurred around daylight. The majority of the damage came in the form of trees down across roadways and power lines down. There was some structural damage across the county, but minimal. As for power outage, at one time 75 percent of Catawba County residences were without power and it took eight days to get all the power restored. Some of the biggest problems from the storm were that Communications Center received a influx of calls from citizens who were wanting to report that their power was out. This made it difficult for the Center to process actual emergencies. Also, the fire and EMS units throughout the county were stretched to the limit because in a lot of cases trees had to be cut out of the way by the fire department so EMS crews could get to medical emergencies. In total the EOC was up and running for three days, and then slowly moved over into a public assistance operation."*

In reviewing local emergency incident reports for the past ten years, the only recently recorded hurricane or tropical storm impacts in Catawba County were associated with Hurricane Danny and Hurricane Opal. In July 1997, the remnants of Hurricane Danny caused some isolated flooding problems throughout the county. In 1995, the county experienced severe weather due to the remains of what was Hurricane Opal. The system was a tropical depression when it came through the area, but it produced heavy thunderstorms and heavy rainfalls causing damage and flooding in areas of Catawba County.

Severe Thunderstorms and Tornadoes

Severe Thunderstorms

Thunderstorms are common throughout the state of North Carolina, and have been known to occur during all calendar months. In addition to the high winds associated with these events, thunderstorms can also bring dangerous lightning which can cause fires, property damage and may cause death or serious injury to humans. Hail is another element of this form of inclement weather, and can cause varying degrees of property and crop damage. Catawba County has experienced 185 recorded thunderstorm events (including wind and lightning) since 1950, which have resulted in two (2) injuries, three (3) fatalities and more than $3.7 million in property damage (NCDC, 2008). **Table 5.4** provides details of those events that resulted in recorded casualties or property damage. A total of 112 hail events are known to have impacted Catawba County since 1950, resulting in $10 million in property damage (NCDC, 2008). The size of the recorded hailstones recorded range from 0.75 inches to two inches. No deaths, injuries or crop damages have been reported as a result of hailstorm activity.

Table 5.4
Severe Thunderstorm and Lightning Activity in Catawba County (1950-2008)

Location of Storm	Date of Occurrence	Type of Event	Magnitude	Deaths/ Injuries	Property Damage	Details
Maiden	05/04/1993	Thunderstorm Winds	N/A	0/0	$500,000	Winds blew down trees, one destroying a mobile home. A house boat on Lake Norman was destroyed and other house roofs and boats were damaged.
Maiden	08/17/1993	Thunderstorm Winds	N/A	0/0	$500,000	Several mobile homes were overturned and outbuildings damaged.
Catawba County	06/10/1995	Thunderstorm Winds	N/A	0/0	$10,000	Trees down and roof damage.
Maiden	07/25/1995	Thunderstorm Winds	N/A	0/0	$250,000	Very strong winds destroyed two mobile homes and damaged several others. Thirty people had to be evacuated, but no injuries were reported. A commercial building had a wall blown down.
24 Counties, including Catawba	01/18/1996	High Wind	0 knots	0/0	$75,000	Gradient winds caused considerable damage in the foothills and piedmont as a front moved through.
Hickory	05/27/1996	Thunderstorm Wind	50 knots	0/0	$20,000	Multicell development kept severe thunderstorms over Burke and Catawba counties for more than two hours. Large hail fell and damaging winds affected several communities. The area most affected was Sweetwater (two miles east of Hickory) where roofs were blown off several mobile homes and outbuildings were destroyed. Trees fell on homes. The damage may well be more than estimated.
Sherrills Ford	07/01/1996	Thunderstorm Wind	60 knots	0/0	$50,000	An isolated severe thunderstorm caused extensive damage over a very small area on Lake Norman. Boats and boat docks were damaged and trees were blown down. The storm moved from north to south.
Hickory	08/03/1996	Lightning	N/A	0/0	$100,000	No details/description available for this event.
Newton	06/02/1997	Lightning	N/A	0/0	$15,000	Lightning at Newton struck several residences, causing fire damage.
Hickory	07/16/1997	Lightning	N/A	0/0	$55,000	Lightning struck a house, sparking a fire which caused significant damage. Severe thunderstorms developed mainly in the foothills of North Carolina during the afternoon. Damaging winds up to 75 MPH downed trees and power lines.

Location of Storm	Date of Occurrence	Type of Event	Magnitude	Deaths/ Injuries	Property Damage	Details
16 Counties, including Catawba	02/24/1998	High Wind	50 knots	0/0	$20,000	High gradient winds in the wake of an exiting strong storm system combining with saturated soil conditions to blow down some trees and power lines across the foothills and piedmont.
Hickory, Plateau, and Claremont	05/26/1998	Thunderstorm Wind	50 knots	0/1	$0	Hail and wind lasted 15 to 20 minutes at some locations. Numerous trees and power lines were downed, some on homes, and numerous power outages occurred. In the Town of Catawba, a shed was blown apart and siding taken off a garage. A 5-year-old girl was injured in her mobile home when a tree struck it.
Hickory	05/27/1998	Lightning	N/A	0/0	$5,000	Lightning struck an apartment in Hickory and caused an attic fire.
Hickory	06/22/1998	Thunderstorm Wind	50 knots	0/0	$10,000	Multicell thunderstorms moved across the mountains and into the foothills during the evening hours. Some of the storms became severe and produced mainly wind damage. A tree fell on a house in Hickory. Elsewhere, scattered trees and some power lines were downed.
Hickory	07/16/1998	Lightning	N/A	0/0	$15,000	Lightning struck a house causing quite a bit of damage. The Hickory Fire Department received several other lightning related calls.
Newton	07/25/1998	Lightning	N/A	0/0	$30,000	Lightning damaged a home after entering through a breaker box and stereo system.
Hickory	09/28/1998	Thunderstorm Wind	52 knots	0/0	$10,000	A strong storm developed in southern Caldwell County and quickly moved into western and northern Catawba County where it became severe. An employee of an auto dealership reported that a small tornado moved quickly from the northwest across the dealership causing damage to the building and several cars. Farther east, wind damage caused numerous trees and power lines to fall — especially in the Conover and Claremont areas. Large hail was also observed.
Hickory	07/12/2000	Lightning	N/A	0/0	$5,000	Slow-moving thunderstorms produced heavy rain during the late afternoon and early evening. Five and a half inches of rain fell in two hours in Maiden, causing a drain pipe to back up and a large section of the road to be washed out. Lightning caused damage to a home in Hickory.

Location of Storm	Date of Occurrence	Type of Event	Magnitude	Deaths/ Injuries	Property Damage	Details
21 Counties, including Catawba	03/20/2001	High Wind	55 knots	0/0	$1,000,000	No details/description available for this event.
Terrell	05/02/2002	Thunderstorm Wind	65 knots	0/0	$10,000	Windows were blown out of a service station.
Conover	06/13/2002	Thunderstorm Wind	50 knots	0/0	$1,000	Some trees and power lines were blown down.
Hickory	07/22/2002	Thunderstorm Wind	52 knots	0/0	$1,000	A few trees and power lines were blown down.
Claremont	08/15/2002	Thunderstorm Wind	55 knots	0/0	$25,000	Numerous trees and power lines were blown down. A carport attached to a home was damaged, and fell on a car.
Hickory	08/24/2002	Thunderstorm Wind	50 knots	0/0	$3,000	Trees and power lines were blown down in and around Hickory.
Hickory	05/02/2003	Thunderstorm Wind	60 knots	0/1	$20,000	According to Catawba County, the EOC was activated. A tree fell on an apartment and a tree fell on a house in Maiden. In the Cooksville area, a tree fell on an outbuilding. A porch was damaged by a tree on Sherrills Ford Road. A home was damaged on Mull Road. Duke Energy reported about 9,000 customers were without power. One injury occurred when a female was trapped under a fallen tree. Several roads were closed due to downed trees and power lines.
Newton	05/02/2003	Thunderstorm Wind	60 knots	0/0	$10,000	Numerous trees and power lines were blown down. The gutters were blown off of at least one home.
Sherrills Ford	05/02/2003	Thunderstorm Wind	60 knots	0/0	$20,000	
Newton	05/03/2003	Thunderstorm Wind	52 knots	0/0	$2,000	
Longview	07/18/2003	High Wind	55 knots	0/0	$10,000	A couple of large trees were blown down. One tree fell on an outbuilding in Hickory. An elementary school in Longview sustained some structural damage.
Hickory	07/29/2003	Thunderstorm Wind	50 knots	0/0	$5,000	Trees and power lines were blown down. One tree fell on a vehicle.
Hickory	07/29/2003	Lightning	N/A	0/0	$50,000	Lightning struck a house, igniting a fire which caused significant damage.
9 Counties, including Catawba	03/07/2004	High Wind	65 knots	1/2	$385,000	Numerous trees and power lines were blown down, while roofs were torn off of some buildings. Some outbuildings and barns were damaged or destroyed.

Location of Storm	Date of Occurrence	Type of Event	Magnitude	Deaths/ Injuries	Property Damage	Details
Hickory	03/07/2004	Thunderstorm Wind	65 knots	0/0	$50,000	Numerous barns and outbuildings were damaged or destroyed. Trees, power poles, and billboards were blown down. Power outages were widespread.
Newton	07/15/2004	Strong Wind	45 knots	1/0	$1,000	Gusty winds at a golf course in Newton blew down a tree which fell on a golf cart. The 59-year-old man who was driving the cart was killed.
Claremont	11/25/2004	Thunderstorm Wind	60 knots	0/0	$10,000	Barn had tin roof removed. An unanchored ten-by-ten foot aluminum building was moved 150 feet and turned over. An anchored, wood frame building was moved about 2 feet, and a carport was flipped onto a car. Several trees were uprooted.
2 Counties, including Catawba	04/02/2005	High Wind	55 knots	0/0	$4,000	Numerous trees and power lines were blown down, resulting in quite a few power outages. At least one tree fell on a vehicle.
Hickory	08/30/2005	Strong Wind	40 knots	0/0	$15,000	Gusty winds developed over the North Carolina mountains and foothills as the remnants of Hurricane Katrina passed west of the region. A few trees and power lines were blown down here and there, with at least one tree on a house in Hickory.
23 counties, including Catawba	04/16/2007	High Wind	60 knots	0/0	$500,000	Thousands of trees fell across the area, resulting in widespread power outages. Numerous trees fell on roads, homes, and vehicles. In Catawba County, a 30-foot brick wall on top of a building in Newton was blown down, while sections of a metal roof were torn off a business in Viewmont.
TOTALS:	**0/1**	**$3,797,000**				

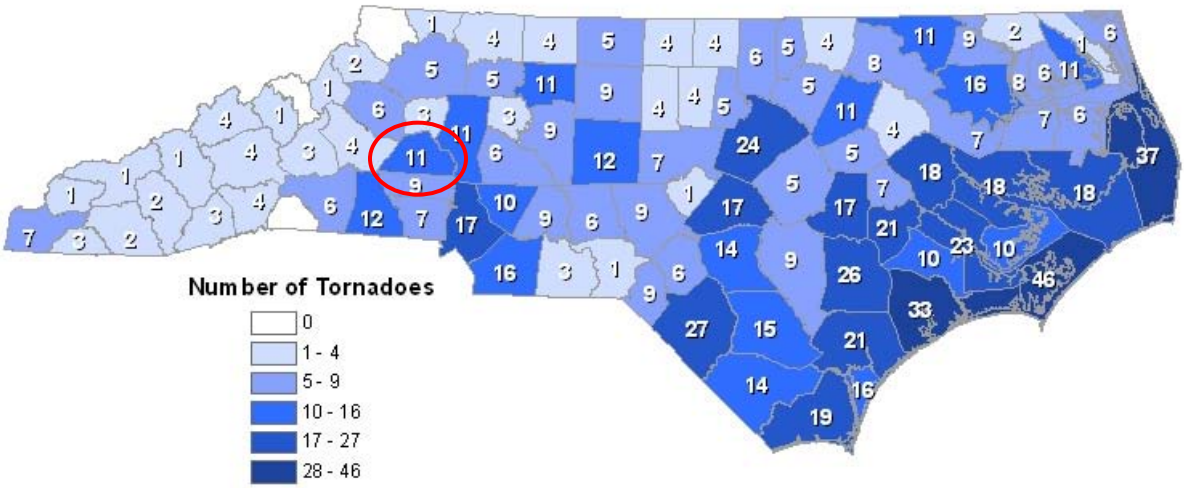
Source: NOAA, National Climatic Data Center

Tornadoes

When compared with other states, North Carolina ranks #22 in number of tornado events; #20 in tornado deaths; #17 in tornado injuries; and #21 in damages. These rankings are based upon data collected for all states and territories for tornado events between 1950 and 1994 (SPC, 2003). According to the State Climate Office of North Carolina, most (43 percent) of tornado occurrences in North Carolina are minimal (F0) in intensity, followed F1 (37 percent). **Figure 5.3** shows total tornado occurrences for all North Carolina counties. The illustration indicates that 11 events have been recorded in Catawba County from 1950 to 2003.[4]

[4] For comparison, there are three counties in North Carolina which have had no recorded tornado events, and one county has reported as many as 46.

Figure 5.3
Observed Tornadoes per County, 1950 – 2003



Source: The State Climate Office of North Carolina

According to National Climatic Data Center records, Catawba County experienced 12 tornado events from 1950 through 2008 (**Table 5.5**), one more than the state-recorded total. These events are reported to have caused no deaths, six injuries and more than $26 million in property damage (NCDC, 2008).

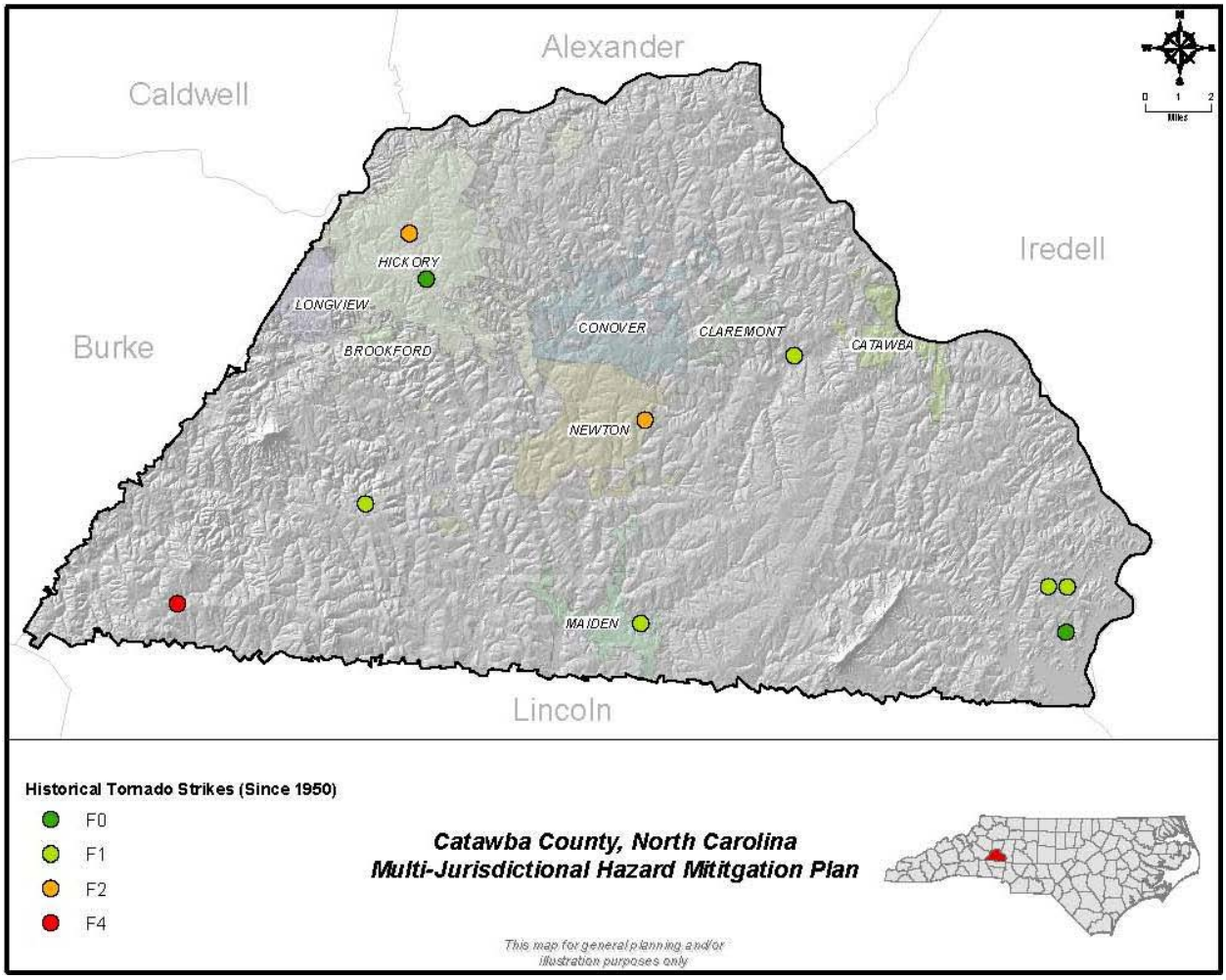
Table 5.5
Tornado Events in Catawba County (1950–2008)

Location	Date of Occurrence	Magnitude	Deaths	Injuries	Property Damage	Details
Catawba County	08/09/1951	F2	0	0	$25,000	No details/description available for this event.
Catawba County	08/18/1954	F2	0	0	$25,000	No details/description available for this event.
Catawba County	05/23/1973	F1	0	2	$25,000	No details/description available for this event.
Catawba County	05/27/1973	F1	0	0	$250,000	No details/description available for this event.
Catawba County	03/14/1975	F1	0	0	$3,000	No details/description available for this event.
Catawba County	05/25/1975	F1	0	0	$3,000	No details/description available for this event.
Catawba County	09/18/1982	F1	0	0	$25,000	No details/description available for this event.
Catawba County	05/05/1989	F4	0	3	$25,000,000	No details/description available for this event.
Catawba County	03/07/1992	F0	0	0	$3,000	No details/description available for this event.
Catawba County	11/22/1992	F1	0	0	$250,000	No details/description available for this event.
Northeast Hickory	08/16/1994	F2	0	1	$500,000	A tornado touched down just northeast of Hickory. Extensive damage was reported in the residential communities of Sandy Ridge and Kool Park. Two mobile homes and one house were completely destroyed. Flying debris caused extensive damage to cars and trucks. Several roofs and chimneys were damaged. Several trailers were overturned.
Hickory	09/28/1998	F0	0	0	$20,000	A strong severe storm quickly moved into western and northern Catawba County. An employee of an auto dealership reported that a small tornado moved quickly from the northwest across the dealership causing damage to the building and several cars. This was likely a "gustnado" type of tornado. Farther east, wind damage caused numerous trees and power lines to fall — especially in the Conover and Claremont areas. Large hail was also observed.
TOTALS:			**0**	**6**	**$26,129,000**	

Source: NOAA, National Climatic Data Center

Figure 5.4 illustrates the location where confirmed tornadoes have touched down in relation to the incorporated areas of the county. The Fujita Scale classification of each tornado is indicated next to each occurrence.

Figure 5.4
Historical Tornado Strikes in Catawba County (Since 1950)



Source: CCGIS, NOAA

Wildfire

According to the most recent statistics made available through the North Carolina Division of Forest Resources (NCDFR), Catawba County experiences an average of 99 wildfire events per year. The majority of these (45 percent) are caused by debris burning, which is generally consistent with historical statistics for Catawba County and other areas across North Carolina. In 2008, there were a total of 52 recorded wildfire occurrences, most of which were small brush fires. There are no known records of any deaths, injuries or significant property damage attributed to a wildfire event in Catawba County. **Table 5.6** shows the causes of historical occurrences of wildfire events in Catawba County for 2008 and a five-year average.

Table 5.6
Occurrences of Wildfire in Catawba County

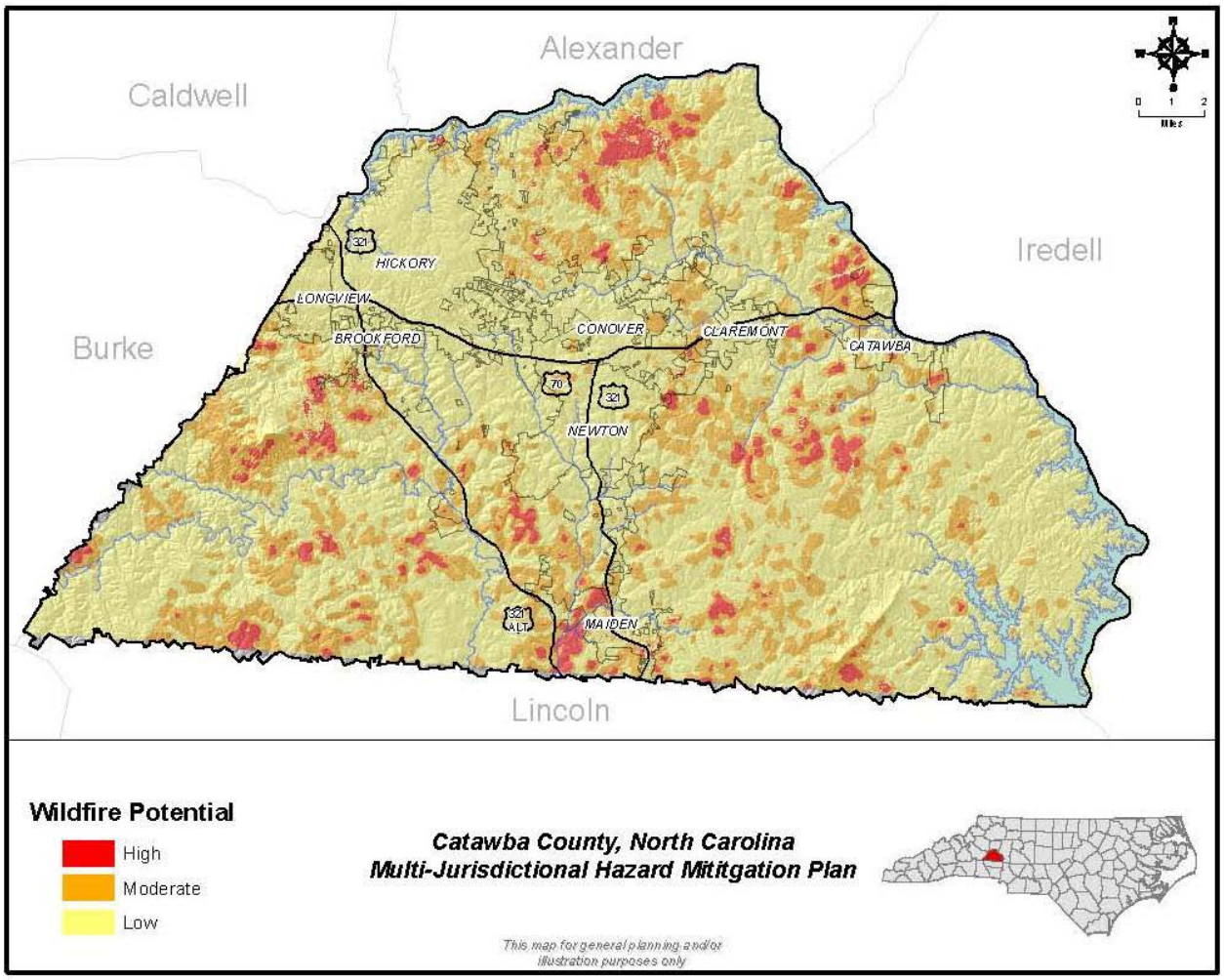
Cause of Fire	Number of Occurrences in 2008	Five-Year Average
Lightning	2	4
Campfire	0	1
Smoking	3	9
Debris Burning	19	45
Incendiary	7	8
Machine Use	5	8
Railroad	0	0
Children	6	12
Miscellaneous	10	12
TOTAL	**52**	**99**

Source: North Carolina Division of Forest Resources

In an effort to map potential wildfire hazard areas in Catawba County, a GIS-based data layer called the "Wildland Fire Susceptibility Index" (WFSI) was obtained from NCDFR. The WFSI is a component layer derived from the Southern Wildfire Risk Assessment (SWRA), a multi-year project to assess and quantify wildfire risk for the 13 Southern states.[5] The Wildland Fire Susceptibility Index (WFSI) is a value between 0 and 1. It was developed consistent with the mathematical calculation process for determining the probability of an acre burning. The WFSI integrates the probability of an acre igniting and the expected final fire size based on the rate of spread in four weather percentile categories into a single measure of wildland fire susceptibility. Due to some necessary assumptions, mainly fuel homogeneity, it is not the true probability. But since all areas of the Catawba County have this value determined consistently, it allows for comparison and ordination of areas of the county as to the likelihood of an acre burning. **Figure 5.5** illustrates the level of wildfire potential for Catawba County based on the WFSI data provided by NCDFR.

[5] The SWRA project provides fire professionals and other stakeholders with a dynamic set of tools for evaluating wild fire risk in a consistent manner across the region, with the ultimate goal of reducing the potential human, environmental, and property loss caused by wildland fires.

Figure 5.5
Wildfire Potential in Catawba County



Source: CCGIS, North Carolina Division of Forest Resources

Drought/ Extreme Heat

According to the Palmer Drought Severity Index (PDSI) illustrated in Section 4, Catawba County is located in a region that experienced severe drought conditions less than 10 percent of the 100-year period during 1895 to 1995, meaning that severe long-term drought conditions are a relatively low risk for Catawba County. However, shorter term droughts of less severity are more common and may occur several times in a decade.

In recent years, all of western North Carolina has experienced severe to extreme drought conditions. Just since 1998, the National Climatic Data Center has recorded 34 instances of drought in Catawba County (**Table 5.7**).[6] Though instances are recorded on a monthly basis by the National Climatic Data Center, instances are usually part of ongoing drought conditions that last months or years. None of these events resulted in any deaths or injuries, and no specific damages to property or crops were recorded. However, according to some NCDC reports, agricultural and other losses attributed to the long-term drought in western North Carolina are estimated to be in the hundreds of millions of dollars.

According to the National Climatic Data Center, there have been no occurrences of prolonged extreme heat events in Catawba County.

Table 5.7
Occurrences of Drought in Catawba County (1998-2008)

Location	Date of Occurrence	Type of Event	Details
28 Counties, including Catawba	07/01/1998	Dry Weather	Dry weather continued through much of the month of July, affecting crops during the critical part of the growing season.
28 Counties, including Catawba	10/01/1998	Drought	The drought which began during the summer continued through October. The only significant rainfall during the month occurred on the 7th and 8th.
28 Counties, including Catawba	11/01/1998	Drought	Dry weather persisted into the late fall with rainfall deficits between five and 10 inches. This affected late season crops and caused water shortages. Water usage restrictions were initiated in many communities.
16 Counties, including Catawba	07/01/1999	Drought	A long term dry spell became a drought in July. Without any widespread rain events, the only relief came in the form of widely scattered afternoon and evening thunderstorms, but even those were few and far between. The lack of rainfall lowered water tables significantly and significant damage to crops began to occur.
28 Counties, including Catawba	08/01/1999	Drought	The drought worsened during the month of August as high evaporation rates and little rainfall occurred. The most severe conditions by the end of the month had developed in the foothills and piedmont. Water restrictions began in several communities, and for some, the first time in memory. Hay and late crops dried up in many counties. Ponds and wells began to dry up as well, affecting homeowners, farmers, and businesses such as nurseries. In addition, boaters were running aground on recreational lakes due to low water levels.

[6] Drought occurrences recorded by the National Climatic Data Center are not necessarily unique events, as many instances of drought persist through multiple reporting periods. This is reflected in the details provided for some long-enduring occurrences in Table 5.5.

Location	Date of Occurrence	Type of Event	Details
28 Counties, including Catawba	09/01/1999	Drought	Rainfall continued to be scarce through the month of September, prolonging the drought conditions which existed all summer. However, some areas in the piedmont picked up some rain from the remnants of Hurricane Dennis early in the month and from Hurricane Floyd two weeks later. Although this rain brought some relief, more wells ran dry and many more areas began mandatory water restrictions.
28 Counties, including Catawba	10/01/1999	Drought	The return of some rainfall as well as lower evaporation rates due to the change of seasons, resulted in the drought easing somewhat. Drought classifications were lowered in some cases, and some places lifted water restrictions. However, the drought had not ended by the end of the month.
28 Counties, including Catawba	08/01/2000	Drought	The two-year drought was reaching a critical stage by late summer. Many 80- to 100-foot wells were going dry. Area lakes were at record low levels causing property damage to docks, boats, etc.
28 Counties, including Catawba	09/01/2000	Drought	Overall, drought conditions continued, despite some locations receiving near their month's average rainfall. Low stream flow and municipal water supply remained the largest issues with many towns and cities enacting water restrictions. Citizens were quoted as saying this is the driest they have ever seen it. Despite the drought conditions, impact on crops seemed to be minimal.
28 Counties, including Catawba	10/01/2000	Drought	Effects of the drought intensified as many areas received absolutely no rain during the month, setting records for the longest stretch without measurable rainfall in several locations. Wells continued to dry up and lake levels continued to drop. Many communities were forced to start more stringent water conservation measures.
28 Counties, including Catawba	11/01/2000	Drought	The long-term drought continued to affect the region. Rainfall during the month was near or slightly above normal, but this had little effect on the ground water levels. Numerous wells dried up during the fall, and well borers and drillers could not keep up with the demand. Large lakes reported record low levels and some communities continued or initiated water control measures.
28 Counties, including Catawba	02/01/2001	Drought	The long term drought's impact became more severe, even during the winter, as water levels in lakes dropped and stream flow on rivers reached the lowest in memory. More and more communities began water restrictions and started preparing for a busy fire weather season.
28 Counties, including Catawba	03/01/2001	Drought	Despite beneficial rain during March, the drought continued to grip most of the area. Severe water restrictions were implemented in parts of the North Carolina piedmont, where reservoir had dropped to all-time low levels
28 Counties, including Catawba	04/01/2001	Drought	Some relief to the long-term drought occurred at mid-month, but for the most part, the rainfall deficit for the three-year period actually grew larger by the end of April. Numerous wells went dry during April.
28 Counties, including Catawba	05/01/2001	Drought	Unprecedented drought conditions continued. Some rivers and lakes reached record-low levels. Well-drilling companies in the North Carolina piedmont were recording twice as much business as usual.
27 Counties, including Catawba	08/01/2001	Drought	The effects of the long-term drought became more severe, especially in the North Carolina piedmont. Critical water conditions were beginning to concern officials and residents of Charlotte.

Location	Date of Occurrence	Type of Event	Details
28 Counties, including Catawba	11/01/2001	Drought	Drought was again the major concern during November. An extended short-term dry spell exacerbated the 3.5-year drought, beginning in mid-October and persisted through late November. During that stretch of weeks, many areas received no measurable rainfall. Toward the end of the month, wildfires became common, burning many acres, especially in the higher terrain. Extremely low lake levels affected boating and water supplies. The North Carolina piedmont had received about half the normal rainfall for the calendar year by the end of November. Many additional wells and ponds dried up, tree farms closed and many communities began or expanded water restrictions. Streams were observed with record low flow levels.
28 Counties, including Catawba	12/01/2001	Drought	Very little active weather during December signaled that the drought was still present — and becoming critically important to more and more people. Many communities initiated either mandatory or voluntary water restrictions. Record low ground water supplies, lake levels, and stream flows were reported across all of western North Carolina.
28 Counties, including Catawba	08/01/2002	Drought	The water supply situation reached crisis levels in some communities, as the effects of the long term drought continued to plague western North Carolina. Water levels on area lakes were as much as 10 feet below full pond.
16 Counties, including Catawba	05/01/2004	Drought	A period of dry weather that began in August of 2003 resulted in moderate drought conditions across portions of western North Carolina by late spring of 2004. Streamflow and lake levels began to run below normal, and a few communities instituted water restrictions.
28 Counties, including Catawba	05/01/2007	Drought	The effects of an extended period of dry weather were exacerbated by an abnormally dry May, with many locations reporting one of the driest Mays in recorded history. By the end of May, many climatological stations were reporting yearly rainfall deficits as high as 10 inches. The result was severe to extreme drought conditions across much of western North Carolina by the end of the month. Water restrictions were implemented in some counties across extreme western North Carolina. The very dry conditions added to agriculture hardships caused by a hard freeze and widespread damaging winds in April.
24 Counties, including Catawba	06/01/2007	Drought	Despite an increase in thunderstorm activity, drought conditions persisted across much of western North Carolina. The persistent drought continued to cause hardships to agricultural interests that were still recuperating from the April freeze.
22 Counties, including Catawba	07/01/2007	Drought	Drought conditions persisted across much of western North Carolina during July. By the end of July, voluntary water restrictions were instituted in almost all North Carolina counties along and west of I-77. Agricultural interests continued to be especially hard hit. The absence of rain negatively affected the hay crop, creating concern for the loss of livestock.
24 Counties, including Catawba	08/01/2007	Drought	Severe to extreme drought conditions persisted across much of western North Carolina during August. By the end of the month, voluntary water restrictions continued in almost all North Carolina counties along and west of I-77. Stream flows and groundwater levels approached record low levels. Water levels on some reservoirs decreased by as much as 1 foot every 10 days. Agricultural interests continued to be especially hard hit, and the North Carolina governor requested

Location	Date of Occurrence	Type of Event	Details
			federal disaster aid by the end of the month.
24 Counties, including Catawba	09/01/2007	Drought	Extreme drought conditions persisted across western North Carolina through September, as the region experienced another month of well-below normal precipitation. By the end of the month, most locations were running a yearly rainfall deficit of 11-17 inches. Stream flows and groundwater levels were near record low levels, with many streams running at 5 percent or less of normal flow. Water levels on area reservoirs were some of the lowest in recorded history. Agricultural interests continued to be especially hard hit. Farmers continued to struggle to feed livestock due to a lack of hay and poor pasture conditions, forcing many cattle to be sold or slaughtered. Agricultural and other losses attributed to the drought are estimated to be in the hundreds of millions of dollars.
24 Counties, including Catawba	10/01/2007	Drought	Unusually dry weather continued across western North Carolina through October. Although a soaking rain near the end of the month resulted in near-normal monthly precipitation for the mountains, the piedmont saw another month of well-below normal rainfall. Most areas were on pace to break yearly rainfall deficit records. By the end of the month, exceptional drought conditions were reported across the majority of the area. Water flow on area streams continued at 3 to 6 percent of normal, while lake levels remained at near-record lows. Although most cities and towns were requesting voluntary water restrictions be observed, mandatory restrictions were ordered in quite a few communities. In some areas, the water situation was becoming dire, with Monroe, NC officials reporting that water supplies would be exhausted by early 2008 if significant rain did not occur. Also, private wells were beginning to dry up in many areas. Agriculture continued to be severely impacted by the drought.
24 Counties, including Catawba	11/01/2007	Drought	November provided no relief from the effects of the long term drought. In fact, another month of well-below normal rainfall made an already dire situation even worse. Many locations remained on pace to set annual records for rainfall deficit. By the end of the month, the vast majority of the region was experiencing exceptional drought conditions. Streamflow on area rivers remained extremely low, generally less than 10 percent of normal. Meanwhile, lakes continued to gradually fall toward record low levels.
24 Counties, including Catawba	12/01/2007	Drought	The latter half of December saw a transition to a wetter pattern across the southeast. Most observing stations in western North Carolina reported above normal monthly rainfall for the first time since January 2007. However, this was not enough to put much of a dent in the long-term drought as extreme to exceptional drought conditions persisted into the New Year. Although the increase in rainfall did allow for some recharge of area streams, many were still running at less than 25 percent of normal flow at the end of the month.

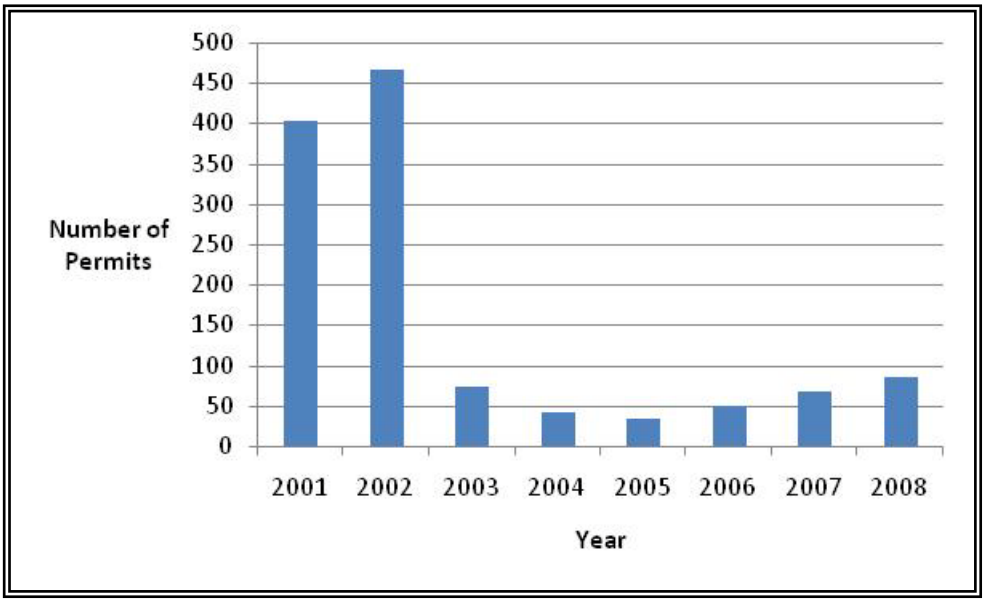
Location	Date of Occurrence	Type of Event	Details
24 Counties, including Catawba	01/01/2008	Drought	January saw a return to dry weather across western North Carolina. Most observing stations across the region reported a rainfall deficit of 1 to 2 inches during the month, resulting in another month of exceptional drought conditions across most of the area. Water levels on area lakes remained within a foot or two of record low stages. However, rivers and streams remained somewhat recharged from the December rains, with streamflow on most waterways running 25 to 75 percent of normal.
24 Counties, including Catawba	06/01/2008	Drought	Although near normal rainfall was observed across much of the area during the late winter and early spring, another period of abnormally dry weather in May and June exacerbated severe to extreme drought conditions over the western Carolinas and northeast Georgia. Much of the area saw less than 2 inches of rain during this period of time. By the end of the month, much of the mountains and foothills of western North Carolina were running 10 inches below normal annual rainfall. Total rainfall deficits since the beginning of 2007 were around 20 inches or more in the hardest hit areas. By the end of the month, flow on almost all major streams was running less than 10 percent of normal. Many area crops suffered.
24 Counties, including Catawba	07/01/2008	Drought	Unusually dry weather continued through the month of July, with severe to extreme drought conditions persisting across the area. Afternoon and evening thunderstorms provided some degree of relief across portions of the North Carolina piedmont, but locations across Upstate South Carolina and extreme western North Carolina reported annual rainfall deficits of nearly 11 inches by the end of the month. Mandatory water restrictions were instituted across much of the North Carolina foothills. Water well levels began to descend below record low levels, most of which were recorded during the 1999-2002 drought. The vast majority of major streams across the area continued to run 1-10 percent of normal flow. Agriculture continued to be hard hit, with some areas reporting a 100 percent loss of the corn crop.
24 Counties, including Catawba	08/01/2008	Drought	Dry weather persisted across much of the area for most of August, although portions of the North Carolina Piedmont began to see relief from the dry conditions early in the month, due to an increase in daily thunderstorm activity. Elsewhere, exceptional drought conditions persisted and even expanded slightly westward to cover more of far western North Carolina and northeast Georgia. During the early part of the month, flows on most of the major streams across the area were running at record low levels, with the French Broad River setting a minimum flow record that had stood for almost 100 years. Only a handful of streams were running at more than 1 to 7 percent of normal. Groundwater levels were 2-5 feet below normal. Significant agricultural impacts persisted, with losses to summer crops, including hay, estimated at 30%. The dry weather also affected the livestock industry, due to shortages of pasture crops necessary for feeding. By the end of the month, Tropical Storm Fay had dropped up to 11 inches of rainfall across the area, providing some relief from the drought conditions, especially across the North Carolina Piedmont.
24 Counties, including Catawba	09/01/2008	Drought	The heavy rain brought by Tropical Storm Fay in late August provided some relief to the drought conditions across the area. This was particularly true across the North Carolina piedmont, where improving conditions were aided by normal September rainfall. However, another dry month resulted in a persistence

Location	Date of Occurrence	Type of Event	Details
			of extreme to exceptional drought conditions across the North Carolina mountains and foothills. Voluntary water restrictions remained widespread during the month. A few communities held onto mandatory restrictions early in the month, but many of these were lifted by the end of the month. Well water remained near record low levels in many areas, while lake levels persisted well below normal stages. Rainfall from Fay resulted in some improvement in streamflows, although most rivers and major streams remained at less than 25 percent of normal, with many still running at less than 10 percent of normal. By the end of the month, government officials had requested a federal disaster declaration for most of the counties in the area, due to crop damages.
16 Counties, including Catawba	10/01/2008	Drought	Another abnormally dry month resulted in a persistence of severe to exceptional drought conditions over much of the mountains and foothills of North Carolina. Some slight improvement was observed in well water levels, but they remained near record lows. Most rivers and major streams continued to flow at less than 10 percent of normal. Voluntary water restrictions continued in most areas, with a few areas continuing to institute mandatory restrictions. Meanwhile, severe crop losses resulted in a federal disaster declaration for much of the larger agricultural communities across the area.
16 Counties, including Catawba	11/01/2008	Drought	Another month of below normal rainfall resulted in a persistence of severe to exceptional drought conditions over much of western North Carolina through November. In fact, drought conditions actually worsened in some areas, with portions of the central North Carolina mountains deteriorating to exceptional drought conditions late in the month. Slight improvements in well water levels continued across the area. Most rivers and major streams continued to flow at less than 10 percent of normal. Voluntary water restrictions continued in most areas, with a few areas continuing to institute mandatory restrictions.

Source: NOAA, National Climatic Data Center

While more specific data on the economic costs of the recent drought conditions for Catawba County are not readily available, the County's Environmental Health Division has tracked the number of well replacement permits each calendar year since 2001. While there may be a variety of reasons for well replacement, County staff has indicated that the vast majority of permitted replacements are due to wells drying up due to severe drought conditions. **Figure 5.6** illustrates the number of replacement well permits in Catawba County and demonstrates the impact the peak drought conditions experienced in the years 2001-2002.

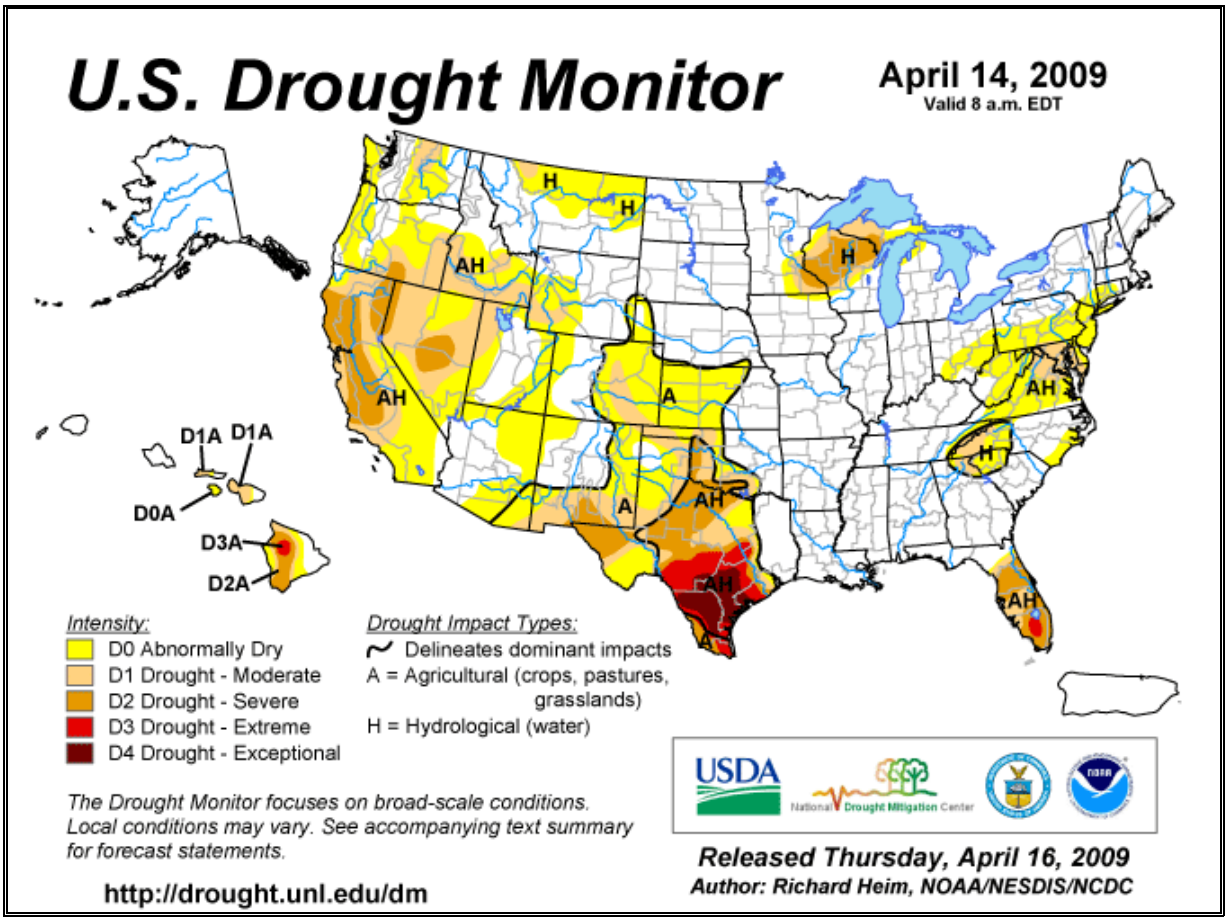
Figure 5.6
Number of Permits for Replacement Wells in Catawba County, 2001-2008



Source: Catawba County Building Services

Figure 5.7 shows a U.S. Drought Monitor summary map from the United States Department of Agriculture for April 14, 2009. Drought Monitor summary maps identify general drought areas and label droughts by intensity, with D1 being the least intense and D4 being the most intense. According to the Figure, Western North Carolina was still experiencing abnormally dry conditions in April 2009. Weekly-updated maps may be obtained online from The Drought Monitor Web site, maintained by the National Drought Mitigation Center, located at http://drought.unl.edu/dm.

Figure 5.7
U.S. Drought Monitor Summary Map



Winter Storms and Freezes

According to the National Climatic Data Center, Catawba County has experienced 60 reported winter storm events since February 1994 (**Table 5.8**). These events together are accountable for an estimated $4.5 million in property damages for Catawba County.

Table 5.8
Winter Storm Activity in Catawba County (1994-2008)

Location of Storm	Date of Occurrence	Type of Event	Deaths/ Injuries	Property Damage	Details
73 Counties, including Catawba	02/10/1994	Ice Storm	0/0	$0	The greatest ice accumulation of one to two inches and associated damages to trees and power lines occurred in the northern Piedmont and North Foothills regions.

Location of Storm	Date of Occurrence	Type of Event	Deaths/ Injuries	Property Damage	Details
10 Counties, including Catawba	01/06/1996	Heavy Snow	0/0	$0	Total snow accumulations ranged from four inches in the southernmost part of the area to 15 inches in the northern tier. At the end of the storm, wind chills dropped to dangerous levels.
25 Counties, including Catawba	01/11/1996	Winter Storm	0/0	$0	The second snowstorm within a week — causing up to a foot of snow — was reported in some parts of the mountains, with most mountain and foothill locations receiving three to six inches. In the piedmont, there was more of a mixture of ice with minimal ice storm conditions reported. There were some power outages and numerous traffic accidents.
Catawba County	01/16/1996	Ice Storm	0/0	$250,000	No details/description available for this event.
19 Counties, including Catawba	01/26/1996	Ice Storm	0/0	$0	Rain moved in while cold air was still trapped. Significant freezing rain resulted with numerous traffic accidents reported across the entire area. Ice accumulations neared "ice storm" conditions in the foothills and northern mountains. The freezing temperatures persisted into the evening as the rain became quite heavy.
15 Counties, including Catawba	02/02/1996	Ice Storm	0/0	$3,333,000 estimated for Catawba County	Significant icing took place in foothill counties. Later in the day, the freezing rain began to change over to sleet and then snow as drier and colder air surged in. This left a very slick and dangerous surface on top of the massive accumulations of ice. Power outages were common. Many major population centers including Hickory were reporting 50 percent power outages and reportedly the storm became the "worst ice storm ever" in local power company records. Many customers did not have power restored for up to a week during extremely cold weather. Numerous shelters were opened and some counties declared official emergency conditions.
14 Counties, including Catawba	02/03/1996	Snow	0/0	$0	Light snow accumulated to one to three inches on top of the ice. Travel problems worsened in some places.
23 Counties, including Catawba	02/16/1996	Snow	0/0	$0	Snow fell and accumulated to several inches with heavier amounts in the northern mountains.
11 Counties, including Catawba	02/13/1997	Ice Storm	0/0	$0	Several inches fell in parts of the piedmont with up to 3.5 inches around Cherryville. In the foothills and piedmont the snow changed to a sleet storm during the afternoon with several inches accumulations.
10 Counties, including Catawba	12/29/1997	Heavy Snow	0/0	$0	Snowfall ranged between one and four inches across the southern foothills and southern piedmont, to four to eight inches across the northern foothills and northwest piedmont. There were hundreds of traffic accidents and a few thousand people in the foothills were without power for a while.

Location of Storm	Date of Occurrence	Type of Event	Deaths/ Injuries	Property Damage	Details
8 Counties, Including Catawba	12/23/1998	Freezing Rain/ Sleet	0/0	$0	Freezing rain and sleet developed early Wednesday morning and persisted through the morning of Christmas Eve, causing enough glaze to cause damage.
8 Counties, Including Catawba	12/24/1998	Ice Storm	0/0	$0	Freezing rain accumulated to damaging levels around midnight and by morning there were numerous power outages reported due to downed trees and power lines. Road problems were mostly limited to bridges and overpasses.
11 Counties, including Catawba	01/02/1999	Ice Storm	0/0	$0	Sleet became very heavy along and north of Interstate 40 where four to six inches accumulated. Sleet accumulated to between one and two inches south of Interstate 40 before changing to freezing rain.
13 Counties, including Catawba	02/01/1999	Freezing Rain	0/0	$0	Accumulations of ice were up to one eighth of an inch and mainly on trees.
16 Counties, including Catawba	02/19/1999	Snow	0/0	$0	Most light snow accumulations were between one and two inches. Although there was a band of 3-inch accumulations stretching from the northern mountains, southeast through Morganton and to Shelby.
15 Counties, including Catawba	02/24/1999	Snow	0/0	$0	Most counties received between a dusting and one inch of snow. However, there was one band of two to three inch accumulations that stretched from the central part of the mountains across the foothills and into the piedmont near Statesville.
13 Counties, including Catawba	03/9/1999	Snow and Sleet	0/0	$0	Light snow and sleet fell — accumulations ranged between one and three inches. Some light freezing rain mixed in from time to time as well.
19 Counties, including Catawba	12/24/1999	Snow	0/0	$0	Enough Christmas Eve snow fell in parts of the foothills and piedmont to be noticeable, but any light accumulation melted quickly.
9 Counties, including Catawba	01/18/2000	Heavy Snow	0/0	$0	Precipitation began as light rain, but quickly turned to snow as the atmosphere cooled to below freezing. Snowfall ranged between three and six inches across the area, with a narrow band of one to three inch accumulation of snow and sleet to the immediate south.
14 Counties, including Catawba	01/20/2000	Snow	0/0	$0	Across most of the central mountains, northern foothills and northwest piedmont, one to three inches of snow fell.
27 Counties, including Catawba	01/22/2000	Heavy Snow	0/0	$0	Snow became heavy across the mountains, foothills and piedmont. Generally four to six inches of snow fell across the foothills and piedmont.
Catawba County	01/24/2000	Winter Storm	0/0	$30,000	According to Catawba County, Emergency Management relocated special needs persons and moved group home residents to another location.

Location of Storm	Date of Occurrence	Type of Event	Deaths/ Injuries	Property Damage	Details
14 Counties, including Catawba	01/29/2000	Freezing Rain	0/0	$0	This was the last in a series of five winter storms that wreaked havoc on western North Carolina in an 11-day span. Precipitation which briefly began as some light sleet and snow turned quickly to freezing rain. The freezing rain was heavy enough across the southern piedmont to result in a 1/4 to 1/2 inch glaze. Scattered power outages resulted.
28 Counties, including Catawba	11/19/2000	Snow	0/0	$0	Generally one to three inches of snow fell.
11 Counties, including Catawba	12/13/2000	Freezing Rain	0/0	$0	Significant ice accumulation due to light freezing rain was limited to bridges, overpasses and a few secondary roads, with several accidents.
12 Counties, including Catawba	12/17/2000	Snow	0/0	$0	Heavy rain, with embedded thunderstorms, crossed the region and winds increased into the 50 to 60 MPH range, resulting in numerous downed trees and power lines. Flurries were reported as far east as Hickory.
16 Counties, including Catawba	12/19/2000	Snow	0/0	$0	Foothill locations, especially those closest to the mountains, recording two to three inches of snow. Farther east, in the northwest piedmont, accumulations were limited to less than two inches. More than 200 traffic accidents were reported from the region due to the wintry weather.
14 Counties, including Catawba	02/22/2001	Snow/ Sleet	0/0	$0	In the lower elevation foothill and piedmont, sleet was predominant, although most locations that received any wintry precipitation at all reported a sleet/ snow mixture. Salisbury, Hickory and Mocksville each reported around an inch of sleet, and numerous icy roads, in addition to a light blanket of snow.
15 Counties including Catawba	04/17/2001	Snow Showers	0/0	$0	No details/description available for this event.
13 Counties, including Catawba	01/02/2002-01/03/2002	Heavy Snow	0/0	$0	Flurries and light snow began in the early evening and became moderate to heavy by late evening on the 2nd. Heavy snowfall accumulations were reached across this portion of the foothills and piedmont overnight on the 3rd, with four to six inches observed by noon.
Burke, Catawba, and McDowell Counties	01/06/2002	Ice Storm	0/0	$0	Snow and sleet began in the early morning, with one to four inches of mainly sleet accumulating by early afternoon.

Location of Storm	Date of Occurrence	Type of Event	Deaths/ Injuries	Property Damage	Details
11 Counties, including Catawba	12/04/2002	Heavy Snow/ Ice Storm	0/0	$624,000 estimated for Catawba County	Snow accumulated to three to five inches by late evening. A transition to sleet and then freezing rain occurred during the late evening, and ice accumulated to between 1/4 and 1/2 inch. The result was widespread power outages, which lasted for a week or more in some areas. According to Catawba County Emergency Management, the Emergency Operations Center was activated, heavy debris resulted, shelters were opened, and a presidential disaster declaration was received.
11 Counties, including Catawba	12/25/2002	Winter Weather/ Mix	0/0	$0	Light snow fell throughout the day across the North Carolina mountains, resulting in snowfall amounts of between a trace and three inches within the valleys.
12 Counties, including Catawba	01/16/2003	Winter Weather/ Mix	0/0	$0	Light snow fell during the evening across portions of the foothills and piedmont, and accumulated to one to two inches. Numerous traffic accidents ensued.
19 Counties, including Catawba	01/23/2003	Heavy Snow	0/0	$0	Eight to 12 inches of snow had fallen in the foothills by mid-morning. Otherwise, snow accumulations were generally in the three to six inch range.
5 Counties, including Catawba	02/06/2003	Winter Weather/ Mix	0/0	$0	A light sleet quickly changed over to a mixture of snow and rain across portions of the piedmont and foothills. Snow accumulations were generally two inches or less, but isolated amounts as high as four inches were reported.
18 counties, including Catawba	02/27/2003	Winter Weather/ Mix	0/0	$0	A light freezing rain developed during the overnight hours in areas from the Blue Ridge mountains eastward to the I-77 corridor. Light ice accumulations were mainly confined trees, bushes, and automobiles. However, some slick spots did develop on bridges and overpasses, especially in the piedmont.
8 Counties, including Catawba	03/30/2003	Winter Weather/ Mix	0/0	$0	Some light snow fell across the foothills and northwest piedmont during the morning. Most locations received no snow accumulation. However, portions of the western foothills received as much as an inch by noon.
12 Counties, including Catawba	12/4/2003	Winter Weather/mix	0/0	$0	Light freezing rain and sleet fell for much of the day, resulting in ice accretion on trees and power lines of generally 1/8 inch or less. Some icy spots developed on bridges and overpasses.
3 Counties, including Catawba	12/14/2003	Ice Storm	0/0	$0	Freezing rain began during the early morning hours, and ice accretion of 1/4 to 1/2 inch had occurred by late morning. Scattered power outages resulted, especially in locations from Shelby to Hickory to northern Iredell County.
19 Counties, including Catawba	1/25/2004	Heavy Snow	0/0	$0	Snowfall intensified throughout the morning and afternoon, and by early evening 3 to 5 inches had accumulated across much of the area.

Location of Storm	Date of Occurrence	Type of Event	Deaths/ Injuries	Property Damage	Details
5 Counties, including Catawba	2/5/2004	Winter Weather/mix	0/0	$0	Light freezing rain developed during the evening hours across portions of the northern foothills and northwest piedmont and continued through the overnight hours into the morning of the 6th. Some roads became slick and hazardous.
7 Counties, including Catawba	2/12/2004	Winter Weather/mix	0/0	$0	Snow developed over the foothills and portions of the western Piedmont during the morning, accumulating to a quick inch or so in some areas. Most of this snow accumulated in about an hour during mid-morning, as a band of heavy snow moved over the area.
11 Counties, including Catawba	2/15/2004	Winter Weather/mix	0/0	$0	Snow and sleet fell periodically during the afternoon and evening across much of the mountains, northern foothills, and northwest piedmont. Up to 2 inches of snow accumulated across the area, causing slick spots to develop on some roads.
16 Counties, including Catawba	2/26/2004	Heavy Snow	0/0	$194,000 estimated for Catawba County	Scattered thunderstorms contributed to intense snowfall rates of 2 to 3 inches per hour from time to time, especially in the piedmont, where total snowfall of 12-22 inches occurred. Thousands of people were stranded on I-77 during the early afternoon, and some required rescue. The weight of the snowfall caused damage to numerous roofs, while some roofs completely collapsed.
7 Counties, including Catawba	1/22/2005	Winter Weather/mix	0/0	$0	Light freezing rain and freezing drizzle expanded into the remainder of the foothills and the northern piedmont during the daylight hours, resulting in quite a few slick spots across the area. Several traffic accidents were reported.
5 Counties, including Catawba	1/29/2005	Winter Storm	0/0	$0	After 1 to 3 inches of snow fell across the area during the morning and early afternoon, a layer of 1/4 to 1/2 inch of sleet, as well as a thin layer of glaze, accumulated on top of the snow during the afternoon and evening. This created extremely dangerous driving conditions and numerous accidents ensued.
11 Counties, including Catawba	2/27/2005	Winter Weather/mix	0/0	$0	Total snow accumulations ranged from a trace across the southwest mountain valleys and lower elevations of the foothills and piedmont, to 2 inches in the higher elevations.
20 Counties, including Catawba	3/17/2005	Winter Weather/mix	0/0	$0	Wet snow, mixed at times with rain and sleet developed during the early morning hours and persisted through late morning. Accumulations ranged from just a dusting to as much as 3 inches. Slushy roads led to a few traffic accidents across the area.
16 Counties, including Catawba	12/8/2005	Winter Weather	0/0	$0	No details/description available for this event.

Location of Storm	Date of Occurrence	Type of Event	Deaths/ Injuries	Property Damage	Details
7 Counties, including Catawba	12/15/2005	Ice Storm	0/0	$43,000 estimated for Catawba County	Ice accretion began to cause damage in the northwest piedmont of North Carolina. Quite a few trees fell and power outages numbered in the tens of thousands. Several trees and large limbs fell on and damaged homes and vehicles. Total ice accumulation ranged from a half inch or more to around 1/8 of an inch.
11 Counties, including Catawba	3/20/2006	Winter Weather	0/0	$0	A brief period of heavy sleet developed across portions of the central mountains, foothills, and western piedmont during the morning. Although there was little or no accumulation, trace amounts of sleet accumulated on some roads, causing several traffic accidents.
18 Counties, including Catawba	1/18/2007	Winter Weather	0/0	$0	Widespread light precipitation, mainly in the form of freezing rain, produced light ice accretion mainly confined to elevated surfaces, although some slick spots developed on bridges and overpasses. Quite a few traffic accidents occurred and a few sporadic power outages were reported.
4 Counties, including Catawba	2/1/2007	Winter Weather	0/0	$0	Snow began to mix with and eventually changed over to sleet and freezing rain by late morning. Up to 2 inches of snow, along with light accumulations of sleet and ice occurred before a transition to rain in the early afternoon. Slick roads resulted in quite a few traffic accidents, especially along the I-40 corridor.
8 Counties, including Catawba	1/16/2008	Heavy Snow	0/0	$0	Total accumulations of 2-5 inches were reached across the area during the pre-dawn hours. Some amounts as high as 8 inches were reported in the higher elevations.
13 Counties, including Catawba	1/19/2008	Winter Weather	0/0	$0	Most locations reported accumulations ranging from trace amounts to less than an inch. However, a few spots received as much as 2-3 inches, particularly along the southern escarpment of the Blue Ridge.
5 Counties, including Catawba	2/13/2008	Winter Weather	0/0	$0	An area of moderate snow developed in the lee of the mountains and moved quickly across the northern foothills and northwest piedmont during the evening. Spotty accumulations of around an inch were reported in a short period of time.
TOTALS:			**0/0**	**$4,474,000**	

Source: NOAA, National Climatic Data Center

According to the National Climatic Data Center, Catawba County has experienced two periods of prolonged extreme cold temperatures since January 1996 (**Table 5.9**). These events resulted in no deaths nor injuries and no reported property damages.

Table 5.9
Temperature Extremes in Catawba County

Location	Date of Occurrence	Type of Event	Deaths/ Injuries	Property Damage	Details
28 Counties, including Catawba	04/01/1997	Cold	0/0	$0	Several cold snaps following the relatively warm late winter caused temperatures to dip well into the 20s at times yielding damage to the apple crop and perhaps other crops.
28 Counties, including Catawba	12/01/2000	Extreme Cold	0/0	$0	December 2000 will long be remembered for the brutal hold that cold weather had on the region. Temperatures ran six to eight degrees below normal for the entire month. In nearby Charlotte it was the coldest month in 83 years.
TOTALS:			**0/0**	**$0**	

Source: NOAA, National Climatic Data Center

Erosion

Catawba County has not been mapped to show erosion risk. Furthermore, no specific areas of concern have been identified by the Mitigation Advisory Committee. Erosion could take place along stream banks and steep slopes in the area, but no significant historical erosion evidence exists in Catawba County. Due to its geographic location, *coastal* erosion is not a hazard for which any historical evidence would be found in Catawba County.

Dam/ Levee Failure

According to the inventory of dams provided by the North Carolina Division of Land Resources (Dam Safety Program), there are 73 state-regulated dams located in Catawba County. Of these, nine dams are listed as high hazard dams (meaning in the event of a dam failure, there is a probably loss of one or more human lives and more than $200,000 in economic damages).[7] The listing of high hazard dams is provided in **Table 5.10** along with their general location, water body and drainage area, as well as information as to whether the owner of the dam has prepared and submitted an Emergency Action Plan (EAP) to the State of North Carolina. **Figure 5.8** shows the location of all state-regulated dams in Catawba County including their current hazard classification. There is no record of any dam breaches or failures in Catawba County, therefore no damage, deaths or injuries can be attributed to dam/ levee failure. However, the Town of Maiden has expressed some concern over the structural integrity of the Maiden Water Plant Dam and has been coordinating with state agencies on possible remedies, including permanent removal. The Town also recently completed the preparation of an EAP for the dam.

Table 5.10
High Hazard Dams in Catawba County

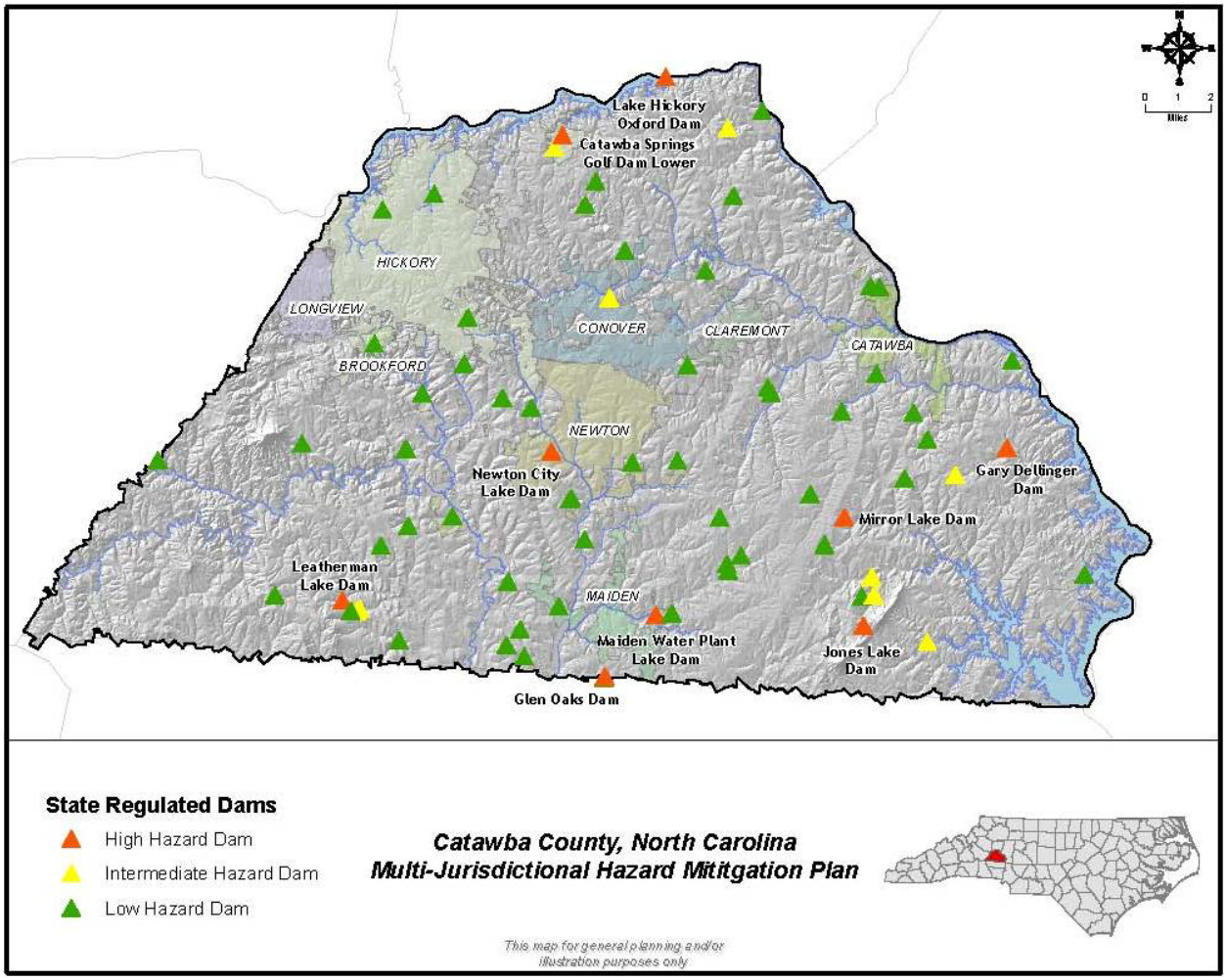
Dam Name	General Location	Water Body	Drainage Area	Emergency Action Plan?
Catawba Springs Golf Dam Lower	St. Stephens/Oxford	Lake Hickory	Unknown	N

[7] Dam hazard classification does not indicate the structural integrity of the dam itself, but rather the anticipated effects if a failure should occur.

Gary Dellinger Dam	Sherrils Ford	Terrapin Creek	1460	N
Glen Oaks Golf Course Dam B	Town of Maiden	Hog Branch	108	N
Jones Lake Dam	Sherrils Ford	South Fork Creek	57	N
Lake Hickory/Oxford Dam	St. Stephens/Oxford	Catawba River	838400	N
Leatherman Lake Dam	Plateau	Pott Creek	300	N
Maiden Water Plant Lake Dam	Town of Maiden	Maiden Creek	5284	Y
Mirror Lake Dam	Sherrils Ford	N. Fork Mountain Creek	67	Y
Newton City Lake Dam	City of Newton	Clark Creek	397	Y

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

Figure 5.8
State-Regulated Dams in Catawba County



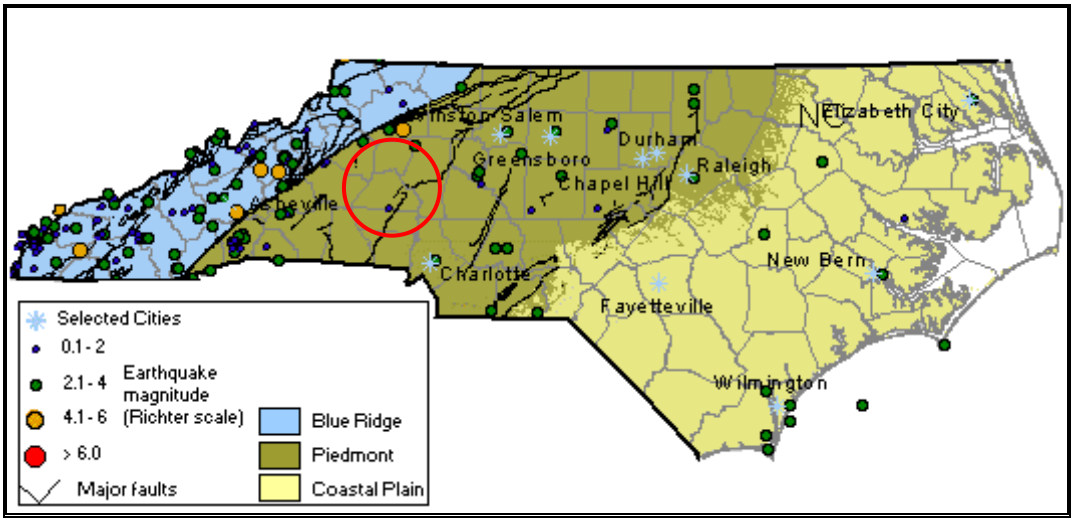
Source: CCGIS, North Carolina Division of Land Resources, Dam Safety Program

Earthquakes, Sinkholes and Landslides

Earthquake

North Carolina is affected by both the New Madrid Fault in Missouri and the Charleston Fault in South Carolina. During the last 200 years, both of these faults have generated earthquakes measuring greater than 8 on the Richter Scale. **Figure 5.9** shows geological and seismic information for North Carolina. Approximately two-thirds of North Carolina is subject to earthquakes, with the western and southeast regions most vulnerable to a very damaging earthquake. **Table 5.9** lists the significant earthquake events which have impacted Catawba County as compiled from National Geophysical Data Center records.

Figure 5.9
Geological and Seismic Information for North Carolina



Source: North Carolina Geological Survey

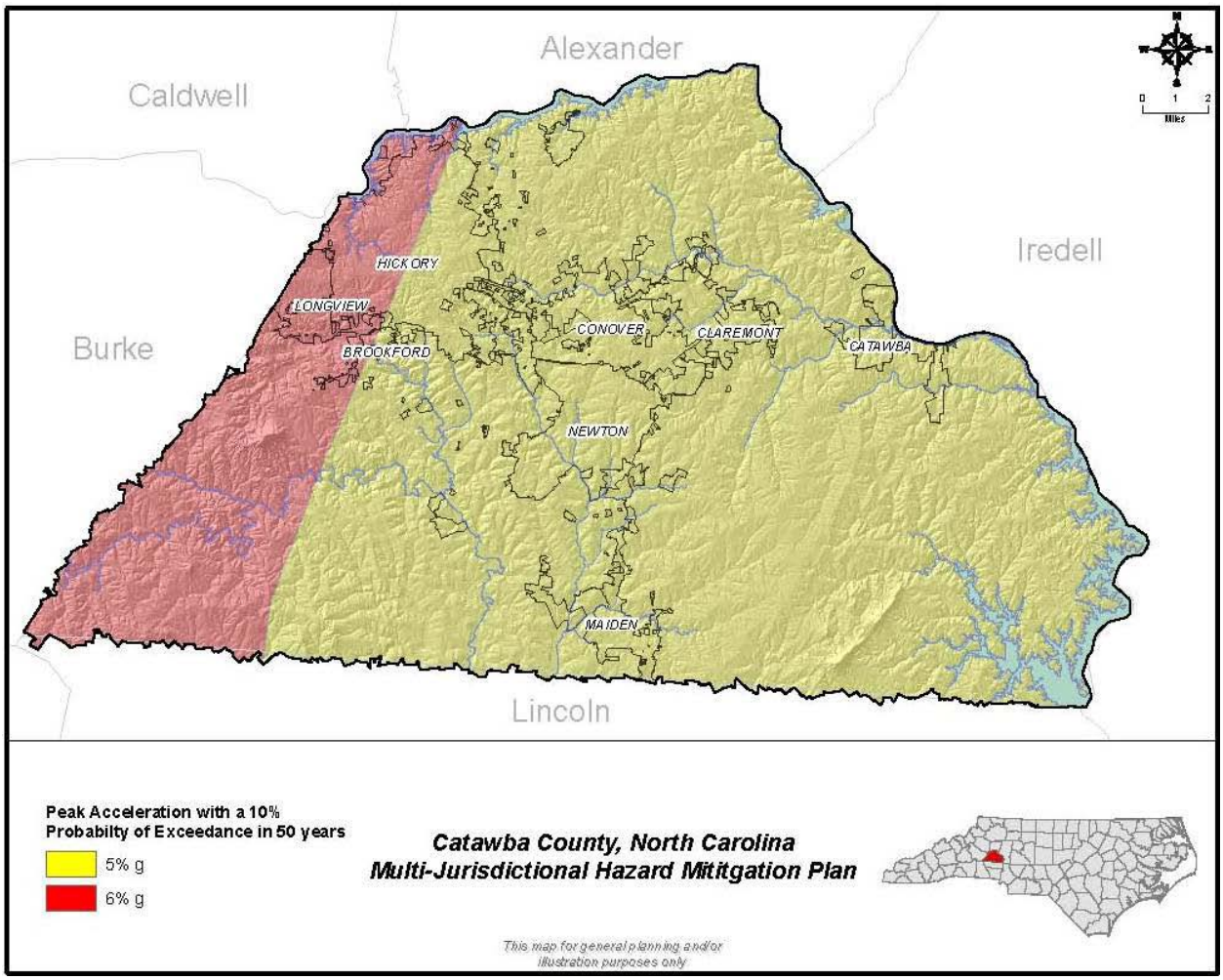
Table 5.11
Significant Seismic Events in Catawba County

Date of Occurrence	Reported Location	Modified Mercalli Intensity (if known)	Details
09/01/1886	Hickory	VI	337 miles from epicenter
02/21/1916	Hickory	V	107 miles from epicenter
08/26/1916	Newton	IV	42 miles from epicenter
11/03/1928	Newton	III	130 miles from epicenter
05/13/1957	Claremont	IV	76 miles from epicenter
05/13/1957	Conover	IV	70 miles from epicenter
05/13/1957	Hickory	V	59 miles from epicenter
05/13/1957	Maiden	IV	73 miles from epicenter
05/13/1957	Newton	IV	71 miles from epicenter
09/13/1976	Long View	II	109 miles from epicenter

Source: National Geophysical Data Center

Figure 5.10 shows the two intensity levels associated with Catawba County, based on the national USGS map of peak acceleration with 10 percent probability of exceedance in 50 years.[8] According to these maps, most of Catawba County sits within a zone of 5%g (peak ground acceleration) with some areas in the extreme western part of the county in zone of 6%g. This indicates that the county as a whole exists within an area of moderate seismic risk.

Figure 5.10
Geological and Seismic Information for Catawba County



Source: CCGIS, USGS

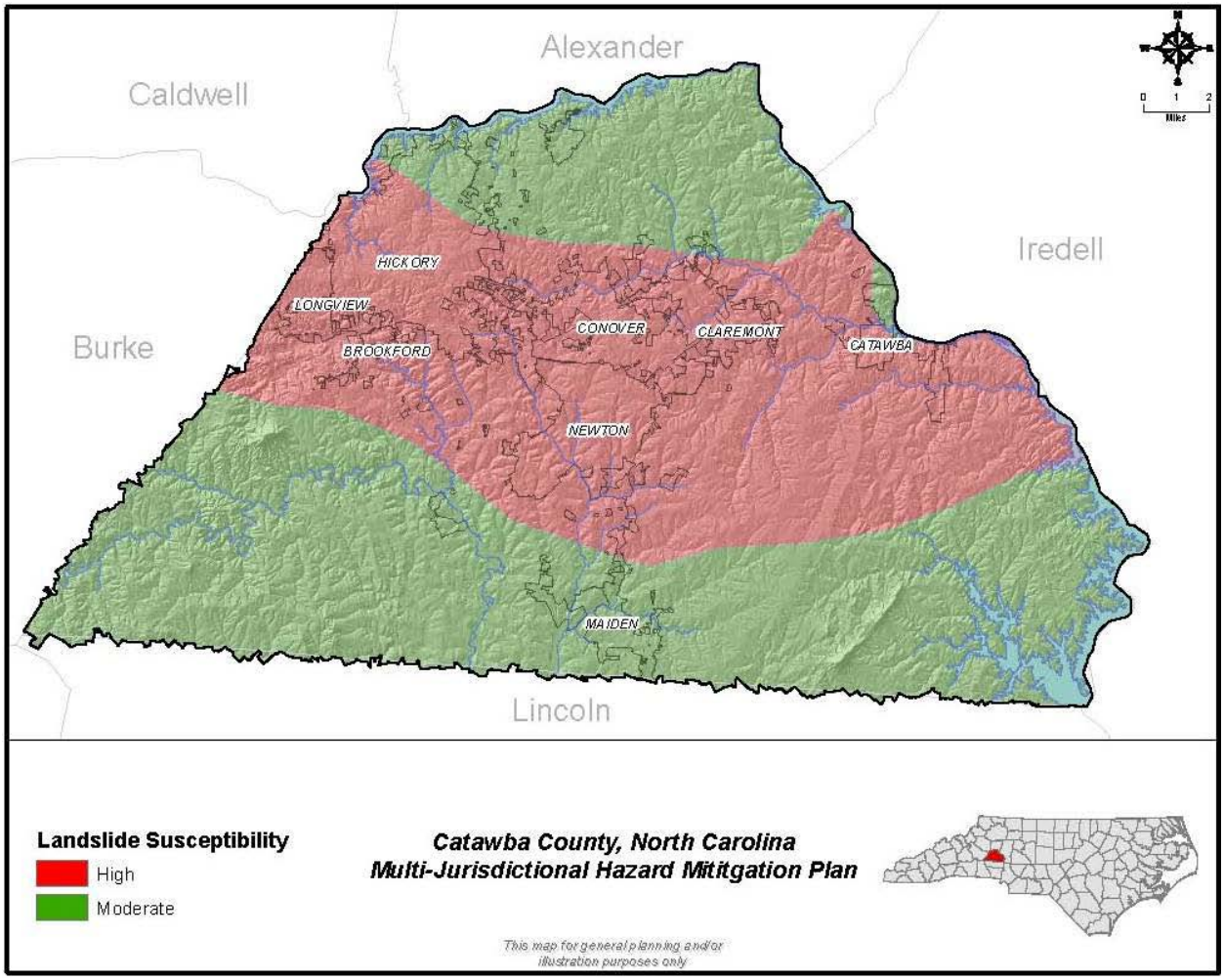
[8] This national base map is presented and discussed in the *Hazard Identification* section of this risk assessment. The zones indicated on the Catawba County map are based on the national map.

Sinkholes and Landslides

Catawba County has experienced minor sinkhole activity in the past, although very few have caused any reported property damages and those that have occurred were determined to be human-caused versus naturally occurring events.

There is no recorded historical evidence of any significant landslide activity in Catawba County. Overall, according to national base maps provided by the U.S. Geological Survey[9], all of Catawba County is within a zone of either high incidence or moderate susceptibility/ low incidence (**Figure 5.11**). This implies that there is some significant potential risk that is not supported by any historical data or detailed landlide hazard mapping presently available.

Figure 5.11
Landslide Potential



Source: CCGIS, USGS

[9] This national base map is presented and discussed in the *Hazard Identification* section of this risk assessment. The terms used here are more thoroughly defined in that section.

Effects of Climate Change on Natural Hazards

In recent years, there has been growing concerns and considerable attention focused among scientists, planners, emergency managers and others on the implications of climate change with regard to natural hazards. While the subject is often met with significant uncertainty, skepticism and scientific debate, it is clear that global warming is now expressing itself in altered rates and intensities of weather and climate extremes (U.S. Global Change Research Program, 2009). Recent climate projections suggest more rapid changes in the near future (Intergovernmental Panel on Climate Change, 2007), and while the specific effects of these changes may be highly regional and even local in nature, it is generally accepted that they will affect natural hazards such as heat waves, storm surge, wildfire and drought.

Climate prediction models provide a glimpse of the future, and while they not agree on all of the details, most models predict a few general trends. First, following years of study by more than 600 scientists, the Intergovernmental Panel on Climate Change (IPCC) distilled the world's accumulated knowledge into this conclusion: "warming of the climate system is unequivocal." The IPCC went on further to report that increases of greenhouse gases in the atmosphere will likely boost temperatures over most land surfaces (forecasting a temperature rise of 2.5 to 10 degrees Fahrenheit over the next century), with most scientists having high confidence that such increases are due to greenhouse gases produced by human activities.

Second, there is general consensus that global warming will change the frequency and intensity of some natural hazards, worsening some and lessening others, thus complicating standardized risk assessment and mitigation planning data such as the one percent annual chance flood (or 100-year flood event). More uncertain but possible outcomes of an increase in global temperatures include increased risk of drought, wildfires and heat waves, and increased frequency and intensity of storms, including hurricanes and tropical storms with higher wind speeds, new patterns of rainfall and snowfall (less frequent but more intense precipitation), rising sea levels and more intense mid-latitude storms. The IPCC reports that both heat waves and intense rain events have increased in frequency during the last 50 years, and that since the 1970's the area affected by drought and the number of intense tropical storms also have increased. IPCC scientists say these events were more likely than not influenced by human-induced global warming.

The exact change in temperatures, climate extremes and natural hazards will vary regionally, and the impacts for Catawba County remain unclear. For most places, global warming will result in more hot days and fewer cool days, with the greatest warming happening over land. Longer, more intense heat waves will become more frequent. High latitudes and generally wet places will tend to receive more rainfall, while tropical regions and generally dry places will probably receive less rain. Increases in rainfall will come in the form of bigger, wetter storms, rather than in the form of more rainy days. In between those larger storms will be longer periods of light or no rain, so the frequency of drought will increase. Hurricanes will likely increase in intensity due to warmer ocean surface temperatures (NASA Earth Observatory, 2009).

Amid these predictions of intensifying downpours, sea level rise and more potent hurricanes, FEMA launched a study in May 2009 on the fiscal impact that climate change could have on the National Flood Insurance Program. The study suggests that among other mitigation-related actions, the special flood hazard zones identified, mapped and regulated by FEMA could be expanded in some areas due to the influence of long-term climate change. The findings are expected to be released in March 2010.

Climate Change Impacts for the Southeastern United States

The latest scientific assessment from the U.S. Global Change Research Program (USGCRP) was recently completed in June 2009, and is entitled "*Global Climate Change Impacts in the United States*." The report summarizes the science and the impacts of climate change on the United States, now and in

the future. It focuses on climate change impacts in different regions of the U.S. and on various aspects of society and the economy such as energy, water, agriculture, and health.

According to the report, the U.S. Southeast region's annual average temperature has risen 2°F since 1970, with the greatest seasonal increase in the winter months. The percentage of the Southeast in moderate to severe drought increased over the past three decades, but there has been an increase in heavy downpours. The power of Atlantic hurricanes has increased since 1970, associated with an increase in sea surface temperature.

Continued warming is projected for the Southeast, with the greatest temperature increases in summer. The number of very hot days is projected to rise at a faster rate than average temperatures. Average annual temperatures are projected to rise 4.5 degrees Fahrenheit under a lower emissions scenario and 9 degrees Fahrenheit under a higher emissions scenario with a 10.5 degrees Fahrenheit increase in summer and a much higher heat index (see the full report for information on the emissions scenarios). Sea-level rise is projected to accelerate, increasing coastal inundation and shoreline retreat. The intensity of hurricanes is likely to increase, with higher wind speeds, rainfall intensity, and storm surge height and strength.

According to the **USGCRP** report, the key issues identified for the Southeast Region included the following:

- Projected increases in air and water temperatures will cause heat-related stresses for people, plants, and animals.
- Decreased water availability is very likely to affect the region's economy as well as its natural systems.
- Sea-level rise and the likely increase in hurricane intensity and associated storm surge will be among the most serious consequences of climate change.
- Ecological thresholds are likely to be crossed throughout the region, causing major disruptions to ecosystems and to the benefits they provide to people.
- Quality of life will be affected by increasing heat stress, water scarcity, severe weather events, and reduced availability of insurance for at-risk properties.

Data Sources

American Society of Civil Engineers (ASCE), "Facts About Windstorms."
Web site: www.windhazards.org/facts.cfm

Bureau of Reclamation, U.S. Department of the Interior
Web site: www.usbr.gov

Federal Emergency Management Agency (FEMA), Department of Homeland Security
Web site: www.fema.gov

Intergovernmental Panel on Climate Change (IPCC)
Web site: www.ipcc.ch

NASA Earth Observatory.
Web site: http://earthobservatory.nasa.gov/

National Climatic Data Center (NCDC), U.S. Department of Commerce, National Oceanic and Atmospheric Administration
Web site: http://lwf.ncdc.noaa.gov/oa/ncdc.html

National Geophysical Data Center
Web site: http://www.ngdc.noaa.gov/

National Hurricane Center, National Oceanic & Atmospheric Administration (NOAA)
Web site: http://www.nhc.noaa.gov/

National Severe Storms Laboratory (NSSL), U.S. Department of Commerce, National Oceanic and Atmospheric Administration
Web site: www.nssl.noaa.gov

National Weather Service (NWS), U.S. Department of Commerce, National Oceanic and Atmospheric Administration
Web site: www.nws.noaa.gov

Storm Prediction Center (SPC), U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service
Web site: www.spc.noaa.gov

The Tornado Project, St. Johnsbury, Vermont
Web site: www.tornadoproject.com

United States Geological Survey (USGS), U.S. Department of the Interior
Web site: www.usgs.gov

U.S. Global Change Research Program (USGCRP),
Web site: www.globalchange.gov/