

NORTH CAROLINA GEOLOGICAL SURVEY
DIVISION OF LAND RESOURCES
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

MAP OF KNOWN AND POTENTIAL DEBRIS FLOW PATHWAYS IN HENDERSON COUNTY, NORTH CAROLINA

FOR SHALLOW TRANSLATIONAL SLOPE MOVEMENTS

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GEOLOGIC HAZARDS MAP SERIES 5
SLOPE MOVEMENT HAZARD MAPS OF HENDERSON COUNTY, NORTH CAROLINA
SHEET 3 of 3, VERSION: APRIL 29, 2011

EXPLANATION

	Map Symbols	Map Unit Designation	Description
Increasing Relative Hazard		Known debris flow pathways	Areas within the pathways of known mapped recent debris flows (those occurring circa 1951 or later).
		Potential debris flow pathways	Areas within the potential flow paths of debris flows and other shallow, translational slope movements that could potentially initiate within the unstable and upper threshold (high hazard) stability zones predicted on the Stability Index Map. Slope movements that initiate on slopes destabilized by modification within these high hazard zones may also follow similar flow paths.
Decreasing Relative Hazard		Areas of past debris flow activity	Areas mapped as slope movement deposits outside the areas of potential flow paths are designated as areas of past debris flow activity. Debris flows and other slope movements have previously deposited material at these locations. For this reason future slope movements could also affect these areas. Additionally, a potential hazard exists for slope movement deposits because they typically consist of deep, unconsolidated accumulations of clay- to boulder-sized material that can be unstable in high, steep-sided excavations, and in areas over-steepened by stream erosion.
		Areas of no known or potential debris flow activity	Areas that are outside of the known and potential debris flow pathways as well as outside the mapped extents of past debris flow activity. Damage is unlikely in these areas from natural slope movements that originate from within the other map units. While these areas are unlikely to be damaged by debris flows or other shallow, translational slope movements, modification or alteration of slopes in this map unit could result in slope movement activity.

Table 1. Definitions and explanation of map unit designations.

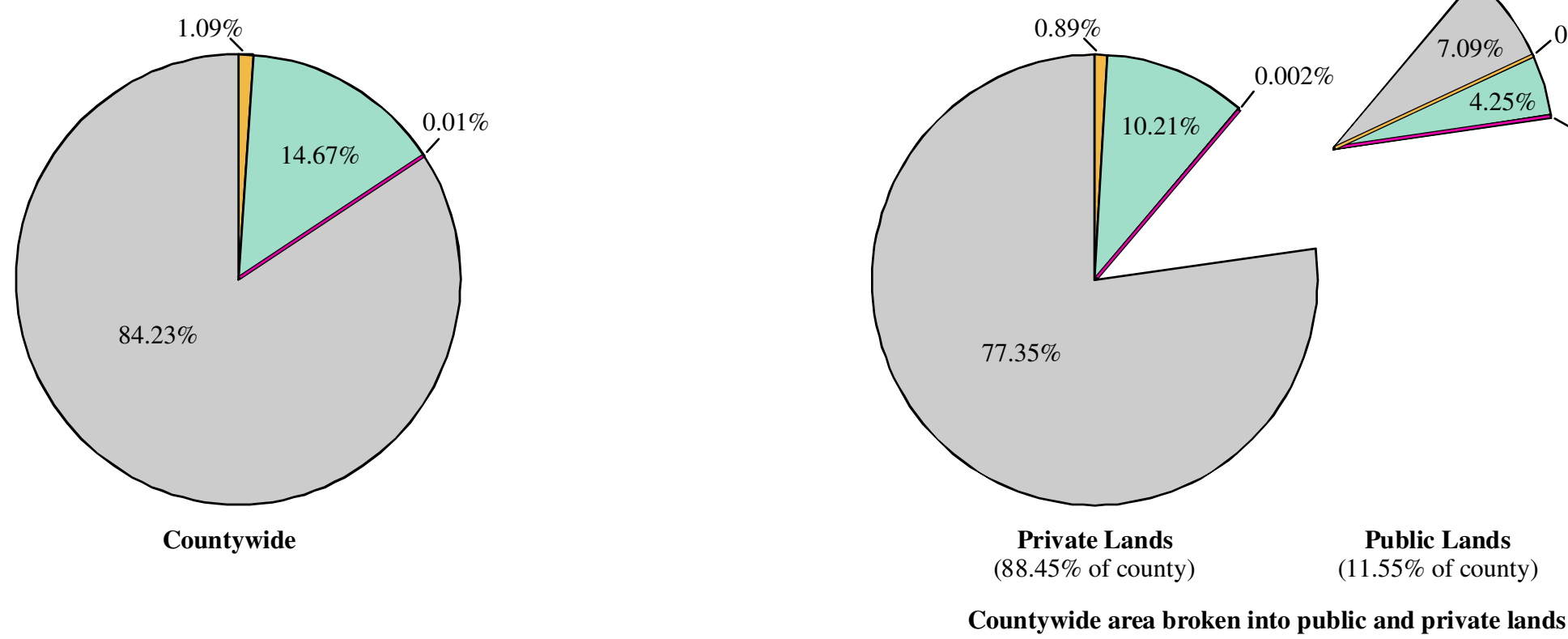
Selected slope movement initiation zones

Note: Locations of slope movement initiation zones shown on this map sheet depict only shallow translational movements on unmodified slopes. These locations were used to calibrate the SNUMAP model (Sheet 2) used to derive this map (Sheet 3). For a comprehensive listing and locations of the types of slope movements and deposits identified and/or field verified in Henderson County, see Sheet 1 (Slope Movements and Slope Movement Deposits Map).

OTHER MAP FEATURES

- Roads
 - Interstates
 - Primary roads
 - Secondary roads
 - Blue Ridge Parkway
- Rivers
 - Rivers
 - Lakes
- Political Boundaries
 - Municipal boundaries
 - Henderson County boundary

RELATIVE PERCENTAGES OF PUBLIC AND PRIVATE LANDS WITHIN EACH MAP UNIT DESIGNATION



OVERVIEW OF THE MAP OF KNOWN AND POTENTIAL DEBRIS FLOW PATHWAYS

Background and Purpose

The North Carolina General Assembly authorized the North Carolina Geological Survey (NCGS) to produce landslide hazard maps for 19 western counties in response to the number of slope movements (landslides) and destruction caused by the remnants of Hurricane Frances and Ivan in western North Carolina (N.C.) in September 2004. The intent of the Landslide Hazard Mapping program is to provide the public, local government, and local and state emergency agencies with a planning tool that describes and locates areas where slope movements have occurred, or are likely to occur, and the general areas at risk from these slope movements. The locations of previous slope movements and their deposits are important because slope movements often reoccur in the same general areas, and they typically deposit material in areas where there are pre-existing slope movement deposits.

The slope movement hazard map series for Henderson County, N.C. consists of three maps (Geologic Hazards Map Series 5 (GHMS-5, Sheets 1, 2, and 3)) that are designed to be used in conjunction with each other. Brief descriptions of this map (Sheet 3) and accompanying maps follow.

- Sheet 1, Slope Movement and Slope Movement Deposits Map, shows the extent and distribution of known historical slope movements (all types) and pre-existing slope movement deposits.
- Sheet 2, Stability Index Map, shows where naturally occurring, shallow, translational slope movements (e.g., debris flows) may begin on slopes without prior ground disturbing activity in response to a major rainfall event.
- Sheet 3 (this map), Map of Known and Potential Debris Flow Pathways, shows where debris flows may travel if they occur.

These printed maps are smaller scale representations of the digital spatial data that have been created for use in a Geographic Information System (GIS) (Wooten et al., 2011). The NCGS's landslide hazard map products are not intended to be a substitute for a detailed, site-specific analysis by a qualified geologist or engineer.

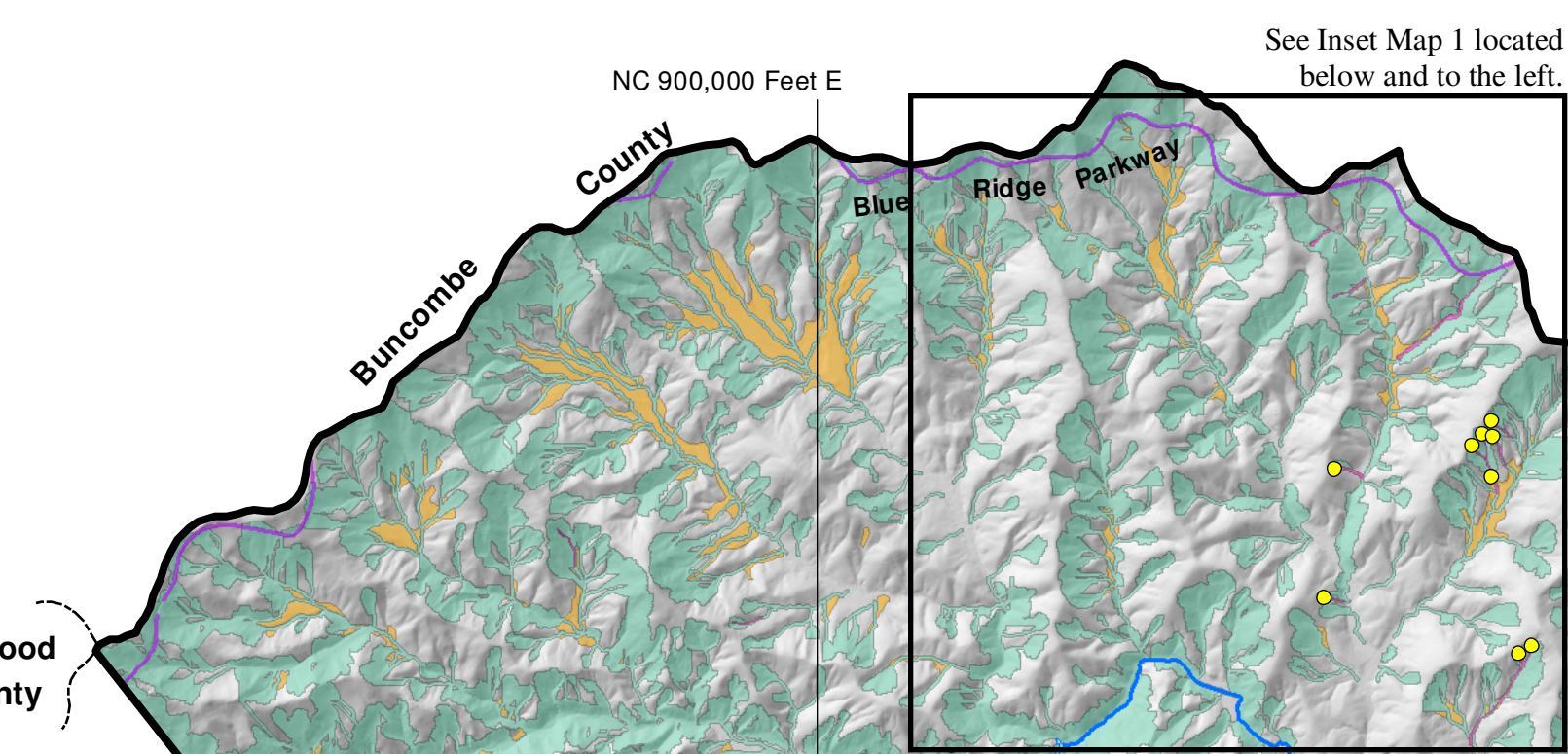
Map of Known and Potential Debris Flow Pathways (Geologic Hazards Map Series 5, Sheet 3)

This color-coded map portrays areas that potentially could be affected by debris flows or other shallow, translational slope movements. The Stability Index Map (Sheet 2) shows areas where shallow translational slope movements are more likely to originate in response to a rain event producing recharge to the shallow groundwater system of at least 5 in (125mm) in a 24-hour period. The Map of Known and Potential Debris Flow Pathways show areas likely to be in the path of these slope movements if they do occur. The pathways include areas significantly further downslope from where the slope movements may initiate. Designated units on this map are: known debris flow pathways, potential debris flow pathways, areas of past debris flow activity, and areas of no known or potential debris flow activity. Table 1 shows the color codes used on the map with explanations that correspond to the map unit designations.

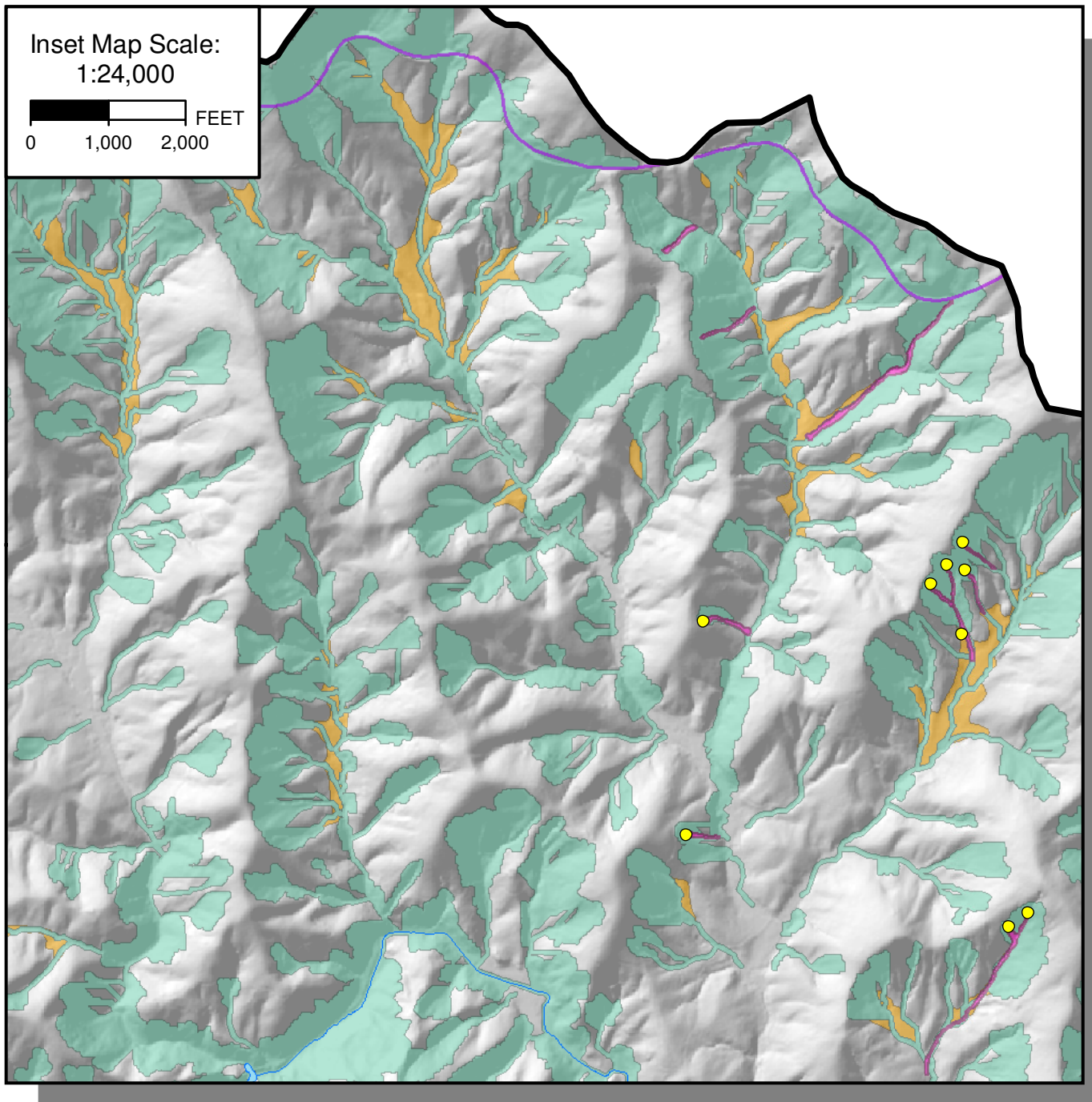
The Map of Known and Potential Debris Flow Pathways indicates the distribution of areas that could potentially be affected by debris flows or other shallow, translational slope movements given the conditions on the ground at the time the map was made. Changes in the landscape as a result of human activity and future debris flows and other types of landslides can alter the potential pathways of subsequent debris flows; therefore, the map represents the general areas that could potentially be affected by debris flows and other shallow translational slope movements. In these locations of known, potential, and past debris flow activity, further slope stability analysis, including on-site field investigation, is recommended prior to siting facilities or undertaking ground disturbing activities.

ACKNOWLEDGEMENTS

The North Carolina Geological Survey would like to thank Henderson County Government for their assistance and cooperation. Special thanks go to the residents of Henderson County for their willingness to provide information and property access. The North Carolina Department of Transportation - Geotechnical Engineering and Materials and Tests Units, the U.S.D.A., Forest Service and Natural Resources Conservation Service provided much useful data and assistance. Field and map reviews and comments by Francis Ashland, Nick Bozdog, Matt Cable, Bart Cattamach, Jack Drost, Brad Johnson, Brett Lavery, Carl Merschat, Kate Schurer, James Simons, Chip Smith, Kenneth Taylor, Cheryl Waters-Torrey, and Leonard Wiener are greatly appreciated.



Inset Map 1. Detailed view of a portion of Pisgah National Forest showing a concentration of landslides triggered by the storm of November 3-6, 1977.

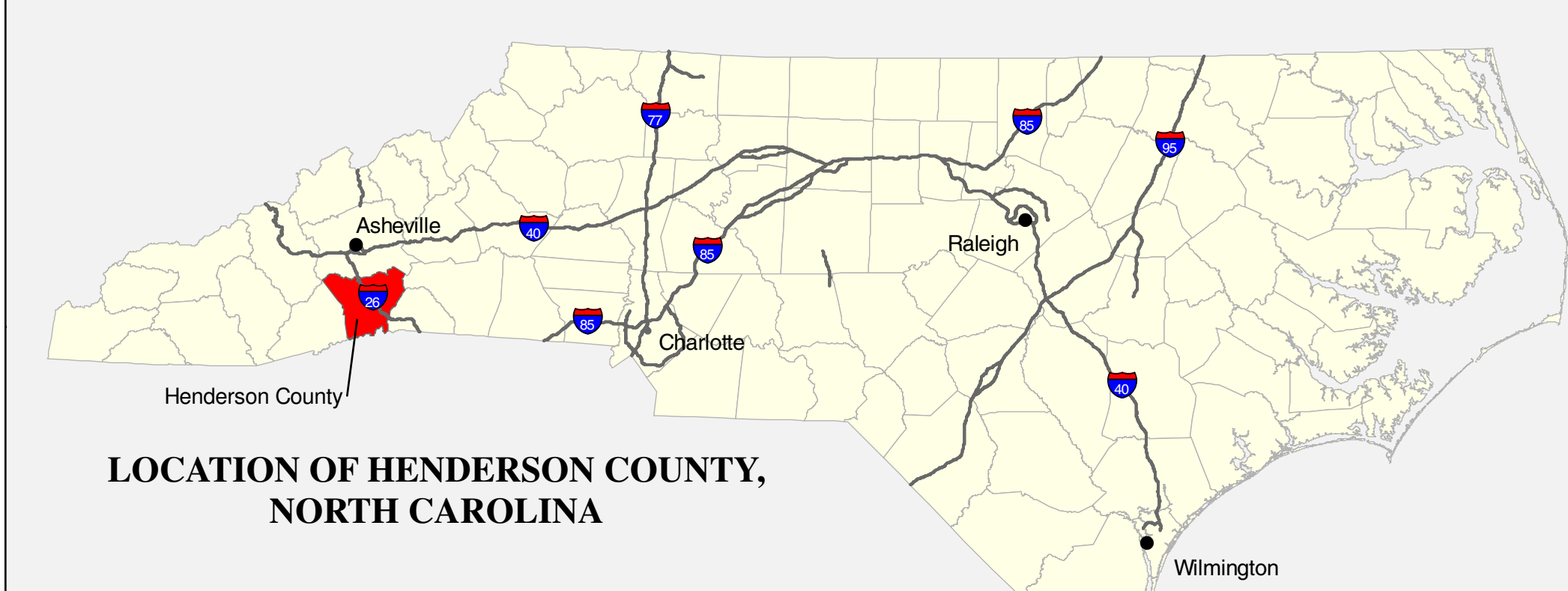


Inset Map 2. Detailed view of two debris flows in Bear Rock Estates, Henderson County. The larger debris flow occurred on September 8, 2004, during Hurricane Frances and the smaller debris flow reportedly occurred in the mid-1990s. This inset shows the maximum recommended scale (1:6,000) for using the landslide hazard map data.

Map Information:
Area of Henderson County: 375mi², 971.5km², or 240,056 acres
Datum: North American Datum of 1983
Coordinate System: North Carolina State Plane, Zone 3200
Projection: Lambert Conformal Conic
Cartography: by North Carolina Geological Survey
Produced in a Geographic Information System (GIS) using ArcGIS™.

Basemap:
Hillshade derived from 20-foot resolution LIDAR (Light Detecting And Ranging) digital elevation data provided by the North Carolina Floodplain Mapping Program using an artificial sun azimuth of 315° and a sun altitude of 45°.

Based on information and data available as of April 29, 2011, concurrent with the GIS versions of the maps released to Henderson County on this date.



LOCATION OF HENDERSON COUNTY, NORTH CAROLINA