



APPALACHIAN LANDSLIDE CONSULTANTS, PLLC
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A L C

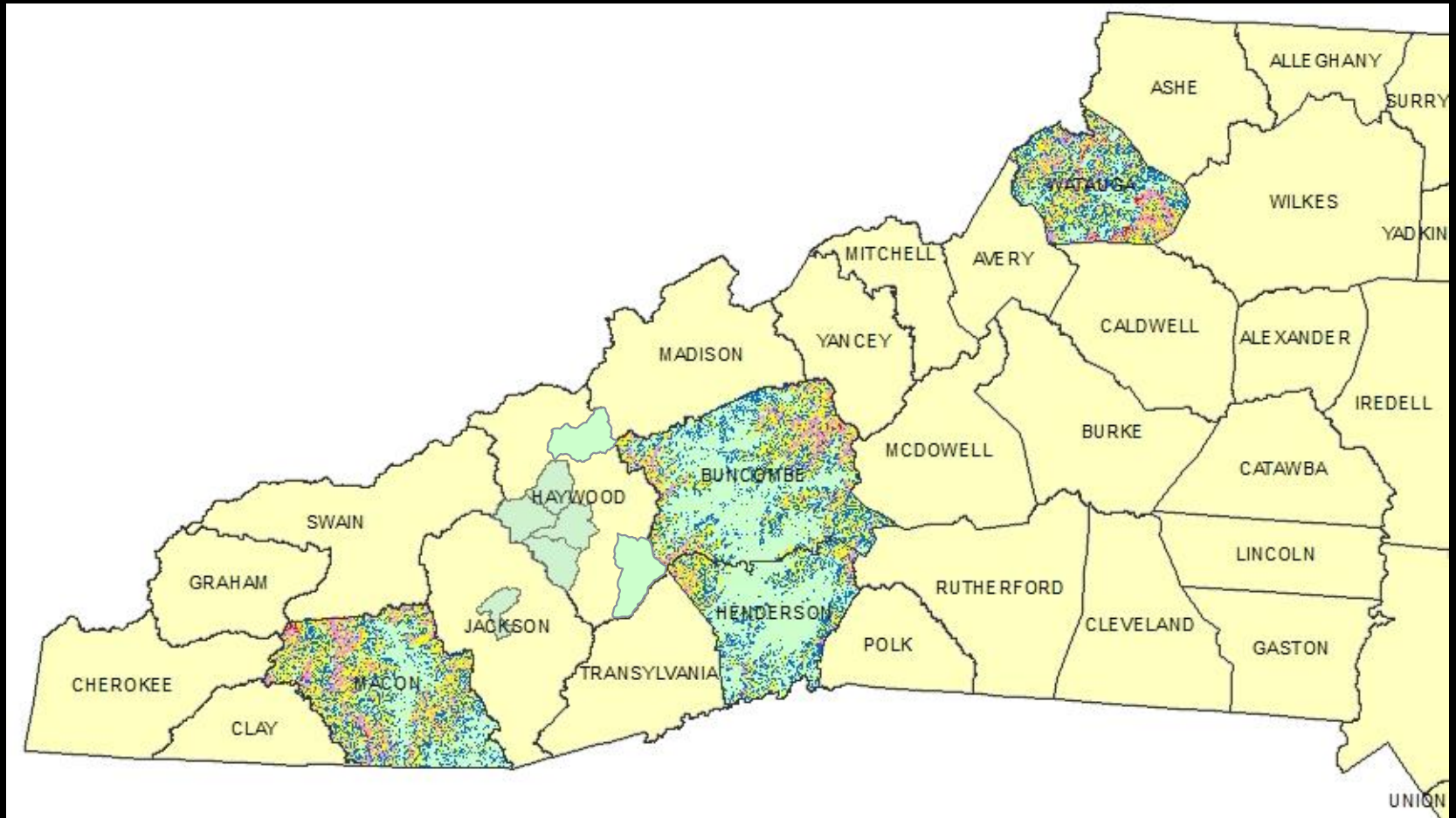
JACKSON COUNTY LANDSLIDE MAPPING

Jennifer Bauer, L.G. – Principal Geologist
Stephen Fuemmeler, L.G. – Principal Geologist

PURPOSE OF LANDSLIDE MAPPING?

- Better understand the impacts landslides have or may have on Jackson County
 - Provide a tool to help make informed decisions and protect life and property
 - Indicate where a site specific evaluation is warranted
-

NORTH CAROLINA LANDSLIDE MAPPING



Maps by ALC and NCGS

Landslide Info

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graph TD; A[Landslide Info] --> B[Landslide mapping]; B --> C[How to use it];
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Landslide mapping

How to use it

Landslide Info

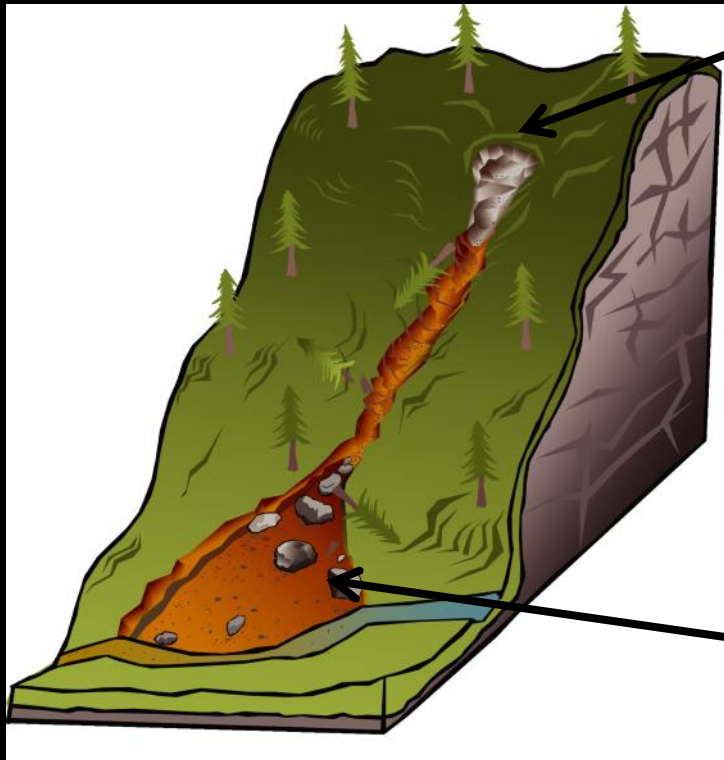
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Landslide mapping

How to use it

DEBRIS FLOW – NATURAL SLOPE

Long Branch Road
Maggie Valley, NC
January, 2013

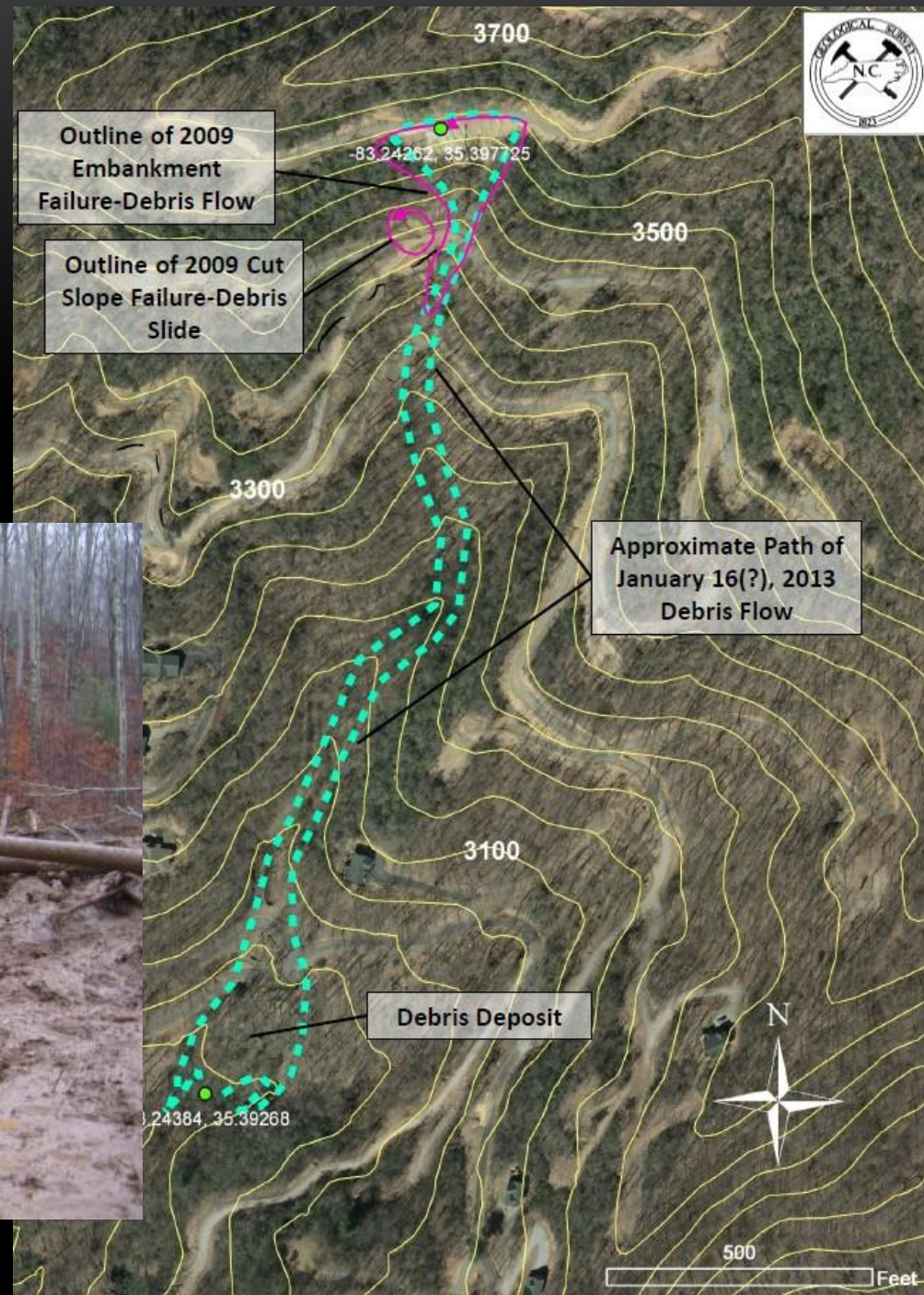


DEBRIS FLOW – MODIFIED SLOPE

Mountain Heritage
Jackson County, NC
January 16 (?), 2013



Photos courtesy of NCGS



DEBRIS SLIDE – MODIFIED SLOPE

Dandelion Drive
Jackson County, NC
July, 2013



Photos courtesy of Jackson Co.
Erosion Control

DEBRIS SLIDE – MODIFIED SLOPE

Example of
working with the
County



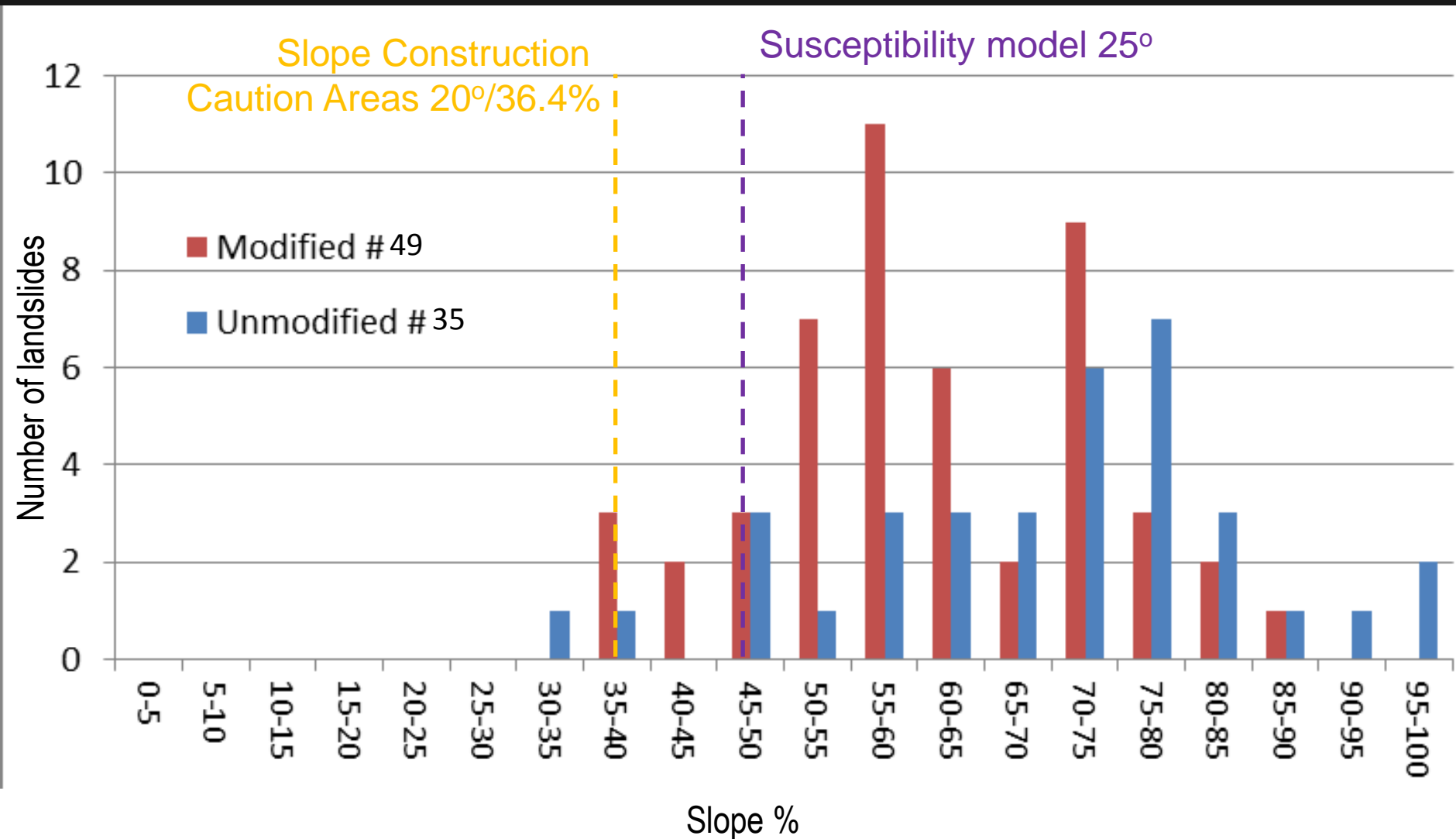
INVENTORY DATABASE - SPECIALIZED FIELDS

	Landslide ID *	Landslide Name	Future Movement	Safety Impact Potential	Water Impact Potential
	201307300002	Shadow Lane 2	High	Moderate	Low
	201307300001	Shadow Lane 1	High	High	Low
	201307290003	<Null>	Low	Low	Low
	201307290002	<Null>	Low	Low	Moderate
	201307260003	<Null>	Low	High	Low
	201307260002	<Null>	Low	Low	Low
	201307230006	<Null>	Low	Low	Low
	201307230003	<Null>	Low	Low	Low
	201307230002	<Null>	<Null>	Moderate	Low
	201307230001	<Null>	High	Low	High
	201307190013	<Null>	High	Low	High
	201307190007	<Null>	Low	Low	High
	201307180009	<Null>	Low	Low	Low
	201307180008	<Null>	Low	Low	Low
	201307160002	<Null>	High	Moderate	Moderate

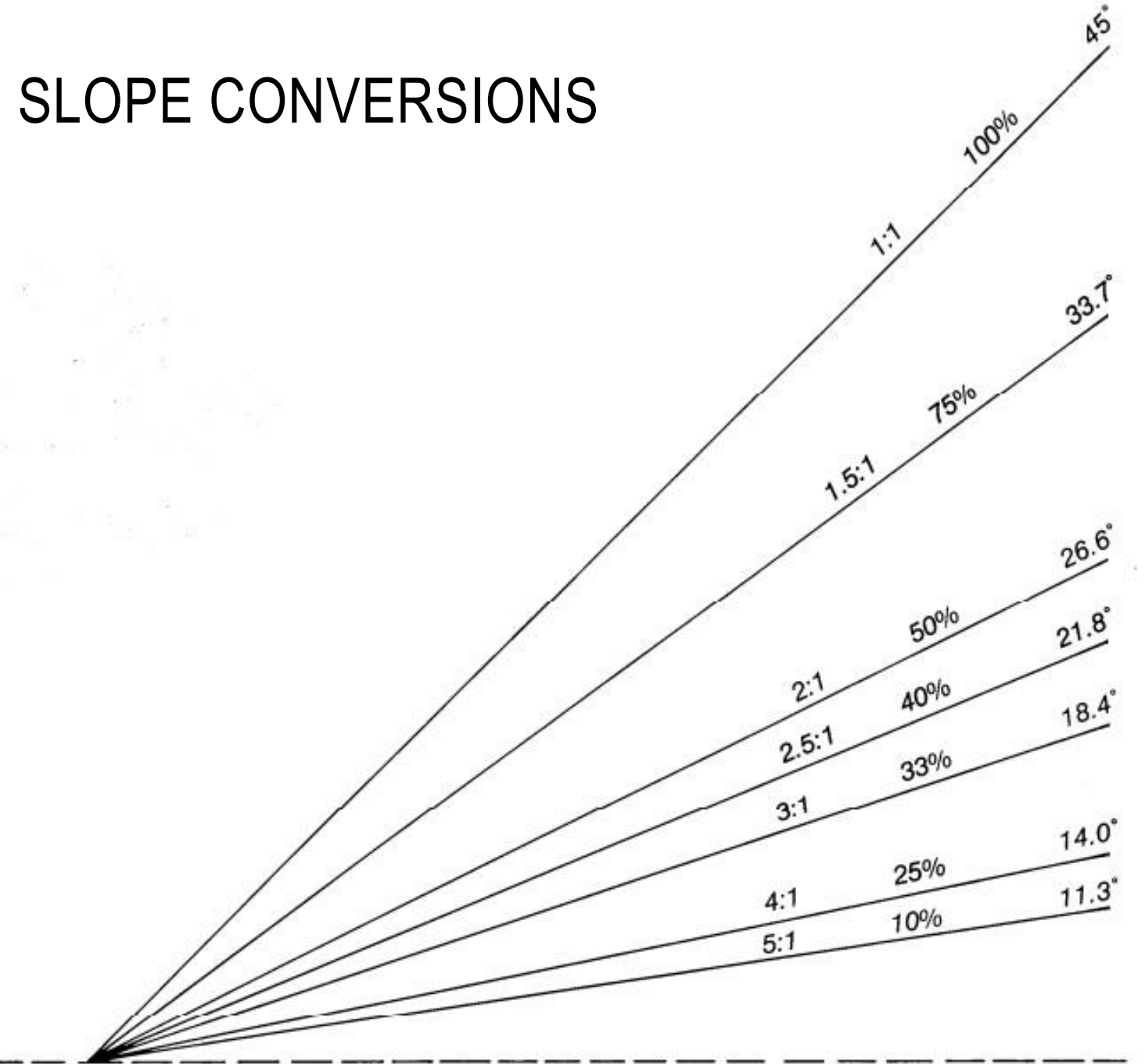
LANDSLIDES IN JACKSON COUNTY

- 202 landslides in the ALC and NCGS database in Jackson County
 - 142 on modified slopes (70%)
 - 55 on natural, unmodified slopes (30%)
- 126 field verified by ALC or NCGS

JACKSON COUNTY LANDSLIDES VS. ORIGINAL GROUND SLOPE



SLOPE CONVERSIONS



From Watauga County's Ordinance to Govern subdivisions and multi-unit structures. Section 70.01 Suitability of the Land

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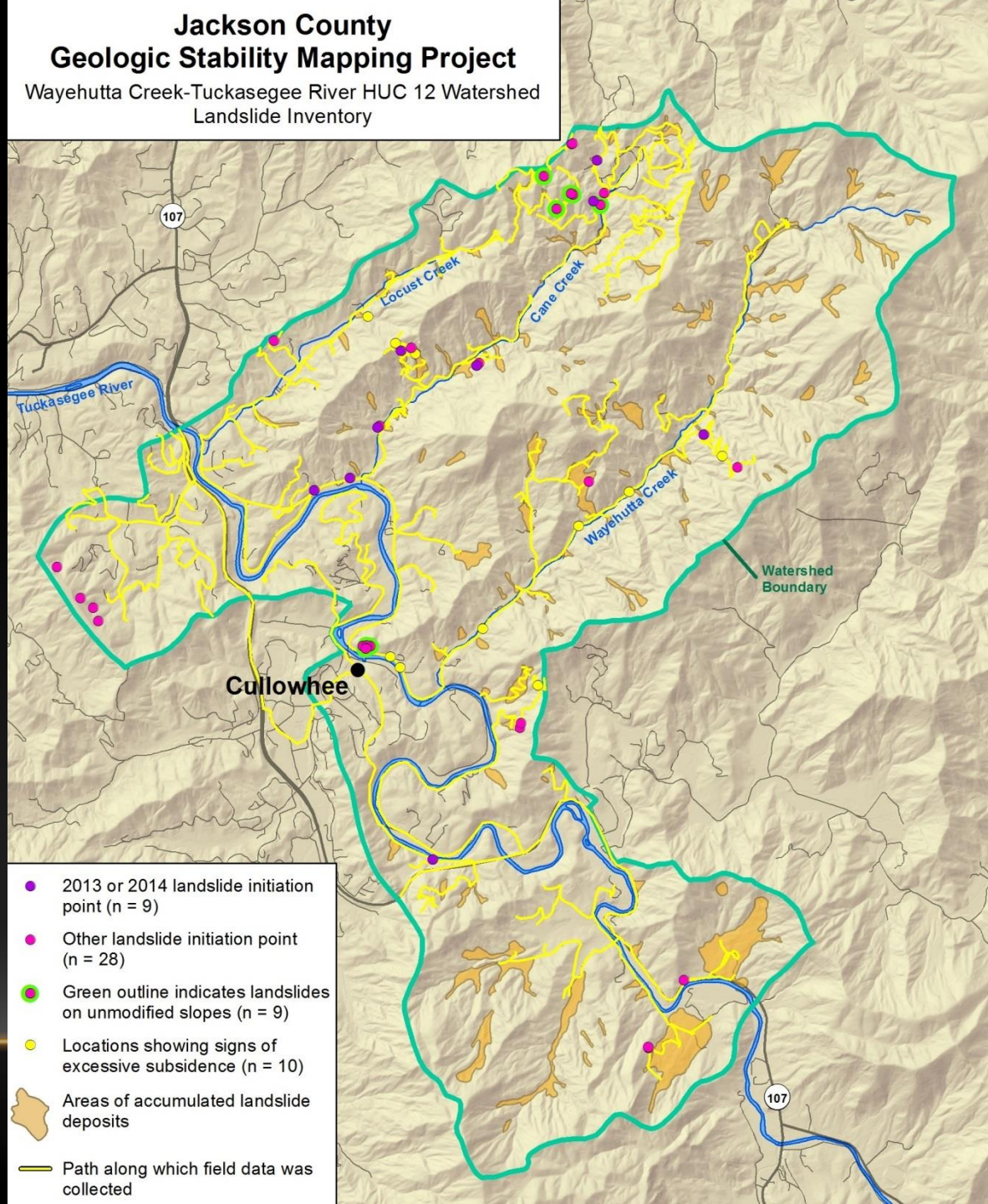
Landslide mapping

How to use it

LANDSLIDE INVENTORY

Example:
Wayehutta Creek
Watershed

- 37 - Number of landslides
- 10 – Number of subsidence locations
- 116 – Number of landslide deposits



EDUCATION AND OUTREACH

WNC Landslide Facts

While just over 20% of WNC has been mapped for past landslide occurrences, over 3,500 landslides have been catalogued. The vast majority of landslides in WNC are of the type called "debris flows" or "mudflows," which are narrow slurries of mud, rock, and water that can travel for long distances down mountain streams and drainages. Most debris flows happen during periods of heavy rain. The good news is that the narrow width of debris flows makes most of them easy to avoid by using wise building practices or by seeking shelter out of harm's way during severe rain events.

- ▶ Multiple landslides happen in WNC every year.
- ▶ There are 172 known historic landslides in Jackson County; 45 of those originated on natural, undisturbed slopes.
- ▶ Since 1940, 67% of all known landslides in WNC started on slopes that people have modified.
- ▶ In WNC, at least 46 people have been killed and 57 homes have been destroyed by historic landslides.
- ▶ Landslide occurrence significantly increases on slopes over 20° (36%).
- ▶ Most of the cleanup costs after a large landslide are paid for by taxpayers.
- ▶ Sediment is our #1 water quality pollutant. A typical embankment failure transfers around 20 dump truck loads (400 tons) of sediment into streams.

Project Background

The Wayehutta Creek project is paid for by nonprofit funds. It is a collaboration between public and private stakeholders, the Southwestern North Carolina Resource Conservation and Development Council, Jackson County Planning Board, and Appalachian Landslide Consultants, PLLC.

The landslide inventory is scheduled to be completed the summer of 2014. The potential landslide source areas and pathways will be completed as funding allows. These maps and a user's guide will be available online when the project is complete.



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Jackson County Planning Board
(828) 631-2261

RC&D

Southwestern NC Resource Conservation &
Development Council
PO Box 1230, Waynesville, NC 28786

Published April, 2014

JACKSON COUNTY GEOLOGIC STABILITY MAPPING PROJECT

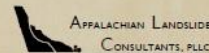
Landslide Companion Maps
for Heavy Rain Events



Mountain Heritage debris flow near Dillsboro. 1/17/2013

Helping protect your family and
community from landslides.

Safeguarding the local economy
and water quality.

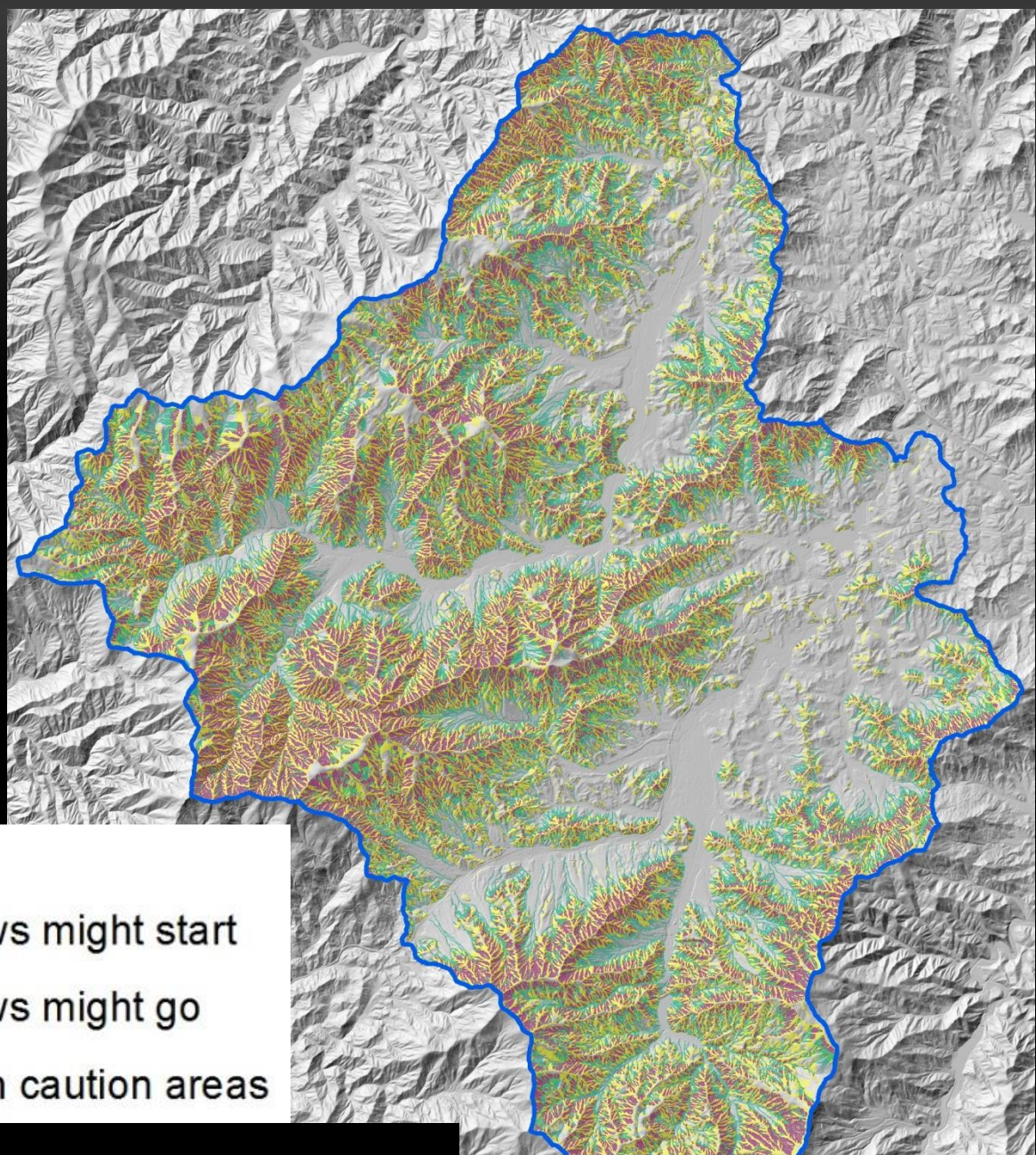


RC&D






LANDSLIDE SUSCEPTIBILITY MAPS

Example:
Jonathan & Richland
Creek Watersheds,
Haywood County

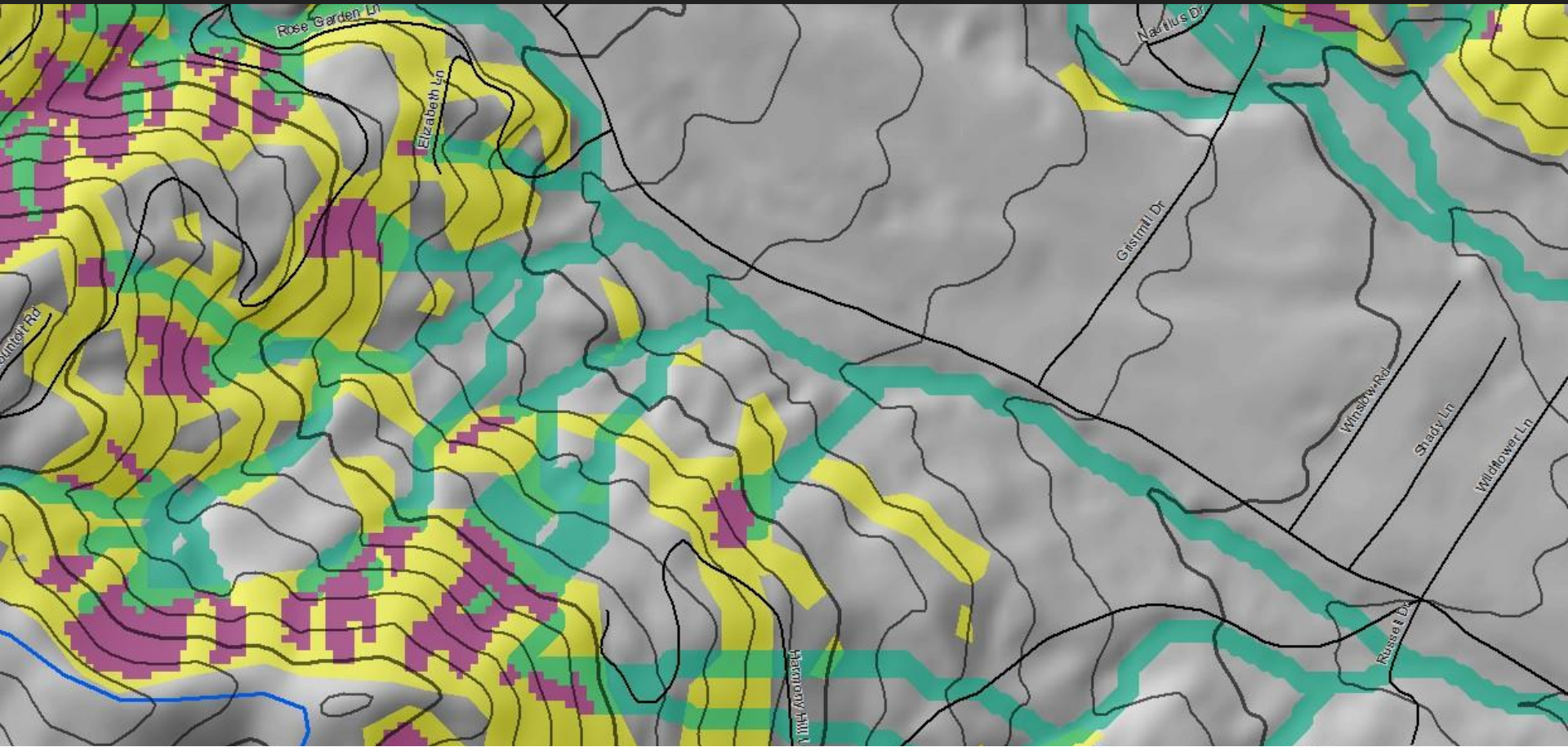


Feature




-  Where natural debris flows might start
-  Where natural debris flows might go
-  JC RC slope construction caution areas

2004 Lidar DEM

LANDSLIDE SUSCEPTIBILITY MAPS



Feature

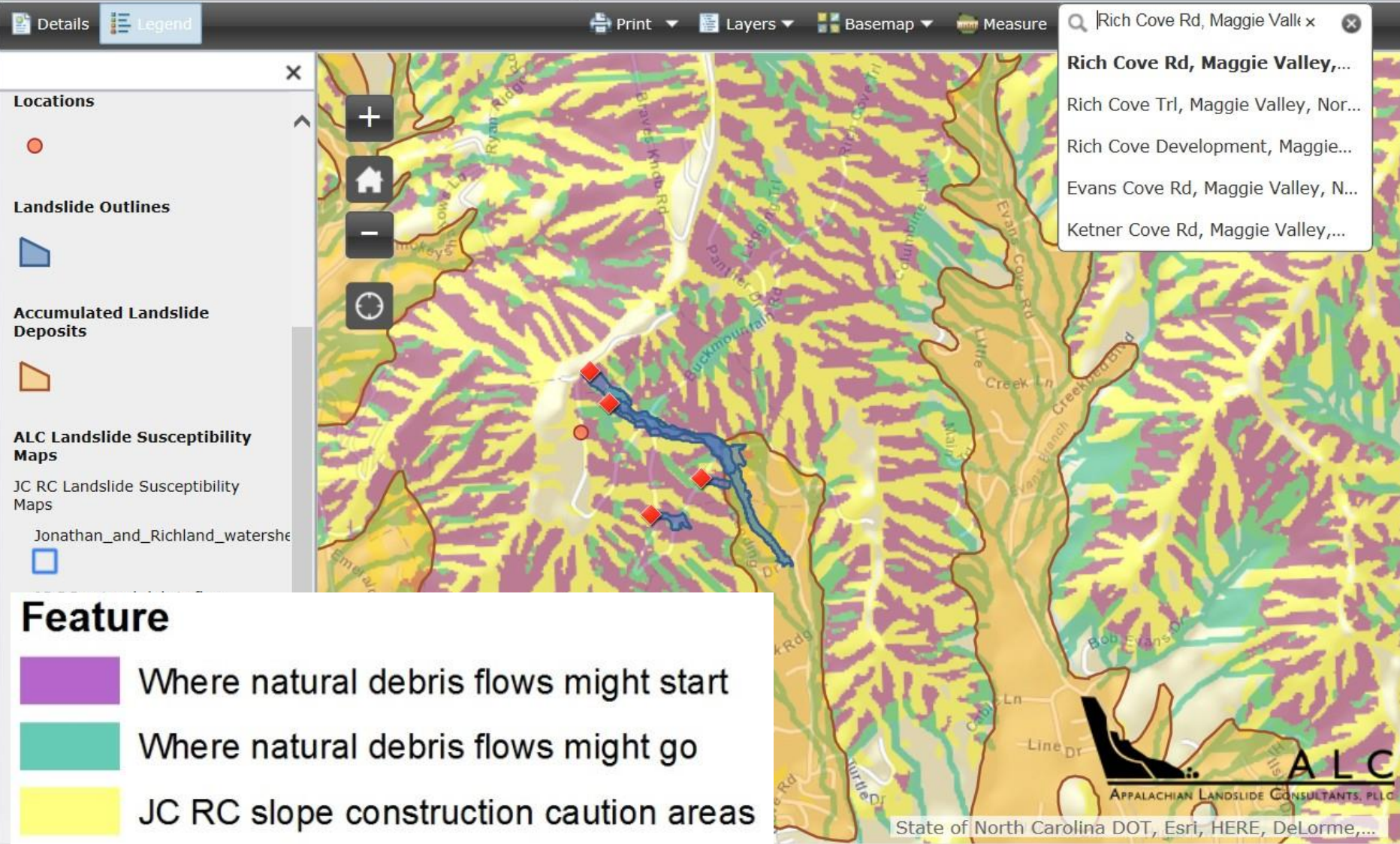
-  Where natural debris flows might start
-  Where natural debris flows might go
-  JC RC slope construction caution areas

90% of natural common landslide types fall within 20 feet of purple areas

97% of modified landslides fall within yellow areas (36.4%, 2.7:1)

ALC ONLINE MAP DISTRIBUTION

Landslide Hazard Maps of WNC (BETA)



ALC USER'S GUIDE FOR ONLINE MAPS

GEOLOGIC STABILITY MAPS LANDSLIDE SUSCEPTIBILITY GUIDE

The LANDSLIDE SUSCEPTIBILITY MAP shows areas that might be more susceptible to landslides during extreme rain events. Use this guide to find out **what it means** and **what to do** if you have a landslide caution area on your property.

Is there a Landslide **CAUTION AREA** near the area you are interested in?

NO

WHAT DOES IT MEAN?

This area is unlikely to be impacted by the most common types of landslides (debris flows and slides) that affect Western North Carolina. However, certain types of bedrock or poor construction techniques can still lead to landslides outside of a caution area.

WHAT TO DO?

Now take a look at the **LANDSLIDE INVENTORY MAPS** to see if there is a known landslide in the area. If you still have concerns about the area, contact a **qualified geologist or geotechnical engineer**.

YES

Is it **WHERE NATURAL DEBRIS FLOWS MIGHT START?**

These areas are more likely to become unstable during **extreme** rain events and form a debris flow (a fast moving landslide made up of a slurry of mud, rock, and trees). It usually takes a **rare** combination of soil saturation plus a long period of intense rainfall to trigger natural debris flows. Since these conditions vary greatly from one mountain cove to another, most of these areas will not form a debris flow in any given storm.

These areas are **marginally stable** in their natural condition. Be **extremely careful** when building homes, roads, or driveways here; contact a qualified geologist or geotechnical engineer. Look at **WHERE NATURAL DEBRIS FLOWS MIGHT GO** to see the path of a potential debris flow from this area.

DELIVERABLES

- Complete the landslide inventory for entire county
 - Susceptibility Maps for entire county
 - User's Guide
 - Educational brochure for the public
 - Participation in stakeholders and project partners meetings
 - Work with project partners on online map distribution
 - Workshops for end users (real estate industry, other user groups)
-

ESTIMATE

- All deliverables - \$143,000
- June, 2014 estimate was \$158,000
- Inventory – 1 year
- Susceptibility maps and educational component – 6 months

Landslide Info

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Landslide mapping

How to use it

LANDSLIDE MAP BENEFITS

- Identify past, current, or impending landslide sites that can be remediated
 - Identify landslide prone areas that need extra care during development
 - Increase citizen's awareness of the potential landslide hazards and their role in planning for and avoiding these hazards
 - Use information during heavy rain events to ID areas where EM may want to be on higher alert for landslides
-

COST VS. BENEFIT

- Estimated ~\$143k to finish the county
- The average WNC house costs \$165,000 (HCBOR May 2015); saving one house could pay for the entire landslide map series for Jackson County.
- 400 cubic yards of sediment from typical embankment failure > 20 dump truck loads, repair can cost from \$50-\$100k – these can be prevented

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THANK YOU

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