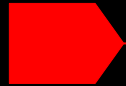


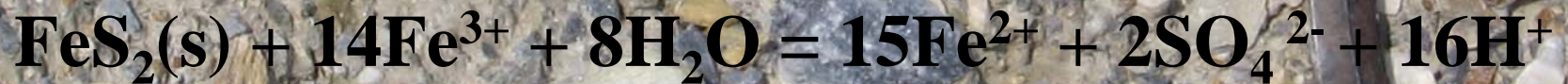
Geohazard and Transportation Aspects of Sulfidic Rock (Acid Rock) in North Carolina



Problem causing minerals:

pyrite - Fe^{2+}S_2

pyrrhotite - Fe^{2+}S



(from Byerly, 1996)



Problem Rock Types in Western North Carolina:

Ammons Formation – Horse Br Member

Anakeesta Formation

Boyd Gap Formation

Farner Formation

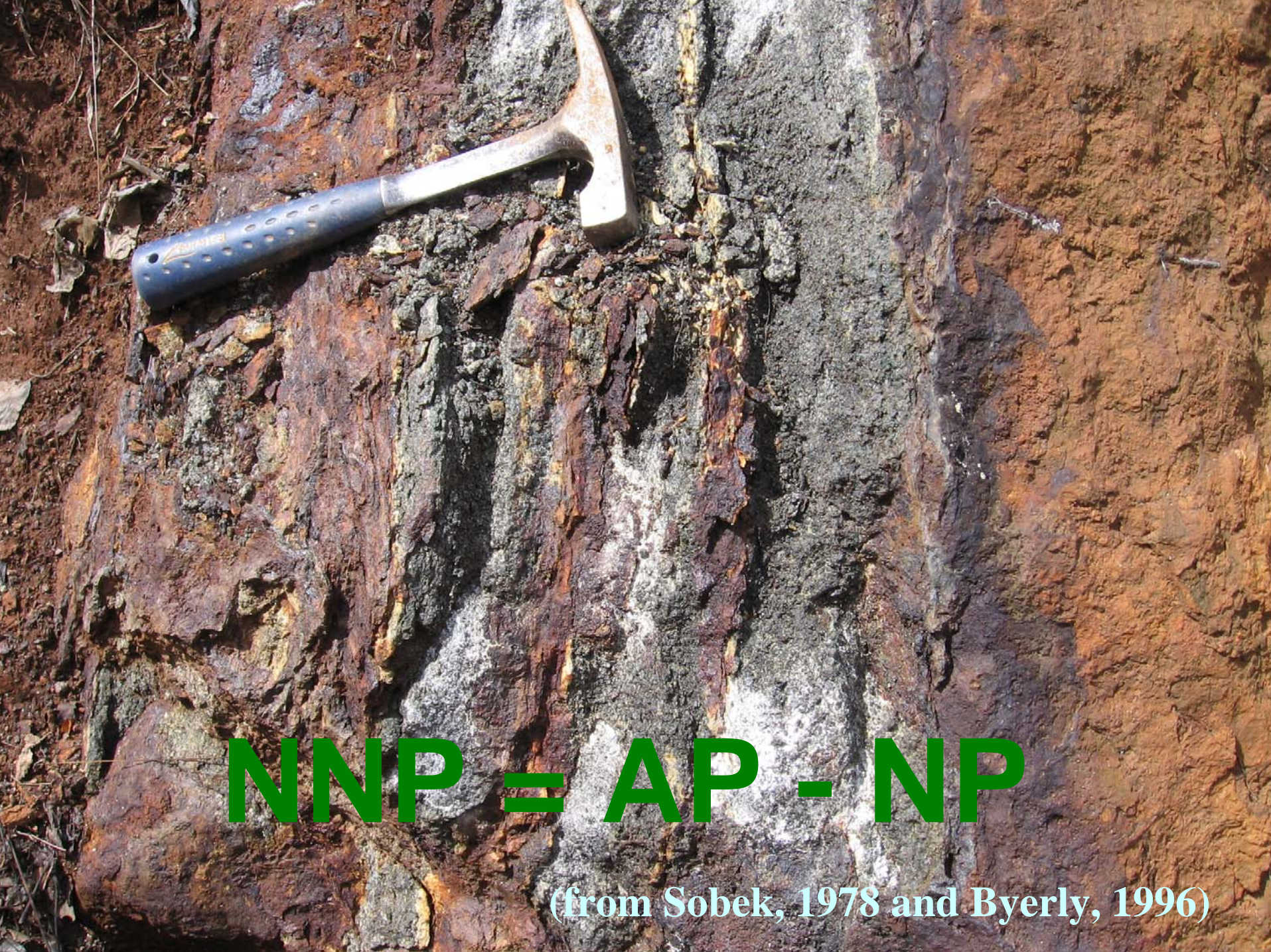
Great Smoky Slate

Mineral Bluff Formation –Moderate

Slate of Copper Hill Formation

Tusquitee Quartzite

Wehatty Formation



NNP = AP - NP

(from Sobek, 1978 and Byerly, 1996)



US 64 (Murphy, NC)

Needmore Road (Almond, NC)

US 19/74 (Almond, NC)

North Shore Road Extension (Great Smoky
Mountain National Park)

US 441 (Great Smoky Mountain National Park)

Cherohala Skyway, NC&TN

Foothills Parkway, TN

I-26 in NC&TN



Option 1: For small volume, average NNP is ~ -10 or less, hot rock can be mixed in with larger volume of waste in typical embankment.

Option 2: If a larger volume has an average NNP of -10 or slightly hotter (more negative), then it can still be put in embankments and layered with 90% CaCO_3 limestone equivalent.

Option 3: If much hotter that $\text{NNP} = -10$, then special treatment including encapsulation with impermeable geomembrane and limestone lifts would be required.



**US64 –
Murphy, NC**



**Needmore Road
along the
Little Tennessee River**







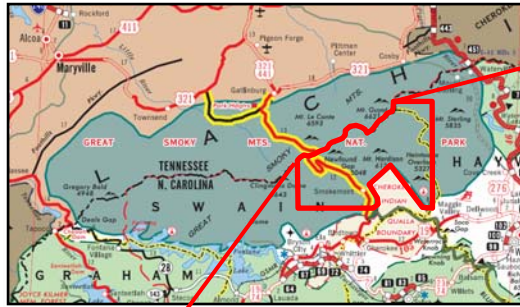
US19/US74/NC28

US19/US74/NC28

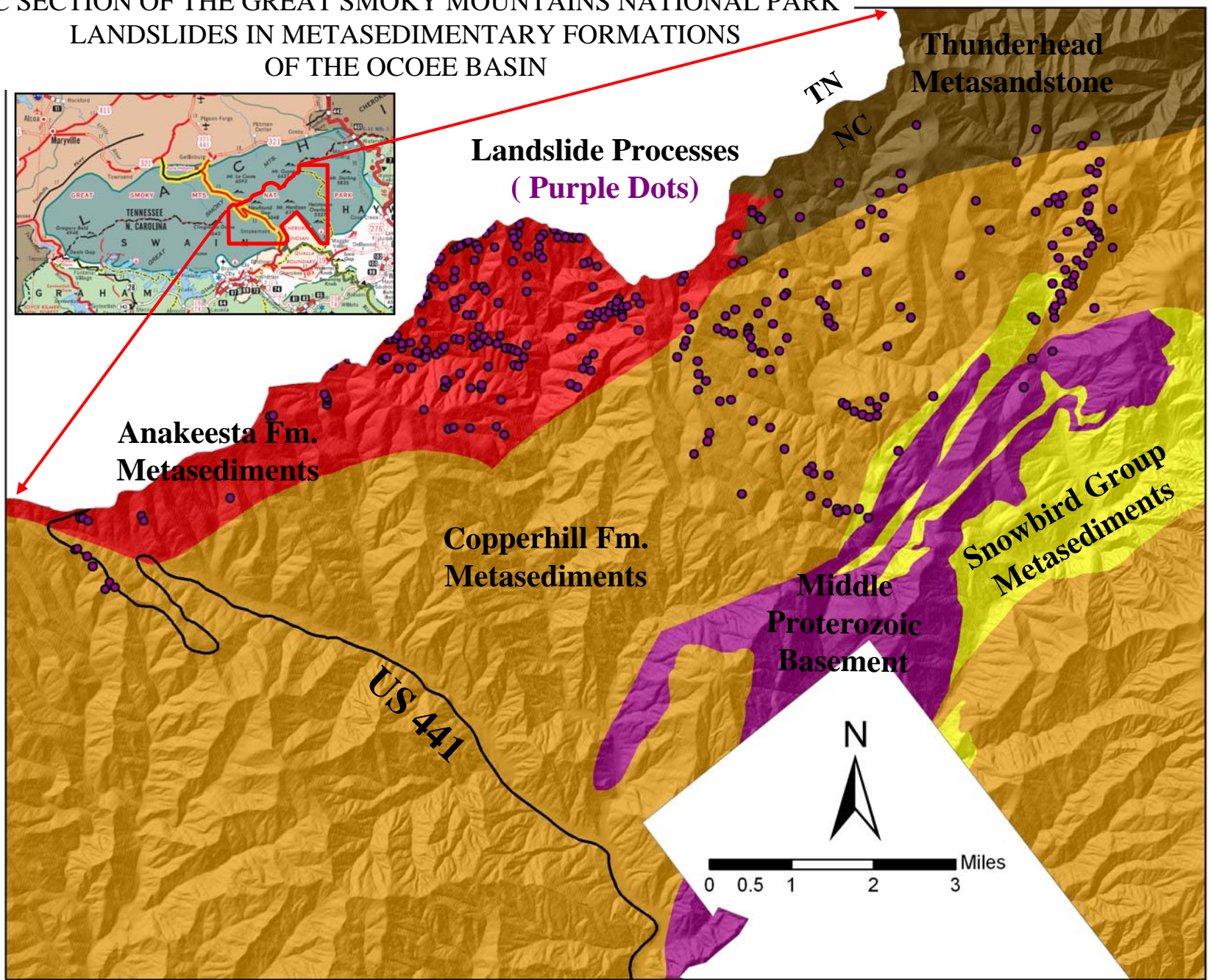




NC SECTION OF THE GREAT SMOKY MOUNTAINS NATIONAL PARK
LANDSLIDES IN METASEDIMENTARY FORMATIONS
OF THE OCOEE BASIN



Landslide Processes
(Purple Dots)



Thunderhead
Metasandstone

TN
NC

Anakeesta Fm.
Metasediments

Copperhill Fm.
Metasediments

Middle
Proterozoic
Basement

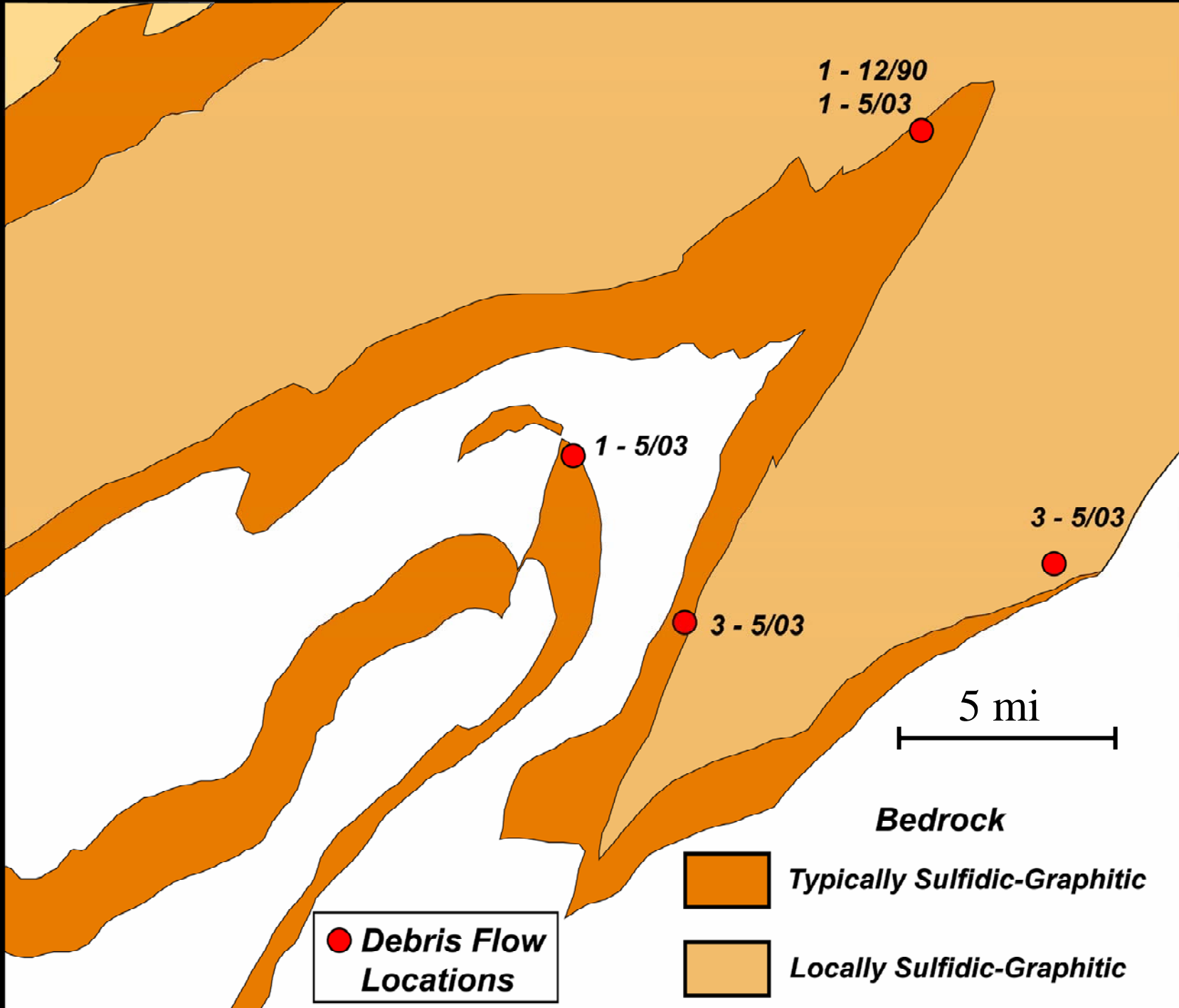
Snowbird Group
Metasediments

US 441





(From USGS, Southworth, 2005)

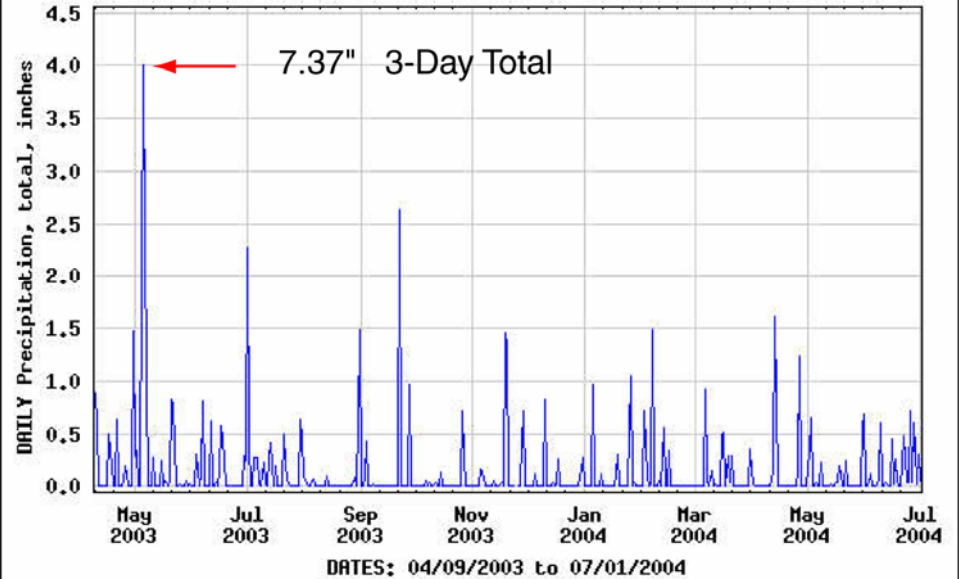


Date	Gage height, feet Maximum	Gage height, feet Minimum	Stream-flow (ft ³ /s) Mean	Precipitation total, inches Sum
04/24/2003	3.26	2.99	1,200	.00
04/25/2003	3.20	3.12	1,170	.03
04/26/2003	3.31	3.18	1,250	.19
04/27/2003	3.23	3.10	1,150	.00
04/28/2003	3.18	3.02	1,080	.00
04/29/2003*	3.09	3.02	1,040	.00
04/30/2003	3.40	3.07	1,280	1.47
05/01/2003	3.45	3.22	1,350	.29
05/02/2003	3.27	3.18	1,210	.33
05/03/2003	3.31	3.15	1,230	.00
05/04/2003	3.18	3.07	1,140	.00
05/05/2003	5.14	3.07	1,790	4.01
05/06/2003	8.06	5.14	8,860	2.42
05/07/2003	7.89	7.01	9,070	.94
05/08/2003	7.40	5.33	6,240	.00

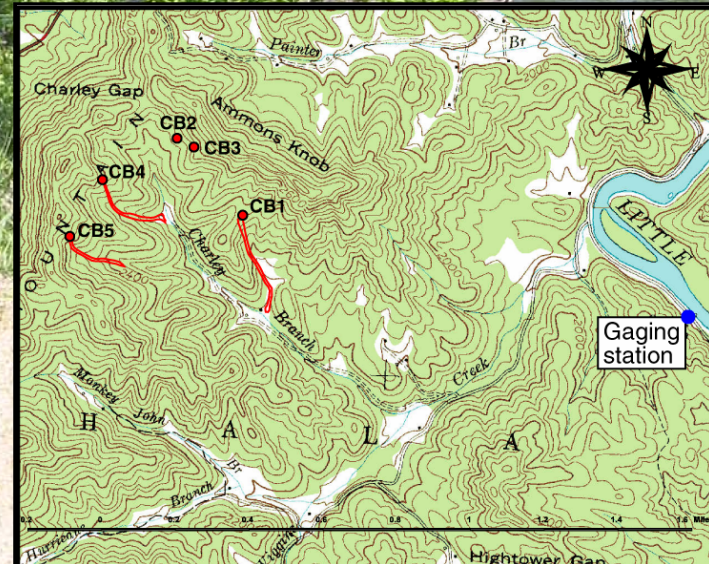
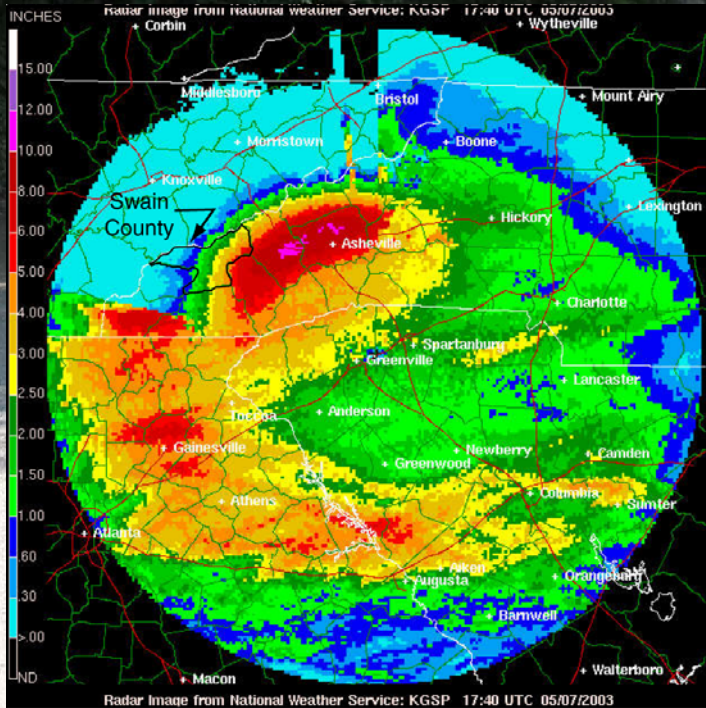
*Magnitude 4.6 earthquake in Fort Payne, AL felt locally with an intensity of III - IV.



USGS 03503000 LITTLE TENNESSEE RIVER AT NEEDMORE, NC

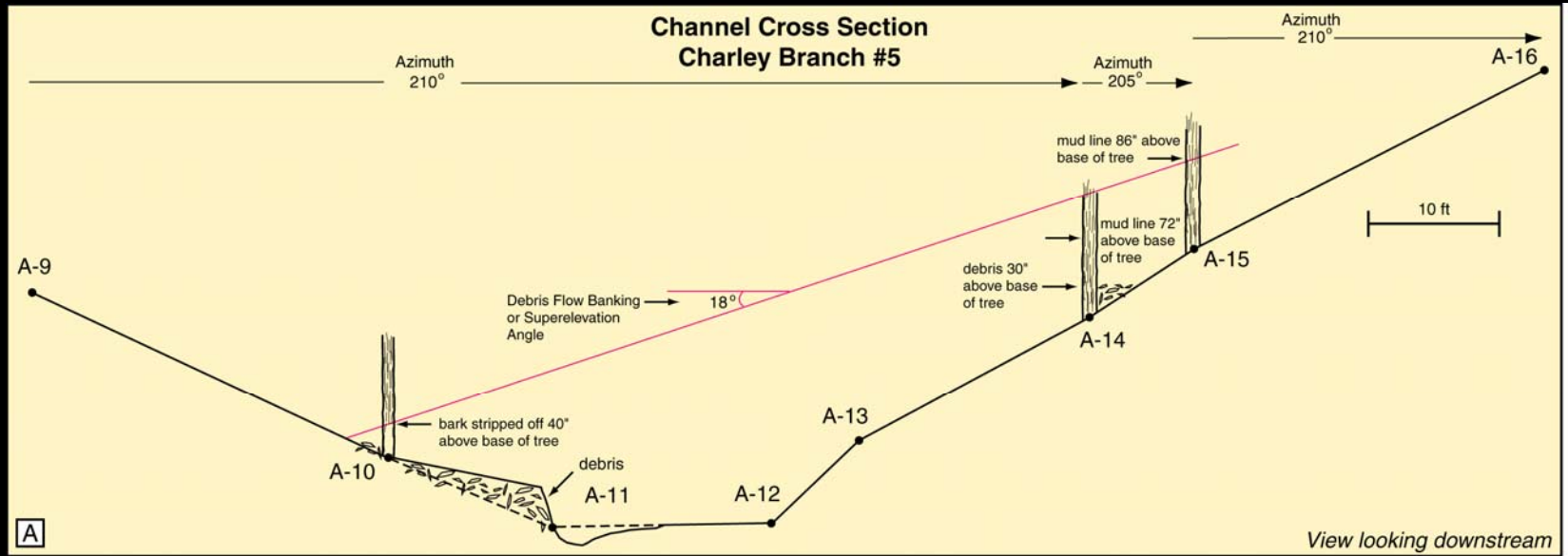


Provisional Data Subject to Revision



Velocity: 25 mph = 37 ft/sec

Discharge: 30,000 ft³/sec



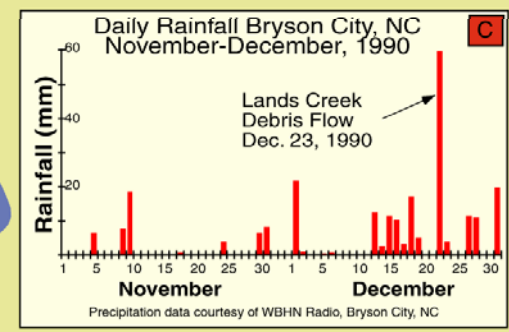
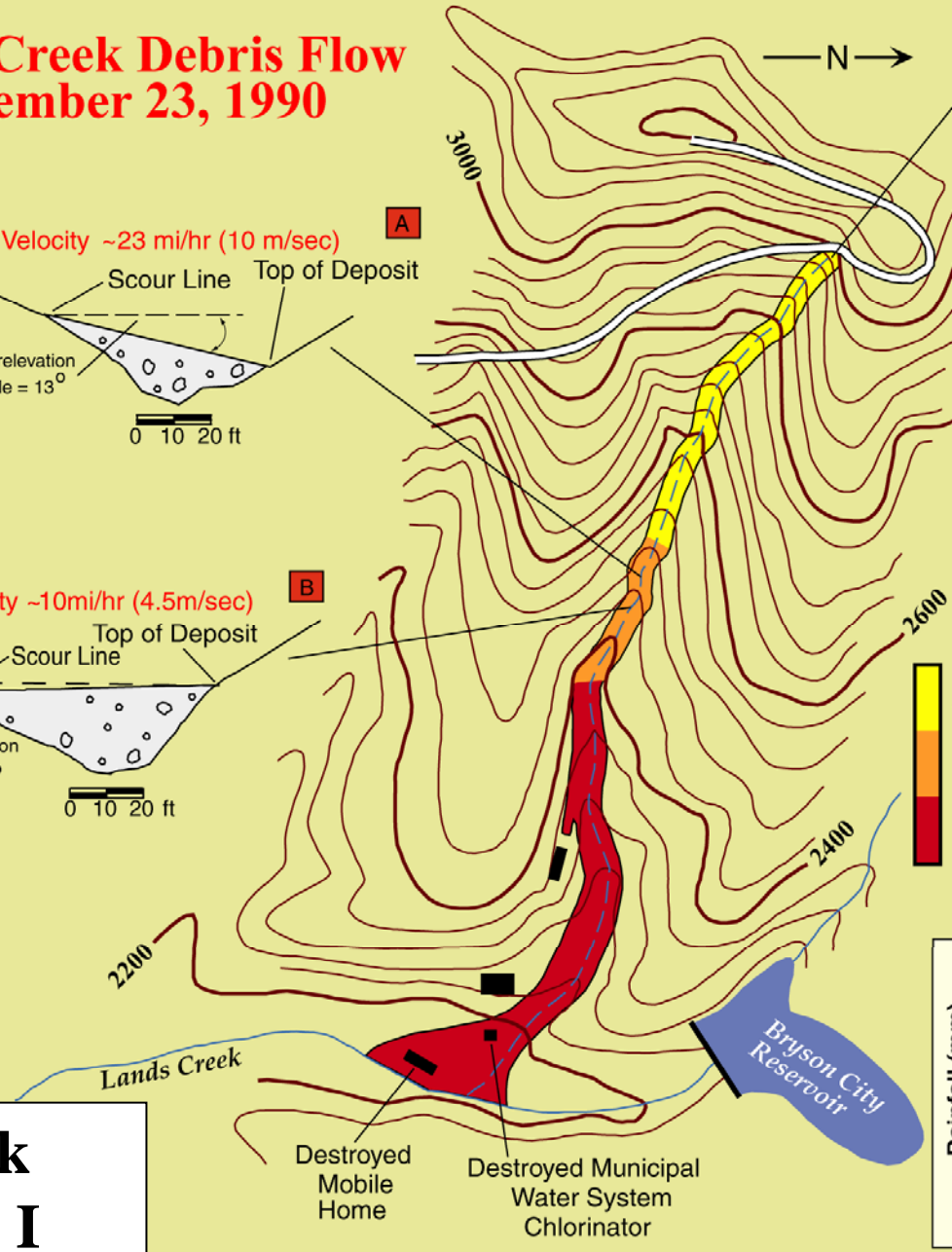
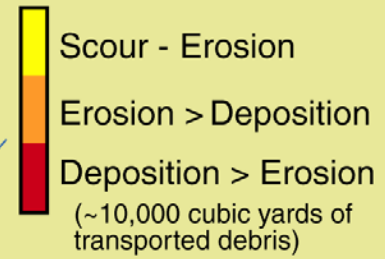
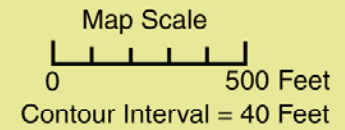
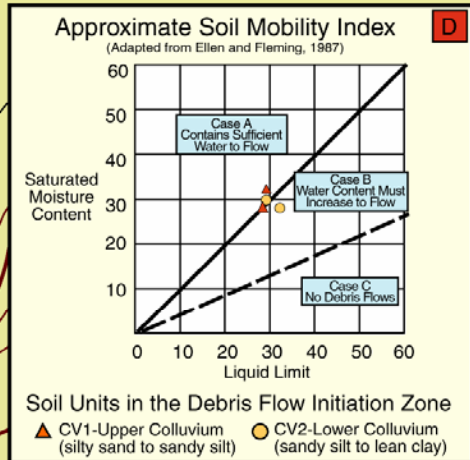
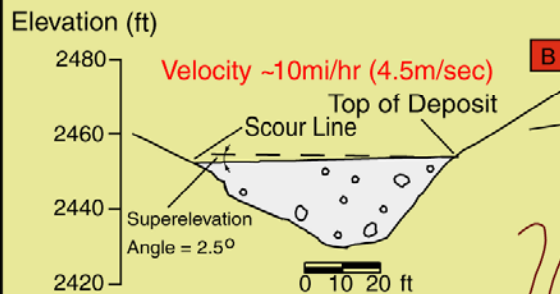
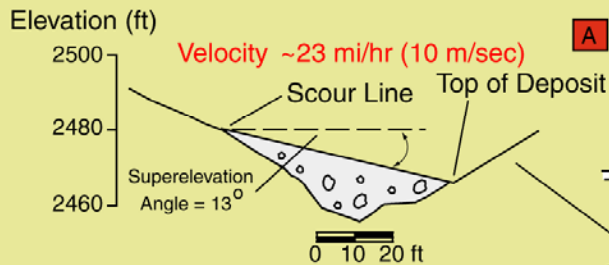


Charley Branch Debris Flows
May 5-7, 2003 Swain County



Charley Branch Debris Flows
May 5-7, 2003 Swain County

Lands Creek Debris Flow December 23, 1990



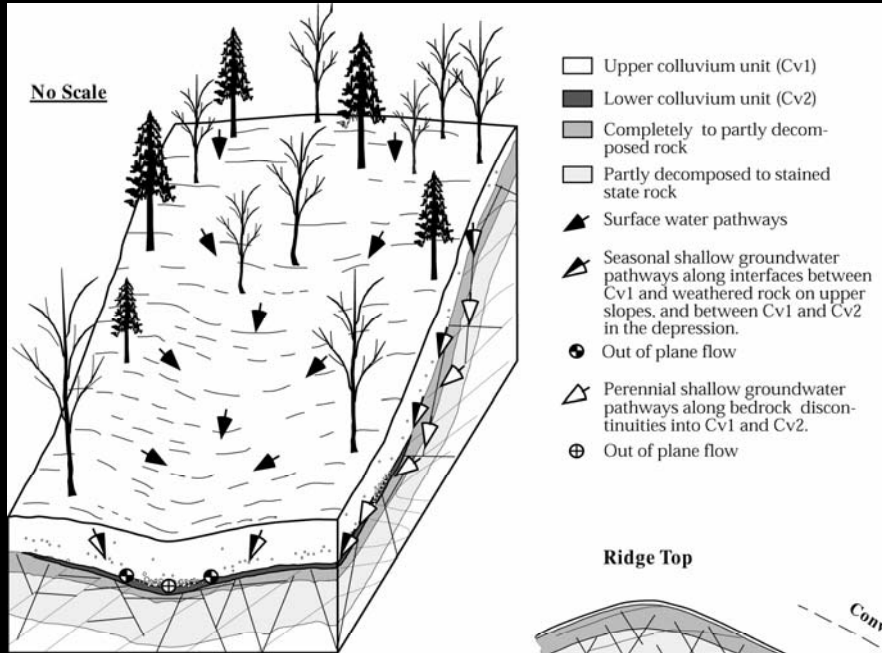
Lands Creek Debris Flow I December 23, 1990

Lands Creek Debris Flow I

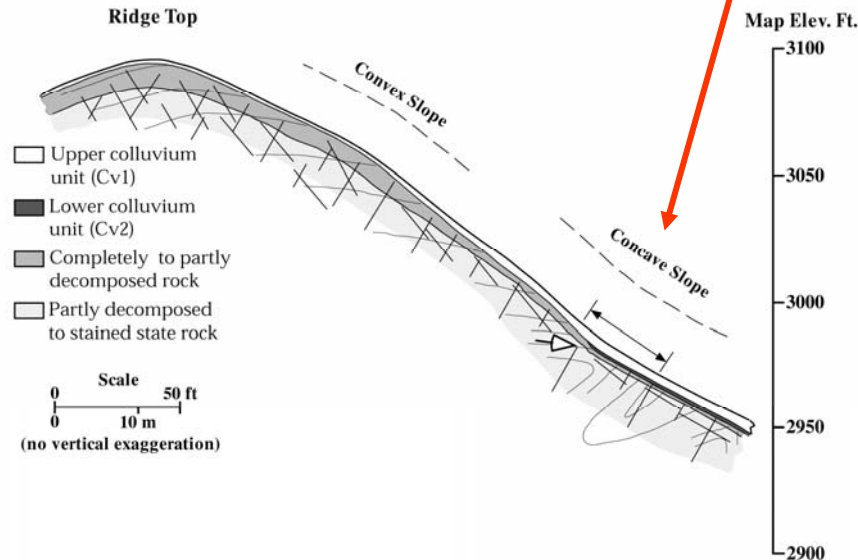
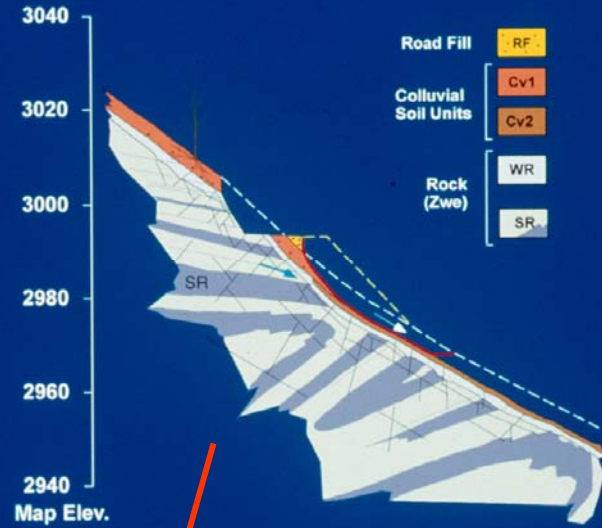


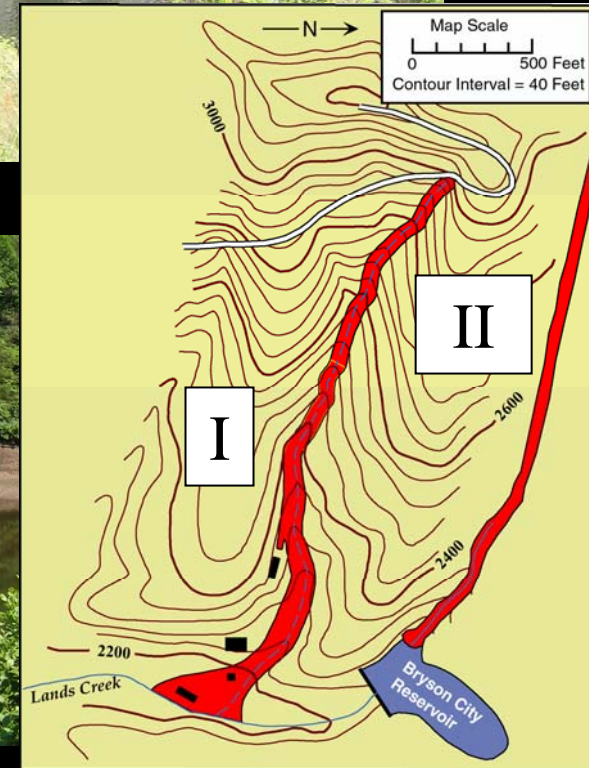
Dec. 23, 1990
Swain County

Lands Creek Debris Flow I

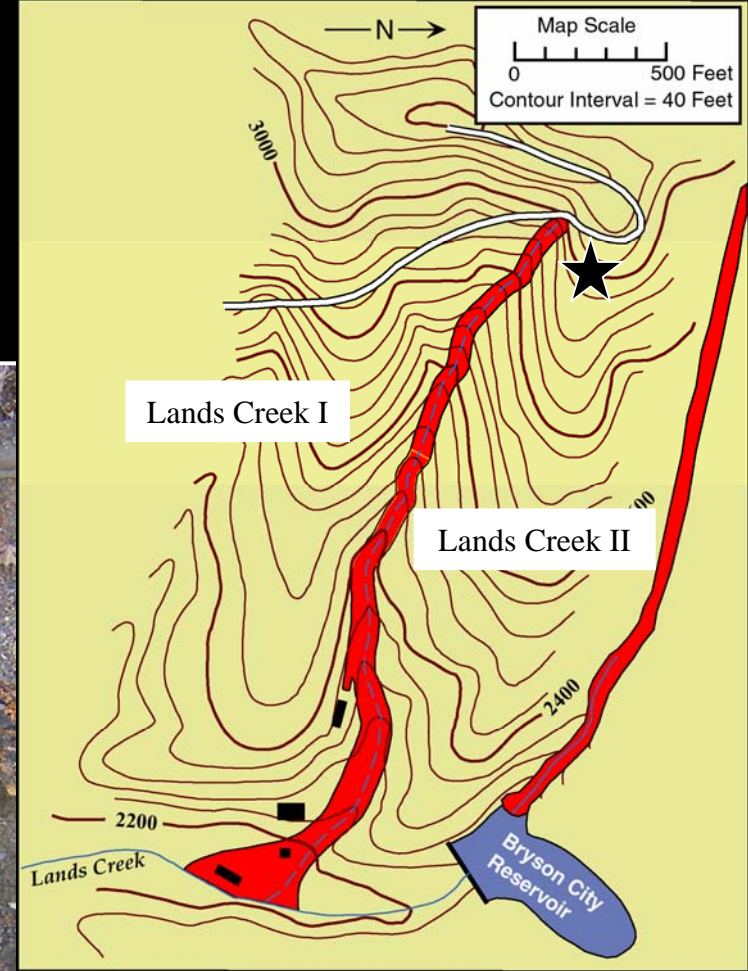


Geologic Cross Section Through Debris Flow Initiation Zone





Lands Creek Debris Flow II – May 5-7, 2003 – Swain County

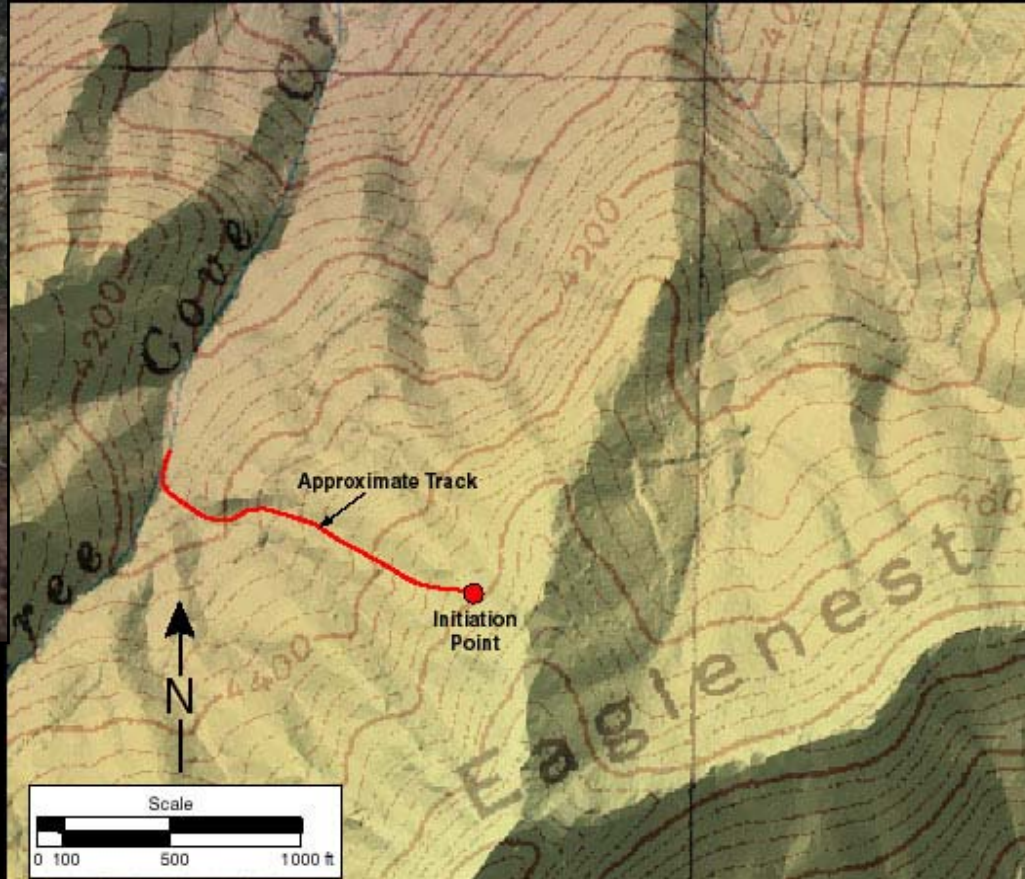


**Lands
Creek III
?**

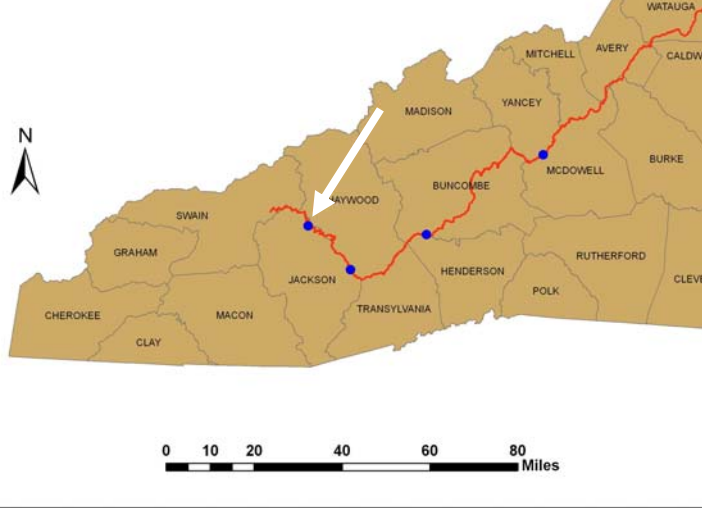


Eaglenest Ridge

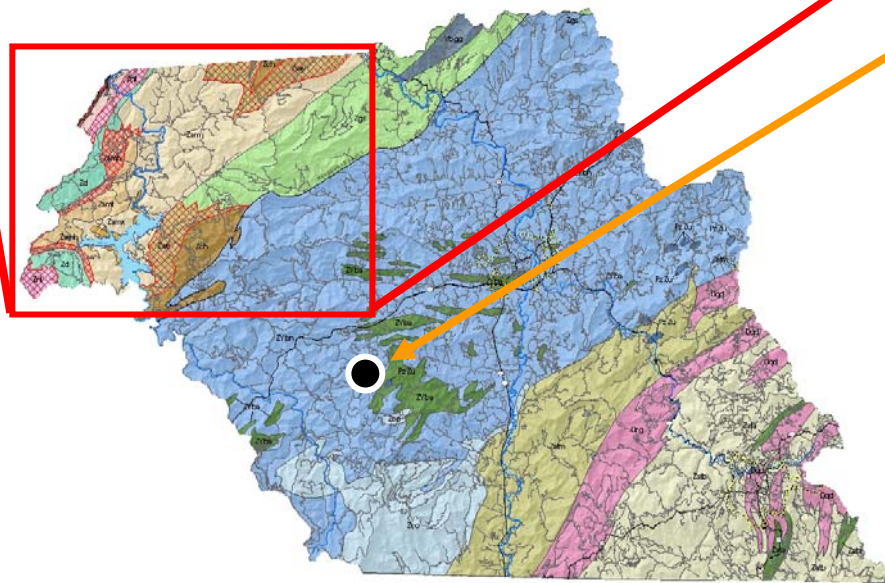
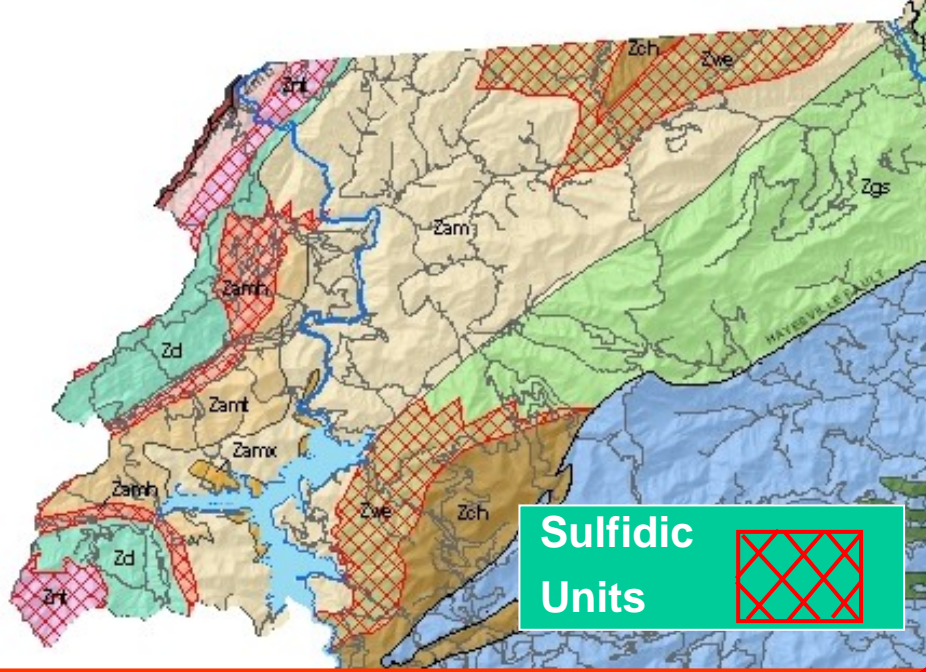
August 31, 2006



**Rock Slide
Blue Ridge Parkway
Mile Marker 452
Cranberry Ridge Overlook
August 18, 2006**







Macon County General Bedrock Geologic Units

Locations of Inactive and Abandoned Mines in North Carolina

Candor
Acid
Drainage
Landslides

Phoenix Mine
Collapse

North State Mine
Subsidence

Loflin Mine
Arsenic

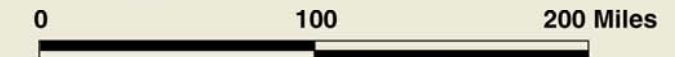
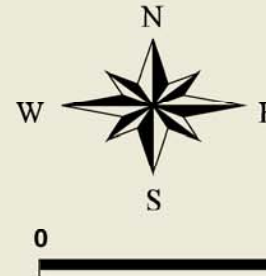
Mine Locations

- Unknown Subsurface Workings
- Known Subsurface Workings

□ Municipal Boundaries

County Boundaries	Projected population growth - 2000 Census
□	-1591 - 1123
□	1124 - 5286
□	5287 - 12238
□	12239 - 25580
□	25581 - 170943

— Interstate Highways



Acidic Conditions



Sulfide Oxidation

- Engineering Problems
- Geochemical Releases



Questions?



Tommy Douglas
North Carolina Geological Survey

2090



NC DEPARTMENT OF
ENVIRONMENT AND
NATURAL RESOURCES

<http://www.geology.enr.state.nc.us>

828-296-4639

Tommy.Douglas@ncmail.net