North Carolina Department of Environmental Quality
Policy and Innovation Group

Kenneth B. Taylor, State Geologist

North Carolina Geological Survey
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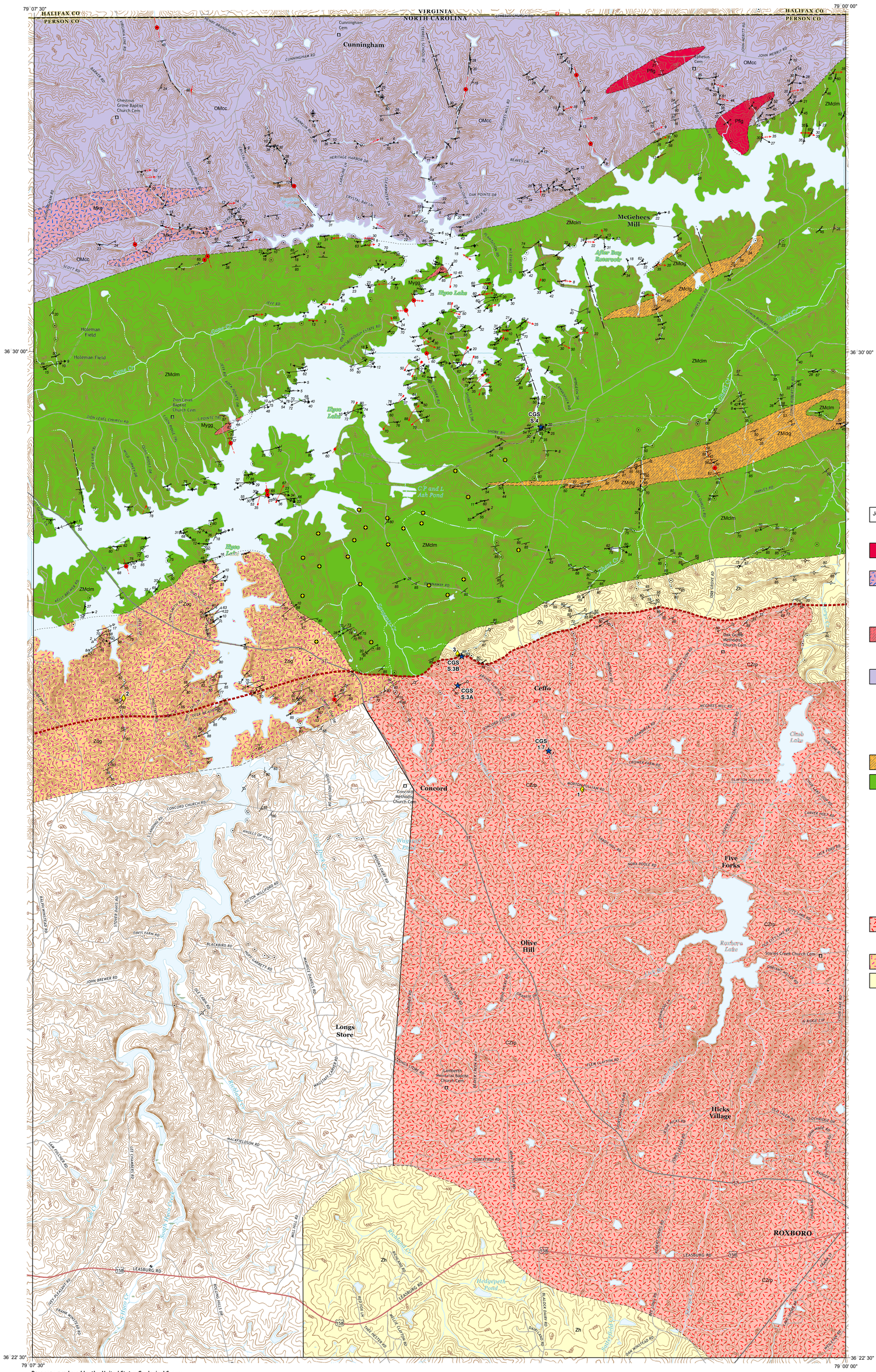

EXPLANATION OF MAP SYMBOLS

CONTACTS AND OTHER FEATURES

- inferred
- concealed
- diabase inferred
- approximate southeastern limit of Hyco shear zone (gradational)
- linear geomorphic feature interpreted from hillshade LiDAR - origin unknown
- Strike and dip of inclined main phase foliation (SM)
- Strike and dip of inclined main phase foliation (multiple observations at one location)
- Vertical main phase foliation
- Vertical main phase foliation (multiple observations at one location)
- Strike and dip of inclined main phase foliation and layering (SM + LYR)
- Strike and dip of inclined main phase foliation and layering (SM + LYR) (multiple observations at one location)
- Vertical main phase foliation and layering (SM + LYR)
- Horizontal main phase foliation and layering (SM + LYR)
- Strike and dip of inclined late phase foliation (SL)
- Strike and dip of inclined late phase foliation (SL) (multiple observations at one location)
- Horizontal late phase foliation (SL)
- Strike and dip of late pegmatite dike
- Strike and dip of late pegmatite dike (multiple observations at one location)
- Vertical late pegmatite dike
- Vertical late pegmatite dike (multiple observations at one location)
- Bearing and plunge of mineral lineation (LM)
- Horizontal mineral lineation (LM)
- Bearing and plunge of main phase fold axis (FM)
- Horizontal main phase fold axis (FM)
- Bearing and plunge of late phase fold axis (FL)
- Horizontal late phase fold axis (FL)
- Observation station location
- Diabase station location
- Groundwater monitoring well locations with bedrock data Duke Energy Roxboro Steam Electric Plant (SynTerra, 2015)

1 U-Pb age dates with associated number

1 – U-Pb age date - 546.5 +3.0/-2.4 Ma; Roxboro granite (Wortman et al., 2000)
2 – U-Pb age date - 612.4 +5.2/-1.7 Ma; Osmond biotite granite gneiss (Wortman et al., 2000)
3 – U-Pb age date - 619.9 +4.5/-3.0 Ma; Hyco Formation felsic gneiss (Wortman et al., 2000)

CGS 1.7 2017 Carolina Geological Society field trip stop location with number (Hibbard et al., 2017)

CGS 1.7 - Roxboro granite
CGS S.3A - Roxboro granite - nature of Virgilina deformation
CGS S.3B - Roxboro granite - nature of Virgilina deformation
CGS S.4 - Country Line Complex in Hyco shear zone

INTRODUCTION

This is a compiled geologic map of data from geologic investigations along the Hyco Shear Zone. Detailed discussions of the geologic interpretations are provided in Hibbard et al. (1998) and Hibbard et al. (2017). Monitoring well boring location data from the Comprehensive Site Assessment Report for the Duke Energy Roxboro Steam Electric Plant (SynTerra, 2015) is included on the map. Geologic contacts of Glover and Sinha (1973) were modified based on newly collected geologic data.

Unit Descriptions

Jd

Jd – Diabase: Black to greenish-black, fine- to medium-grained, diabase; consists primarily of plagioclase, augite and may contain olivine. Occurs as dikes up to 100 ft wide. Typically occurs as spheroidally weathered boulders with a grayish-brown weathering rind.

Alleghanian granitoids (ca. 335-319 Ma)

Pflg

Pflg - Farmers Lake granite: Light grey, weakly to moderately foliated, homogeneous fine- to medium-grained biotite granite. The granite occurs as sporadic stocks and dikes, most of which are too small to be resolved at 1:24,000 scale mapping. It intrudes the Kilgore granite, the Cunningham complex, and the Country Line complex. A U-Pb zircon age date of 319.6 +/-0.7 Ma on the granite (Yanceyville Quadrangle.) is interpreted to reflect the crystallization age of the pluton (Wortman et al. 1998).

Mkg

Mkg - Kilgore orthogneiss: Medium grey, medium- to coarse- grained, K-feldspar-plagioclase-quartz-biotite orthogneiss. Locally megacrystic and heterogeneously deformed; feldspar commonly displays a distinct 'clastic' texture. Deformation ranges from a single, weak to moderate foliation to the northwest to an intense, gneissic foliation in the southeast, along the contact between the pluton and adjacent Country Line complex. In most places along the contact, the Kilgore granite gneiss is concordantly interlayered with gneiss of the Country Line complex, although locally, it crosscuts layering in the complex (Shell, 1996). The Kilgore gneiss also contains enclaves of amphibolite and diorite lithically identical to immediately adjacent Country Line complex rocks in the hangingwall. These enclaves range from equidimensional pods in the north to elongate narrow lenses and layers in the south. The mafic enclaves contain a gneissic layering and foliation that is generally oblique to the foliation in the surrounding granitoid. A 327 ± 1.5 Ma U-Pb zircon age from the Kilgore granite (on the Leasburg Quadrangle.) is interpreted as the crystallization age for the pluton (Wortman et al., 1998).

Mygg

Mygg - Yanceyville Orthogneiss (included in the Country Line complex): Whitish to light grey, foliated, medium- to coarse-grained biotite granite gneiss. Overprinted by the same sequence of deformation as the surrounding mafic gneisses in the Country Line complex. Contains xenoliths of the enclosing layered mafic gneisses and locally, dikes of the granite gneiss crosscut layering in the mafic gneisses (Shell, 1996). The Yanceyville granite gneiss has a U-Pb zircon age of 335.4 +/- 2.2 Ma (Wortman et al. 1998) (on the Yanceyville Quadrangle).

Milton Terrane – Milton-Chopawamsic Arc (ca. 475-450 Ma)

OMcc

OMcc - Cunningham complex: Heterogeneous mixture of medium to dark grey biotite gneiss and biotite schist ranging from massive, equigranular granitic gneiss to layers and lenses of biotite ± garnet ± sillimanite schist. The most common rock type is biotite gneiss that represents a hybrid between these two end-members, although distinct irregular-shaped areas of either end-member can be found. The granitic gneiss is locally K-feldspar megacrystic with crystals up to 50 mm long. Layering, at centimeter to meter scale, is defined by feldspar porphyroclast concentration as well as biotite content; it is generally subtle in most of the unit, but it is accentuated near the contact of the gneisses with the Country Line complex. Locally, meter-scale pods of amphibolite, dioritic gneiss, and calc-silicate gneiss are enveloped in a matrix of biotite gneiss. The granitic gneiss is compositionally similar to and appears to grade into the Carboniferous Kilgore orthogneiss. The biotite schist is similar to, and appears to grade into the Ordovician(?) Milton schist and paragneiss. Thus the complex appears to be a mixture of Ordovician and Mississippian rocks.

Carolina Terrane

The Country Line complex (ca. 614 – 323 Ma)

ZMclg

ZMclg – Unseparated biotite granite orthogneiss: Buff weathering, medium grey, weakly to strongly foliated, mainly medium grained biotite granite.

ZMclm

ZMclm – Neoproterozoic mafic gneiss and amphibolite interlayered with Mississippian pegmatites and orthogneiss: Greenschist to amphibolite facies mafic gneisses with interlayered granitoids and granitic pegmatites; subordinate biotite gneiss and minor metapyroxenite, semipelitic schist, and felsic schist (Shell, 1996). The mafic gneisses range from amphibolites to biotite-amphibole gneisses. Commonly, they are layered on a centimeter to meter scale, although in some places they are massive, with a medium- to coarse-grained gabbro-like texture. The mafic gneisses are extensively interlayered with granitic pegmatites, locally envelope brownish-grey, fine-grained granitoids, and are intruded by cross-cutting granitic pegmatites.

North of the Yanceyville granite gneiss (Yanceyville and Leasburg quadrangles), the complex is characterized by a very regularly layered (centimeter-scale), fine- to medium-grained gray biotite + blackish green amphibole gneiss with interlayered granitic gneiss (Shell, 1996). Locally, over the span of a few meters, the regularly layered gneiss grades into migmatite (sensu lato) with a network of foliated coarse granitoid containing meter scale pods of amphibolite with layering and foliation oblique to that in the granitoid.

Biotite gneiss is a minor component of the Country Line complex; typically it is a fine- to medium-grained equigranular, gray quartz-feldspar-biotite + garnet gneiss. Generally it forms massive and homogeneous lens-shaped bodies that are too small to be resolved at 1:24,000.

Zircon from a layered mafic gneiss sub-unit in the South Boston, VA area has yielded a discordant upper intercept age of 613.9 +/-9.3 Ma that is interpreted to reflect a protolith age for the mafic gneisses. Zircon and sphene from the same sample have yielded a concordant age of ca. 323 Ma (Wortman et al., 1998). Concordantly interlayered pegmatites increase in volume towards the Mississippian Yanceyville orthogneiss (Yanceyville and Leasburg quadrangles), suggesting that the concordant pegmatites are also Mississippian. Thus, the complex is a mixture of Neoproterozoic and Mississippian rocks.

Albemarle Arc (ca. 550-530 Ma)

CZrp

CZrp - Roxboro Pluton: Massive to locally very weakly foliated, leucocratic (CI less than 10), pinkish, medium- to coarse-grained, hypidiomorphic granular, metamorphosed granite. Mafic minerals present in rock are most commonly biotite intergrown with chlorite and/or hornblende intergrown with actinolite. Pluton map pattern truncates Aaron Formation units and Hyco Formation volcanics. Wortman et al. (2000) reported a U-Pb age of 546.5+3.0/-2.4 Ma for the Roxboro pluton. Boulder fields are a common geomorphic expression above the Roxboro pluton.

Hyco Arc (ca. 635-610 Ma)

Zog

Zog - Osmond Granite: Light grey, fine- to medium-grained, foliated biotite granite. Wortman et al. (2000) reported a U-Pb age upper intercept date of 612.4 +5.2/-1.7 Ma.

Zh

Zh - Hyco Formation: Dominantly greenschist facies felsic volcanic and volcaniclastic rocks with subordinate intermediate and mafic components. The formation extends along the eastern margin of the Hyco shear zone. Primary features are well preserved in most of the Hyco Formation. The most common rock type is felsic crystal tuff containing abundant anhedral crystals of either quartz or plagioclase up to 3 mm in diameter. The tuffs are typically interlayered with felsic lapilli tuffs, quartz-muscovite phyllites, pebbly volcanic conglomerate, and intermediate to mafic crystal tuffs. The Hyco Formation records felsic to intermediate magmatism during a ca. 20 m.y. span starting at ca. 633 Ma (Wortman et al., 2000; Bradley and Miller, 2011).

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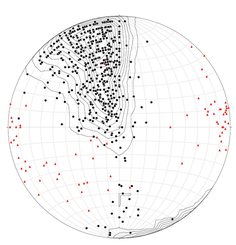
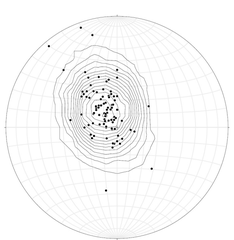
Equal-Area Schmidt Net Projections and Rose Diagram

Plots and calculations created using Stereonet v. 8.6.0 based on Allmendinger et al. (2013) and Cardozo and Allmendinger (2013).

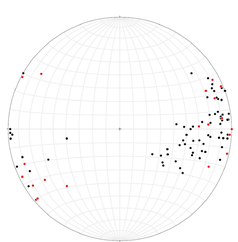


Equal Area Schmidt Net Projection of Contoured Poles to Main Phase Foliation and Layering (SM) [black circles] and Bearing and Plunge of Main Phase Lineations (LM) [red triangles]
Contour Interval = 2 sigma
Main Phase Foliation N = 525
Main Phase Lineation N=79

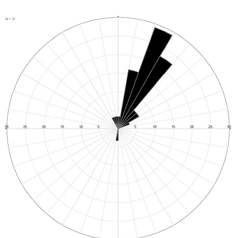
Contours displayed for SM only



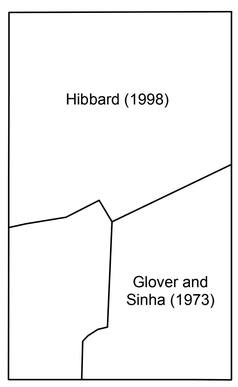
Equal Area Schmidt Net Projection of Contoured Poles to Late Phase Foliation (SL)
Contour Interval = 2 sigma
N =95



Equal Area Schmidt Net Projection of Bearing and Plunge of main phase fold axes (FM) [red circles] and late phase folds axes (FL) [black circles]



Unidirectional Rose Diagram of Late Pegmatites
N = 31
Outer Circle = 30%
Mean vector = 025.0° ± 06.6°
Max value =29.03226% between 021° and 030°



INDEX TO GEOLOGIC MAPPING

Base map produced by the United States Geological Survey
Modified by the North Carolina Geological Survey for use with this map.

North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and 1 000-meter grid: Universal Transverse Mercator, Zone 17S
10 000-foot ticks: North Carolina Coordinate System of 1983

This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery.....NAIP, June 2014
Roads..... U.S. Census Bureau, 2015 - 2016
Names.....GNIS, 2016
Hydrography.....National Hydrography Dataset, 2014
Contours.....National Elevation Dataset, 2008
Boundaries.....Multiple sources; see metadata file 1972 - 2016

Wetlands.....FWS National Wetlands Inventory 1977 - 2014

UTM GRID AND 2016 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
For Olive Hill Map

U.S. National Grid
100,000-m Square ID
PA
Grid Zone Designation
17S

SCALE 1:24 000

1 0.5 0 KILOMETERS 1 2
1000 500 0 METERS 1000 2000
1 0.5 0 1
MILES
1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000
FEET

CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the National Geospatial Programs US Topo Product Standard, 2011. A metadata file associated with this product is draft version 0.6.19

QUADRANGLES LOCATION

ADJOINING QUADRANGLES
1 Milton
2 Alton
3 Cluster Springs
4 Leasburg
5 Roxboro
6 Ridgeville
7 Hurdle Mills
8 Timberlake
9 Olive Hill

ROAD CLASSIFICATION
Expressway
Secondary Hwy
Ramp
Local Connector
Local Road
4WD
Interstate Route
US Route
State Route

ALTON, NC/VA
OLIVE HILL, NC

Compiled Geologic Map of the Hyco Shear Zone and Adjacent Portions of the Alton and Olive Hill 7.5-Minute Quadrangles, Person County, North Carolina

Geology by: James P. Hibbard (includes modified contacts of Lynn Glover, III and A.K. Sinha)

Digital Cartography by: Brandon T. Peach, Michael A. Medina, and Philip J. Bradley

2017

Environmental Quality

NC STATE UNIVERSITY

This is an Open File Map. It has been reviewed internally for conformity with North Carolina Geological Survey mapping standards and with the North American Stratigraphic Code. Further revisions or corrections to this Open File map may occur.

ACKNOWLEDGEMENTS

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