2.6 GEOLOGY

This section presents a brief description of the geologic conditions present at and in the vicinity of the VCSNS site.

2.6.1 PHYSIOGRAPHY AND GEOMORPHOLOGY

The site is located within the Piedmont Physiographic Province of central South Carolina. The Piedmont Physiographic Province is bounded on the southeast and northwest by the Coastal Plain and Blue Ridge Physiographic Provinces, respectively (Figure 2.6-1). The site lies approximately 2 1/4 miles northwest of Jenkinsville, South Carolina, and about 1 mile east of the Broad River (Figure 2.1-3). The site topography is characteristic of the region, consisting of gently to moderately rolling hills and generally well-drained mature valleys. Within the 6-mile site area, topography ranges from about 560 feet to 210 feet MSL. All local streams drain into the Broad River. The local drainage pattern is generally dendritic; however, a subtle trellis pattern is also evident and probably a result of regional bedrock structure and joint systems. Steep gullies exist within the site area resulting from differential weathering of the basement rock and possible exacerbation by previous agricultural activity.

Most of the local terrain is mantled by residual soils and saprolite that overly igneous and metamorphic bedrock at depth. Relatively few natural bedrock outcrops are present within the site area, which is characteristic of the long weathering history and deep residual soil development of the Piedmont. The original undisturbed soils at the site typically consist of red to reddish-brown stiff clayey and silty soils with varying sand content. With depth, the soils become more yellow to reddish-brown micaceous sandy silt and/or silty sand.

2.6.2 SITE GEOLOGY

The VCSNS site lies within the Charlotte terrane, a region characterized by Neoproterozoic to Early Paleozoic plutonic rocks that intrude a suite of mainly metaigneous rocks (Hibbard et al. 2002). Within the site area, geologic units can be subdivided into three major rock categories. The first and oldest major rock category consists of amphibolite grade metamorphic rocks. The second category consists of felsic plutonic rocks that intrude the amphibolite grade metamorphic rocks. The third and youngest category consists predominantly of mafic rocks associated with Mesozoic diabase dikes that intrude the other two major rock types.

The site is located within the Winnsboro plutonic complex, a granitoid plutonic complex that includes abundant xenoliths of older surrounding greenschist- and amphibolite-facies metamorphic rocks (Secor et al. 1982; Figure 2.6-2). The felsic Winnsboro plutonic complex intruded the metamorphic country rock, which is composed primarily of interlayered and folded gneiss and amphibolite. Lithologic contacts and foliations in the metamorphic rocks exhibit a predominant northeast striking structural grain and are interpreted to represent metamorphosed rocks of igneous, volcanic, and sedimentary origin (Secor et al. 1982; Figure 2.6-2).

The Carboniferous plutonic rocks at the site are composed primarily of granodiorite, which yielded Rb-Sr and K-Ar ages of about 300 million years from unweathered samples obtained from the excavation for Unit 1 (Dames & Moore 1974). Borehole data from the area of proposed Units 2 and 3 indicates that the Winnsboro plutonic complex at the site includes a range of igneous rock compositions and textures that include granodiorite, quartz diorite, migmatite, and pegmatite dikes (MACTEC 2007).

The youngest rock type in the site area exists as a series of steeply dipping diabase dikes that were emplaced during the Mesozoic extension associated with rifting of the Atlantic Ocean (Figure 2.6-2). Individual dikes strike N15°-30°W, are several miles long, and typically a few to tens of feet thick.

A relatively thick weathering profile is developed on the bedrock units in the site area. Borehole data for proposed Units 2 and 3 reveals that the thickness of residual soil and saprolite ranges from several feet to several tens of feet (MACTEC 2007). Locally, alluvium is present along the Broad River, within Frees Creek, and in the flatter segments of smaller drainages and erosion gullies.

There are no known volcanic hazards that could impact the site. This is based on the geologic and tectonic setting of the old, stable cratonic crust in which the last documented volcanic activity occurred during Mesozoic rifting of the Atlantic Ocean. Earthquakes, however, do continue to occur within the old, stable crust, albeit at a relatively low rate of recurrence. The most significant historical earthquake to occur within the site region was the 1886 Charleston, South Carolina, earthquake. This event produced Modified Mercalli Intensity X shaking in the Charleston epicentral area and about VI-VII shaking in the site area. Small to moderate size earthquakes do occur throughout the Appalachian region and at distances much closer to the site than the 1886 Charleston earthquake. An example of this seismicity is the 1913 m_b 4.8 Union County earthquake, which was likely centered greater than 50 miles north of the site. This earthquake produced lower shaking intensities at the site than the larger, more distant 1886 Charleston earthquake.

2.6.3 GROUNDWATER

The hydrogeology of the VCSNS site is consistent with the hydrogeology of the Piedmont Province. Groundwater at the site occurs in two hydrogeologic zones—an upper zone within the residual soil, saprolite, and weathered bedrock profile and a deeper zone within the jointed and fractured crystalline bedrock. The groundwater flow regime in the upper zone roughly mimics the topography and discharges into drainage swales, whereas the deeper zone in the fractured bedrock flows westward towards the Broad River. For additional details on groundwater, refer to Subsection 2.3.1.2.

Section 2.6 References

1. Dames & Moore 1974. *Supplemental Geologic Investigation, Virgil C. Summer Nuclear Station — Unit 1*, Fairfield County, South Carolina, prepared for SCE&G, 1974.

2. Hibbard et al. 2002. Hibbard, J. P., Stoddard, E. F., Secor, D. T., and Dennis, A. J. *The Carolina Zone: Overview of Neoproterozoic to Early Paleozoic Peri-Gondwanan Terranes along the Eastern Flank of the Southern Appalachians, Earth Science Reviews,* v. 57, p. 299-339, 2002.

3. MACTEC (MACTEC Engineering and Consulting, Inc.) 2007. *Final Data Report, Results of Geotechnical Exploration and Testing,* MACTEC Project Number 6234-06-3534, 2007.

4. Secor et al. 1982. Secor, D.T., Peck, L, Pitcher, D., Prowell, D., Simpson, D., Smith, W., Snoke, A., *Geology of the area of induced seismic activity at Monticello Reservoir, South Carolina,* Journal of Geophysical Research, Volume 87, p. 6945-6957, 1982.

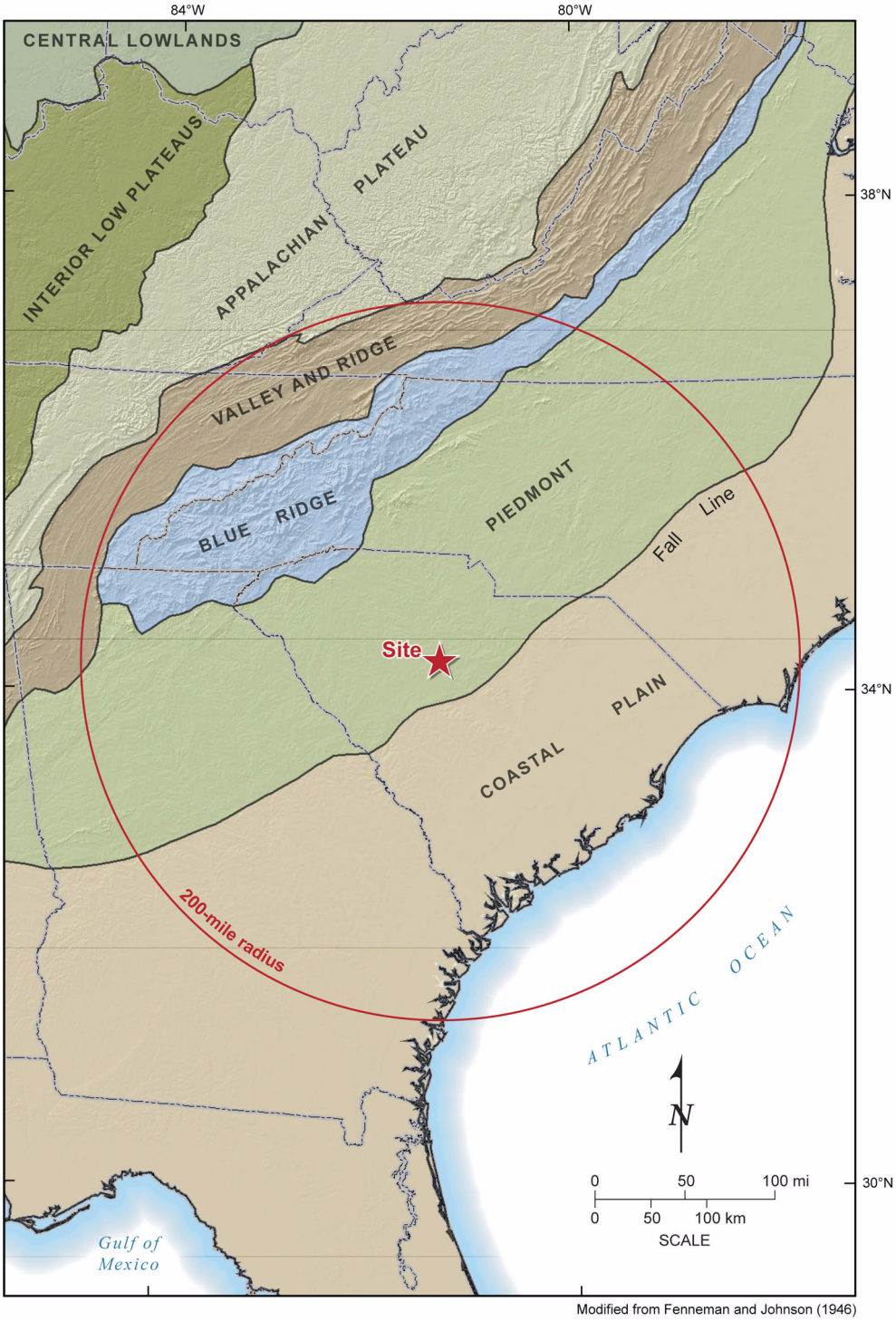

Figure 2.6-1. Map of Physiographic Provinces

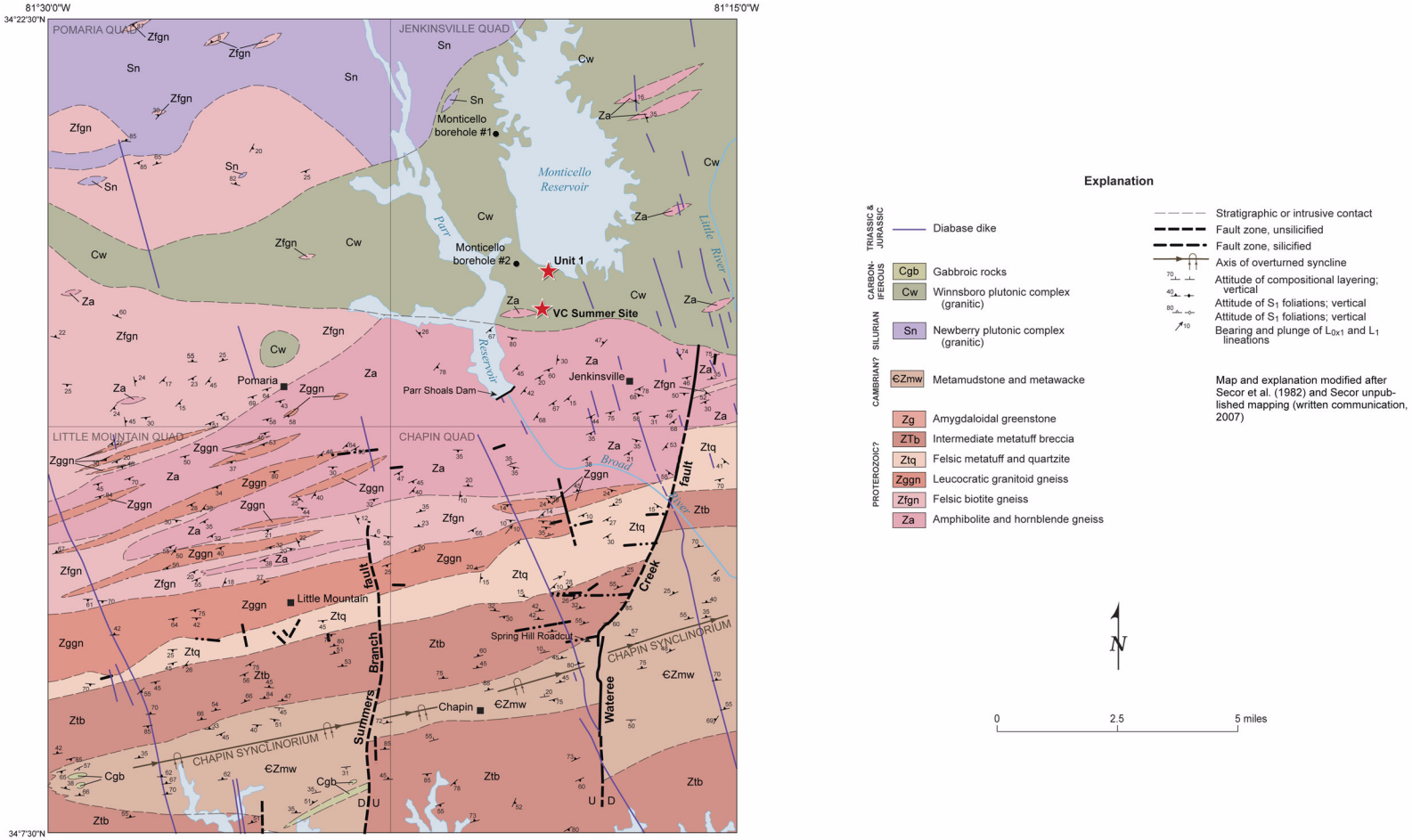

Figure 2.6-2. Geologic Map of the Jenkinsville, Pomaria, Little Mountain, and Chapin 7.5-Minute Quadrangles