3.0 NATURAL SETTING

3.1 Physiographic Setting

It is potentially misleading to describe the location of archaeological site 7NC-B-54 (Ronald McDonald House) as within the Piedmont physiographic province. Although this is technically correct, the Delaware Piedmont is very different from that seen elsewhere. Delaware contains only a small extent of Piedmont (due to modern political boundaries), and it is proximal to both the Coastal Plain and to salt water. The Delaware Piedmont is within a short distance of the coast, standing in marked contrast with the Piedmont physiographic province located in states further to the south, such as Virginia and North Carolina. The compressed nature of physiographic zones in northern Delaware undoubtedly had an impact on pre-contact period settlement, exposing the pre-contact period peoples who occupied the area to highly diverse resources with minor shifts in settlement locations.

Site 7NC-B-54 (Ronald McDonald House) is located on a small ridge nose overlooking the Alapocas Run (formerly known as Blue Ball) drainage in Delaware's Piedmont, which occupies the northernmost six percent of the state (DNREC 1997:3). The elevation of the site is approximately 97.8 m (321.0 ft) above mean sea level. The Piedmont is characterized as a transition zone between the Appalachian physiographic province to the northwest and the Coastal Plain physiographic province to the south.

3.2 Geology, Lithic Raw Materials, and Soils

With the exception of the extreme northern Piedmont portion of Delaware, all of the state is comprised of loose and poorly consolidated Cretaceous-aged sediments, not rock (Delaware Geological Survey 1976). The Piedmont physiographic province is an eroded and dissected area of uplands developed on these metamorphic crystalline bedrocks (Costa and Cleaves 1984). The rocks present in the vicinity of archaeological site 7NC-B-54 (Ronald McDonald House) are a mixture of metamorphic gneisses and plutonic igneous rocks designated as the Wilmington Complex (Delaware Geological Survey 2007). "The tectonic setting proposed for the origin of the Wilmington Complex is thought to be the deep part of a volcano that developed over an east dipping subduction zone," the tectonic events that produced the Appalachian Mountain System (Delaware Geological Survey 2007). These rocks are estimated to be more than 500 million years old (Woodruff and Plank 1995).

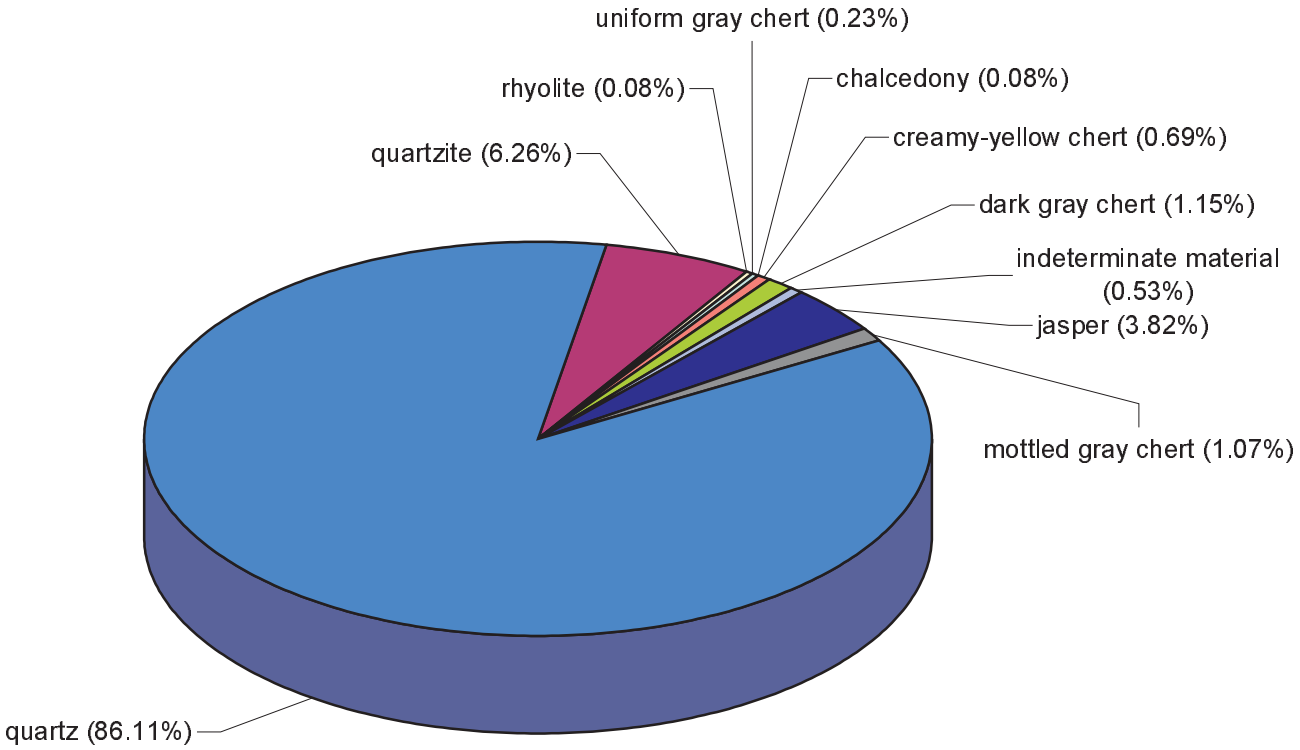
The gneisses in this area are called “blue rocks“ because of their color; however if exposed, they weather to a blue-gray or gray color. “Since their formation approximately 570,000,000 years ago, these rocks have experienced a long history of burial, high-grade metamorphism, deformation, uplift, and erosion” (Delaware Geological Survey 2007). The metamorphism has totally recrystallized the rock to produce a monolithic body of rock that is well suited to house and fence construction.

Lithic raw materials represented in the Site 7NC-B-54 (Ronald McDonald House) artifact assemblage include quartz, quartzite, jasper, cherts, chalcedony, and rhyolite (Figure 3; Table 1). In general, primary (i.e., bedrock) sources of lithic raw materials are uncommon in the vicinity of archaeological site 7NC-B-54 (Ronald McDonald House) as the majority of this area is covered by a think mantle of Pleistocene sediments. While this situation virtually excludes surficial bedrock exposures of raw material, the same processes that resulted in the deposition of these sediments also transported a variety of knappable stone from primary outcrops located to the north. Thus, Native American knappers could have selected from a variety of lithic raw materials, including chalcedony, chert, quartz, and quartzite from secondary deposits (e.g., stream terraces, lag deposits, gravel bars) for stoneworking (Catts *et al.* 1988:14). Many of these lithic resources, particularly quartz, quartzite, and jasper originate in the metamorphic formations of the Piedmont physiographic province.

Table 1.
Percentage of Lithic Raw Material by Individual Cluster and Full Site Assemblage

Lithic Raw Material	Cluster 1 Activity Area	Cluster 4 Activity Area	Cluster 5 Activity Area	Cluster 6 Activity Area	Full Site Assemblage*
Chalcedony					0.08%
Creamy Yellow Chert	6.09%			0.12%	0.69%
Dark Gray Chert	0.87%	1.01%		0.46%	1.15%
Jasper	35.65%		1.92%	0.12%	3.82%
Mottled Gray Chert	7.83%	1.01%			1.07%
Quartz	28.70%	95.96%	67.31%	95.93%	86.11%
Quartzite	13.91%	2.02%	29.81%	3.37%	6.26%
Rhyolite					0.08%
Uniform Gray Chert	1.74%		0.96%		0.23%
Indeterminate	5.22%				0.53%

*Includes all excavated artifacts from Site 7NC-B-54 (Ronald McDonald House), including those not assigned to any of the four studied cluster activity areas.



1310 Total Artifacts

DELAWARE DEPARTMENT OF TRANSPORTATION	
BLUE BALL AREA TRANSPORTATION IMPROVEMENTS PHASE III SITE 7NC-B-54 (RONALD MCDONALD HOUSE) BRANDYWINE HUNDRED NEW CASTLE COUNTY	
RAW MATERIALS, FULL ASSEMBLAGE	
FIGURE - 3	SKELLY and LOY Inc. CONSULTANTS IN ENVIRONMENT - ENERGY ENGINEERING - PLANNING

Common in Delaware lithic assemblages is quartz, a tenacious stone of variable flaking quality. The majority, or 86.11 percent, of the lithic artifacts recovered from archaeological site 7NC-B-54 (Ronald McDonald House) are quartz. Quartz is the most common mineral on earth and is found in nearly every geological environment. It is hard, rating a "7" on the Moh's Hardness scale, and exhibits cohesiveness, but is less than ideal for toolmaking because its fracture is not truly conchoidal (Baaken 1993:5). Unlike other easily knapped raw materials, "quartz has a large-scale crystal structure (although individual crystals are not normally apparent)" which causes it to "break along crystal plains, so the fracture is hard to control" (Baaken 1993:5). Also the resulting break is irregular, and may have areas where the break is flat rather than curved (Baaken 1993:5). Due to the difficulty of knapping quartz, it is often seen in the archaeological record as expedient tools.

Breaking open a quartz cobble produces a number of usable flakes with very sharp edges. These can be used for various cutting tasks and discarded as they become dull. They can be discarded so casually because an absolute minimum of time and effort is put into their creation (Baaken 1993:5). The local availability of the quartz may have helped offset the difficulty of working with the material in toolmaking.

Primary sources of siliceous raw materials in Delaware are also found within what is called the Delaware chalcedony complex (Wilkins 1976), a conglomeration of cherts, jaspers, and chalcedonies of variable knapping quality (Wall *et al*. 2001:16). Most of these materials are probably jaspers of variable knapping quality (Custer 1989:56), such as the material called Iron Hill jasper, found in an aboriginal quarry context at Site 7NC-D-34. Jasper accounts for only 3.82 percent of the lithic raw materials at Site 7NC-B-54 (Ronald McDonald House). Argillite, found in Lockatong formation deposits in the Piedmont region of northern Mercer County, New Jersey (Didier 1975; Widmer 1965:21-22), is also common on sites in the region (Custer 1989), although none was identified at archaeological site 7NC-B-54 (Ronald McDonald House). The popularity of argillite as a lithic raw material declined during the Late Woodland period, when it was replaced by jasper, chert, and other siliceous raw materials (Wall *et al*. 2001:16).

In many areas of the eastern United States, the precise definition of chert or other raw material types can be used to pinpoint the procurement location (outcrop) and allow for a rough approximation of territorial range of a group to be determined. In Delaware, however, most artifacts made of chert, quartzite, and chalcedony consist of materials derived from secondary deposits; thus, many regional specialists do not assign the raw material to a specific named type (e.g., Jacoby *et al.* 1997; Petraglia *et al.* 1998). Cherts comprise less than 3.5 percent and

chalcedony less than 1.0 percent of the lithic raw materials identified in the Site 7NC-B-54 (Ronald McDonald House) artifact assemblage.

Occasionally, artifacts from primary bedrock sources are found on sites in the region. Sources of Iron Hill jasper are located to the southwest of the site area near Newark. This distinctive material varies in color from yellow to dark brown and ranges in quality from excellent to poor. When good to excellent quality jasper is found, a wide variety of lithic tool forms are easily made (Petraglia and Knepper 1996). In addition to being found in primary outcrops, jasper cobbles can be found as secondary sources in certain streams on the Delmarva Peninsula. Approximately 3.82 percent of the lithic raw materials found at archaeological site 7NC-B-54 (Ronald McDonald House) are jasper.

Primary sources of ironstone, an iron-cemented sandstone, are located along the Elk River and Herring Island at the upper end of the Chesapeake Bay (Ward 1988:7). This material is noted with some frequency from site assemblages located in the general vicinity of archaeological site 7NC-B-54 (Ronald McDonald House), and Ward (1988:15) notes a cluster of sites with relatively high proportions of ironstone in the vicinity of Churchman's Marsh, which is located southwest of the site location.

Exotic raw materials occasionally encountered on archaeological sites in the region include argillite and rhyolite, both with primary outcrops located to the north and west of the archaeological site location. Rhyolite comprises less than 1.0 percent of the lithic raw materials identified at archaeological site 7NC-B-54 (Ronald McDonald House). Upper and Middle Alapocas Run offer cobble packages of knappable quartz and quartzite. These cobbles are exposed in the stream bed, and appear to be the same as the lithic raw materials used at Site 7NC-B-54 (Ronald McDonald House).

The following general soils information is taken from the *Soil Survey of New Castle County, Delaware* (Matthews and Lavoie 1970). The soil association mapped at the site is the Neshaminy-Talleyville-Urban land. This soil association consists of level to moderately sloping, well-drained, medium-textured soils that range from being relatively undisturbed to severely disturbed. The soils in this association have formed over dark-colored gabbraic rocks on upland topographic landforms. The specific soil type mapped at the site is Talleyville silt loam, 2 to 5 percent slopes, moderately eroded (TaB2). This soil type has a profile consisting of a very thick surface layer and subsoil that developed in two distinctly different kinds of material. The surface layer and upper part of the subsoil developed in a mantle of silty material. The lower part of the subsoil developed in material weathered in place from diabase and other dark-colored rocks. Geomorphological investigations at the archaeological site confirmed the mapped soil type and

the integrity of those soils. Based on the lack of plow scars and the presence of an E horizon in the excavated profiles at Site 7NC-B-54 (Ronald McDonald House), it appears that the soils present have either never been plowed, or have been only lightly plowed during the historic period. Despite the lack of evidence for ceramic manufacture or use at archaeological site 7NC-B-54 (Ronald McDonald House), the soils present in the vicinity of the site contain suitable potting clay that would have been available to the pre-contact period peoples using or traveling through the area. A sample of clay from the bank of Alapocas Run was collected, was used to form a coil-built pot, and was successfully fired over coals (Christopher Espenshade, personal communication 2007).

3.3 Paleoenvironment

Since several references (e.g., Custer 1984; Dent 1995) contain complete and detailed discussions of the paleoenvrionment of Delaware, including the archaeological site location, and no pollen samples were available for study at archaeological site 7NC-B-54 (Ronald McDonald House), the following discussion of climate, flora, and fauna is general. Ice core records from Greenland and Antarctica and sediment records from the world's oceans have shown that over the past 100,000 years, climate has varied substantially across the globe. Within the Pleistocene epoch, the most significant ecological changes were associated with glacial pulses; however, since northern Delaware was located well south of the actual glaciers, its climate was only indirectly influenced by them (Dent 1995:73). These indirect influences came in the form of sea level rise and fall, as well as changing climatic, floral, and faunal regimes.

Sea level rise has not been consistent over time. From *ca.* 14,000-15,000 years ago to 7,000 years ago, sea level rose fairly rapidly, while after that it rose less rapidly (Dent 1995:83). By approximately 3,000 years ago, even though sea level rise continues, the formation of the Chesapeake Bay was essentially complete (Dent 1995:84). Based on the calculations of sea level rise for the Chesapeake Bay area, humans could have been exploiting estuarine resources for many years prior to the formation of the bay (Dent 1995:84). Along with the rise in sea level came a concomitant rise in the water table, which caused the formation of many inland wetlands that may also have been exploited by pre-contact period peoples in the area. These “Holocene wetlands, themselves secondary effects of the transgression sequence, soon presented unique interior habitats that became important foci for prehistoric settlement and subsistence systems” (Dent 1995:85). Some of the wetlands, no doubt, were present in the vicinity of archaeological site 7NC-B-54 (Ronald McDonald House).

Regional floral and faunal communities began to change *ca.* 10,000 years ago. Pollen records indicate the presence of beech, hemlock, and birch forests with a transition between the former pine-spruce late Pleistocene forest and the oak-hickory association, which was established *ca.* 8,200 years ago (Dent 1995:86; Whitehead 1965, 1972). The oak-hickory forest persisted until *ca.* 3,500 years ago. From *ca.* 7,600 years ago to 5,000 years ago, a warmer and moister environment led to a reduction in pine and birch along with the almost total disappearance of spruce and fir (Dent 1995:86). At *ca.* 5,000 years ago, drier conditions altered vegetation and oak became the dominant species, with increases in pine, hickory, and walnut. Major non-arboreal taxa include cinnamon fern, blueberry, and elderberry (Dent 1995:87). Many of the arboreal and non-arboreal flora would have contributed to the diet of the pre-contact period peoples using the area. From 5,000 years ago to 1,700 years ago, there is a reduction in arboreal species and an expansion in herbaceous species (Dent 1995:87). Custer (1984:31) relates a sub-Boreal climatic episode to the period from 3,110 B.C. to 810 B.C. and a sub-Atlantic episode from 810 B.C. to A.D. 1000. He also equates both of these episodes to the Woodland I cultural period, the main time period associated with Site 7NC-B-54 (Ronald McDonald House). After *ca.* 1,700 years ago, the climate in the area became cooler and moister, with mixed deciduous forests reestablished (Dent 1995:87).

The modern vegetational pattern present in the archaeological site 7NC-B-54 (Ronald McDonald House) area was classified by Braun (1950) as Oak-Chestnut forest and later reclassified by Küchler (1964) as Appalachian Oak forest. This tall, broadleaf deciduous forest type is dominated by white oak and northern red oak. Other species include sugar maple, sweet birch, bitternut hickory, beech, tulip poplar, white pine, scarlet oak, scrub oak, chestnut oak, and black oak. The length of the growing season and the total annual precipitation postulated for the site area would have been sufficient to support maize agriculture, a primary component of the subsistence base of Late Woodland through historic period populations. Native mixed hardwoods would have been originally associated with the Talleyville silt loam (mapped) soils present at the archaeological site (Matthews and Lavoie 1970:37).

The floral and faunal distributions across Delmarva can be described as a mosaic with a high variety of species present in a small area (Custer 1986:46-47; Thomas *et al.* 1975). The greatest variety of animals would have been found in the grass/woodlands settings and in perennial and seasonal water sources. Principal mammal species which served as potential resources for the aboriginal inhabitants of the site area were mastodon, mammoth, musk ox, vole, lemming, mouse, white-tailed deer, caribou, elk, giant beaver, river otter, porcupine, cottontail rabbit, gray squirrel, and opossum. Important fur-bearing mammals included beaver,

muskrat, raccoon, and red and gray foxes. Dent (1995:94) states that 121 different mammalian species, 301 bird species, 28 amphibian species, and 37 reptilian species are recognized for the Chesapeake Bay area during the Holocene period. Avian fauna of aboriginal importance would have included wild turkey and ruffed grouse, as well as various species of waterfowl, including migratory species who travel the Atlantic Flyway in great numbers each year. Numerous species of fish and shellfish were available in freshwater streams and swamps, the brackish waters of the Chesapeake Bay, and the salt waters of the Atlantic Ocean.

Though the general nature of the floral and faunal resources present at the location of Site 7NC-B-54 (Ronald McDonald House) during the pre-contact period can be extrapolated from evidence in nearby areas, dramatic changes in the composition and extent of the original forest and other vegetal habitats and their associated faunal communities have occurred. Human-induced changes began with Native American land clearance practices for the creation of horticultural fields and village sites, and continued with European contact, settlement, and development. There is little reliable documentation of the composition and extents of the original floral and faunal communities locally present at archaeological site 7NC-B-54 (Ronald McDonald House). However, there is no doubt that based on the numerous and varied types of floral and faunal resources that would have been available to pre-contact period peoples occupying the site area, that hunting, gathering, trapping, and fishing would have been practiced.