METHODS

3.4 Field Methods

The archaeological field investigations at the Sandom Branch Site Complex by the CR Division were conducted in two phases—site evaluation (Phase II) and data recovery (Phase III)—consistent with conventional Cultural Resource Management practices in the State of Delaware. Each phase of investigation had distinct goals, and field methods varied according to these goals. In addition, each phase was conducted in two distinct stages. A scope of work was prepared for the first stage of each phase, and based on the results, a plan for the ensuing stage was developed. Conducting the archaeological investigations in this manner allowed for timely input from DESHPO and DelDOT officials, both in the form of document review and formal site visits during the course of fieldwork. The staged evaluation and data recovery program allowed efficient and flexible use of available resources, focusing efforts on the areas within the sites that were likely to contain the most pertinent information. Table 5-1 lists the excavations by investigation phase and stage, type, and location.

Table 5-1. Site Evaluation (Phase II) and Data Recovery (Phase III) Excavations at the Sandom Branch Site Complex by Site.

Phase	Excavation Type	7NC-J-227	7NC-J-228	Non-site	Total
Evaluation (Phase II)	Shovel Tests	103	98	10	211
	Stage 1 Units	14	10	–	24
	Stage 2 Units	12	19	–	31
Data Recovery (Phase III)	Stage 1 Units	105	118	–	223
	Stage 2 Units	123	71	–	194
	Shovel Test Totals	103	98	10	211
	Excavation Unit Totals	254	218	–	472

3.4.1 Site Evaluation (Phase II)

The purpose of the site evaluation (Phase II) was to determine the significance of the cultural resources discovered at the Sandom Branch Site Complex as a result of earlier survey investigations (Phase I). Significance was assessed on the basis of criteria required for nomination of the resource for inclusion in the NRHP, and the ability of the site to address specific research questions formulated in existing management plans for the State of Delaware (Custer 1986, 1994; Custer and De Santis 1986).

Site evaluation (Phase II) fieldwork was undertaken by the CR Division between March and August 1999. Initial work involved relocating the site, refinement of horizontal boundaries, and identification of artifact concentrations within those boundaries. Controlled surface collection at the sites was not practical due to the lack of ground surface visibility resulting from dense brush and leaf litter across the site area. A program of subsurface testing was conducted, consisting of the systematic excavation of shovel test pits (STPs) and test units.

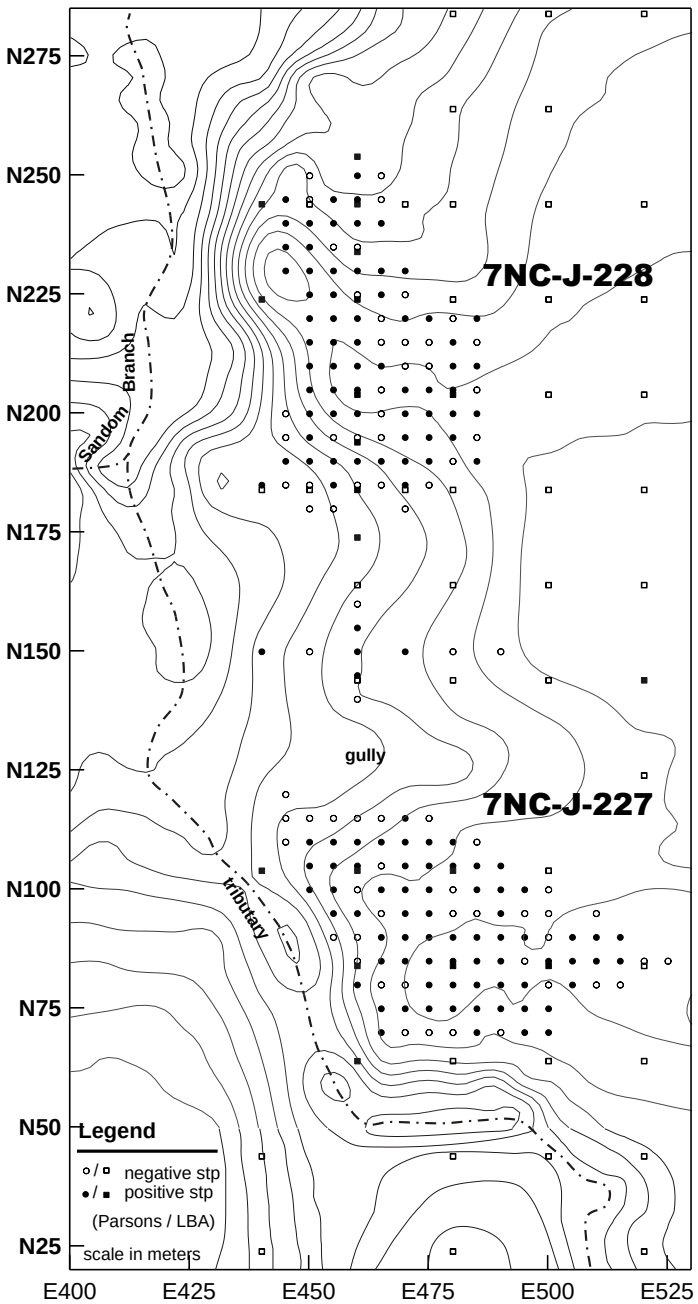

Figure 5-1. Phase I Shovel Test Grid, Sandom Branch Site Complex.

Site Evaluation (Phase II), Stage 1

In total, 211 STPs were excavated on a five-meter grid within the boundaries of the sites as drawn by LBA (Bedell and Jacoby 1998) following their identification survey (Phase I) (Figure 5-1). The centerline coordinates for the proposed SR1 ROW were used as a baseline for mapping and data controls. The baseline was established on an azimuth of 350 degrees from magnetic north and was staked at five-meter intervals. All STPs and subsequent 1-m^2 test units were assigned north and east grid coordinates relative to the baseline. Vertical controls for test units and for later block excavations were maintained by a series of intermediate datum points tied into the known elevations of the centerline stakes. Shovel test

data were used to generate artifact distribution maps that aided in the redefinition of site boundaries. Delineation of these boundaries resulted from analysis of a combination of localized topographic conditions and artifact frequencies: i.e., two consecutive negative STPs within a grid transect formed a boundary.

Each STP measured ca. 50 cm in diameter and was excavated at least 10 cm into culturally sterile subsoil. STPs were excavated by natural stratigraphic levels (i.e., by soil color/texture change), and depths were measured relative to ground surface. All sediments were screened through quarter-inch mesh hardware cloth to ensure uniform recovery of cultural materials. Stratigraphic profiles were recorded on standard forms, listing soil texture, color (using Munsell Soil Color Chart notation, 1990 Edition), and inclusions. Horizontal provenience data included site, transect, and grid coordinates (northing and easting).

Based on the results of shovel testing, 24 test units, measuring 1 m^2 each, were placed in locations selected on the basis of high artifact counts, potentially intact sub-plow zone contexts, or a lack of plow disturbance (Plate 5-1). These units confirmed the artifact concentrations and sub-plow zone potential first identified during shovel testing. Where present, plow zone deposits were excavated as a single vertical context. Below the plow zone, excavation was conducted in 10-cm arbitrary levels within natural stratigraphy. All excavated sediments were screened through quarter-inch mesh hardware cloth to ensure uniform recovery of cultural materials, and artifacts were separated by stratum and level. Profile sections were recorded for each test unit on standard forms, listing data similar to that recorded for STP excavations: soil consistency and color, and natural and cultural inclusions. Sections were also drawn to scale and documented photographically. Features identified below the plow zone were bisected and sampled to determine their morphology, contents, and if possible their cultural affiliation and function. Features were drawn and photo-documented in plan view and profile section. All unit excavations were continued until culturally sterile subsoil was reached.

Plate 5-1. Site Evaluation (Phase II) Testing at 7NC-J-228.

Site Evaluation (Phase II), Stage 2

An additional 31 test units expanded the investigation of identified features and were used to assess artifact density across the site complex. The majority of these units were placed at 10-m intervals within the Stage 1 test unit grid. At the end of site evaluation (Phase II) testing, three documents were submitted to DelDOT and DESHPO regarding the results of the investigations and recommendations for further work: a management summary, a determination of eligibility, and a data recovery plan (Rutherford 1999a, 1999b, 1999c).

3.4.2 Data Recovery (Phase III)

The results of the site evaluation (Phase II) test units confirmed the presence of discrete concentrations of prehistoric artifacts across the area comprising the Sandom Branch Site Complex. The two sites, 7NC-J-227 and 7NC-J-228, were found to retain sufficient integrity and information potential to meet eligibility Criterion D for listing in the NRHP, and on that basis, data recovery (Phase III) excavations were recommended. Field methods were aimed at addressing specific research topics developed for each site in a Data Recovery Plan, the details of which are included herein in the Research Design, Section 4.0. Like the evaluation portion of the investigation, data recovery excavations were carried out in two stages, with field consultations between the CR Division, DelDOT, and the DESHPO to discuss current results and follow-on work.

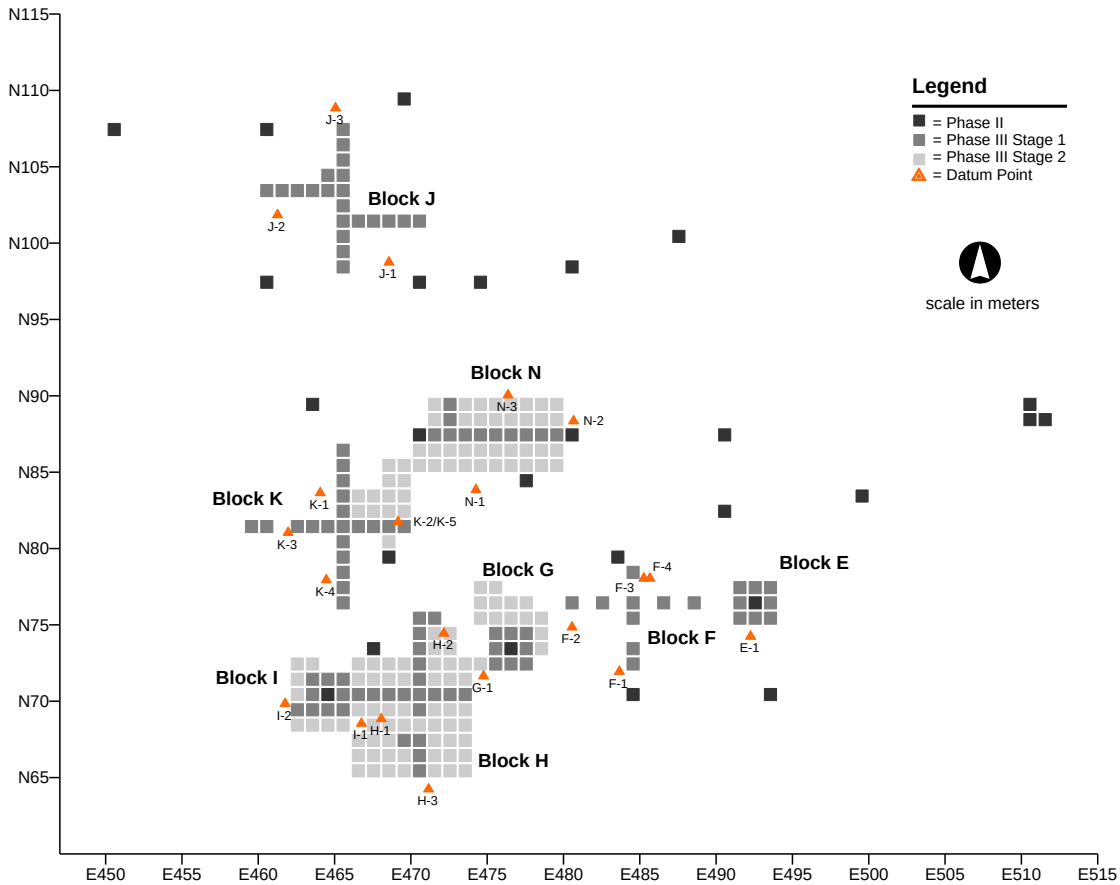

Figure 5-2. Staged Placement of Excavation Units, Site Evaluation (Phase II) and Data Recovery (Phase III), 7NC-J-227.

Data Recovery (Phase III), Stage 1

The initial stage of data recovery consisted of the excavation of 223 excavation units (1 m^2) distributed within the two sites so as to provide both comprehensive coverage of the main site areas and coverage of peripheral areas that contained lower artifact densities. The focus of the excavations was broad exposure in specific locations identified as a result of site evaluation (Phase II) testing, with units arranged in a series of block excavations. The sites were excavated simultaneously, and excavation blocks were assigned alphabetic designations

in sequence, A through N, and in their order of excavation, without regard to site. Similarly, features were recorded on a single, sequential feature log for both sites, to avoid potential record-keeping errors associated with duplicate numbering.

7NC-J-227. Small blocks of 8 to 9 units were excavated at 7NC-J-227 (Blocks E, G, I) to investigate individual thermally altered stone features (Figure 5-2). In addition, trench-like or cruciform configurations comprised of 9 to 21 units (Blocks F, H, J, K) were used to examine areas between features, as well as a concentration of prehistoric ceramic sherds. A trench comprised of 11 units (Block N) was used to examine an intermediate area with less evident activity.

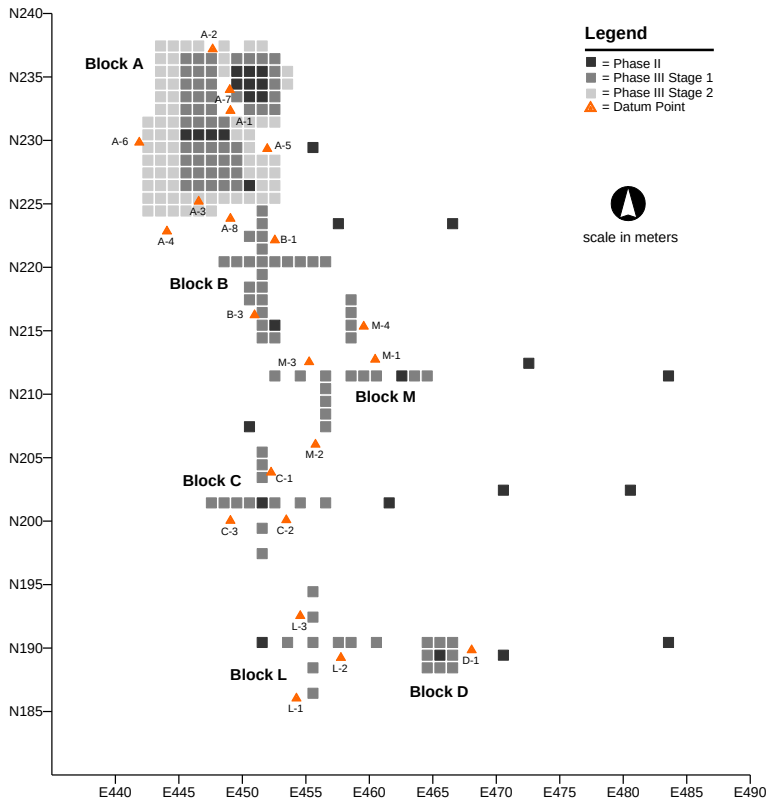

Figure 5-3. Staged Placement of Excavation Units, Site Evaluation (Phase II) and Data Recovery (Phase III), 7NC-J-228.

7NC-J-228. A block of 50 units (Block A) was arranged in a 5-x-10 m configuration over the most concentrated zone of prehistoric activity at the northern end of 7NC-J-228 (Figure 5-3). A smaller block of 8 units (Block D) examined a specific thermally altered stone feature, while other artifact clusters were investigated using 10-x-10 m cruciform configurations consisting of 9 to 23 units each. Four such configurations (Blocks B, C, L, M) were used to examine particular artifact concentrations that included an intermediate area that prior testing had indicated displayed evidence of less intensive activity, and a portion of the landform that showed potential for containing subsurface features.

Unit excavation procedures conformed to those used in previous stages of the investigation. Alternating units were excavated within the cruciform blocks, initially in an effort to minimize excavation in areas containing low artifact density or a lack of cultural features. Complete block excavation was halted once the information recovered indicated that further excavation would produce redundant results. Three blocks, C, F, and L, were not completed based on this criterion, and the units assigned to these areas in the excavation plan were shifted to blocks where additional investigations were warranted. All alterations to the original data recovery plan were conducted in consultation with DelDOT and the DESHPO.

Data Recovery (Phase III), Stage 2

An additional 194 excavation units were proposed and excavated in Stage 2 of the data recovery investigations (Figures 5-2, 5-3). The units were distributed within both sites to expand excavations in selected areas begun in Stage 1. At 7NC-J-227, 123 units were excavated, connecting several smaller blocks around a series of thermally altered stone features (Blocks G, H, and I) (Plates 5-2, 5-3), and expanding blocks associated with concentrations of ceramic sherds (Blocks K, N). At 7NC-J-228, the remaining 71 units were added to Block A to further examine the horizontal distributions of a series of large, basin-shaped features and several thermally altered stone features (Plate 5-4).

3.5 Laboratory Methods

3.5.1 Field Lab Procedures

Artifacts recovered during both phases of the archaeological investigation were inventoried at the Field Lab, located in Little Heaven, Delaware. Artifacts were classified by general category (prehistoric; historical) and specific type (thermally altered stone, flaking debris, nail, brick, etc.), and tallied by horizontal and vertical provenience.

The inventories produced in the Field Lab were entered into a preliminary database and used to generate a series of artifact distribution maps by means of commercially available mapping software. These distribution maps were continuously updated to provide feedback to field personnel that aided in the direction of test unit and excavation block placement throughout the evaluation and data recovery investigations.

3.5.2 Fairfax and Springfield Lab Procedures

Comprehensive artifact processing, cataloging, and analysis was performed or directed by CR Division personnel, initially in Fairfax, Virginia, and later in Springfield, Virginia, after the CR Division moved to Versar. Artifacts were processed to the standards of the October 1993 Delaware State Museums Sampling and Curation Policy (DESHPO 1993).

Artifacts were cleaned in plain water, and bagged by material and artifact type in 4-mil polyethylene zip-lock bags. Diagnostic artifacts were labeled with the Provenience/Catalogue Control Number (99/56 for 7NC-J-227, and 99/57 for 7NC-J-228) as well as the bag number, using acryloid B-72 sealant and black or white pigment ink. Catalog numbers and provenience information were written in indelible ink on the outside of the bags, and an acid-free tag with the same information was placed in the bags.

Artifacts are stored in acid-free trays within 20” x 20” x 3” corrugated polypropylene flat boxes. All photographic images are stored in archival slide and print sleeves, and contain photo logs. Field records are on acid-free paper.

Plate 5-2. Excavation: Block I, 7NC-J-227.

Plate 5-3. Excavation: Block H at 7NC-J-227, with Feature 35 in Foreground.

Plate 5-4. Excavation: Block A, 7NC-J-228.

In addition to the artifacts, a large number of samples were collected and the following outlines which samples will be curated. All unmodified lithic cobbles collected as part of the local gravel resources study will be discarded. All charcoal samples from test units will be retained. The charcoal samples are lister below in Table 5-2.

Table 5-2: Sandom Branch Charcoal Samples

North	East	Stratum	Level	Feature	Portion	Bag No.
7NC-J-227						
69	464	I	1	5	W	5012
73	475	C	1	0		5014
104	464	B	2	0		5015
69	471	I	1	35		5017
72	467	B	1	0		5020
7NC-J-228						
190	465	B	1	0		5003
233.5	451.8	I	1	9	S	5016
233.5	451.8	II	1	9	S	5017
233.5	451.8	II	2	9	S	5018
233.5	451.8	II	3	9	S	5019
233.5	451.8	II	4	9	S	5020
233.5	451.8	II	5	9	S	5021
233.5	451.8	II	8	9	S	5022
233.5	451.8	III	1	9	S	5023
233	451	II	3	9	N	5044
233	451	II	4	9	N	5045
233	451	II	4	9	N	5046
233	451	II	5	9	N	5047
236	444	I	0	27		5055

Twelve 2-liter soil samples from twelve individual features were analyzed for ethnobotanical remains, and the heavy and light fractions of the floated samples will be curated to allow for future study.

A total of 146 soil samples were collected and analyzed as part of the geoarchaeological studies that included geochemistry and sedimentology (Appendix H). Therefore, it is recommended that a limited number of the remaining soil samples be retained and that they be from the deeper basin features that contained cultural material as well as carbon. Due to the fact that ethnobotanical sampling was already performed, it is proposed that these be pint-sized (approximately 500 grams) samples. Remaining soil samples from deeper basin features containing cultural materials and charcoal include Feature 5 from 7NC-J-227, and Features 7, 9, and 43 from 7NC-J-228. One pint-size sample from each of these features will be retained, for a total of 4 curated pint-sized soil samples. These samples have been thoroughly air-dried and are stored in 4-mil polyethylene bags.

3.5.3 Analytical Methods

A full artifact inventory was compiled using database management software for analyses and for integration with a Geographic Information Systems (GIS) developed for the project (Appendix D). These procedures were also applied to artifacts recovered during LBA's survey (Phase I) investigations of the Sandom Branch sites. In addition to provenience information, coding for database entry included the information listed below:

- group–indicating whether prehistoric or historical period artifact
- *material*–prehistoric artifacts, raw material type using general mineralogical terms
- *morphological type*–prehistoric artifacts, technologically derived terms are generally employed, though some widely accepted functional terms are used
- *typology*–prehistoric artifacts, generally accepted morphological types associated with known chronological periods
- *segment*–indicating completeness or, if incomplete, the section of the artifact represented (proximal, medial, distal)
- *amount of cortex*–flakes, expressed as a percentage of the dorsal surface
- *color*–recorded for lithic artifacts
- *size grade*–measured on flaking debris as an indication of geometric dimension
- *weight*–expressed in grams, reported as an additional indication of artifact size

Once inventoried, the artifact assemblages were subject to a variety of analyses related to chronology, function, technology, and other behavioral processes. In addition to descriptive attribute analysis, conducted during cataloging, in-house studies included: lithic usewear analysis; examination of lithic raw material availability (Appendix E); refitting of thermally altered stones (Appendix F); ceramic cross-mending and lot analysis (Appendix G); a mineralogical analysis of ceramic paste and temper; and spatial and activity area analyses. Procedures performed by outside laboratories or consultants included geoarchaeological (Appendix H), ethnobotanical (Appendix I), and radiocarbon (Appendix J) analyses. Results of these studies are synthesized in the appropriate sections of the Archaeological Findings in the main text of the report. Complete texts of specialized studies are presented as appendices. The remainder of this section contains information about the methods and terminology used in several of the analyses.

Lithic Material and Technology Analysis

Points. Points are chipped stone artifacts, usually bifacial in manufacturing technology and bi-laterally symmetrical in shape, that have a thinned, proximal end that functioned as a hafting element, and a distal end with blade edges that converge to an apex or point. Labels ranging from "projectile point" to "hafted biface" have been used to designate these artifacts. The simpler term *point* is used here, chosen since it does not imply an undemonstrated function, as in the former case, but is not as deliberately non-functional as the latter.

The descriptive analyses of points from the Sandom Branch sites have been organized morphologically. Where possible, points were also assigned to conventional types based on regionally accepted styles. For artifacts that were sufficiently complete, a standardized series of attribute data were recorded. These data included dimensional measurements, such as

length, width, thickness, and several angle measurements, along with a suite of nominal variables related to shape, raw material, knapping characteristics, and edge wear. The metrical data, as presented, should be considered with some caution, since damage, reuse, and rejuvenation, particularly when associated with scavenging, can alter the shape of a tool from its original form, as a number or researchers have noted (Frison 1968; Flenniken and Raymond 1986; Towner and Warburton 1990; Dibble 1995). Thus, a tool's dimensions represent the form of the artifact following its last use, or as often, the last attempt at retooling, and does not necessarily reflect its original size and shape.

Comparative analyses are included for each point type, as appropriate, using published metrical data from large type collections. Where possible, the statistics have been derived from original reports of the type sites for each point type. Since this form of data can be relatively limited in availability, the entries have in some cases been supplemented by data from other large, published collections, primarily in the Delaware Valley. Occasionally, the comparative and chronological expositions in the text may repeat information from point descriptions presented in previous sections. This was done because two separate sites were under investigation, and it was assumed that some readers might go directly to the sections dealing with one site without reading the material related to the other.

Note should be made of the term used to designate one of the point types, the small stemmed points referred to in the text as Woodland I stemmed. In Section 3.0 above, the Delmarva chronology, introduced by Custer in the mid-1980s, was presented as a secondary or alternative system that was seen as less helpful for the current site analyses than the conventional chronology used throughout eastern North America. The label Woodland I stemmed, adopted from the regional chronology, is a hold-over from previous work in which the points were introduced as a particular form that is recognized on many if not most sites in Delaware (Petraglia et al. 2002). Originally the label was meant as a preliminary or working term, but no alternative has been developed and the initial name has stuck (see, for example, Hranicky 2002). In the end, the label may be a broadly useful designation, because the points appear at the moment to have had a long span of use, possibly from the end of the Late Archaic into the Middle Woodland, which comprises much of what Custer has defined as the Woodland I.

Other Chipped Stone Tools and Flaking Debris

The remaining chipped stone tools were categorized during the cataloging process based on form and manufacturing characteristics.

Bifaces. Bifacial artifacts were defined by the presence of patterned flake removals from opposing surfaces along at least one edge. Most bifaces were further defined by a regularized shape. All of the complete bifaces from the sites were measured for length, width, thickness, and weight.

Bifaces were subdivided into two categories during the cataloging process: *early stage* and *late stage*. These subdivisions were based on several attributes related to the overall appearance of the artifacts, including the degree of shaping that had been undertaken, relative thickness, and the sinuosity of edge profiles. These characteristics are related to the

perceived level of completion of the biface, and while their recognition can be subjective, they provide a general basis for comparison against examples from experimental and theoretical models (e.g., Muto 1971; Collins 1975; Callahan 1979; Johnson 1981). Early stage bifaces result from the initial efforts at producing a bifacial edge on a cobble, pebble, or flake blank. Typically, early stage bifaces exhibit comparatively random flaking produced by hard hammer percussion. Flake scars are often wide and deep. The amount of flaking may vary from minimal to fairly evident, with little overall shaping of the artifact evident and the resulting bifacial edge being sinuous in profile. Early stage bifaces are relatively thick in cross section and often retain remnant cortex. By contract, late stage bifaces display slightly greater width:thickness ratios than early stage bifaces, indicating that further thinning has been accomplished. Late stage bifaces also exhibit a greater degree of shaping and straighter edges in profile, suggesting more designed and patterned flaking. Edge modification may be present in the form of platform preparation, implying the use of controlled flaking techniques.

Unifaces. These artifacts were defined by the presence of unifacial flake removals that had shaped at least one edge of the piece. Complete unifaces were measured for length, width, thickness, and weight. The edge angle of the bit, or working edge, was measured at the approximate center of the bit using a goniometer.

Retouched Flakes. Retouched flake tools were characterized in the analysis by marginal flake scars at least 3 mm in length oriented perpendicular to the flake edge that had resulted in minimal shaping along the flake perimeter. The focus of the flaking on retouched flake tools was edge modification rather than formal shaping.

Utilized Flakes. Utilized flake tools were identified by the presence of usewear along the edges of the artifact, but no evidence of intentional edge modification. Usewear was indicated by the presence of various types of edge degradation or modification, such as microflake removal, rounding, or blunting.

Cores. Cores represent one of the basic residues of lithic reduction. They can range in size and complexity from pebbles (6-64 mm) or cobbles (64-256 mm) with only a single flake removal, to an exhausted cobble core that is rounded and unworkable. In most cases, cores that occur archaeologically are pieces that were rejected because additional flake removal was impractical, either because of poor material quality (in the case of a tested cobble or a fractured core), or because the size or shape of the core made further flaking difficult. By general implication, cores are usually assumed to have been used for flake production. While it is recognized that some cores were worked into bifacial tools, it can be difficult to discern intent in the early stages of reduction when only one or two flakes have been removed. And so, cores have been described together in this analysis regardless of the final goal of the reduction process.

In the analysis, cores were separated into two categories based on flake removal patterning: multidirectional and bipolar. Multidirectional cores were defined as cores with flake removal occurring in a random pattern from multiple platforms. Bipolar cores were identified by a distinctive arrangement of opposing striking platforms. In bipolar reduction, the core was

placed on a hard surface, usually a dense stone serving as an anvil, and was struck from above. The blow typically produced crushed platforms on opposite sides of the artifact, and generated flakes that were flat and sheared or were distinctly convex in shape.

Flaking Debris. Flaking debris was separated into two basic categories: flakes and chips. Flakes were defined by the presence of identifiable attributes such as bulbs of percussion, striking platforms, dorsal flake scars, and feather, snap, or hinge terminations. Chips, sometimes referred to as shatter, represented small-to-medium sized, angular pieces of lithic material with no identifiable flake attributes.

Flaking debris usually represent by far the majority of the artifactual material recovered from a pre-Contact American Indian archaeological site, and the Sandom Branch Site Complex is no exception. Efficient analysis of such a large number of artifacts can be challenging. A useful approach to this task involves analysis of size based on interval data (Henry et al. 1976; Stahle and Dunn 1984; Shott 1994). The process used in the current study is ultimately based on techniques of so-called flake aggregate, or mass analysis, as documented by Ahler (1986, 1989). The procedure consists of grading the artifacts according to standardized size intervals, and retrieving various quantitative data from each size grade. These data may then subjected to a variety of statistical manipulations that can be used to generally characterize the type or types of reduction technology represented in the assemblage. Size grading for the Sandom Branch assemblages was conducted using the following interval scale:

- Size Grade 1: < 1 cm
- Size Grade 2: ≥ 1 cm and < 2 cm
- Size Grade 3: ≥ 2 cm and < 3 cm
- Size Grade 4: ≥ 3 cm and < 4 cm
- Size Grade 5: ≥ 4 cm and < 5 cm
- Size Grade 6: ≥ 5 cm

Usewear and Edge Angles

Usewear patterns and tool edge angles are measurable attributes that can provide basic indicators of tool use (Crabtree 1974; Wilmsen 1974; Hayden 1979; Carmichael 1985). In general terms, experimental studies have indicated that unifacial microflaking (serial flake removals measuring less than 3 mm in length) can be characteristic of activities involving a scraping motion, while bifacial microflaking typically suggests a cutting motion. When these patterns are accompanied by edge rounding or blunting, the scraping or cutting of soft materials, such as hides, fibers, or other vegetal material, may be implied. Experimental data have also suggested that the angle of a unifacial bit may correspond with the type of material the tool was intended to process: 26-35 degrees, light cutting or scraping work; 46-55 degrees, medium work; 66 to 75 degrees, heavy work.

Accordingly, usewear and edge angle analyses were conducted for selected artifacts from the Sandom Branch Site Complex. Usewear analysis was carried out with a 10x hand lens in bright light. Evidence of both usewear and retouch were recorded along each working tool edge. Retouch, as defined above, may result from trimming during initial manufacture,

intentional edge modification (i.e., flake tools), tool shaping, or resharpening episodes. Usewear was indicated by the presence of various types of edge degradation or modification, such as microflake removal, polish, rounding, or blunting. As noted, edge angles were measured at the approximate center of each tool edge or bit using a goniometer.

Cobble Tools/Groundstone

Cobble tools were used for a variety of tasks including battering, abrading, grinding, and pecking. These tools typically consisted of unmodified, rounded cobbles procured locally from stream beds or other exposed gravel deposits. In the current analysis, two functional categories were recognized: hammerstones and anvils. Some cobble tools contained multiple usewear patterns and were categorized based on most frequent use type in evidence. One additional form of groundstone artifact was documented in the current analysis, a ground slate fragment.

Thermally Altered Stone Refitting

Refitting of thermally altered stone fragments was employed for Features 30 and 35. The purpose of the refit study was to provide information about feature function, feature formation, and site structure. Selected artifacts were labeled with bag numbers to maintain provenience information. During this labeling process, a number of refits were found, generally from the same vertical and horizontal provenience. These initial refits were marked along the mended edge. Artifact bags were laid out in respective provenience order so that spatial juxtapositions of potentially conjoinable pieces could be viewed. The artifacts were sorted by unit, stratum, level, and lithic material. The grouping of thermally altered stone by material type proved useful in locating artifacts that refit. All of the stone fragments within the sample area were examined and refitted by a single person to provide consistency.

Locally Available Lithic Resources

As part of the data recovery investigations, a study of locally available lithic resources was implemented. This study followed methodologies established as part of data recovery investigations at the Hickory Bluff site (Petraglia et al. 2002). Similar to the Hickory Bluff Raw Material Study, sampling for this study was focused on Pleistocene deposited pebbles and cobbles of the Columbia Formation. The Sandom Branch studies were initiated to systematically analyze the lithologic and size characteristics of locally available raw materials. A descriptive framework enabled the comparison of the recovered lithic artifact assemblages to the locally available raw materials allowing for interpretations of prehistoric lithic resource procurement. Samples for the current study were collected from exposed pre-Holocene Columbia Formation deposits within the Sandom Branch and Blackbird Creek watersheds, as well as from deposits exposed during data recovery excavations.

Ceramics

Each sherd was examined individually and catalogued for six attributes: temper, interior surface treatment, exterior surface treatment, decoration, weight, and thickness. After this analysis, sherds greater than 2 cm in diameter were sorted visually into broad categories based on temper and dominant surface treatments. Cross-mending was undertaken to reunite sherds from individual vessels and to restore as many portions of vessels as possible.

Lots

The ceramic assemblage was then grouped by lots that were determined on the basis of cross-mends as well as distinctive paste attributes, surface treatment, and decoration. After grouping the sherds, the lots were compared to the ware type descriptions established in Delaware (primarily in Griffith 1982 and Custer 1985) and were classified in relation to these established types. The examination of the collection in the framework of established ware typologies was conducted to facilitate the discussion of chronology and help highlight the similarities and differences of the collection with others in the region. Lots were designated with an alphanumeric abbreviation based on type and numerical order (e.g., the first Minguannan lot was abbreviated MI1). The artifact attributes that defined the lot were analyzed and described.

The ceramic paste was the most important criterion for determining lots. The dominant tempering material and the variety of inclusions within the paste were identified first by visual inspection. Measurements were taken in millimeters (mm) to quantify the range of particle size. Magnification (10x) was used to describe percentages of various inclusions using comparative diagrams for estimation of aplastic/temper density (Orton et al. 1993: 238). The texture of the paste was recorded to characterize the feel and describe the relative blend and compaction of the paste.

Exterior, interior, and core surface colors on a representative sherd from each lot were recorded, using a Munsell Color Chart (1990 Edition). When differences were evident between sherds in a lot or on areas of a vessel, the range of the major distinctions was recorded. Surface treatments on both the exterior and interior surfaces of sherds were examined for evidence of scraping, smoothing, finger impressions, fabric/mat/net impressions, cordage impressions, adherent residue, and any other surface variation present. When applicable, information regarding cordage was recorded, including twist, size, and orientation. Each ceramic lot was examined for decoration separately from surface treatment. Decoration implies a more specific attempt to control appearance, and may also carry further symbolic meaning.

Vessel Form

Information regarding vessel form was gathered where possible given the fragmentary nature of the ceramic assemblage. Descriptions were prepared for three portions of a vessel: lip, rim, and body/base. Sherds were examined to determine vessel shape, breakage patterns (as a potential indication of coil manufacture), and when applicable, volume capacity.

Petrographic Thin-Section Analysis

A sample of ceramics from the collection was selected for petrographic thin-section analysis to more fully characterize the range of natural inclusions within and between major ceramic types, the nature of the clays being utilized, and the variety of the tempering agents. A representative sherd from each of the ten vessel lots was analyzed. In addition, experimental clay tiles were submitted for petrographic analysis to determine whether the paste of the ceramics found archaeologically displayed characteristics similar to those of the nearby clays. The tiles were made from clays collected from the banks of the nearby Blackbird Creek. No tempering agents were added to the clay used for the test tiles. The clay had been formed into tiles while plastic and then allowed to dry for a day prior to firing. The tiles

were fired at 784° centigrade for three hours in a modern kiln. These samples were included. The sherds were thin-sectioned by Spectrum Petrographics, Inc. of Winston, Oregon. Thin-sections were stained to aid the identification of potassium feldspars, embedded in an epoxy resin, and left uncovered. Each slide was labeled with a number provided by Spectrum Petrographics, Inc., and the numbers were cross-referenced with the artifact catalog numbers.

Thin-sections were examined both qualitatively and quantitatively to provide both general and descriptive data for comparison of the sherds. Qualitative analysis involved a visual scan of each sherd in plane polarized light. Characteristics of the matrix (color, behavior under plane and polarized light, texture, iron staining) were recorded for each sherd, as were observations regarding the sorting of inclusions, size and shape of voids, and orientation of the ceramic fabric. Fabric orientation is the term used to describe the parallel alignment of matrix, inclusions, temper, and voids within the paste. Alignment is most clearly observed when along the long axis of the sherd, although it can also be noted when the orientation is diagonal. Parallel fabric orientation implies that during manufacture, the clay was stretched and/or compressed primarily in one direction, an effect most often observed in vessels that were coil-constructed. Quantitative analysis involved point counting of the constituents of the sherd: matrix, voids, temper, and natural inclusions. The point count was accomplished using a 1- by 1-mm grid.

Features

In the field, features were bisected and sampled to determine their shape and to retrieve their contents (Plates 5-5, 5-6). The initial characterization of the features during analysis consisted of typing them on the basis of general form. The typology used was one developed for a similar array of features documented at the Hickory Bluff site (7K-C-411), on the St. Jones River south of Dover (Petraglia et al. 2002). Table 5-3 contains descriptions of the feature types in this system that were applicable to the current range of features. Two main forms were recognized in the present analysis: concentrations of artifacts (thermally altered stone fragments); and excavated basins. Sub-type designations were assigned on the basis of the detailed attributes detailed in the table.

Spatial Analyses

Analysis of artifact distributions within and between sites was conducted using commercially available software (Surfer) that generates contour plans from grid-based data. The software was originally designed to produce topographic maps diagramming the physiographic features of a landscape. It has subsequently been adopted by other disciplines, including archaeology, to model various additional types of data. Archaeologists regularly use the software to perform a type of spatial analysis that results in frequency maps of horizontal artifact distributions. Isopleths, or lines connecting areas of equal magnitude (in this case frequency), are determined by one of a series of interpolation algorithms that estimate the distribution of material at a given point within the site grid by examining the arrangement of the surrounding data. Artifact concentrations are implied by contour lines that form concentric polygons indicating regions of higher or lower artifact frequency.

Plate 5-5. Feature Excavation: Feature 9, Block A, 7NC-J-228.

Plate 5-6. Feature Documentation: Feature 5, Block I, 7NC-J-227.

Table 5-3. Cultural Feature Typology Developed for the Hickory Bluff Site.

Cultural Feature Types	Description
Type A - Artifact Features	cultural aggregation of artifacts
Type A1	concentration of thermally altered stone
A1 subtypes	
A1-a	<1 m in diameter
A1-b	>1 and <2 m in diameter
A1-c	>2 m in diameter
Type A2	concentration of diagnostic artifacts
Type A3	concentration of modified lithic raw materials
Type A4	concentration of lithic raw materials
Type B - Basins	displacement of soil
Type B1	large, >2 m in greatest horizontal dimension
B1 subtypes	
B1-a	>2 m in greatest horizontal dimension; >1 m in depth
B1-b	>2 m in greatest horizontal dimension; length 2x width
B1-c	>2 and <3 m in greatest horizontal dimension
B1-d	>3 m in greatest horizontal dimension
Type B2	medium, >1 and <2 m in greatest horizontal dimension
Type B3	small, <1 m in greatest horizontal dimension

Activity Area Analysis

The artifact distributions at the two sites were complex. Artifact frequencies were high in many areas indicating extensive prehistoric activity and the probable re-use of living surfaces. Individual sets of artifacts appeared to have been deposited over existing artifacts, and were subsequently scattered and intermixed. Yet, broad patterns of archaeological site structure were still expected to be present, and it was anticipated that from that structure, information about the original activities would be recoverable. That is, of course, the aim of any archaeological spatial analysis, i.e., determining the behavioral factors behind the contexts that have been discovered through excavation. The first step in this analysis was to look for broad patterns of activity from which more specific details might be inferred.

In the case of the Sandom Branch sites, spatial analysis was limited by the shallow depth of the portion of the soil column containing the cultural deposits, which had allowed the individual components to become intermingled. To reduce the complexity of the detailed spatial distribution data, the artifacts and features from the main excavation blocks were grouped into general categories by presumed function, in a process adapted in part from work at 28ME-1B, at the Abbott Farm National Landmark (Cavallo 1987). The inferences that were used to assign the materials to particular groups stemmed from a combination of experimental data (that distinguish such things as scraper edges or cutting edges on tools); assumptions based on general artifact form; and artifact or feature functions that have been securely documented at other sites. Table 5-4 contains a broad list of characteristic site activities and the artifacts or other archaeological evidence that may be expected to have been associated with them. The list is not intended to be exhaustive, but rather to incorporate general activities for which there may be clear evidence at either of the two Sandom Branch sites. The numbering of groups, while indicating similarities between activity sets, is mainly for the purposes of abbreviation in mapping the groups across the excavation blocks.

Activity Groups

Stone Tool Manufacturing

1a) *Bipolar Reduction*: This activity involves the primary reduction of pebbles and small cobbles through bipolar percussion. Artifact evidence includes extensive yet small-sized cortical flakes, hammerstones (particularly with pecking on broad surfaces rather than protruding ends), anvil stones, wedge-shaped cores, or plano-convex early stage bifaces.

Table 5-4. Activity Groups and Associated Archaeological Evidence.

Activity Group		Archaeological Evidence
1a)	bipolar pebble reduction	cortical debitage, hammerstone, anvil, core, biface
1b)	tool maintenance	non-cortical debitage, late stage/finished biface
1c)	general lithic reduction	mixed or non-specific debitage, variously finished bifaces, cores
2a)	processing / cutting	asymmetrical bifacial tool, utilized flake
2b)	processing / scraping	unifacial scraper, utilized flake
2c)	processing / heating	thermally altered stone fragment, ceramic
2d)	processing / grinding, crushing	pitted stone
3a)	procurement / hunting	point
3b)	procurement / quarrying	tested pebbles/cobbles, hammerstones
4)	storage	ceramic, pit feature
5)	ceremony	feature, non-utilitarian artifacts

1b) *Tool Finishing and Maintenance*: This group includes the debris from late stage biface production or from tool refurbishing and edge rejuvenation. Artifact evidence includes extensive amounts of non-cortical flaking debris; small, wide flakes with small platforms typical of pressure flaking; or late stage or finished bifaces, and in particular, bifaces with asymmetrically shaped or steeply beveled blades characteristic of resharpening.

1c) *General Lithic Reduction*: This group includes lithic reduction debris that is non-specific in terms of the type of reduction it represents or that evidences a range of types. Artifacts include mixed flaking debris—cortical and non-cortical, large and small—and a variety of core and biface types.

Resource Processing

In general, this group comprises an assortment of economic and utilitarian activities involved in the manipulation, preparation, and handling of plant, animal, or mineral resources.

2a) *Cutting*: Tasks for which cutting or sawing motions are required, including such things as butchery or cutting and shaping wood. The working edges of tools used in these activities are most often bifacially shaped, and usewear occurs as bifacial scalar or lunate flaking, with

striations or polish on both surfaces of the cutting edge. Artifact evidence includes bifaces, especially those with asymmetrically shaped blades indicative of the maintenance of a single, long cutting edge, or utilized flakes with usewear occurring bifacially as described above. Certain forms of bending snap breaks can be characteristic of cutting implements used in a prying motion.

2b) *Scraping*: This group includes tasks for which a uni-directional scraping motion is employed, such as cleaning hides, planing wood, or extracting and processing plant fibers. Working edges typically occur on the side or end of a large flake, or can occur as a formally modified or shaped bit on a uniface. Usewear occurs as scalar flaking or step fracturing (implying light and heavy use, respectively), and may include striations or polish, all emanating from one face of the working edge. Artifact evidence occurs as unifacial scrapers or utilized flakes.

2c) *Heating*: includes a wide range of activities requiring open fires. Heat may be used for bodily warmth, or for the processing of foodstuffs or other resources through either direct or indirect heating, e.g., roasting or smoking. Archaeological evidence includes: thermally altered stone artifacts in concentrated features or scattered within site deposits; burned or reddened earth; or, ceramic fragments, implying the heating of liquids. Note that fires also provide a source of light, but specific archaeological evidence for such use is difficult to identify; lighting is thus combined implicitly in the present analysis under heating for warmth.

2d) *Grinding or Crushing*: Tasks in which materials are processed using tools such as mauls, grinding stones, pestles, or metates. The activities implied could range from cracking nuts for nutmeat, as a direct food source or as a preliminary to extracting oils, to crushing pebbles, sand, or shell to form temper for ceramics. Artifact evidence may include hammerstones, anvils, or pitted stones.

Procurement

Activities involving the acquisition of resources, ranging from the hunting and gathering of food resources to the quarrying of lithic material for stone tool manufacture.

3a) *Hunting*: Artifact evidence occurs mainly in the form of points used as projectile tips. Projectile points tend to have well-made, symmetrically shaped blades. They may be present as complete or broken artifacts, the latter including proximal fragments (the hafting element and part of the blade) and distal fragments (blade tips). Usewear patterns particular to hunting with projectiles include impact fractures emanating from the distal ends of blades, transverse snap breaks across blades, and certain forms of basal damage.

3b) *Quarrying*: This activity entails the acquisition of lithic raw material, generally for the purposes of tool manufacture. Artifact evidence includes hammerstones, primary flaking debris (large cortical flakes), and concentrations of unmodified or partially modified lithic material, such as concentrations of unworked or tested pebbles or cobbles, the latter consisting of clasts with only one or two flakes removed to test the quality of the raw material.

Storage

4) *Storage*: These activities are related to the containment and short-term or long-term storage of material items. Archaeological evidence includes artifacts used as containers, such as bowls, basketry, bags, or ceramic vessels, as well as a specific group of features—pit features. Pits designed for storage are often deep, have relatively straight sides, and may have been lined.

Ceremony or Ritual

5) *Ceremony or Ritual*: This is an overarching group of non-utilitarian activities that encompasses acts and events related to non-material or spiritual aspects of life. The group has not been broken down further in the present analysis because the material evidence for these activities is usually non-specific, making the delineation of subcategories based on archaeological evidence impractical. The evidence that can be identified from archaeological contexts may consist of certain feature types, such as thermally altered stone features related to purification ceremonies, or pit features related to burial practices; or particular artifacts with demonstrably symbolic representations.

Viewshed Analyses

A viewshed analysis was conducted to examine aspects of human interaction with the landscape that might not be readily evident with conventional archaeological approaches. The analysis, typically computer based, compares relative elevation and aspect (the compass orientation of a slope) between a specific point and surrounding areas, giving an indication of the terrain visible from that point (Lake et al. 1998; Wheatley 1995; Tripcevich 2002). The results of viewshed analyses can help approach an interpretation of past landscape use, providing a means of visualizing the world as it was experienced by the people living within it.

Viewshed analyses have been used to aid an understanding certain features of past cognition—how people saw and understood the world around them. In an early study of barrow sites in England, for example, Lock and Harris (1996) used viewshed analysis to demonstrate that long barrows in the Danebury region of England were not mutually visible, supporting a theory that the barrows had been used as territorial markers. In an alternate finding, Wheatly (1995) demonstrated that long barrows of the Stonehenge group (Avebury and Salisbury Plain) tend to occur in locations from which high numbers of other barrows were visible. Maschner (1996) analyzed village locations on the Northwest Coast, demonstrating that villages around A.D. 500 moved to landscapes with views encompassing approximately three times the visibility of the previous locations. This was interpreted as reflecting a perceived need for increased defense. In a more recent study, Jones (2006:525) came to a similar conclusion regarding Onondaga Iroquois settlement: site location was interpreted as a measure of defensibility, and was: “a major factor governing settlement location during the Late Woodland and early Historic periods in the Northeast because of the high frequency of warfare.” .” The viewshed analysis supported a conclusion that village locations were chosen primarily on the basis of agricultural needs, “but not at the expense of…defensibility” (Jones 2006:537).

Kvamme (1990:7) proposed some ground rules for conducting and then interpreting a viewshed analysis. The viewshed operation is based on the premise that: a digital elevation model (DEM) represents the terrain accurately, the paleoenvironment can be modeled with relative confidence; the object of observation stands out sufficiently to be visible; and, finally, the measured landscape attributes were relevant and significant to the prehistoric inhabitants. The latter is the conceptual leap that must be bridged by the archaeologist's interpretations. Some have argued that the analytical process over-represents ecological data and simplifies complex socio-cultural variables that may also be involved in landscape use (Kvamme 1997; Tilley 1994; Wheatley and Gillings 2000). However, viewshed analysis is perhaps more accurately described as a middle-ground that draws on geographically measurable attributes to reflect the experiences of individuals and the ways they made their settlement choices (Wheatley 1995).