5.0 METHODOLOGY

This section presents the methods employed for the cultural resources investigations at Site 7NC-J-204, the Jones Sites in the SR1 corridor, New Castle County, Delaware. Archival research was conducted at numerous repositories in the State of Delaware and the District of Columbia, complimenting findings of the archaeological investigations. Appropriate site-specific field methods were developed through continual monitoring and onsite consultation with DelDOT and the Delaware SHPO. Field methods included excavation of shovel test pits and test units, systematic soil sampling, large scale mechanical stripping of plow zone deposits, and real time preparation of artifact distribution maps based on preliminary field counts. A field laboratory was established at a DelDOT facility in Little Heaven, Delaware to aid in preliminary artifact processing, assessment, and development of the database. The preliminary database was used to generate real time distribution maps using the SURFER® software program. Detailed artifact processing and analysis was conducted at the Parsons archaeological laboratory in Fairfax, Virginia. Spatial analyses were conducted and aided interpretation of site activities and settlement patterning.

5.1 HISTORICAL RESEARCH METHODOLOGY

Archival research consisted of a records search, review of historic maps, and regional and local historical background research. Land use planning documents, as well as deed, tax and census records at the New Castle County Building in Wilmington and the Delaware Public Archives in Dover, provided information concerning the historical development of the Jones Site area. Acts of the General Assembly, Clerk of the Peace Records, and books, historical maps, photographs, and probate records were reviewed at the Delaware Public Archives and the Delaware Agricultural Museum in Dover, the Delaware Historical Society and the Wilmington Public Library in Wilmington, and the Library of Congress in Washington, DC. Original documents regarding the estate of one of the owners were examined at the Small Special Collections Library at the University of Virginia in Charlottesville, Virginia. Online references on genealogy and history were utilized.

A detailed archival research program was conducted concurrently for both the Appoquinimink and Blackbird Hundreds in New Castle County, as well as northern Duck Creek Hundred in Kent County. The Jones site was situated only 5 miles north of Duck Creek, the northern boundary of the latter hundred. While the site was physically situated in New Castle County, many of the land owners were absentee land owners living in the Smyrna area in Duck Creek Hundred, Kent County. Thus, many of the probate, tax, and legal documentation were located in both counties. Archival records in other hundreds were included in the research, but were only peripheral to the main research domains and utilized for comparative analysis.

The oral history interviews for the Jones Site were conducted by Patrick O'Neill of Parsons. The histories were conducted with only a few individuals, as the period of significance for the Jones Site was late 18th and early 19th century, several generations before living relatives or current landowners were born. The interviews were not recorded, but short transcripts have been added

to the technical report where pertinent. Michael McGrath and George Bradley were formally interviewed primarily for the information on the Frederick Lodge Site and the 19th century Reynolds family. However, one of Mr. McGrath's ancestors, emigrating from Canada, purchased the tract just north of the Jones Site in the early 20th century, and knew of some old building locations to the west of the site. Rick Hobson was also informally interviewed. No specific list of questions was utilized during the interviews, but questions applicable to the research domains were discussed, including:

1) their age, address, if they had relatives in the area;
2) how long had they lived in the area;
3) who did they purchase the land from,
4) did they know of any structures on the property;
5) had they collected or heard of anyone collecting artifacts from the property;
6) had they heard of the names associated with other historic sites on SR1 Parsons was investigating; and
7) would they be willing to come for a site visit.

We used the *Deedmapper* computer program to draw land tracts from the metes and bounds given in historic deeds and surveys. The early land patents for the SR1 corridor from the Jones site northward to Blackbird Creek were translated using *Deedmapper* and overlaid onto modern 7.5-minute topographic maps. However, this methodology provided only a rough approximation of the shape of land tracts, especially those that had more complex shapes. Also, adjoining tracts often did not align with one another properly when mapped tracts were joined at common points. This was particularly frustrating for the Jones site, since the intersection of three historic land patents was originally thought to be located within the site boundaries.

Another issue that arose was finding landmarks to georeference historic land plats with modern maps. The main highway near the Jones site (SR 13 or Dupont Highway) was widened and straightened in the 1920s and was dualized in the 1930s. Thus, the highway proved to be unreliable as a georeference point. One of the most recognizable physical manifestations of historic land tract boundaries was observed on aerial photographs of the area taken in 1926 (US Army Air Corps 1926). The northwest corner of the Turner tracts from an 1802 plat of the division of the land is still visible in 1926 between the highway and this corner as a wooded area on the Turner tract as opposed to a cleared area on the adjoining land to the north. By overlaying the 1802 plat onto the 1926 photograph in a GIS, this Turner boundary line was extended across the highway heading southwest to its endpoint – the point where the Turner, White, and Brown tracts joined. This provided a clearer understanding of how the three tracts related to the Jones site boundaries, and suggested that the site was situated on the Brown tract but within several hundred feet of the other tracts. However, all three tracts were combined into one farm by the 1860s so the later components of the site (i.e. the machine-made brick well) may date to the later farm.

5.2 FIELD METHODOLOGY

The archaeological field investigations at Site 7NC-J-204 were conducted in phases 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. A scope of work was prepared for the initial stage of Phase II investigations. Field counts of artifacts were tabulated and used to generate SURFER® distribution maps. Based on resulting distribution maps, a more refined understanding of artifact distribution within each site emerged. Formal field visits by DelDOT and the Delaware SHPO at the completion of the first stage were conducted and the preliminary distribution maps were examined to determine direction and focus of continued Phase II and Phase III excavations. Conducting the Phase II and Phase III archaeological investigations in this manner allowed for timely input from DelDOT and the Delaware SHPO. 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.

Prior to any field investigations, a health and safety plan was prepared. Hazards identified included vehicular traffic, working around heavy equipment, cold weather, poison ivy/oak, and insects.

Various field methodologies for the recovery of prehistoric and historical data were employed at Site 7NC-J-204. These methods included shovel test pit (STP) excavation, 1 x 1 meter (m) test unit excavation, systematic soil sampling, and mechanical removal of the plow zone in order to expose sub-surface features (Table 5-1).

Table 5-1. Phase II and Phase III Excavations at the Jones Site (7NC-J-204)

Phase	Excavation Type	Block A (North)	Block B & C (South)	East Area	Total
Phase II	Shovel Tests 10m interval	151	135		286
	Shovel Tests 5 m intervals	40	104		144
	Shovel Tests- Total	***191***	***239***	***Included in Block A***	***430***
	Stage 1 Units	3	2	1	6
	Stage 2 Units	9	15	4	28
	Test Units- Total	***12***	***17***	***5***	***34***
	Mechanical Stripping	300 square m	579 square m	0	879 square m
Phase III	Shovel Tests (Block C)	0	134	0	134
	Mechanical Stripping				7000 square m
	Soil Sampling (plow zone)	205	626	0	781
	Soil Sampling (Sub-plow zone)	233	663	0	896
	Soil Sampling- Total	438	1289	0	1677

5.2.1 Phase II Site Evaluation

Phase II site evaluation was conducted to determine the significance of the archaeological materials at the Jones Site. Significance was assessed on the basis of criteria required for nomination of the resource to the National Register of Historic Places (NRHP), the ability of the site deposits to address specific research questions formulated in existing management plans for

the State of Delaware (Bedell 1999, DeCunzo and Catts 1990, DeCunzo and Garcia 1992), and the physical integrity of the site deposits to convey information pertinent to research contexts.

Phase II fieldwork was conducted by Parsons between March and June 1999. Systematic shovel testing was initiated to relocate and refine the site boundaries and to identify artifact concentrations and features. Test units were judgmentally placed and excavated in areas of artifact concentrations to identify sub-plow zone potential and subsurface features. Mechanical stripping was implemented to expose additional cultural features.

Phase II, Stage 1

In total, 430 STPs were excavated across the Jones Site. The original grid was established on a 10-m interval; 286 STPs were excavated at this level. Two areas, designated Block A (northern portion of the site) and Block B (southern area of the site), displayed increased artifact densities. Additional STPs located at 5-m intervals were excavated in the 30 x 35 m area in Block A and in the 45 x 85 m area in Block B.

STPs measured approximately 30 centimeter (cm) in diameter and extended at least 10 cm into culturally sterile subsoil, where possible, in accordance with Delaware state guidelines. Natural stratigraphic breaks (i.e. soil color/texture change), dictated STP excavation, with depths measured from ground surface. A stratigraphic profile of each STP was recorded on a standard form, listing soil color, texture, and inclusions. Standardization of soil color descriptions resulted from use of the Munsell® Soil Color Chart (1994 edition). Soil excavated from each STP was screened through ¼ inch (6 millimeter [mm]) hardware cloth to ensure uniform recovery of cultural materials. Systematic shovel testing generated initial distributional data indicating artifact densities and areas of greatest archaeological potential.

Based on artifact concentrations, six 1 x 1 m test units were hand excavated. Three test units were located in the northern portion of the site (Block A); two test units were placed in the southern area of the site (Block B). One test unit was located on the eastern edge of the site to investigate a possible cultural feature.

Test unit excavation established the degree of subsurface integrity, located subsurface features, and provided control with respect to the vertical distribution of artifacts. All test units measured 1 x 1m. Disturbed sediments, redeposited strata, and introduced fill were removed as individual stratigraphic units rather than excavated in arbitrary levels. Test units containing intact subsoil or B-horizon deposits were excavated in 10 cm arbitrary levels within the natural strata. All of the excavated material was screened through ¼ inch mesh hardware cloth. Excavation continued until pre-Holocene deposits were exposed or to a depth of 1 m below surface, in accordance with regulations dictated by the Occupational Safety and Health Administration (OSHA) and enforced by the site safety officer. Standardized field notes documented unit placement, soils, artifacts, depth of excavation, reason for termination of excavation (i.e. natural stratigraphic break, arbitrary break, presence of features), excavators, date of excavation, and all observations. Scale drawings, 35 mm black and white prints, and color slides of a representative wall from each test unit documented individual stratigraphic sequences. Plan view photographs and scale

drawings, where appropriate, completed documentation. During fieldwork, site maps illustrating unit placement were created and maintained.

Phase II, Stage 2

Additional Phase II investigations included the hand excavation of twenty-eight 1 x 1 m test units and the mechanical excavation of six strip trenches (Table 5-2). The Phase II strategy involved removing the plow zone from the areas of highest artifact concentrations, particularly around the brick concentration. The test units were placed to investigate features observed in the strip trenches and to test areas outside the reach of the strip areas.

Mechanical stripping of the plow zone in linear trenches exposed sub-plow zone features. Excavation consisted of controlled removal of the uppermost horizon with a backhoe, outfitted with a smooth (toothless) bucket attachment. Backhoe operations were monitored at all times. Smooth bucket excavation results in a smooth excavation surface allowing greater visibility of potential features. Upon excavation, crew members removed the glossy sheen created by the backhoe with flat-headed shovels and trowels to better expose potential features for identification and mapping.

Table 5-2. Phase II Mechanical Stripping Data

Trench	Provenience	Length	Width	Area
1	Block A	164 feet (50 m)	10 feet (3 m)	1,640 square feet (150 square m)
2	Block A	164 feet (50 m)	10 feet (3 m)	1,640 square feet (150 square m)
3	Block B	318 feet (97 m)	10 feet (3 m)	3,180 square feet (291 square m)
4	Block B	213 feet (65 m)	10 feet (3 m)	2,130 square feet (195 square m)
5	Block B	46 feet (14 m)	10 feet (3 m)	460 square feet (42 square m)
6	Block B	56 feet (17 m)	10 feet (3 m)	560 square feet (51 square m)
Total		961 feet (293 m)		9,610 square feet (879 square m)

Field Conditions

The brick clamp area on the north end of the site and posthole features on the southern end of the site had been covered with Mylar after completion of the Phase II fieldwork, and the site was left undisturbed for almost seven months before the start of Phase III fieldwork. Hurricane Floyd deposited several inches of rain on the site just after the completion of Phase II field work in September 1999, which caused some slumping in the strip trench walls and backdirt piles, but the majority of the site was untouched. The Phase III investigations began in early February, 2000, just two days after a record breaking 16-inch snow fall. The upper 10 to 15 cm of soil (basically the plow zone) was already frozen solid prior to the snow storm, and the snow acted as

an insulator, preventing the sun from thawing the frozen ground. To expedite the thawing process, a front-end loader was used to push the snow off to the side of the proposed excavation block areas on the site. The snow was manually removed from Block A and Block B to minimize damage in re-opening these areas for the Phase III investigations.

The subsequent rains and drying periods since August 1999, and the freezing and thawing of the harsh winter of January and February 2000, did not greatly impact the condition of the Block A related features exposed during the Phase II investigations. However, the Phase II features in Block B on the southern end of the site had been severely impacted. A temporary PVC pipe Quonset hut was erected over the exposed portion of the main feature in Block A to accelerate the thawing of the feature and to protect it from further effects related to the harsh winter conditions occurring at that time.

5.2.2 Phase III Data Recovery

Data recovery methods included soil sampling, mechanical stripping, spoilpile removal, feature excavation and additional STP excavation in the area east of Block B, designated Block C (under the spoilpile) (Figure 5-1).

Soil Sampling

The initial soil sample collection strategy consisted of two control transects extending in a "cruciform" format on a grid oriented along north-south and east-west axes. Hand excavated samples were collected in both the Ap horizon (plow zone) and subsoil at 15 ft. (5 m) intervals along each transect, for a total of 150 soil samples from the cruciform, although only 126 were actually collected. The north-south control transect was designed to cross the large spoil pile on the southeast portion of the site to determine if the presence of the pile had impacted the surrounding native soils by leaching or runoff.

Both Blocks A and B were sampled on a 10 x 10 ft. (3 x 3 m) grid potentially resulting in the collection of 280 samples from Block A and 784 samples from Block B (Table 5-3). Block A was originally designated a 30 x 40 m area but was enlarged by 10 m to the south and 10 m to the west into a 40 x 50 m block, to encompass all of the features (Feature 4). Block B originally was a 90 x 40 m area that was enlarged by 10 m to the south to ensure all of the area around the southern Phase II features was encompassed.

The soil samples were collected with care to minimize the potential for cross-contamination. Each sample measured approximately one liter in volume and was collected in resealable 4mil polyethylene bags with an acid-free tag with complete provenience information. Samples were not taken where the surface was covered by standing water created from melting snow and ice. The bags were opened and allowed to dry over a long period of time in a controlled environment in the field lab in Little Heaven, Delaware to prevent molding. A one-liter sample size was collected, even though the submittal laboratory only required 15 g, as a precautionary measure for future sample submission for other possible research strategies.

Table 5-3. Soil Sampling Strategies by Area

Area	Size	Interval	Plow zone	Sub-plow zone	Spoil Pile	Feature	Total
Block A	40 x 50 m	3 m (10 ft)	205	233		40	478
Block B	100 x 40 m	3 m (10 ft)	443	493	32	39	1007
Block C	110 x 55 m	4.5m (15 ft)	133	170		26	329
Cruciform	Control transects		58	58	10		126
Total			839	954	42	105	1940

Phase III Mechanical Stripping

Once the soil samples were taken from both the Ap and subsoil regions in Blocks A and B and the cruciform control area, the Ap horizon was mechanically stripped from both blocks with a

backhoe and a smooth-bladed bucket. Block A was stripped within grid coordinate lines N260 to N310, and E560 to E600. A natural low spot was located in the southern end of Block A allowing water to stand during recent rains, so a large sump area was excavated outside the proposed block south of the southwest corner of the block to allow water to drain from the brick clamp area. Block B was stripped within grid coordinate lines N120 to N220, and E560 to E605. A sediment fence was constructed around the down slope side of the entire region area to prevent silting of the nearby drainage and swamp.

Spoil Pile Removal

The spoil pile area east of Block B was not investigated until after a lapse of several months after Blocks A and B were completed and comments were received from the DESHPO on the need for further work on the site. The historic artifact concentrations, fence line posthole features, and sub-plow zone pits adjacent to the edge of Block B and the spoil pile, all suggested the site extended under the dirt mound.

A temporary dirt staging area in the cultivated field to the east of the site was cleared by a small Phase I survey in September 2000 (Parsons ES 2000b) that did not identify an extension of the Jones Site boundaries to the east (Figure 5-2). After the staging area was cleared, the spoil pile was mechanically removed from the area east of Block B to within approximately 20 cm of the old ground surface and placed on the staging area platform.

The Ap horizon under the spoil pile was left intact for a short time to conduct a Phase I survey and extend the soil sampling program into the new proposed block area, designated Block C. The spoil pile had been placed on the southwest corner of the site prior to the original Phase I by UDCAR in the early 1990s and had never been fully investigated to the level of effort conducted on the rest of the site. The area just outside the southeast corner of the Block C area exhibited signs of damage from earthmovers placing the soil on the spoil pile from the early 1990s and was not included in the Block C boundaries. Block C was laid out to encompass any possible feature or structural complex that might have existed within the ROW based on the STPs from the Phase I efforts by UDCAR which encompassed the spoil pile.

Phase III Shovel Testing in Block C

Block C was aligned on the site grid system for the Phase I level STP program and a total of 134 STPs were excavated across the area at 5 m (15 ft.) intervals. To save time and effort, the soil chemistry samples were also removed from the Ap and subsoil horizons of the STPs as they were encountered. The soil chemistry samples were taken at 3m (10ft) intervals in Blocks A and B, and at 15 ft. intervals in Block C; however, it was determined that the effect would be minimal on the interpretation of site function areas based on intervals from other similar soil chemistry testing programs. Block C was an amorphous shape basically extending between N90 to N200 and E590 to E645 with the west side of the block adjacent to the east side of Block B. Elevations of the top and bottom of the Ap horizon using the exposed STP profiles in Block C were taken to complete the site topographic map without the elevations of the spoilpile. After the STPs were excavated and the elevations taken in Block C, the Ap horizon was mechanically removed with a backhoe and smooth-bladed bucket.

Combined, Phase III mechanical stripping in all three block areas removed just over 11,671 square meters (2.88 acres) of the Ap horizon (Table 5-4). The field crew monitored the backhoe at all times and identified features as they were discovered, consulting the crew chief and field supervisor when needed. All features were flagged, including the obviously recent soil sample and old shovel test locations, for review by the crew chief and field supervisor prior to feature excavation. By flagging the old and new shovel tests, the grids utilized during the shovel test and soil chemistry sample programs could be identified to avoid mistaking these for features. After each block was stripped of the Ap horizon, each was then shovel scraped/cleaned, and all remaining historical and prehistoric cultural features that were not eliminated were recorded on the site map.

Table 5-4. Phase III Mechanical Stripping Data

Provenience	Length	Width	Total Area	Phase II Area	Total Phase III Area

Table 5-4. Phase III Mechanical Stripping Data

Provenience	Length	Width	Total Area	Phase II Area	Total Phase III Area
Block A	164 feet (50 m)	131 feet (40 m)	21,484 square feet (2,000 square m)	3280 square feet (300 square m)	18,204 square feet (1,700 square m)
Block B	328 feet (100 m)	148 feet (45 m)	48,544 square feet (4,500 square m)	6,330 square feet (579 square m)	42,214 square feet (3,921 square m)
Block C	361 feet (110 m)	180 feet (55 m)	64,980 square feet (6,050 square m)	0	64,980 square feet (6,050 square m)
Total			135,008 square feet (12,550 square m or 3.1 acres)	9,610 square feet (879 square m or 0.22 acres)	125,398 square feet (11,671 square m or 2.87 acres)

Feature Excavation

No formal hand excavation units were placed on the Jones Site during Phase III investigations, except for the bisection of the brick clamp heat signature (Feature 18) and the clay mixing pit (Feature 4) when hand-excavated trenches were required. The brick clamp heat signature (Feature 18) was bisected by a 4 x 1 m wide trench to reveal feature morphology in profile. Two such trenches also bisected the procurement pit (Feature 4) from north to south (14 m) and from east to west (11 m). All trench units were assigned coordinates using the southwest corner, and rarely was the unit excavated beyond the base of the feature. Unit forms were completed for the trench units in the two above described features to ensure horizontal and vertical control on the artifacts, and only elevations, artifacts recovered, and quick observations were recorded, as the more detailed information and profiles were recorded on the feature forms.

Procedures for sub-Ap horizon features included excavation, mapping, recording, artifact provenience and collection, and specialized sample collection, with photographs taken of the plan view and profile at the appropriate time. All cultural features in Blocks A and B were photographed, drawn, bisected, and then fully excavated to determine depth and morphology. After the first half of a feature was excavated, the base of that half was extended into the subsoil as a window completely exposing the second half of the feature and surrounding subsoil for profiling and photographing. Artifacts, if present, and soil samples were recovered from all excavated cultural features. The features were usually excavated as a single unit, which was bisected for profiling and then totally removed. Block C feature excavation procedures were similar to Blocks A and B in that all cultural features were photographed, drawn, and bisected, and most were fully excavated to determine depth and morphology. However, a small number of postholes and amorphous stain features in Block C were only bisected and profiled, but not fully excavated because of redundancy of recorded information between other site features, such as the dozens of square fence post features in Blocks B and C, with agreement from the DESHPO and DelDOT not to complete the excavations on those feature types after bisection.

The vast majority of the features were excavated in stratigraphic zones and not arbitrary levels. Larger features, such as the well and larger pit features, were excavated in controlled arbitrary levels because of depth. When possible, a two-liter soil sample was taken from each feature; an entire feature may have been removed as a single sample, collecting both halves after excavation. Matrix not contained in a specialized sample was screened through a ¼ inch hardware cloth screen.

A rainstorm dumping 5 ½ inches of water onto the site in March 2000, created problems for the remaining excavations. Water was constantly standing in the south end of Block B, and needed to be constantly pumped out of the well during excavation. The matrix from the brick lined well and the pit features from Block B were water screened in ¼ inch mesh screens placed over a wheel barrow using the water that was rapidly seeping in to the well as well as recycling the standing water in the southwest corner of Block B with a 1 ½ inch gas powered water pump.

Well Excavations

Two major features provided challenges for excavation on the Jones Site: the excavation of the brick-lined well (Feature 156) and the barrel well (Feature 268). The brick-lined well was encountered first and the field team was able to excavate the upper portion of the well without compromising OSHA regulations or personal safety issues. Once the inside of the well reached a point lower than OSHA regulations (1 m down and 1 meter back from the edge), the field crew removed the surrounding subsoil to create a sloped working area around the well to allow access to the shaft, which was by that depth solidly lined with brick and wood. The sediments and artifacts inside the shaft were removed in 20 cm levels but the continual filling of water into the shaft obscured context information in the lower half so the bottom half of the well was removed as one level. The excavators could feel the bottom lip of the well but could not continue to dig because water rapidly filled the shaft. A small 1 inch pump was used in an attempt to alleviate the problem, but clogged up with sand. Small sinkholes appeared outside the shaft area as the sand was sucked under the well walls and sucked up into the pump. The bricks lining the interior of the well were removed and portions of the wooden wall were removed for later study and the remainder of the feature was abandoned.

The excavation of the barrel well was approached with particular caution because it appeared to be an older feature from the onset. A study of other wells excavated in Delaware and the region indicated the majority of wells were excavated with only a back hoe and not by hand, providing little context within the feature type. Parsons excavated with both techniques. The north half of the barrel well was removed by two stratigraphic zones (inside the barrel and in the exterior construction shaft) in 20 cm arbitrary levels. When the bisected portion reached a depth lower than the OSHA regulations allowed, a backhoe dug a sloped area around the excavated feature half and cut the subsoil profile to view the well in profile. Shoring was added across the face of the well profile to prevent the wall from collapsing, and the north half was excavated in 20 cm increments. When the top of the bottom barrel (third barrel) was encountered intact in the north half of the feature, the south half of the middle barrel slumped out and excavation methods were altered to remove the south half and slope down the edges of the safety hole until the top of the third barrel was exposed in the middle of a gently sloped depression. At that point, it was

decided to expedite the process and remove the remainder of the feature fill by just two proveniences: the top and bottom half of each barrel.

The bottom barrel was well preserved because it was well below the average water table. The safety depression was enlarged and a sump hole added outside the edge of the bottom barrel to allow the water to drain out of the barrel as it filled, with the large water pump removing the water to the other side of the excavation block. The pump was also used to water screen all matrix removed from the bottom barrel, speeding the process and allowing for better artifact recovery. However, the rate of water flowing into the well was so great that the base of the feature was never actually seen by the excavators, but felt with their hands. The barrel hoops were fragmented and fell off of the barrel side when the subsoil was removed. Finally, the barrel staves were removed individually and placed in large trash bags and tightly wrapped to keep wet for transport to the laboratory in Fairfax, Virginia.

Feature Samples

Twelve carbon (C-14) samples were collected from ten features identified during the Jones Site Phase III investigation. The ten features with associated C-14 samples are: Features 22, 102, 104, 112, 145, 149, 151, 157, 159, and 268, the barrel-lined well; however these samples were not tested since the prehistoric component of the site was not NRHP eligible, and the results would not have been useful in understanding the historic component.

In addition, five subsoil samples from various areas in and around the site were collected for the purpose of chemical analysis to determine if these areas may have been sources of locally-available raw material for brick manufacture at the heat signature. One large bucket of soil was collected from each sample and stored at the Parsons lab in Fairfax, VA. The material was allowed to dry and protected from contamination with foil coverings. An experimental study to form and fire bricks from the collected material was suggested, but never performed.

5.3 LABORATORY METHODS

5.3.1 Field Lab Procedures

Artifacts recovered during both phases of the archaeological investigations at the Jones Site were inventoried at the Parsons Field Lab, located in Little Heaven, Delaware with the exception of the barrel components and other artifacts recovered from the barrel well which were transported directly to the Parsons Lab in Fairfax (see Barrel Analysis). 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. Soil samples and feature samples were opened and allowed to dry out in the lab so mold and mildew would not grow in the wet bags.

The inventories produced in the Field Lab were entered into a preliminary database and used to generate a series of artifact distribution maps using the SURFER® 8 program. The locations of various types of artifacts, divided functionally and temporally, were plotted. Distributions

provided temporal and functional indications of cultural activity across the site. The placement of artifacts relative to natural topographic features illustrated the natural and human processes involved within specific site development. The distribution maps were continuously updated to provide feedback that aided in the direction of test unit and mechanical stripping placement throughout the evaluation and data recovery investigations.

5.3.2 Fairfax Lab Procedures

Comprehensive artifact processing, cataloging, and analysis were performed in the Parsons Lab located in Fairfax, Virginia. Artifacts were processed to the standards of the Delaware State Museums Sampling and Curation Policy (DESHPO 1993). Artifacts were cleaned in plain water, and bagged by material type in 4-mil polyethylene zip-lock bags. 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. Curation activities were completed at the Versar lab in Springfield, VA following Versar's acquisition of the Parsons Cultural Resources Group.

Field notes and documentation were copied on acid-free paper and organized using archival materials. Photographs and slides were labeled and placed in archival sleeves. The project records and the artifacts were placed in labeled acid-free boxes. The artifacts and selected data will be curated at the facility of the Delaware State Museum in Dover, Delaware.

5.3.3 Analytical Methods

A full artifact inventory was compiled using dBase III+ and MS Access database management software, which can be easily converted to other applications for analyses and for integration with Geographic Information Systems (GIS). In addition to provenience information, coding for database entry included a variety of information (Table 5-5). The artifact inventory for Site 7NC-J-204 is located in Appendix C.

Table 5-5. Data Categories

Category	Description
Group and Class	broad hierarchical subdivisions for historic period artifacts based on South's (1977) typology for artifact pattern analysis
Raw material	using general mineralogical terms for lithic types (e.g., chert, rhyolite, quartz)
Morphological Type	for Native American artifacts, technologically derived terms are generally employed, though some widely accepted functional terms are used
Typology	for Native American artifacts, generally accepted morphological types associated with known chronological periods; for historical period artifacts, a hierarchical subdivision usually based on manufacturing technology
Function	specific functional classification for certain historical period artifacts
Subtechs	various technological and decorative attributes of historical period artifacts
Segment	indicating completeness or, if incomplete, the section of the artifact represented
Amount of Cortex	reported for certain classes of lithic debitage, and expressed as a percentage of the dorsal surface
Temper	aplastic tempering agent in Native American ceramics

Thickness	reported for Native American ceramics
Lithic Type	geographic source of selected chert, jasper, and rhyolite artifacts, if known
Color	Visible estimation for lithics, Native American ceramics and historical artifacts
Weight	expressed in grams, reported as a gross indication of artifact size; more detailed dimensional data were recorded for selected artifact types--projectile points, for example--as relevant to the analyses employed
Use	indicating the presence or absence of identifiable use wear traces on Native American artifacts
Heat	indicating the presence or absence of evidence of heat treatment of Native American lithic artifacts
Sgrade	size grade, measured on flakes as an indication of geometric dimension

Artifact Identification and Analysis

The artifacts were cataloged by count, raw material, typology, function, and segment. Additional attributes were recorded where they contributed to the determination of the artifact function or temporal range. Cataloging also included grouping the artifacts in categories in order to provide a framework for analysis. The group and class categories were based on a system developed by Stanley South (1977) but were tailored to incorporate 19th and 20th century artifact types. References consulted in the identification of the artifacts included Jones and Sullivan (1985), Munsey (1970), Godden (1991) and Toulouse (1971). Once inventoried, the artifact assemblages were analyzed for information related to chronology, function, technology, and behavioral processes.

Brick Analysis

The color of a fired brick is determined by many factors including the mineral composition of the clay as well as firing conditions such as temperature and duration of firing, an oxidizing or a reducing atmosphere, and the fuel used in the firing. The amount of minerals in the clay, such as iron, chalk, magnesia, and manganese are factors that result in shades of red, white/yellow, tan, and black, respectively. For iron-rich clays, an oxidizing atmosphere results in a brighter red color, whereas a reducing atmosphere results in a duller blue/purple color. In addition, a single brick may be of various shades, having darker patches or a darker exterior or core, depending on composition and firing conditions (Gurcke 1987).

In general, however, an iron-rich brick will be darker and harder when it has been fired at a higher temperature. As stated by Gurcke (1987:126), "At the close of the oxidation stage, bricks composed of red-burning clays exhibit a salmon or pale-red color if burned properly, although they may be soft and weak…With the higher temperatures attained during the vitrification stage, brick colors become darker and more saturated." Therefore, color was recorded for all brick fragments recovered from the Jones sites. Cataloged colors included buff, orange, pink, red, and dark red (Figure 5-3). Softer buff, orange and pink colored fragments were considered mis-fired or low-fired, whereas harder red and dark red fragments were considered high-fired.

Figure 5-3. Brick Color Examples. Left to right: Buff, Orange, Pink, Red, and Dark Red (Bags 322, 334).

In addition to color, the presence or absence of glaze was noted. Glaze on bricks may be intentional or not, and is generally found on the headers of those bricks closest to the heat, where full vitrification occurs. Also noted was glaze that was found over a broken brick surface, usually an indication of a firing error. An example of such a firing error is shown in Figure 5-4.

Barrel Preservation and Analysis

Components of the second and third wooden barrel from the barrel-lined well, Feature 268, were transported to the Parsons lab in Fairfax wrapped in plastic trash bags to retain moisture. Components of the second barrel consisted of cask head planks only; no staves were recovered from this barrel. The third barrel included staves, a bung hole, wooden hoops/rings and cask heads.

These waterlogged pieces were wrapped in 10mil clear plastic, tagged with provenience information and placed in a refrigerator for approximately one month in accordance with procedures detailed by the National Park Service for the preservation of wet-site objects (NPS 1993). Pieces were then removed from the refrigerator, individually washed to remove sand and soil particles and rewrapped in clean plastic. They were shelved, allowed to air dry, and individually tagged with provenience information. Lab technicians periodically examined the pieces for the presence of mold and to ascertain the rate of drying.

Before the pieces completely dried, the individual barrel staves and cask heads were measured for length, width, thickness and identifying marks. Data for the staves and cask heads were recorded on two forms prepared in consultation with the Archaeologist from the Delaware State Museums (Appendix D). These data were then compiled into an Access database for analysis.

Figure 5-4. Brick Fragment with Evidence of Firing Error (#318-3).

Finally, the barrel components were photographed prior to drying. At the completion of the photography, the pieces were reshelved and allowed to dry completely. No mold was detected during the course of the drying process and the pieces remain in a dry, stable condition.

Spatial Analysis

Analysis of artifact distributions within and between sites was conducted using commercially available software (SURFER® 8 program) 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 cluster analysis that results in plans of horizontal artifact distribution. 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.

5.4 SPECIAL ANALYSES

Two special sample programs were conducted on the Jones Site to enhance the data for site interpretation. A soil chemistry sampling program was initiated to compare site functions from the Jones Site to other similar rural archaeological sites in Delaware. Additionally, for the first time in Delaware, a brick chemistry sample program was performed to begin the creation of a data base on chemical signatures of brick manufacturing sites.

5.4.1 Soil Chemistry

Soil chemistry analysis was recommended for the Jones Site to identify functional variation in historical activities in the two major areas of artifact concentrations of the site: Block A (the brick clamp heat signature area) and Block B/C (the posthole/post mold region). The result of the study will be used to identify the type of soil chemistry signatures associated with ephemeral historical sites and define specific activity areas and soil signatures from other similar historical sites using the same strategy. Patterning, or the lack of patterning, of historical activities will be examined and discussed in terms of agricultural tenancy sites and/or other types of ephemeral occupations. A critical evaluation of the utility of soil chemistry analysis for ephemeral historical sites will be presented.

Soil chemistry analysis provides information on specific types of historical activity not readily observable through feature and artifact distributions. The pH reading and four chemical elements - phosphorus, magnesium, calcium, and potassium - have been the standard factors utilized to aid in identification of the presence of structures, livestock pens, fence lines, meat processing areas, privies, or heavily fertilized areas suggesting a cultivated field or garden. These activity areas have been associated with soil chemistry analysis programs from 1985 to the present in Delaware (Catts and Custer 1990; Catts et al. 1995; Custer et al. 1986; De Cunzo et al. 1992; Grettler et al. 1995; Grettler et al. 1996; Hoseth et al. 1990; Scholl et al. 1994). Specific information derived from concentrations of these five factors is indicated below.

- pH - clusters of similar pH levels can indicate the presence of a garden, or localized crop areas, and as Delaware soils are naturally acidic, readings above 6.0 suggest agricultural fertilization (Jamison et al. 1997:83);

- Phosphorus - high levels are good indications of fecal remains, indicating animal pens and privies;

- Magnesium and Calcium - the relationship between the presence of magnesium and a historical site is still unclear, but it usually correlates directly proportionally to calcium concentrations, which can identify bone processing stations, lime kilns, and mortar deposits (Hurry 2000); and,

- Potassium - an excellent indicator to locate and identify wood ash deposits indicating the presence of a hearth, secondary deposits of wood ash, burned fence lines, or other wood burning activities (Catts et al. 1995:97).

The five-element soil chemistry testing program has primarily been implemented in Phase III level archaeological investigations in Delaware where features, structures, and landscapes have already been at least partially identified based on artifacts and/or feature evidence. These previous studies have clarified historical activity areas based on implications from well-defined features and feature patterning. Since no direct or definitive structural evidence has been found on the Jones Site other than the wells, soil chemistry analysis was used to examine whether the existing historical patterns of activity on other sites apply to ephemeral historical occupations such as the Jones Site. Specific research issues addressed through soil chemistry analysis include, but are not limited to:

Block A

- Evidence of other activities not represented by the feature or artifact assemblage, such as an animal pen or holding area, ash dumping episodes from the brick clamp, or mortar/lime producing stations; and
- the type of fuel used to fire the brick clamp.

Blocks B/C

- Evidence of historical activity areas associated with features and artifact assemblage; and
- evidence of historical activity areas not represented by archaeological remains.

A total of 1677 soil samples were taken from both plow zone and sub-plow zone contexts. However, because of the large number of soil samples taken on the Jones Site, a strategy for submitting only a portion of the samples was proposed. The collection of soil samples from Blocks A and B was grid-oriented based on 3 m (~10 ft) intervals. Block C was also grid-oriented but was based on 5 m (~16 ft) intervals. For comparative purposes across the site, the sampling strategy for this analysis was based on a 6m (~20 ft) interval. Therefore, every other sample in the collection grid from Blocks A and B and each sample from Block C were submitted (Table 5-6). Corresponding soil samples from both plow zone and sub-plow zone contexts at each selected grid point were submitted to examine vertical variations in historical activity. In addition to the grid-oriented soil chemistry samples for Block A, samples from six historical features were also submitted and included the heat signature (Feature 18), the mixing pit (Feature 4), two postholes (Features 125 and 146), and the two linear brick-filled depressions (Features 22 and 142). A total of 589 soil samples were submitted to the Soil Agronomy Laboratory at the University of Delaware, Newark for processing and analysis. A one-half cup sample was taken from each larger soil chemistry sample identified to be sent for analysis, even though the lab conducting the study only required a minimum of 15 grams.

Table 5-6. Proposed Soil Samples by Type and Location for Soil Chemistry Analysis

Area	Plow zone Samples	Subplow zone Samples	Feature Samples	Total
Block A	54	60	6	120
Block B	107	119	0	226
Block C	122	121	0	243
Total	**283**	**300**	**6**	**589**

5.4.2 Brick Chemistry

The paucity of archaeological information regarding rural manufacturing in Delaware and specifically, brick production, makes the Jones Site results an unusual opportunity to examine small scale brick production activities from mining the raw materials to firing the brick. We also hoped to identify brick distribution patterns across the site and to assess occupational and functional associations. Both DelDOT and the DESHPO encouraged us to be innovative in research approaches and methods, which led to the initiation of a brick chemistry sampling program at the Jones Site.

Chemical similarity between raw materials and finished products can provide a mechanism for sourcing the final product, and fired clay objects have been particularly popular targets for chemical study because of their durability, abundance in archaeological sites, and the impurities they contain (Gilbert et al. 1993:18-19). The goals of ceramic provenience are to link artifacts with their source materials based on chemical similarity and link ceramic specimens with each other under the assumption that matching chemistry suggests common origin. The effects of industrial processes, such as chemical signatures providing evidence of land use and activity areas, may be preserved in the soils and provide information on an industry's exploitation of and adaptation to the environment (De Cunzo and Catts 1990:132; De Cunzo and Garcia 1993:290).

Identification of locally manufactured bricks and raw source materials based on specific criteria is a proven technique used in the Northeast. The primary focus of sourcing the brick matrix closely follows a study by Dr. Allan Gilbert of Fordham University in New York (Gilbert et al. 1993:18). Since the early 1980s, Dr. Gilbert has been compiling information in a brick database for the entire state of New York and using the chemical signature of bricks to help identify the quarry areas where the raw materials were procured (Sopko and McEvoy 1991). Gilbert et al. (1993:43-44) utilizes an inductively-coupled plasma emission spectroscopy (ICP) referred to as Program K-1, as opposed to the instrumental neutron activation analysis (INAA) because of low cost, accuracy, precision, and number of elements analyzed (Gilbert et al. 1993:43-44). Gilbert uses an analysis of 25 elements as the most effective and cost efficient system, still containing a wide array of elements to enable the study to potentially separate matrix sources.

Specific research issues addressed through chemical analysis of bricks and subsoils pertaining to the Jones Site include:

- occupational association of the brick clamp area with other areas of the site through matching brick chemistry;

- identification of the use of the brick produced onsite;
- variations in brick production through time based on information from the hand molded bricks from an historical post mold from the canopy/shed (Feature 125), the barrel well (Feature 268), and the machine-made bricks in the brick-lined well (Feature 156); and
- identification of local raw material sources that may indicate a complete procurement/manufacturing cycle onsite.

A total of 17 samples (9 soil samples and 8 brick samples) from the Jones Site were submitted for ICP analysis to Dr. Nick Walsh at the University of London, a major contributor to Dr. Gilbert's New York brick studies.

All the soils present on the Jones Site were assumed to have the same or similar chemical composition since they were eroded from the same geological formation and deposited by the same geomorphological processes. However, subtle differences across the site were observed in the soil composition and a sample of three locations of slightly different subsoils was developed. Five subsoil samples were collected at three locations:

- under Feature 4, the possible clay procurement/mixing pit;
- between the postholes near the clamp; and
- in the gleyed soils from the southern end of the site near the marsh.

We initially interpreted Feature 4 to be the procurement pit, and thus the subsoil directly under the feature would hopefully be similar to the brick signatures. If the area around the possible shed/canopy area west of the brick clamp was the production location for the bricks, signatures of additives to the bricks might be present in that portion of the site. Furthermore, the area around the postholes was slightly sandier than the area under the procurement/mixing pit. The gleyed soils from the southern end of the site were much sandier than the subsoils around the clamp region and could provide a different, contrasting chemical signature to serve as a kind of control.

Since few bricks or bats were found outside the brick clamp heat signature area, specific samples were submitted for comparison to the subsoil samples. Two brick samples from each of the following four areas were submitted:

- Feature 4, procurement/mixing pit;
- Feature 125, posthole from the canopy/shed;
- Feature 156, brick-lined well; and
- Feature 268, barrel well.

The brick samples from the procurement/mixing pit (Feature 4) were selected because of the proximity below the plow zone where larger bricks were recovered, larger than the fragments found in the Ap horizon around the clamp complex. For similar reasons, samples were also taken from Feature 125, a posthole in the canopy/shed area west of the clamp, and also sub-plow zone. The brick-lined well (Feature 156) was the only location on the site actually utilizing brick in construction, and a brick sample was taken from that feature for comparison to the others on the site. Furthermore, the brick-lined well was thought to be constructed at a later date (mid-19th century) and the barrel well and clamp were dated around the late 18th century. Brick comparisons between the two time periods might prove useful in interpreting the site.

Dr. Gilbert provided guidance on how to collect the samples from the brick and grinding procedures. Only 0.2 g of crushed and powdered brick or soil was required for the procedure, approximately a level teaspoon. Samples of the brick were ground to a powder with a glass pestle because a porcelain pestle could leave chemical traces, such as mullite, in the powdered sample. Glassine paper was used to gather the sample instead of a metal spoon. The samples were poured into a half-dram size black plastic vial with a screw cap, labeled, then shipped to the lab for processing.

Submitted soil and brick samples were analyzed for 21 elements and 9 oxides (Table 5-7).

Table 5-7. Brick Chemistry Elements and Oxides

Element or Oxide	Chemical Designation
Aluminum Oxide	Al_2O_3
Barium	Ba
Calcium Oxide	CaO
Cerium	Ce
Chromium	Cr
Cobalt	Co
Copper	Cu
Dysprosium	Dy
Europium	Eu
Iron Oxide	Fe_2O_3
Lanthanum	La
Lead	Pb
Lithium	Li
Magnesium Oxide	MgO
Manganese Oxide	MnO
Neodymium	Nd
Nickel	Ni
Phosphorus Oxide	P_2O_5
Potassium Oxide	K_2O
Rubidium	Rb
Samarium	Sm
Scandium	Sc
Sodium Oxide	Na_2O
Strontium	Sr
Titanium Oxide	TiO_2
Vanadium	V
Ytterbium	Yb

Table 5-7. Brick Chemistry Elements and Oxides

Element or Oxide	Chemical Designation
Yttrium	Y
Zinc	Zn
Zirconium	Zr