2.1 Background Research Methods

Background research performed by A&HC included literature review focused on the Woodland I and II periods, as well as archaeological studies conducted in the surrounding region. The background research was conducted using resources available on line at various locations including DelDOT's web site, and at the Pattee Library of The Pennsylvania State University. Included were cultural resource management project reports, as well as research reported in journals, books, theses, and dissertations. Also included were deed and tax records, census records, and genealogical records. The research focused on developing environmental and cultural contexts for the evaluation of data at Sites 7K-F-11 and 7K-F-169 and was performed within the framework of the research issues defined below (Section 4.0). The research also focused on the methodologies and results of specific analyses performed using data from the sites, such as microwear analysis and protein residue analysis. Additionally, extensive background research was performed for the ceramic analysis, including a comprehensive compilation of radiocarbon dates for Delaware ceramic types.

Background research for the historic component at Site 7K-F-11 consisted of additional research to supplement the deed trace established by ADM for the project. Research was conducted at the Delaware Public Archives, at the Kent County Recorder of Deeds office, and online through Ancestry.com.

2.2 Field Survey Methods

Phase II Field Methods

Additional Phase II fieldwork was conducted by A&HC on the east side of SR 1 to further evaluate Site 7K-F-169 (the Soulie Gray Farmstead) and the portion of Site 7K-F-11 (the Gray Farm Site) in this portion of the APE and refine the boundaries between the two components. Fieldwork began with the establishment of a site grid system, based on datum points left by ADM's previous work. The coordinate system was oriented 35 degrees East of North, to align with the grid system previously used on Site 7K-F-11, on the west side of SR 1 (Emory et al. 2007).

Phase II field survey at the Soulie Gray Farmstead (7K-F-169) was undertaken by A&HC in February 2009, in portions of Areas 2 and 5 within the revised APE boundary (Figure 2.1). Phase II testing consisted of the excavation of test units measuring 1 m x 1 m. In Area 5, test units were placed at 20 m intervals, for a total of 50 test units excavated. In Area 2, the interval between test units was reduced to 10 m and the spacing was irregular to avoid test units and strip trenches from previous excavations, as well as large rubble piles from the demolished structure. A total of 15 test units were excavated in Area 2.

Test units were excavated by hand. The Ap horizon was excavated as a single level, since it had no internal stratigraphy. The surface of the E horizon was troweled and examined for evidence

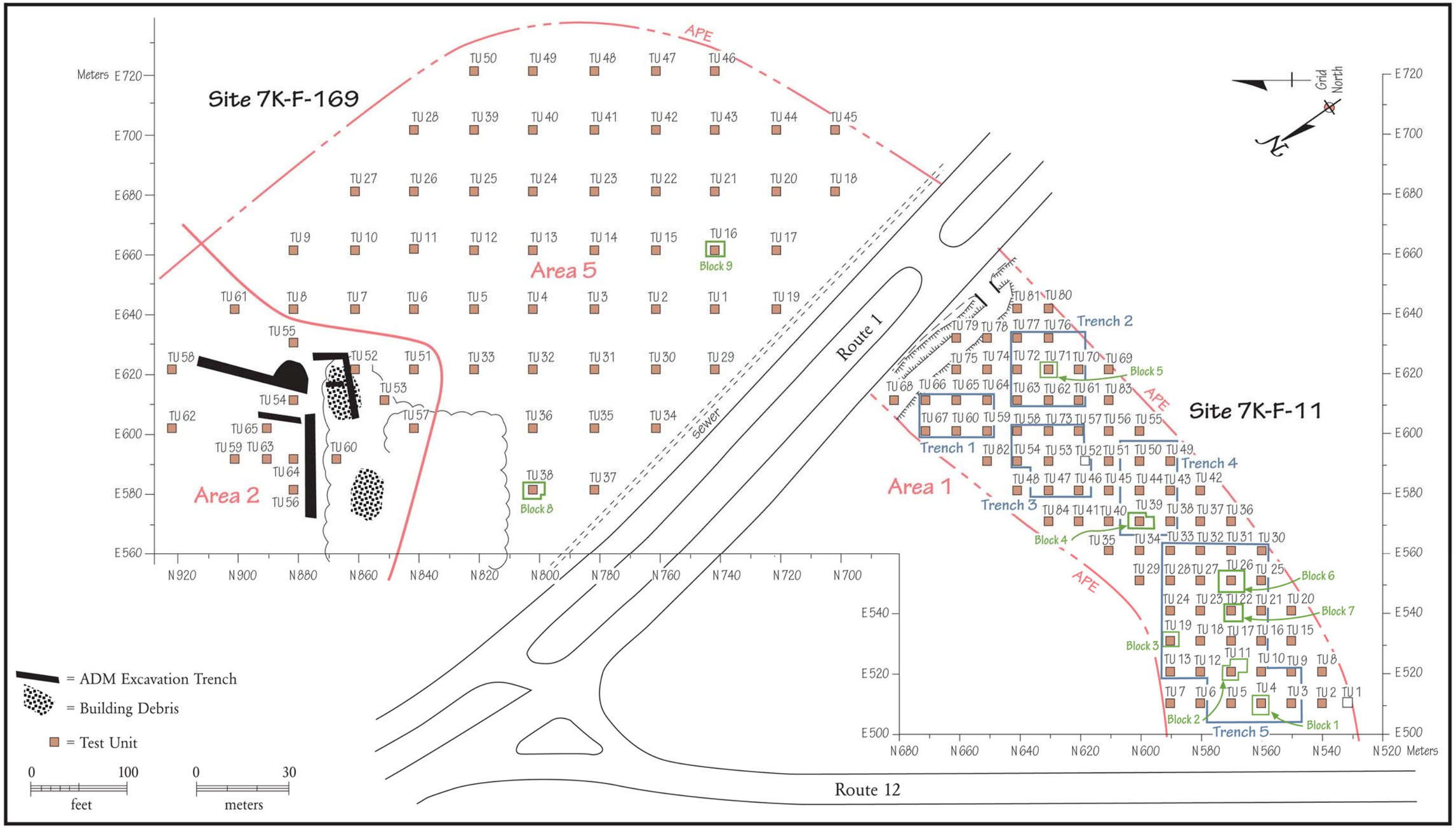

Figure 2.1 Map of Phase II Test Locations at Site 7K-F-169 and Phase III Test Locations at Site 7K-F-11

of cultural features at the Ap/E horizon interface. The E horizon was then excavated in 10 cm levels within the horizon. Excavation extended one 10 cm level into the underlying Bt1 horizon. Features were mapped and photographed in plan view, then profiled by bisection along their longest axis. One half of each feature was excavated in 10 cm levels. The other half was left *in situ*. Cultural features were drawn and photographed in profile.

All soils were screened through 1/4 inch hardware cloth to recover artifacts. Artifacts were provenienced by test unit, excavation level, and soil stratum. All recovered artifacts were returned to the laboratory at A&HC for inventory and curation.

A&HC laboratory personnel Allison Bohn and Monica Padamonsky visited the Delaware archaeological laboratory in July 2008 and worked with the state curator, Charles Fithian, on identification of important diagnostic artifacts, including but not limited to early historic ceramics, prehistoric ceramics, and stone artifacts. Field director Scott Padamonsky also conducted a brief meeting with the curator to view such materials during mobilization for the fieldwork. A handout was prepared for the field crew, to aid in the identification of diagnostic artifacts (see Section 10.4).

Phase III Field Methods

Data Recovery excavations at Site 7K-F-11 were conducted by A&HC in three principal stages, described below. Preliminary results of each stage were reviewed in consultation with DelDOT and SHPO to modify the next stage plan, as needed.

Stage 1 -- Test Unit Excavations on Grid: The first stage of fieldwork was performed in Area 1 (west of SR 1) in February 2009. Stage 1 consisted of the hand excavation of 84 test units on a systematic grid. Test units measured 1 m x 1 m and were placed at 10 m intervals throughout the portion of the APE in Area 1 (Figure 2.1; Photograph 1.2). This consisted of 14 north-south transects, with five to eight test units per transect. The goal of this stage of excavation was to further define the site stratigraphy, to obtain an enlarged sample of diagnostic artifacts and tools, and to refine knowledge of the horizontal and vertical distribution of artifacts and features.

In the excavation of test units, the Ap horizon was provenienced as a single level where it had no otherwise-documented stratigraphy. In areas with a secondary Ap2 horizon, these strata were provenienced independently. After examination of the surface of the E horizon (the Ap/E interface) for features, the E horizon was excavated in 10 cm levels. All soils were screened through 1/4 inch hardware cloth to recover artifacts. Excavation was extend into the Bt1 horizon or deeper as needed, particularly to allow the geomorphologist to review representative soil profiles. A 1 liter soil sample was collected from the Ap horizon in each test unit and a second 1 liter sample from the uppermost level of the E horizon. These were conveyed to the A&HC laboratory for potential future fine-mesh water-screening to obtain small items such as micro-debitage or to provide material for other analyses, for example soil chemistry, starch grain studies, phytolith analysis, or protein residue analysis.

Twenty-six features were identified among the 84 test units. One feature that had been identified during the previous Phase Ib/II survey was also revisited and excavated. Features were exposed

to the fullest extent possible. They were mapped and photographed in plan view prior to excavation. Features were bisected along their longest axis and one half excavated in a maximum of 10 cm arbitrary levels. Feature fill soils were screened through 1/4 inch hardware cloth. If features were identified as cultural in origin, the bisected profile was drawn and photographed, and the remaining half of the feature was excavated. In some cases, the subsoil around features was excavated and screened, using the standard test unit excavation methods described above. Soil samples of 1.5 to 2 liters in volume were retained from all features, for specialized analyses such as flotation or soil chemistry. Final mapping and photography was completed after features were excavated. All feature locations were plotted on a scale map of the APE. Non-cultural features, such as rodent burrows, tree root casts, and unknown soil stains were sampled to identify their non-cultural status. Their locations and characteristics were recorded.

The 84 test units excavated on grid in Stage 1 represented a 1.1% sample of the portion of Site 7K-F-11 lying within the APE in Area 1. The results from this stage of field investigation were used to identify areas of higher overall artifact density and peaks in the density of specific lithic materials. This information was used in designing the second stage of field investigations.

Stage 2 -- Block Excavations: The second stage of fieldwork was undertaken in March and April 2009. It consisted of the excavation of nine blocks of contiguous test units around features of interest that were identified during Stage 1 excavations in Area 1 and during Phase II survey in Area 5. The size and placement of blocks was developed in consultation with DelDOT and SHPO staff. Nine blocks were excavated, representing a total of 102 m^2 of hand excavation. Blocks 1 through 7 were located in Area 1 west of SR 1 and Blocks 8 and 9 were located in Area 5, east of SR 1 (Photograph 2.1). Excavation methods were the same as described above for the Stage 1 test units, including excavation in arbitrary 10 cm levels below the Ap horizon and mapping and bisection of features to determine their cultural or non-cultural origin.

Stage 3 -- Trench Excavations: The third stage of data recovery excavations extended from April to July 2007. Based on the results of the Stage 2 block excavations, five areas were identified in consultation with DelDOT and SHPO staff for the opening of larger trenches in Area 1, west of SR 1. First, the Ap horizon was mechanically removed in these five areas, for a total of approximately 3,300 m^2. The Ap/E horizon interface was shovel-scraped and hoed, then examined for evidence of cultural features and other anomalies (Photograph 2.2). Each feature was cleared, examined, and recorded in plan. Representative features were subjected to various levels of investigation to enable their classification with regard to their potential to yield significant cultural information. A plan to recover a sample of the different types of feature was developed in coordination with DelDOT and SHPO staff. The methods of feature documentation and excavation were similar to those described above for the first stage of excavations (Photographs 2.3 and 2.4).

Geomorphological Investigations: A&HC's Geomorphologist made five site visits over the course of the Phase III fieldwork. Excavation unit and feature profiles were examined in detail and described. Vertical incremental soil column samples were taken from profile walls throughout the excavation area, including two taken as background samples from the margins of mechanically stripped areas assessed to be relatively undisturbed and at some distance from

Photograph 2.1 View of Areas 2 and 5 during Stage 2 block excavations, looking southeast along SR 1. Block 8 is in the foreground and Block 9 in the middle distance.

Photograph 2.2 Trench 3 during stripping, looking northwest. Crew members are cleaning the surface of the subsoil to identify and map soil anomalies.

Photograph 2.3 Trench 5 during the excavation of features, looking northeast. Slumping around the previous excavation of Block 1 is visible at lower right.

Photograph 2.4 Field crew during the mapping of Trench 5 *Left to right:* J. Pickin, D. Cheshaek, B. Koller, W. Mellin, C. Connallon, T. Hitchens, M. Stack, V. Layton, M. Weetman, G. Mellin. *Not shown:* C. Allegretto, J. Breneman, S. Padamonsky.

identified cultural features. Vertical incremental soil column samples were also taken from numerous features. Horizontal incremental soil column samples were also taken across several tree throw features. Bucket augering was conducted in several locations, particularly between the southern edge of the APE and the channel of Murderkill Creek. Surface conditions and stream bank profiles in the vicinity were examined to augment the stratigraphic data. Walking and driving surveys were performed throughout the Murderkill Creek watershed to interpret the landscape of the study area within its broader context.

Soil Samples: In all, 1,033 soil samples were collected during the Phase III excavations. Of these, 596 were from anomalies/features and the remaining samples were taken from test units or other areas of the site. Types of soil samples included standard one liter soil samples taken from all feature strata, additional soil samples from features of interest, samples for radiocarbon dating, OSL and related samples, and standard volumetric column samples from soil strata for particle size, soil chemistry and gravel content analysis.

Site Closure: When excavation of the sample of features had been completed, a field meeting with DelDOT and SHPO staff was held to confirm that sufficient data had been collected through fieldwork. The site was mechanically backfilled and closed July 25, 2009.

2.3 Laboratory and Data Analysis Methods

Artifact Processing/Inventory/Curation: Laboratory analysis began with the washing and basic inventory of the collection, followed by labeling and other activities required for curation. During inventory, lithic artifacts were sorted by raw material and assigned to typological categories. Pull slips were included with artifacts transmitted to subconsultants or specialized laboratories for analytical work, to ensure that their whereabouts were tracked. Historic artifacts were categorized by material, form, function, and age, and tabulated by functional classes such as domestic ceramics, other domestic, architectural, hardware, heating, personal, clothing, etc. Gastropod shell fragments from sub-plowzone contexts were identified taxonomically to the extent feasible and inventoried. For final curation, the collection was labeled, packaged, and delivered to the Delaware State Museum.

Projectile Point Typology: A&HC key level personnel collaborated in the analysis of projectile point typology, comparing the collection to standard references and relevant published research. The projectile points from Phase Ib/II testing were included in the analysis.

Sources used for the projectile point typology included reports from major data recovery projects in Delaware, including Hickory Bluff, Puncheon Run, Carey Farm, and others. Publications from other areas of the Atlantic Coastal Plain and the wider region were also reviewed as needed. Projectile point types were assigned to any completed biface or tool with a bifacially modified hafting base.

Ceramic Typology: The A&HC laboratory director and staff cleaned all ceramics through minimal dry brushing. A&HC then transmitted the ceramic assemblage to Daniel Griffith for detailed typological analysis. Mr. Griffith also selected ceramic specimens as well as samples of local clays for technological analysis by Mr. George Pevarnic, using petrographic thin section

analysis. Mr. Griffith also examined the ceramic assemblage from ADM's previous Phase Ib/II survey.

Ceramic Technology: Petrographic thin sections were produced by George Pevarnik using traditionally accepted methods. Each sample was ground on a lap wheel before being affixed to a glass slide. The sherd material was then polished to produce a thin section. Clay samples were made into briquettes, fired in a kiln, and prepared as described above. The resulting thin sections were analyzed microscopically under plane polarized and cross-polarized light, and mineralogical identifications recorded. Fabric characteristics as they relate to method of vessel construction and firing atmosphere were noted. The results of thin section analysis are pending.

Lithic Analysis: Chipped stone artifacts were assigned to raw material types based on grain, hardness and color, including argillite, various cherts, jasper, quartz, quartzite, rhyolite, siltstone, chalcedony, and siltstone/ sandstone. A technological artifact typology was then used to classify lithic artifacts and to evaluate reduction strategies employed at the site. Biface reduction byproducts included primary biface preforms, secondary biface preforms, and unidentified bifaces, primary biface thinning flakes, secondary biface thinning flakes, and tertiary biface thinning flakes. Flake core reduction byproducts included flake cores, flake core fragments, primary core flakes, and secondary core flakes. Decortication flakes, flake fragments, shatter, and potlids were identified as such, but could not be assigned to either reduction scheme. The various types were distinguished based on presence and amount of cortical surface, size, and flake morphology (e.g. presence and angle of the striking platform, relative thickness).

Utilized flakes were classified both by technological type and as tools showing macroscopic evidence of use, such as systematic microscarring, polish, or edge grinding/dulling. Shaped tools included projectile points, drills, end scrapers, side scrapers, choppers, spoke-shaves, unifaces, and bifaces. An unusually prevalent type found at this site consisted of small graver-like implements that were termed microtools. Ground stone tools included grinding stones, hammerstones, polishing stones, and a nutting stone. Unusually high numbers of grooved abraders were also found at this site.

Microwear Analysis: Bruce Hardy conducted microwear analysis of selected stone tools. Tools were examined at magnifications of 100-500x and the locations of wear traces and/or residues recorded. Wear traces and residues were photographed and identified by comparison with published materials or experimental replicates. The sample of tools examined included types of special interest, including abraders and microtools, as well as projectile points and other tool types that could assist in the interpretation of specific contexts of interest.

Botanical Analysis: Approximately 30 floral specimens were collected during Phase III fieldwork, and soil samples for flotation processing were routinely collected from excavated features. A&HC laboratory staff processed selected floatation samples that included a range of feature types and focused on those considered most likely to contain botanical remains.

Thirty flotation samples and selected floral specimens were submitted for botanical identification to Justine McKnight. Individual floral samples were examined under low magnification (10-40x) and identified at the genus level when possible, or to the family level if generic

assignments could not be made. Identifications were based on standard references and on material in comparative type collections. Flotation samples were also examined under low magnification, and were sorted into general taxonomic categories such as wood, seed, nut, etc. For each flotation sample, carbonized nuts, seeds, cultigens, and other plant parts, along with a sample of 20 carbonized wood specimens, were identified as described above. The items in each taxonomic classification were counted and weighed.

Starch Grain Analysis: Starch grains may be preserved in residues on artifacts which were used to process foodstuffs such as roots, seeds, and nuts. Some starch grains have a rather generic form, while others are specific to either genus or species. Many plants produce several different types of starches, and the researcher has to identify populations of starches, rather than relying on single starches. PaleoResearch Laboratory of Golden, Colorado conducted starch grain identifications for the present study. A&HC submitted ceramic and steatite sherds and ground stone tools, including abraders, for starch grain analysis. Items selected were either dateable in and of themselves or were from contexts of special interest in the overall analysis of the site.

Protein Residue Analysis: Protein residue analysis involves comparison of antibodies in residues washed from artifacts and soil samples to modern analogs. Matches are made and identification of plant and animal proteins to the family level is possible. The University of California at Bakersfield performed protein residue analysis, for matches against both plant and animal residues. The specimens selected for protein residue analysis included projectile points and other chipped stone tools, as well as ceramic sherds and groundstone artifacts. Specimens were selected based on chronological and contextual criteria.

Dating: Radiocarbon dates were procured for samples of carbonized organic material that were separated and removed from the surrounding soil matrix during excavation, as well as for carbonized organic material recovered during feature soil sample flotation. Additionally, two samples of marine shell were submitted for radiocarbon dating. The majority of samples (n=25) were from features of cultural origin, and were selected to provide dates for a representative sample of features and for features with artifact associations of interest. The latter included key ceramic and projectile point types, and tools of special interest such as grooved abraders and microtools. Six additional radiocarbon dates were procured for samples from tree throw features to assess the age of their formation.

Optically Stimulated Luminescence (OSL) and/or Thermo-luminescence (TL) dating were considered for contexts for which absolute dating was desirable but where carbon was lacking, or for which other dating results were ambiguous. In the event, a total of nine OSL samples were submitted. Five were from cultural features with reliable radiocarbon dates, and were submitted to evaluate the accuracy of the OSL dating method as applied to this context. The remaining four dates were from otherwise undated features of interest or from features with ambiguous dating results.

Although situations might have occurred in which TL dating would have been desirable, no such situations were encountered and no TL dates were submitted.

Geoarchaeological Analysis: Analysis and interpretation of the soils and geomorphology of the study area began with a review of the relevant literature. Soil particle size and soil chemistry analysis, including total and organic carbon, were analyzed for selected incremental column samples at the Cornell Nutrient Analysis Laboratory, Cornell University. Results of the laboratory analysis, combined with the geomorphological field investigations, were used to interpret Late Quaternary landscape evolution and surface stability, feature formation, and function. The work focused on distinguishing anthropogenic subsoil disturbances from those caused by animals, tree-throws, etc.

Spatial Distributions: A&HC key personnel coordinated on production of distribution maps using the Surfer® mapping software. Distributions were mapped for prehistoric and historic artifact types, lithic raw materials, and diagnostics. Distributions of FCR and features were also analyzed. The resulting distributions were then interpreted for possible behavioral correlates. Dr. Durland Shumway of The Pennsylvania State University Department of Statistics assisted with the analysis, testing hypotheses for statistical significance using Fishers Exact Tests coupled with Odds Ratio Estimates as well as a variety of multivariate statistical techniques.

Feature Analysis: As indicated below, a preliminary feature typology was developed during the Phase III fieldwork and was used in the field to assign features to types and to assist in feature sampling decisions. During analysis, the initial field typology was refined, informed by past studies and employing quantitative measures of feature size, morphology, and content. Feature attributes analyzed included volume, shape, lithic artifact density, organic content rank, and FCR density. Chronologically diagnostic artifacts present in features were also examined, as were radiocarbon dates and the results of botanical identifications.

Historic Artifact Analysis: Historic materials were identified and categorized into pattern recognition functional groups, including domestic ceramics, other domestic, architectural, hardware, heating, personal, clothing, pipes, and "other." Standard references on ceramics, glass, tableware, nails, buttons, and other materials were consulted. Defining characteristics such as makers' marks, lip form, and other morphological features were recorded. Analysis of pattern recognition assemblage composition helped elucidate the nature of historic occupation or use of the area, and complemented the results of archival research.

Using Surfer® software, detailed historic artifact distribution maps were produced to elucidate patterning in the assemblage. In addition to domestic artifact types, the distributions of architectural materials, including flat glass, brick, nails, etc., were generated to identity likely locations of previous buildings.

ADDITIONAL INFORMATION COMMENTS 17 through 19