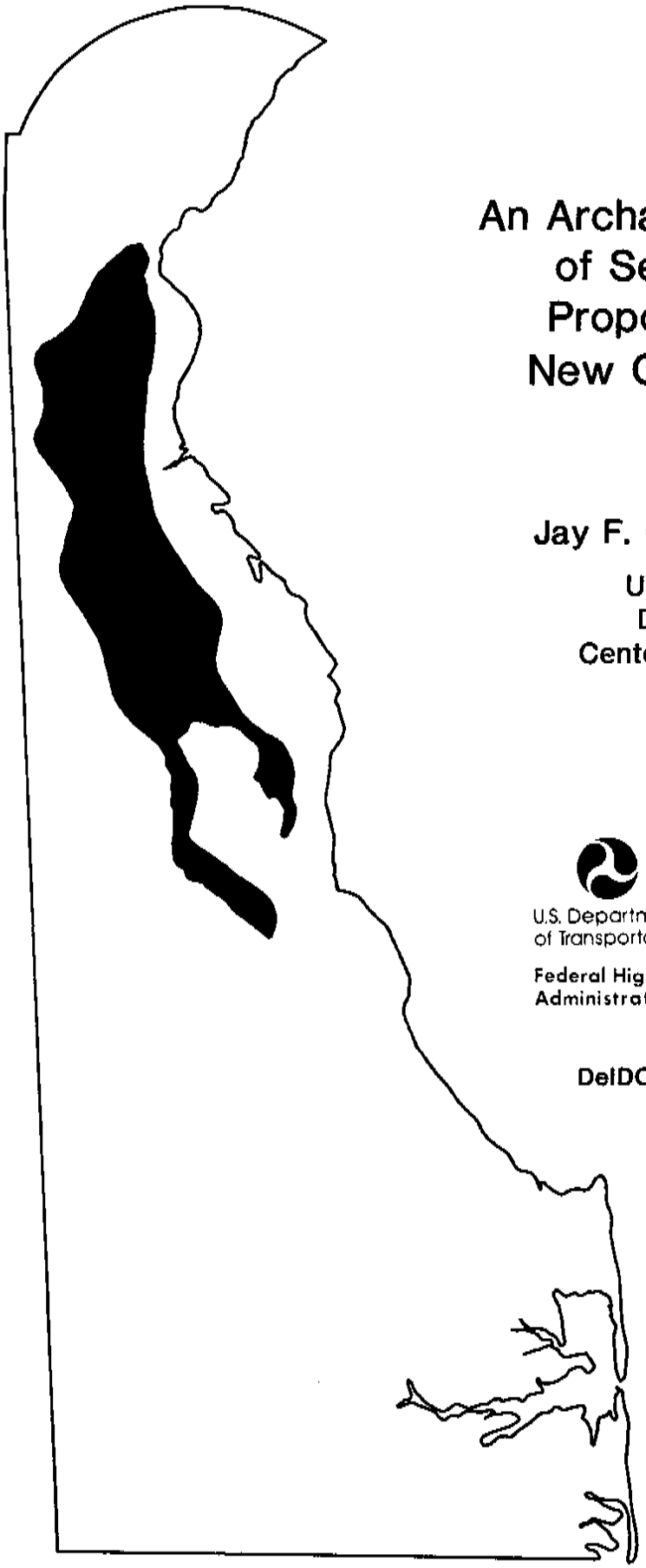

An Archaeological Planning Survey of Selected Portions of the Proposed Route 13 Corridor New Castle County, Delaware

by

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U.S. Department of Transportation
Federal Highway Administration

Delaware Department of Transportation

DelDOT ARCHAEOLOGY SERIES NO. 44

John T. Davis
Director
Division of Highways
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DELDOT PROJECT 83-110-01 ARCHAEOLOGY SERIES NO. 44

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U.S. DEPARTMENT OF TRANSPORTATION
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And

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ABSTRACT

The 1984 Rt. 13 cultural resource survey produced extensive and intensive data on a wide variety of prehistoric and historic sites within the New Castle County portion of the Rt. 13 Corridor. Pedestrian survey and subsurface testing resulted in the recording of 269 new prehistoric sites with the State Bureau of Archaeology and Historic Preservation. In order to test the utility of a LANDSAT - generated predictive model for prehistoric resources, and to provide planning information on cultural resources, investigations were concentrated in three study areas: 1) the Dragon Creek drainage near St. Georges, 2) the Appoquinimink Creek drainage, and 3) the Blackbird Creek drainage. The predictive model included high, medium, and low probability zones with the first two zones being adequately tested by the survey and the last underrepresented in the study areas. In general the results of the field survey compared favorably with the preditions formulated by the model. Artifacts recovered represented all four major periods of Delaware prehistory with diagnostic artifacts ranging from Kirk points of ca. 8000 B.C. to Woodland II triangles of ca. 1500 A.D. Of special note was the discovery of heavy utilization by prehistoric peoples of bay/basin features in the Blackbird Study Area. Investigations revealed that 87% of all bay/basins surveyed had associated archaeological remains.

A "windshield" survey was conducted of 188 standing structures and historic archaeological sites within the three study areas. This survey revealed that nearly all of the structures and archaeological sites previously identified in the initial report have remained intact and that significant archaeological resources are likely associated with the standing structures as well as the archaeological sites. The date range for the identified standing structures in the three study areas ranges from ca. 1690 to the twentieth century and represents a range of residential, agricultural, and industrial types. Locational data from all historic sites was then combined with data on soils, water type, and access to transportation networks to elucidate historic settlement patterns and generate a predictive model for future historic resource management.

TABLE OF CONTENTS

	Page
Abstract	i
Table of Contents	ii
List of Figures	iv
List of Tables	vi
List of Plates	x
Introduction	1
Environmental Setting	9
Regional Prehistory	12
Regional History	15
Research Methods	19
General Research Methods	19
Special Sampling Considerations - Blackbird Area	24
Results	25
General Survey Results	25
St. Georges Area	25
Appoquinimink Area - Surface Survey	32
Appoquinimink Area - Sub-surface Testing	45
Blackbird Area - Surface Survey	48
Blackbird Area - Sub-surface Testing	70
Intensive Test Excavation Results	77
Historic Site Survey Results	95
St. Georges Area	95
Appoquinimink Area	102
Blackbird Area	102
Analysis of Prehistoric Survey Results	114
Evaluation of Prehistoric Predictive Model	114
Settlement Pattern and Site Location Analysis	126
Surface Water Type	127
Distance to Water	131
Elevation	132
Geomorphological Setting	134
Aspect	137
Soil Series	140
Factor Analysis - Locational Variables	141
Site Area Analysis	143
Bay/Basin Utilization	145

Discussion of General Prehistoric Survey Results 149
Paleo-Indian Period 149
Archaic Period 149
Woodland I Period 150
Woodland II Period 151

Analysis of Historic Site Survey Results 152

Site Location Analysis 152
Soil Settings 154
Surface Water Setting 168
Access to Transportation Networks 174
Discussion of Historic Site Location Analysis 185
Nearest Neighbor Analysis 186

Management Considerations 192

Assessments of Site Significance 192
Cultural Resource Planning Maps 194
Future Management and Research Issues 195
Attachments I, II, and III 195

References Cited 210

Personnel 222

Appendicies 223

Appendix I - Project Proposal and Research Design .. 223

Appendix II - Technical Data for Blackbird Area Sampling Design 227

Appendix III - Description of Prehistoric Site Attributes Recorded in General Survey . 230

Appendix IV - Representative Soil Profiles from Subsurface Testing 233

Appendix V - Summary of Subsurface Testing Results . 242

Appendix VI - Results of Pollen, Soil, and Radiocarbon Analysis of Samples from Bay/Basin Features 249

Appendix VII - Listings of Field Survey Sites by Study Area and Significance Class 277

Appendix VIII- Listings of Historic Sites by Study Area and Significance Class 289

Appendix IX - Data Base File Structures 302

LIST OF FIGURES

		Page
Figure 1:	Proposed Route 13 Corridor Study Area	2
Figure 2:	Cultural Resource Management Areas - Route 13 Corridor Study Area	3
Figure 3:	Special Cultural Resource Areas - Route 13 Corridor Study Area	4
Figure 4:	Project Study Areas	5
Figure 5:	St. Georges Study Area	6
Figure 6:	Appoquinimink Study Area	7
Figure 7:	Blackbird Study Area	8
Figure 8:	Physiographic Zones	10
Figure 9:	Subarea Locations - St. Georges Study Area	20
Figure 10:	Subarea Locations - Appoquinimink Study Area ..	21
Figure 11:	Subarea Locations - Blackbird Study Area	22
Figure 12:	Sample Areas - Blackbird Study Area	26
Figure 13:	Sites and Subareas - St. Georges Study Area ...	27
Figure 14:	Sites and Subareas - Appoquinimink Study Area .	33
Figure 15:	Subsurface Test Locations - Appoquinimink Study Area	46
Figure 16:	Sites and Subareas - Blackbird Study Area	49
Figure 17:	Subsurface Test Locations - Blackbird Study Area	71
Figure 18:	Location of Intensive Excavations	78
Figure 19:	Site Map - 7NC-H-20	79
Figure 20:	Composite Profile - 7NC-H-20	80
Figure 21:	Artifact Density Map - 7NC-H-20	81
Figure 22:	Test Trench Profile - 7NC-H-20	84
Figure 23:	Topographic Map - Basin A	86

Figure 24: Surface View No. 1 - Basin A 87

Figure 25: Surface View No. 2 - Basin A 88

Figure 26: Surface View No. 3 - Basin A 89

Figure 27: Surface View No. 4 - Basin A 90

Figure 28: Test Unit Placement - Basin A 91

Figure 29: Stratigraphic Profile - Basin A 93

Figure 30: Basin A Unit Profile 94

Figure 31: Standing Structure Data from BAHP Files - St. Georges Area 99

Figure 32: Historic Archaeological Resources Data - St. Georges Area 100

Figure 33: Standing Structure Data from BAHP Files - Appoquinimink Area 105

Figure 34: Historic Archaeological Resources Data - Appoquinimink Area 106

Figure 35: Standing Structure Data from BAHP Files - Blackbird Area 110

Figure 36: Historic Archaeological Resources Data - Blackbird Area 111

Figure 37: Frequency Distribution - Water Distance 133

Figure 38: Frequency Distribution - Elevation 133

Figure 39: Site Frequencies and Geomorphological Settings 136

Figure 40: Aspect Frequencies 136

Figure 41: Woodland Aspect Frequencies 138

Figure 42: Base Camp Aspect Frequencies 138

Figure 43: Procurement Site Aspect Frequencies 139

Figure 44: Site Area Box Plots by Time Periods 144

Figure 45: Class I Soils Percentages Through Time 159

Figure 46: Box Plot of Water Distance by Time Period for Historic Sites 171

Figure 47: Box Plot of Water Distance by Site Function for Historic Sites 172

Figure 48: Box Plot of Water Distance by Surface Water Type for Historic Sites 172

Figure 49: Railroad Distances - Blackbird Area 181

Figure 50: Railroad Distances - Appoquinimink Area 182

Figure 51: Crossroads Distances - Appoquinimink Area 182

Figure 52: Landing Distances - Appoquinimink Area 183

Figure 53: Landing Distances - Blackbird Area 183

Figure 54: Appoquinimink Area Historic Site Distributions 190

Figure 55: Blackbird Area Historic Site Distributions 191

LIST OF TABLES

Page

Table 1: Special Cultural Resource Areas - Route 13 Corridor Study Area 9

Table 2: Locational Data - St. Georges Study Area 28

Table 3: Cultural Historical Data - St. Georges Study Area 28

Table 4: Locational Data - Appoquinimink Study Area 34

Table 5: Cultural Historical Data - Appoquinimink Study Area 36

Table 6: Locational Data - Blackbird Study Area 50

Table 7: Cultural Historical Data - Blackbird Study Area 54

Table 8: Summary Catalogue - 7NC-H-20 82

Table 9: St. Georges Historic Sites - Summary Descriptions 98

Table 10: Appoquinimink Historic Sites - Summary Descriptions 103

Table 11: Blackbird Historic Sites - Summary Descriptions 108

Table 12: Density Measure Test Data - Appoquinimink Area . 116

Table 13: Density Measure Test Data - Blackbird Area 116

Table 14: Density Measure Test Data - Combined Areas 117

Table 15: Observed and Expected Site Counts for 400m Grid Units 118

Table 16: Observed and Expected Site Percentages for 400m Grid Units 119

Table 17: Frequency of Datable Components in Study Area .. 119

Table 18: Descriptive Statistics - Site Area Measures 120

Table 19: Q-Q Statistics - Site Area Measures 120

Table 20: Non-parametric Range Statistics - Site Area Measures 121

Table 21: Cross-tabulation of Site Types and Probability Zones 122

Table 22: Difference of Proportion Tests - Site Types and Probability Zones..... 123

Table 23: Bay/Basin Mapping Errors 125

Table 24: Surface Water Type Frequencies 127

Table 25: Cross-tabulation of Surface Water Type and Time Period..... 129

Table 26: Cross-tabulation of Functional Site Types and Surface Water Setting - Route 13 Data 130

Table 27: Cross-tabulation of Functional Site Types and Surface Water Setting - DADS High Coastal Plain Data and Total Data 131

Table 28: Water Distance Descriptive Statistics by Time Periods 132

Table 29: Difference-of-Mean Tests - Water Distance 132

Table 30: Elevation Descriptive Statistics by Time Periods 134

Table 31: Geomorphological Setting Frequencies 134

Table 32: Cross-tabulation of Geomorphological Setting and Time Periods..... 135

Table 33: Cross-tabulation of Geomorphological Setting and Site Type..... 135

Table 34: Aspect Frequencies 137

Table 35: Soil Series Frequencies 140

Table 36: Zero-One Cluster-Centroid Transformation Matrices 141

Table 37: Descriptive Statistics - Site Area by Time Periods 143

Table 38: Non-Parametric Range Statistics - Site Area by Time Periods 143

Table 39: Total Study Area Historic Soil Type Frequencies 156

Table 40: Q-Q Statistics - Historic Soil Data 157

Table 41: Agricultural Soil Capacity - Descriptive Statistics 158

Table 42: Significance Tests for Class I Agricultural Soils Percentages Through Time 158

Table 43: Significance Tests for Class I Agricultural Soils Percentages by Site Types 160

Table 44: Woodlot Soil Capacity - Descriptive Statistics 161

Table 45: Significance Tests for Woodlot Soils Percentages Through Time 162

Table 46: Significance Tests for Woodlot Soils Percentages by Site Types 162

Table 47: Grazing Capacity - Descriptive Statistics 163

Table 48: Significance Tests for Grazing Soils Percentages Through Time 164

Table 49: Significance Tests for Grazing Soils Percentages by Site Types 164

Table 50: Hunting Capacity - Descriptive Statistics 165

Table 51: Significance Tests for Wildlife Soils Percentages Through Time 166

Table 52: Significance Tests for Wildlife Soils Percentages by Site Types 166

Table 53: Factor Matrices - Historic Site Soil Data 167

Table 54: Crosstabulation of Historic Site Age and Surface Water Type 169

Table 55: Crosstabulation of Historic Site Age and Surface Water Type 169

Table 56: Crosstabulations of Stream Confluences and Historic Site Age and Function 170

Table 57: Q-Q Statistics for Water Distance Data 170

Table 58: Non-Parametric Range Statistics for Water Distance Data 173

Table 59: Q-Q Statistics for Transportation Access Measures 176

Table 60: Descriptive Statistics Navigable Water Distance 177

Table 61: Difference-of-Mean Test Statistics - Navigable Water Distance 177

Table 62: Descriptive Statistics - Minimum Landing Distance 177

Table 63: Difference-of-Mean Test Statistics - Minimum Landing Distance 178

Table 64: Difference-of-Mean Test Statistics - Minimum Landing Distance and Navigable Water Distance 178

Table 65: Descriptive Statistics - Road Distance 179

Table 66: Difference-of-Mean Test Statistics - Road Distance 179

Table 67: Descriptive Statistics - Minimum Crossroad Distance 179

Table 68: Difference-of-Mean Test Statistics - Minimum Crossroad Distance 180

Table 69: Descriptive Statistics - Minimum Railroad Distance 180

Table 70: Difference-of-Mean Test Statistics - Minimum Railroad Depot Distance 180

Table 71: Zero-One Cluster-Centroid Transformation Matrix - Distance Measures 184

Table 72: Typical Historic Site Locations 185

Table 73: Nearest - Neighbor Statistics 188

Table 74: Prehistoric Site Frequencies 202

Table 75: Historic Site Frequencies - pre-1802 202

Table 76: Historic Site Frequencies - 1802-1849 203

Table 77: Historic Site Frequencies - 1849-1868 204

Table 78: Historic Site Frequencies - 1868-1893 205

Table 79: Surface Water Types 228

Table 80: Extent of Surface Water Types 229

Table 81: Sampled Areas - Blackbird Area 229

List of Plates

Page

Plate 1: Selected Stemmed Points from Sites in the Route 13 North Survey 30

Plate 2: Selected Triangles from Sites in the Route 13 North Survey 31

Plate 3: Selected Notched Points from Sites in the Route 13 North Survey 39

Plate 4: Selected Ground Stone Tools from Sites in the Route 13 North Survey 40

Plate 5: Selected Bifurcated Base Points from Sites in the Route 13 North Survey..... 41

Plate 6: Selected Prehistoric Ceramics from Sites in the Route 13 North Survey..... 47

Plate 7: Bay/Basin Feature on South Side of Barlow Branch, Blackbird Study Area. Site 7NC-H-39 is in Foreground..... 57

Plate 8: Tree-Filled Bay/Basin Feature. West of U.S. 13, Blackbird Study Area..... 58

Plate 9: Selected Kirk Points from Sites in the Route 13 North Survey..... 64

Plate 10: Selected Artifacts from 7NC-H-39..... 65

Plate 11: Bay/Basin Feature Near Site 7NC-H-20, Blackbird Study Area..... 74

Plate 12: Aerial View of Site 7NC-H-20, Blackbird Study Area..... 75

Plate 13: Aerial View of "Basin A", Blackbird Study Area.. 85

Plate 14: Structure N-5044 Looking North from Cox Neck Lane..... 101

Plate 15: Structure N-5141 Looking West from Road 428..... 107

Plate 16: Structure N-5938 Northwest Face of House..... 113

Plate 17: Archaeological Site #294 Foundation Associated with pre-1849 Mill Complex Looking Southwest from Road 463..... 113

INTRODUCTION

The purpose of this report is to provide planning information on the location of cultural resources within selected portions of the proposed Route 13 Corridor. This report specifically considers the cultural resources in three sections of the proposed corridor within southern New Castle County. The areas studied were chosen on the basis of the initial cultural resources planning report (Custer et al. 1984) which considered the distribution of cultural resources within the entire Route 13 corridor (See Appendix I). Figure 1 shows the location of the entire corridor study area. The original report considered the known locations of standing structures, historic archaeological sites, and prehistoric archaeological sites as well as the predicted locations of historic and prehistoric archaeological sites. These known and predicted locations of cultural resources were mapped out within the entire corridor. Areas which contained dense accumulations of cultural resources were noted in the development of cultural resource management zones, and their locations mapped (Figure 2). A series of areas with especially dense concentrations of cultural resources were noted as "problem areas" and targeted for special additional study (Figure 3, Table 1).

The goal of additional study of these areas was to provide detailed preliminary information on the location of cultural resources. This information was intended for use as part of selection of the final alignments for the proposed Route 13 project. It was hoped that with this kind of information in hand, project engineers and planners would be able to minimize the adverse impact of the project on cultural resources. Also, it was hoped that even if impacts could not be minimized, the planning information could be used as parts of later location and identification studies. Furthermore, analysis of historic and prehistoric site locations from the region of the final alignment would allow the generation of meaningful research questions to be used in further survey and excavation stages of the project. These research questions would also be important guides to the determination of the significance of the various types of cultural resources encountered in the study area.

This report specifically describes the results of the planning survey for the three northernmost "problem areas" (Figure 4): 1)St. Georges Study Area (Figure 5); 2)Appoquinimink Study Area (Figure 6); 3)Blackbird Study Area (Figure 7). The remainder of this introductory section provides overviews of the environmental setting of the project area and summaries of the regional history and prehistory. Following these reviews the general research methods are discussed. A presentation of the results of the project follows and the report concludes with a discussion of the significance of the cultural resources encountered.

FIGURE 1

Proposed Route 13 Corridor Study Area

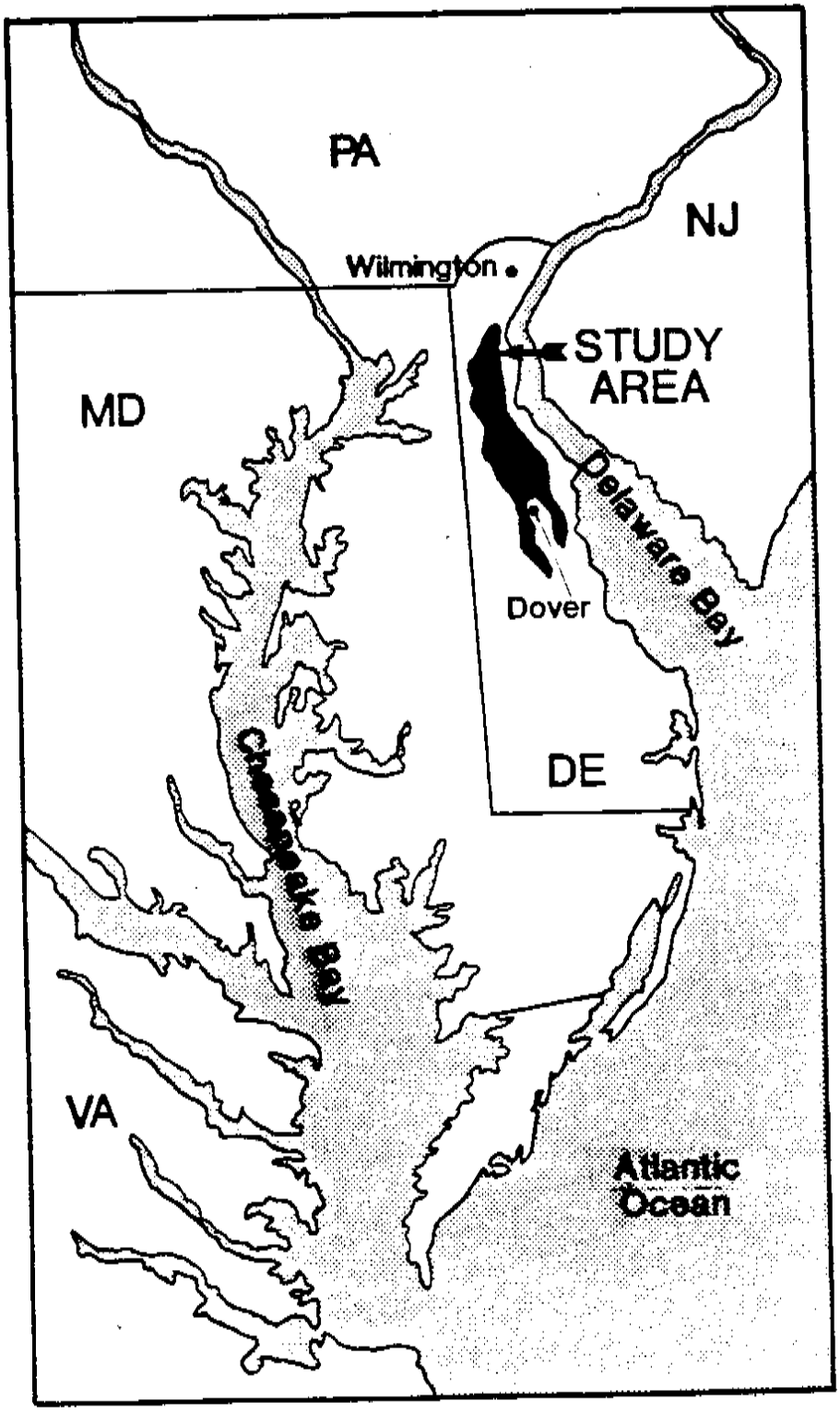


FIGURE 2

Cultural Resource Management Areas – Route 13 Corridor Study Area

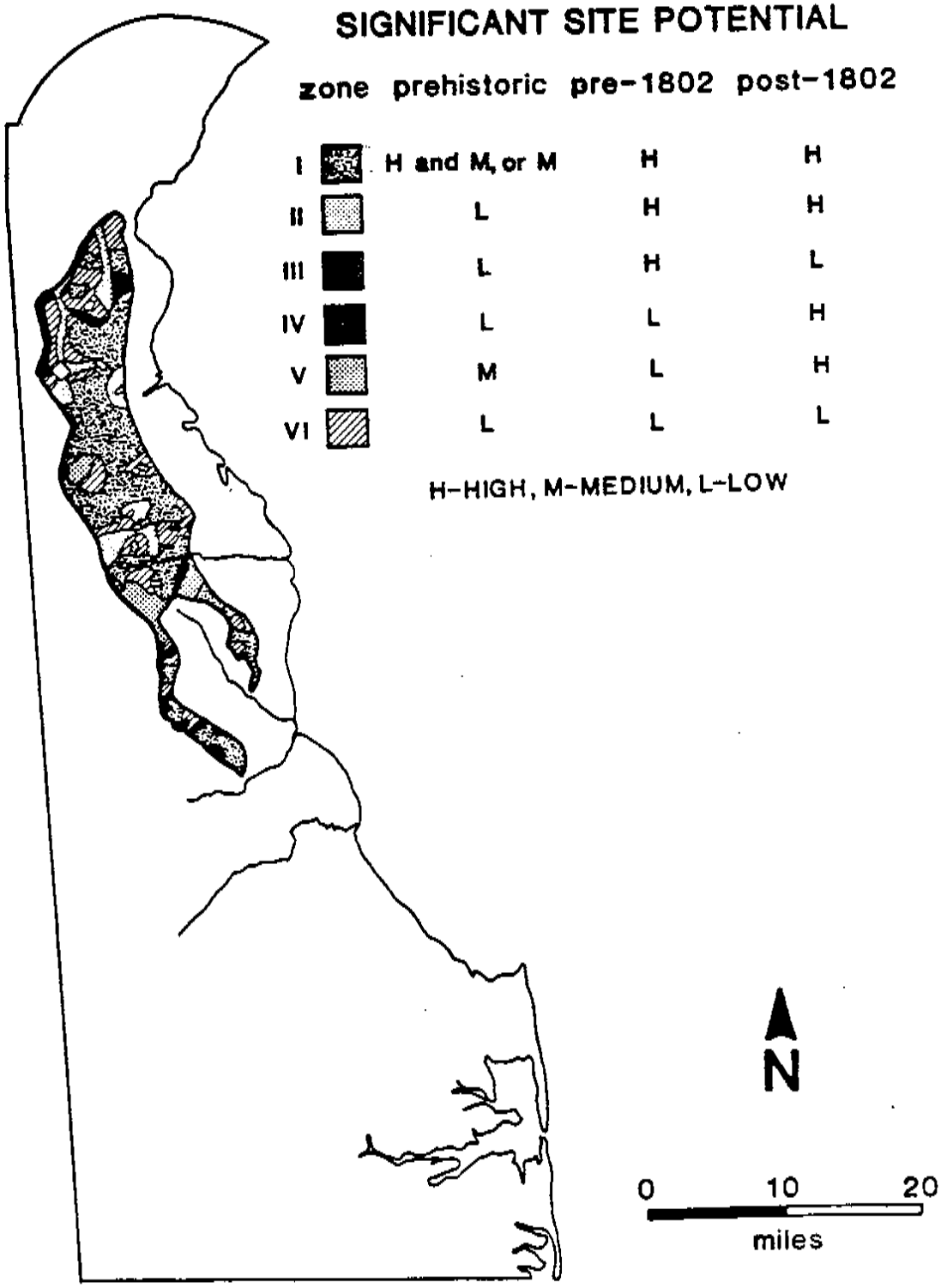
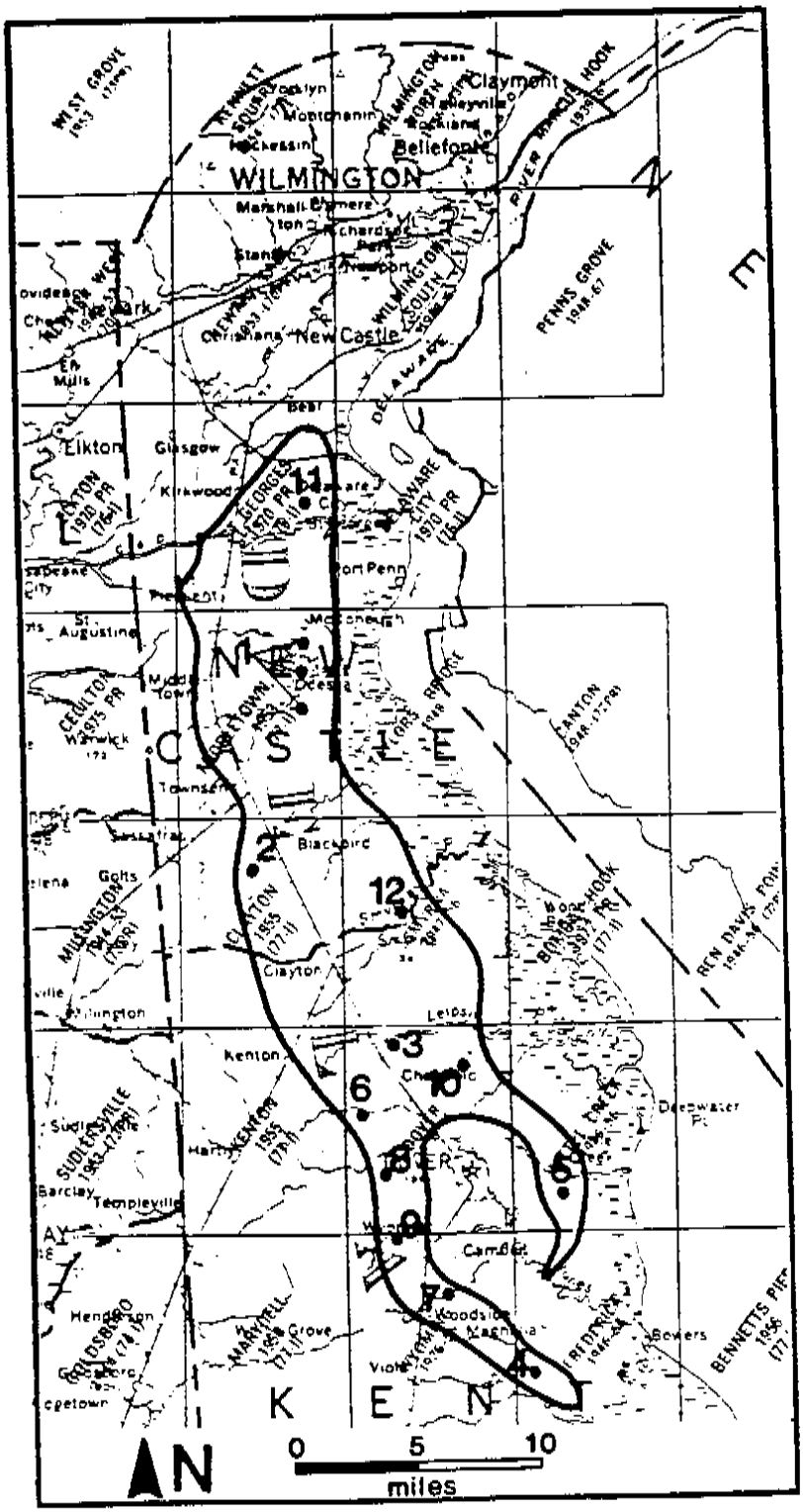


FIGURE 3
Special Cultural Resource Areas– Route 13 Corridor Study Area



NOTE: see TABLE 1 on page 9 for Area names

FIGURE 4
Project Study Areas

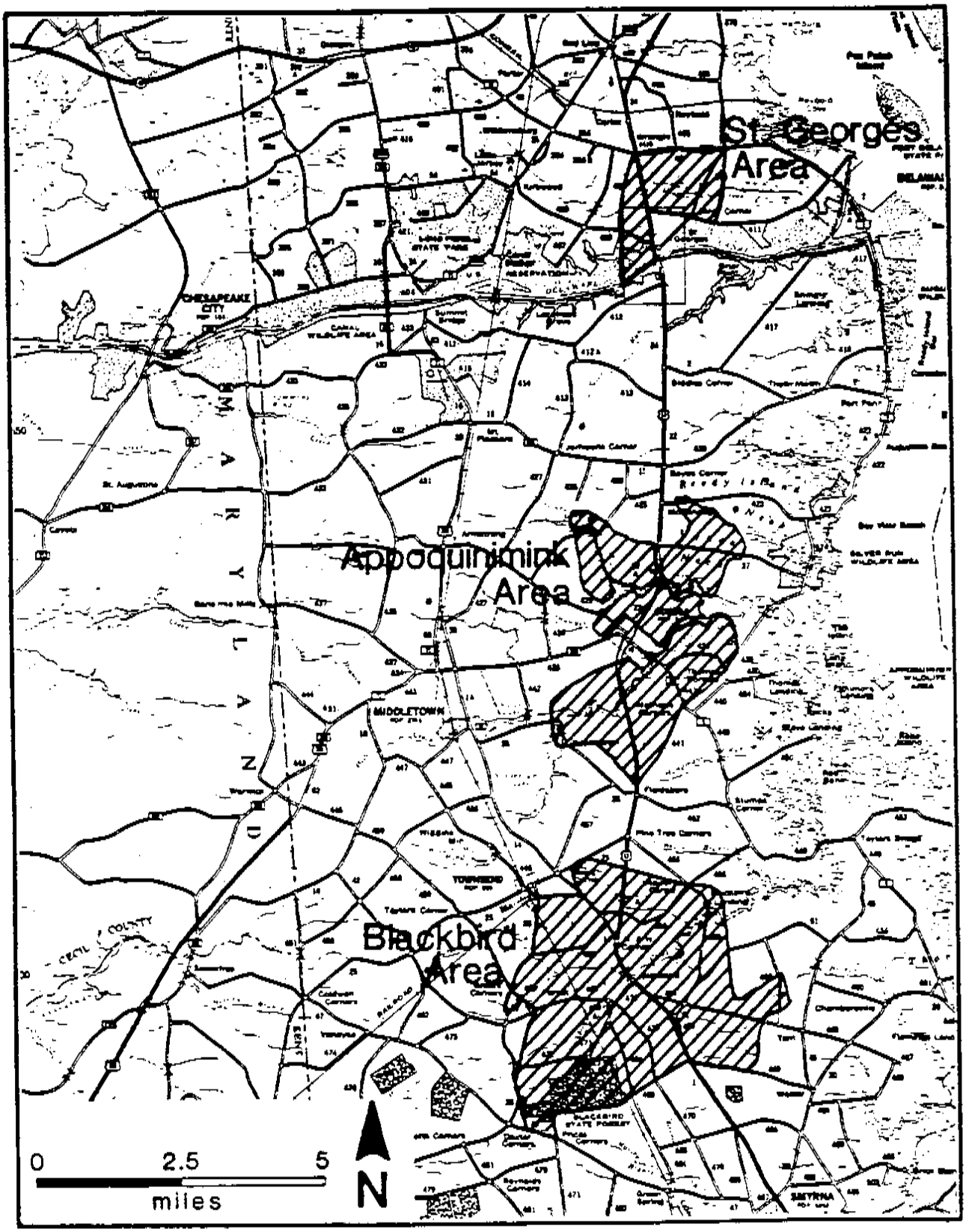


FIGURE 5
St. Georges Study Area

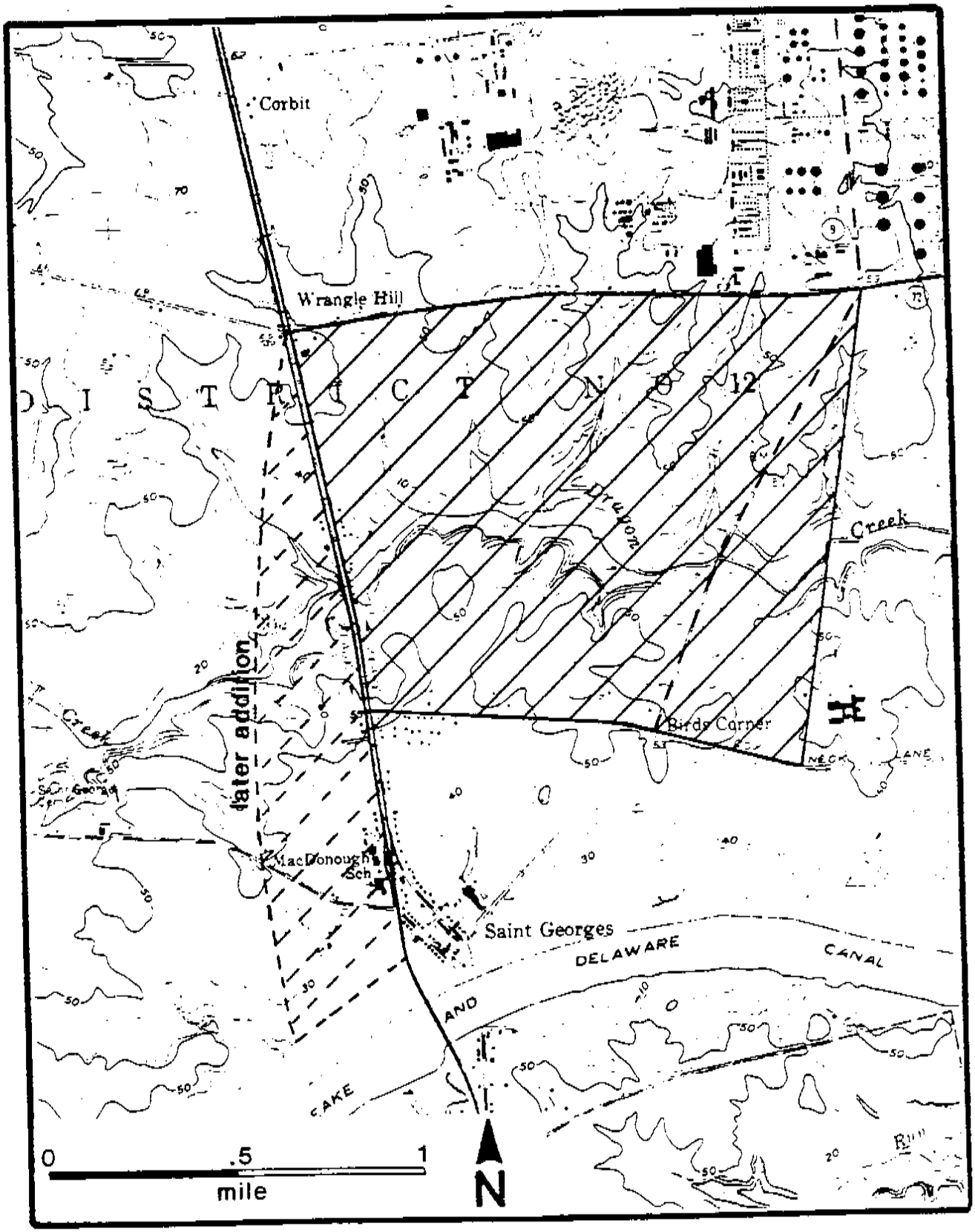


FIGURE 6
Appoquinimink Study Area

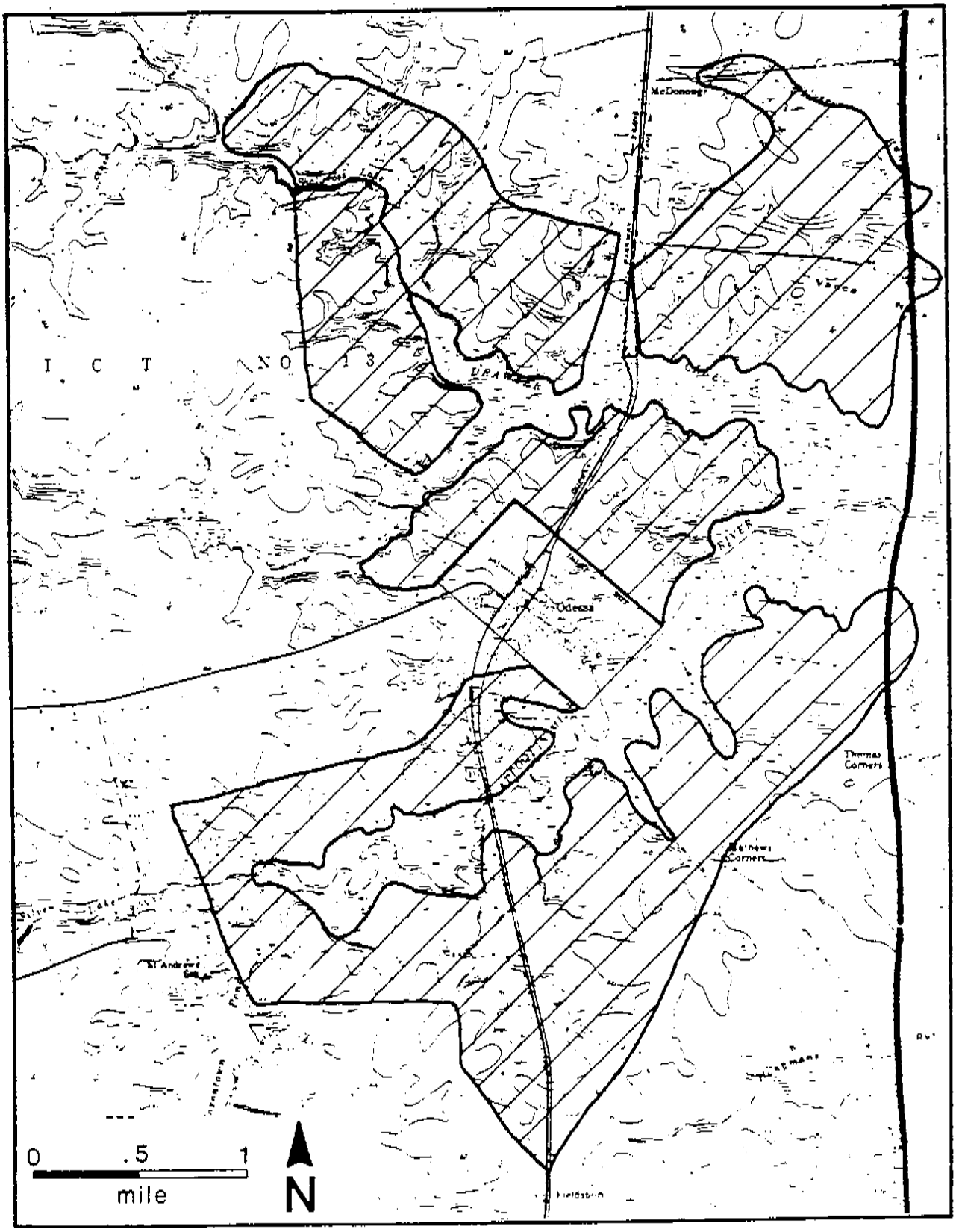


FIGURE 7
Blackbird Study Area

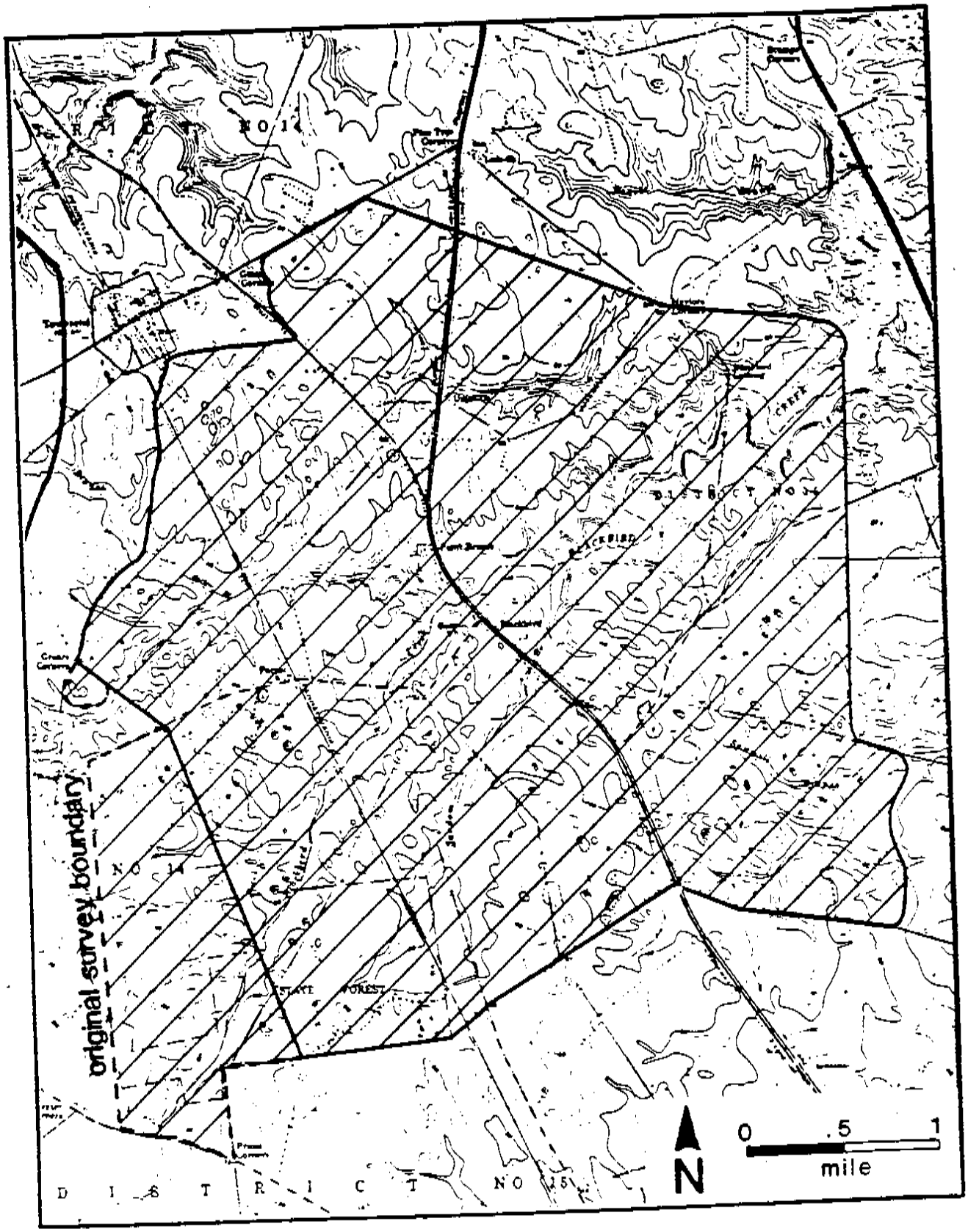


TABLE 1

SPECIAL CULTURAL RESOURCE AREAS - ROUTE 13 CORRIDOR STUDY AREA

1) Drawyers Creek/Appoquinimink River
2) Blackbird/Townsend
3) Leipsic
4) Spring Creek
5) Little River/Pipe Elm Branch
6) Hughes Crossing
7) Derby Pond
8) Chestnut Grove
9) Wyoming Lake
10) Dyke and Muddy Branches
11) St. Georges
12) Smyrna

see Figure 3(p.4) for location of areas

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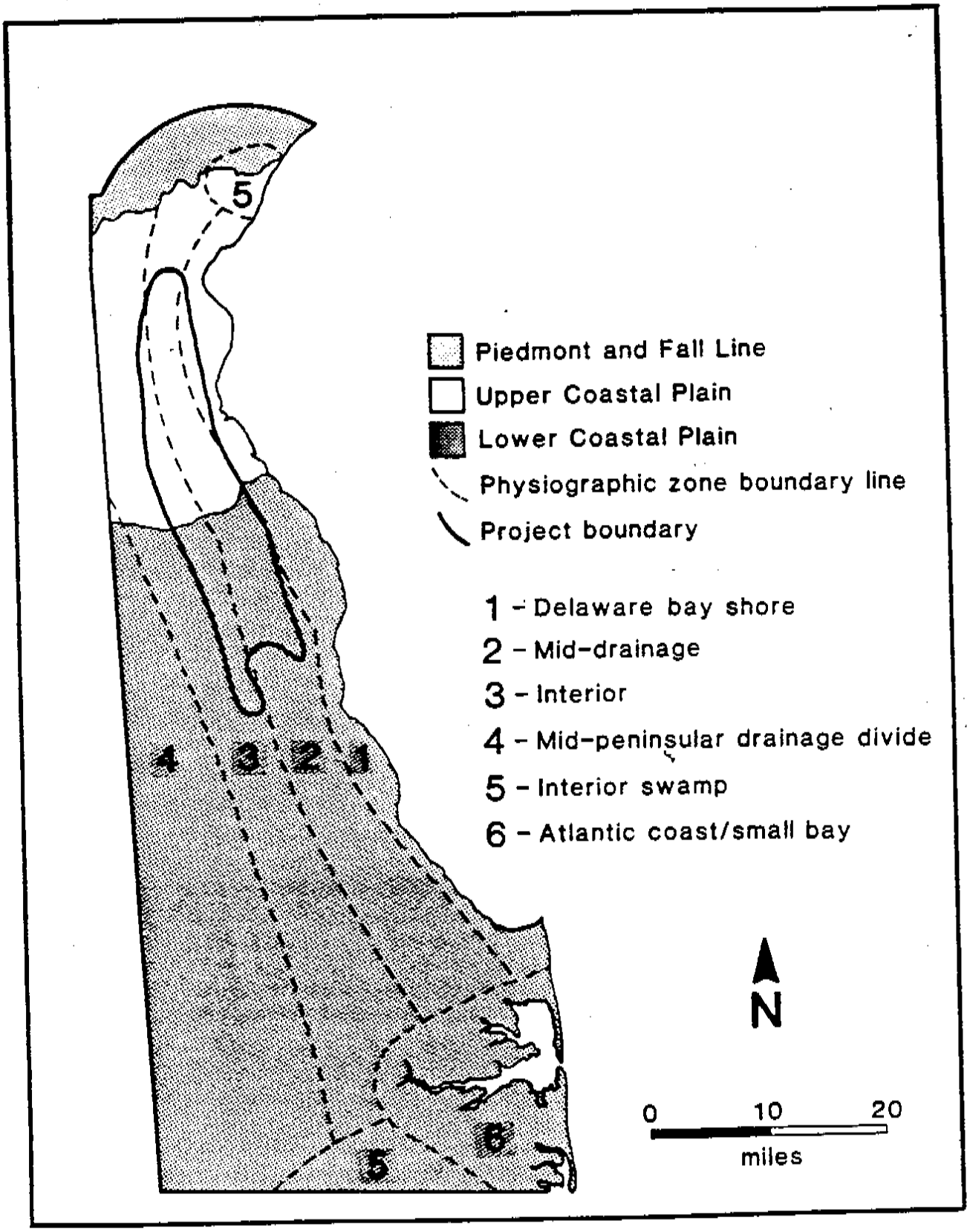
ENVIRONMENTAL SETTING

In order to understand the regional prehistory of the present study it is first necessary to review the region's environments through time. The present study area is located in Delaware's High Coastal Plain. For the study of the prehistoric and historic resources of the region, a number of varied environmental zones are recognized in the High Coastal Plain (Figure 8). Each of these zones is described below and the

FIGURE 8
Physiographic Zones



descriptions are derived from the work of Custer (1984a).

High Coastal Plain. Located between the Fall Line and the Smyrna River, the High Coastal Plain represents the southeastern extension of the coarse gravels of Pleistocene (Columbia) sediments in Delaware (Jordan 1964:40). A rolling topography is present and elevation differences range up to 16 meters (50 feet) from the headlands bordering high order streams and adjacent floodplain marshes. These differences are sufficient to cause differential distributions of plant and animal species (Braun 1967:246-247). Watercourses are deeply incised and are lined by a veneer of relatively recent sediments that is thin along the upper reaches of the drainages and thickens moving toward their mouths (Kraft et al. 1976:13). Most streams are not tidal and the freshwater/saltwater mix allows for a wide range of resources. Soils include a variety of well-drained and poorly drained settings that are distributed in a mosaic pattern across the region.

Within the High Coastal Plain there are a number of smaller environmental zones. These additional sources of environmental variability are generally distributed in broad belts parallel to the Delaware River and Bay shore. Each is described below and depicted in Figure 8.

Mid-Peninsular Drainage Divide. Representing the "spine of the Delmarva Peninsula, this area is defined by the stretch of low, rolling topography that separates the headwaters of streams that drain into the Delaware River from streams that drain into the Chesapeake Bay. Elevation differences are slight and flowing surface water is restricted to the low order headwaters of the larger streams and rivers. Additional water sources of this zone include a number of swamps that have formed in areas of poorly drained soils surrounded by sand ridges. Bay/basin features, known locally as "whale-wallows", represent another water source in this area. Geomorphological evidence indicates that they were formed during the Pleistocene and many seem to have held water, at least seasonally, ever since (Rasmussen 1958:82). The combination of headwater drainages, swampy areas, and bay/basin features with interspersed well-drained areas creates a mosaic of edaphic settings.

Delaware Shore. Included in the Delaware Shore zone are the remnant terraces of the Delaware River as well as the various tidal marshes that fringe the Delaware River and the Delaware Bay. These marshes are found throughout the area and often extend well up the drainages from the river and bay shore. Soils in the area are generally poorly drained; however, pockets of well-drained soils in the areas of higher elevation may be found. Only the eastern edges of the project area are included in this zone.

Mid-Drainage. The Mid-Drainage zone is located between the Delaware Shore and Mid-Peninsular Drainage Divide zones and includes the majority of the study area. The modern tidal limit

along the drainages marks the center of this zone and the major drainages and their tributaries are fresh throughout the inland portion of the zone. Some tidal marshes and poorly drained floodplains are found along the major drainages. Well-drained soils are found on upper terraces of the drainages and on isolated headlands between the major drainages and their tributaries. The extensive combination of brackish and freshwater resources makes this zone one of the richest in Delaware for hunters and gatherers.

It should be noted that the locations of these zones have not remained constant since the end of the Pleistocene because some zones have been subjected to extensive landscape modification. The most important factor in this landscape modification is post-Pleistocene sea level rise. Kraft et al. (1976) note that sea level has been rising along the Atlantic Coast for the past 12,000 years and this sea level rise has transformed the Delaware River of 10,000 B.C. into the current drowned estuary. Many old land surfaces have become submerged and the configuration of the Delaware River and Bay have changed dramatically. In terms of the study area, these effects would be most prevalent in the eastern half of the Mid-Drainage zone and the River Shore zone.

REGIONAL PREHISTORY

This summary of the regional prehistory is abstracted from Custer (1984a). The prehistoric archaeological record of the Delaware Coastal Plain can be divided into four large blocks of time: The Paleo-Indian Period (ca. 12,000 B.C.- 6500 B.C.), the Archaic Period (6500 B.C. - 3000 B.C.), the Woodland I Period (3000 B.C. - A.D. 1000), and the Woodland II Period (A.D. 1000 - A. D. 1650). A fifth time period, the Contact Period may also be considered and spans from A.D. 1650 to A.D. 1750, the approximate date of the final Indian habitation of Delaware in anything resembling their pre-European Contact form. Each of these periods is described below.

Paleo-Indian Period (12,000 B.C. - 6500 B.C.). The Paleo-Indian Period encompasses the time period of the final retreat of Pleistocene glacial conditions from Eastern North America and establishment of more modern Holocene environments. The distinctive feature of the Paleo-Indian Period is an adaptation to the cold, and alternately wet and dry, conditions at the end of the Pleistocene and the beginning of the Holocene. This adaptation was primarily based on hunting and gathering with hunting providing a large portion of the diet. Hunted animals may have included now-extinct megafauna and moose. A mosaic of deciduous, boreal, and grassland environments would have provided a large number of productive habitats for these game animals in central Delaware and watering areas would have been particularly good hunting settings.

Tool kits of the people who lived at this time were oriented toward the procurement and processing of hunted animal resources. A preference for high quality lithic materials is noted in the stone tool kits and careful resharpening and maintenance of tools in common. A mobile lifestyle moving among the game attractive environments is hypothesized with the social organizations being based upon single and multiple family bands. Throughout the 5500 year time span of the period, the basic adaptation remains relatively constant with some modifications being seen as Holocene environments appear at the end of the Paleo-Indian Period.

Numerous Paleo-Indian sites are noted for the Delaware Coastal Plain. Most of the sites are associated with poorly drained swampy areas and include the Hughes Paleo-Indian complex near Felton. Although no clear-cut associations have yet been found, it is also hypothesized that bay/basin features may also be the loci of Paleo-Indian sites (Custer et al. 1983). Generally, the most likely locations for Paleo-Indian sites are not within the project area, except for the area of extensive bay/basin features in the Blackbird - Townsend area.

Archaic Period (6500 B.C. - 3000 B.C.). The Archaic Period is characterized by a series of adaptations to the newly emerged full Holocene environments. These environments differed from earlier ones and were dominated by mesic forests of oak and hemlock. A reduction in open grasslands in the face of warm and wet conditions caused the extinction of many of the grazing animals hunted during Paleo-Indian times; however, browsing species such as deer flourished. Sea level rise is also associated with the beginning of the Holocene in Delaware. The major effect of the sea level rise would have been to raise the local water table, which helped to create a number of large interior swamps. Adapations changed from the hunting focus of the Paleo-Indian to a more generalized foraging pattern in which plant food resources played a more important role. Large swamp settings apparently supported large base camps, but none are known from the study area. A number of small procurement sites in favorable hunting and gathering locals such as bay/basin features are known from Delaware's Coastal Plain.

Tool kits were more generalized than earlier Paleo-Indian tool kits and showed a wider array of plant processing tools such as grinding stones, mortars, and pestles. A mobile lifestyle was probably common with a wide range of resources and settings utilized on a seasonal basis. A shifting band level organization which saw the waxing and waning of group size in relation to resource availability is evident. Known sites include large base camps such as the Clyde Farm Site in northern Delaware and smaller processing sites located at a variety of locations and environmental settings.

Woodland I Period (3000 B.C. - A.D. 1000). The Woodland I Period can be correlated with a dramatic change in local climates and environments that seem to be part of events occurring

throughout the Middle Atlantic region. A pronounced warm and dry period set in and lasts from ca. 3000 B.C. to 1000 B.C. Mesic forests were replaced by xeric forests of oak and hickory and grasslands again became common. Some interior streams dried up; however, the overall effect of the environmental change is an alteration of the environment, not a degradation. Continued sea level rise and a reduction in its rate also made many areas of the Delaware River and Bay shore the sites of large brackish water marshes which are especially high in productivity. The major changes in environment and resource distributions caused a radical shift in adaptations for prehistoric groups. Important areas for settlements include the major river floodplains and estuarine swamp areas. Large base camps with fairly large numbers of people are evident in many settings in the Delaware Coastal Plain, such as the Barker's Landing, Coverdale, Hell Island, and Robbins Farm sites. These sites seem to have supported many more people than previous base camp sites and may have been occupied on a year-round basis. The overall tendency is toward a more sedentary lifestyle.

The tool kits show some minor variations as well as some major additions from previous Archaic tool kits. Plant processing tools become increasingly common and seem to indicate an intensive harvesting of wild plant foods that may have approached the efficiency of agriculture by the end of the Woodland I Period. Chipped stone tools changed little from the preceding Archaic Period; however, broad-blade, knife-like processing tools became more prevalent. The addition of stone, and then ceramic, containers is also seen. These items allowed the more efficient cooking of certain types of food and may also have functioned for storage of certain surplus plant foods. Storage pits and semi-subterranean houses are also known for the Delaware Coastal Plain during this period from the numerous sites.

Social organizations also seem to have undergone radical changes during this period. With the onset of relatively sedentary lifestyles and intensified food production, which might have produced occasional surpluses, incipient ranked societies began to develop as indicated by the presence of 1) extensive trade and exchange in lithic materials for tools as well as non-utilitarian artifacts, 2) caching of special artifact forms and utilization of artifacts manufactured from exotic raw materials. The data from cemeteries of the Delmarva Adena Complex (ca. 500 B.C. to A.D. 0), such as the Frederica Site and the St. Jones Site (Thomas 1976), indicate that certain individuals had special status in these societies and the existence of a simple ranked social organization is hypothesized. Similar data from the Island Field Site show that these organizations lasted up until A.D. 1000, although they may not have always been present throughout all of the Woodland I Period. In any event, by the end of the Woodland I Period a relatively sedentary lifestyle is evident in Delaware`s Coastal Plain. It should also be noted that the greatest number of archaeological sites in the project area date to the Woodland I Period and the Mid-Drainage zone is the focus

of most of the important sites of this period.

Woodland II Period (A.D. 1000 - A.D. 1650). In many areas of the Middle Atlantic, the Woodland II Period is marked by the appearance of agriculture food production systems; however, in the Delaware Coastal Plain there are no clear indications of such a shift. Some of the settlements of the Woodland I Period, especially the large base camps, were also occupied during the Woodland II Period and very few changes in basic lifestyles and overall artifact assemblages are evident. Intensive plant utilization and hunting remained the major subsistence activities up to European Contact. There is some evidence, nonetheless, of an increasing reliance on plant foods and coastal resources throughout the Woodland II Period in the study area. Social organization changes are evidenced by a collapse of the trade and exchange networks and the end of the appearance of elaborate cemeteries.

Contact Period (A.D. 1650 - A.D. 1750). The Contact Period is an enigmatic period of the archaeological record of Delaware which begins with the arrival of the first substantial numbers of Europeans in Delaware. The time period is enigmatic because no Native American archaeological sites that clearly date to this period have yet been discovered in Delaware. A number of sites from the Contact Period are known in surrounding areas such as southeastern Pennsylvania, nonetheless. It seems clear that Native American groups of Delaware did not participate in much interaction with Europeans and were under the virtual domination of the Susquehannock Indians of southern Lancaster County, Pennsylvania. The Contact Period ends with the virtual extinction of Native American lifeways in the Middle Atlantic area except for a few remnant groups.

REGIONAL HISTORY

This overview is abstracted from Munroe (1978), Hoffecker (1973, 1977), Weslager (1961, 1967), Lemon (1972), and Hancock (1932). The earliest colonial settlement in Delaware was the Dutch settlement of Zwaanendael which was established as a whaling colony near present-day Lewes in 1629. The settlement was short-lived as the early colonists were massacred by local Indians in 1632. It was not until 1661, when a Mennonite colony was formed that a permanent settlement was established at Lewes. Further north, the Swedes established Fort Christina in 1638 at the confluence of the Brandywine and Christina Rivers in what is now part of Wilmington. The small colony grew and within a few years a fort, church and small farming community appeared and formed the nucleus for the first permanent European settlement in Delaware. This community contested the earlier Dutch settlements further north in the Delaware Valley.

Dutch colonial interests continued and in 1651 Fort Casimir was established near modern New Castle. Conflicts between the Dutch and the Swedes escalated to military conflict, as both

groups infringed on the colonial interests of the other. The Dutch were ascendent and they appropiated the Swedish colonies. Fort Casimir was renamed Fort Trinity, and New Amstel, a farming and trading settlement, arose nearby. The Dutch claims included all land from the Christina River to Bombay Hook by the early 1660's, including a portion of the study area.

British hegemony of the region began in 1664 when Sir Robert Carr seized the Dutch colonies and, assumed possession for James, Duke of York and Albany. Anglicizing the new colony was a slow and gradual process. The transfer of authority from Dutch to British hands was peaceful with existing land ownership, trading privileges and political structure maintained by the new leadership. The Swedish, Finnish, and Dutch colonists remained and new immigrants of those nationalities, as well as English and Scotch-Irish, supplemented the growing population to form a multi-ethnic community.

In 1682, William Penn was granted proprietary rights over Pennsylvania and the Lower Three Counties which included the city of New Castle, the land within a 12-mile radius of the New Castle courthouse, and the land on the west bank of the Delaware Bay (including all of modern Delaware). Conflicts soon developed between the pacifist Quakers of Pennsylvania and the colonists of the Three Lower Counties, and these led to the establishment of separate governmental bodies and relative autonomy for the southern colonists. However, economic ties continued to link Penn's factionalized colony. The Penn family's claims to interest in the colony were finally relinquished just prior to the American Revolution.

The early Dutch and Swedish pattern of settlement with closely spaced villages along the Delaware River was gradually replaced by the English colonial settlement pattern of scattered farmsteads along emerging transpeninsular roads. This pattern of scattered settlement was encouraged by economic factors. For example, Philadelphia mercantile interests required increasing numbers of marketable foodstuffs for local and export markets and land speculators parceled huge tracts of productive farmland obtained from Penn. Philadelphia's emerging economic influence during the 18th century caused a shift in agricultural activities in Delaware from subsistence to market-oriented crops.

The waterways were important to transportation and commerce as early roads were limited in number and of poor condition. The few existing roads led to landings on rivers and the Delaware Bay where produce and goods were shipped by cheaper, and more efficient, water transport. Some of these locations are included in the study area. The Delaware River - Delaware Bay served as a major focus of water transportation because the majority of Delaware's streams flow eastward to theses bodies. For this reason the large port city of Philadelphia, and to a lesser extent Wilmington and New Castle, exerted major commercial influence on the Delaware counties throughout the 18th century and later. Wilmington, New Castle, and Lewes were also ports for

ocean-going vessels involved in export trade. Overland transport was limited to a few major roads, such as the 18th century post road connecting Philadelphia - Wilmington - New Castle - Odessa - Middletown - Dover - Lewes with a western branch at Milford linking it to the Chesapeake Bay. Small secondary roads and paths interconnected the numerous villages and hamlets and are common within the study area.

By the middle of the 18th century population increases and commercial expansion stimulated the growth of towns and the development of transportation and industry. During the 1730`s successful attempts were made to harness waterpower on the Brandywine and Christina Rivers resulting in the establishment of Wilmington as the foremost milling and shipping center in Delaware. The availability of wheat from the central Mid-Atlantic region, easy and economical transportation, and the proximity of the Philadelphia and New York markets facilitated the commercial rise of the Brandywine mills. During the later part of the 18th century Wilmington's economy focused on shipbuilding, coopering, milling, and import-export trade.

The rise of commerce and industry in Wilmington produced significant effects on the rural areas of New Castle and Kent counties. The technologies utilized in the Brandywine Valley spread to these areas resulting in a extensive network of mills throughout the colony. Millworks in the agrarian areas were frequently multi-functional with water-powered grist, saw and (woolen cloth) fulling operations being performed at different seasons at the same location. The mills primarily produced goods for local markets. At this time, the agrarian Delmarva Peninsula was considered an area of portage between the Chesapeake Bay markets (Annapolis and Baltimore) and the Delaware River and Bay markets (Philadelphia and New York).

The early decades of the 19th century saw the beginning of an agricultural revolution throughout Delaware, most extensively in New Castle County. The first agricultural society in the United States was formed in New Castle County in 1804 with a strong focus on scientific agricultural practices. A number of factors worked in conjunction to establish New Castle County, and Delaware as a whole, as an important agricultural producer. The discovery of marl, a natural fertilizer, during the construction of the Chesapeake and Delaware Canal in the 1820`s enhanced the productivity of Delaware agriculture while the opening of the canal encouraged the production of maket-oriented crops because produce could be quickly and cheaply transported to markets.

The opening of the Philadelphia, Wilmington and Baltimore Railroad in 1839 provided transportation of northern Delaware produce to the growing eastern markets. The extensive production of market-bound crops developed later in Kent and Sussex counties due to a lack of interior transportation facilities, although produce did move by water from seaport towns. When the Delaware Line extended rail service to Dover and later Seaford in the 1850's, a vast agricultural hinterland was opened and

agricultural production for markets increased significantly.

Prior to 1832 Delaware's agricultural products were primarily grains, with fruit and vegetable crops of lesser importance. During the period 1832-1870 Delaware became the center for peach production in the eastern United States. Rich soil, favorable climate and rainfall, excellent transportation facilities, and strategic location near large markets made peach production a lucrative enterprise. Delaware City with its canal location led Delaware and New Castle county in production until the peach blight of the 1850's. The peach industry was hindered in Kent and Sussex counties until the 1850's due to transportation limitations. Early attempts there failed because producers could not move fruit to market economically. Rail service into the area and the absence of the peach blight in the southern counties made the peach industry economical in the 1850's.

By the end of the "peach boom", massive harvests were being shipped by rail and steamship lines to New York where much was readied for resale to the northern states. The peach industry proved profitable for a large number of peach growers, as well as a variety of support industries. Basket factories, canneries, and peach tree nurseries all aided in and reaped the financial rewards of the peach industry. The railroad and steamship lines integral to peach distribution, depended on peach shipment for a large portion of their annual revenue. The construction of "peach houses" of the Italianate architectural style accompanied the influx of money which resulted from the growth of the peach industry and peach houses are common in the study area.

Through the 19th century, and into the 20th century, Delaware's agricultural production continued to focus on the perishable products with a decrease in staples. There has been marked increase in milk and poultry production while the levels of fruit and vegetable production were maintained. Cash crops such as tobacco, have been of importance on a small scale in Kent and Sussex counties.

Throughout Delaware's agricultural history farm labor has been a valued commodity. In the colonial period blacks in slavery and white indentured servants were the primary farm laborers. By the mid-18th century white indentured servants were as numerous as black slaves. Slightly less than one-half of the blacks in the state in 1790 were free; however, by 1810, less than one-quarter of blacks were slaves according to federal censuses. Therefore, in the 18th century, free black laborers played an increasing role in farm production. Abolitionist attitudes were strong in Delaware and legislation enacted by Quaker and Methodist leaders restricted the increase of slaveholding, especially in New Castle and Kent counties, by prohibiting the importation and exportation of slaves. Agricultural factors, as well, reduced the profitability of slaveholding and thus a combination of ethical and economic factors were responsible for the increase in the free black

population in the state prior to Emancipation and the Civil War.

The patterning and density of settlement in Delaware, and the study area specifically, have been strongly influenced by several factors throughout its history, These are: 1) an agrarain economy; 2) the commodity demands of large markets, first Europe and the West Indies, and later domestic commercial-industrial centers, and 3) transportation facilities. The advent of automobile transportation in the 20th century brought about significant improvements in the state road system and opened large tracts of land to productive agriculture. The DuPont Highway constructed in the 1920's linked the northern and southern sections of the state and shifted the agrarian focus of the southern counties permanently toward non-local markets.

RESEARCH METHODS

GENERAL RESEARCH METHODS

Each of the three study areas was subjected to a preliminary reconnaissance to determine the surface visibility of the ground surfaces and to determine the percentage of the area which was wooded and could not be studied with surface survey. All locations targeted for surface and subsurface study were identified, landowners and/or tenants notified of our survey intentions, and permission requested from each. Most landowners granted access; however, where access was denied, the land was not surveyed.

Surface survey of locations within the study area consisted of walking the fields in regularly spaced intervals. The extent of surface visibility was noted for each field and expressed as a percent figure. It is an estimate of the visible ground surface versus the vegetated surface and is an impressionistic figure best considered a relative, rather than absolute, value. So as to organize the pedestrian survey, each of the study areas was divided into numbered subareas. Figures 9-11 show the subarea divisions with each of the project areas. The subareas were designed to be roughly equal in size and were delineated by prominent features like roads and perennial streams.

The term "locus" was employed to initially designate discrete artifact concentrations found during the surface survey and was defined as any area with at least one flake, a few pieces of fire-cracked rock or a concentration of historic materials. The very thin scatter of historic materials found throughout many large fields was regarded as "field scatter" associated with cultivation and fertilization . A locus was later determined to constitute an archaeological site if it possessed more than a few artifacts given an area's visibility and erosion conditions. Thus, an archaeological site is here defined as the location of prehistoric and historic activity as expressed by an artifact concentration. Each locus was given a letter designation within the subarea.

FIGURE 9
Subarea Locations – St. Georges Study Area

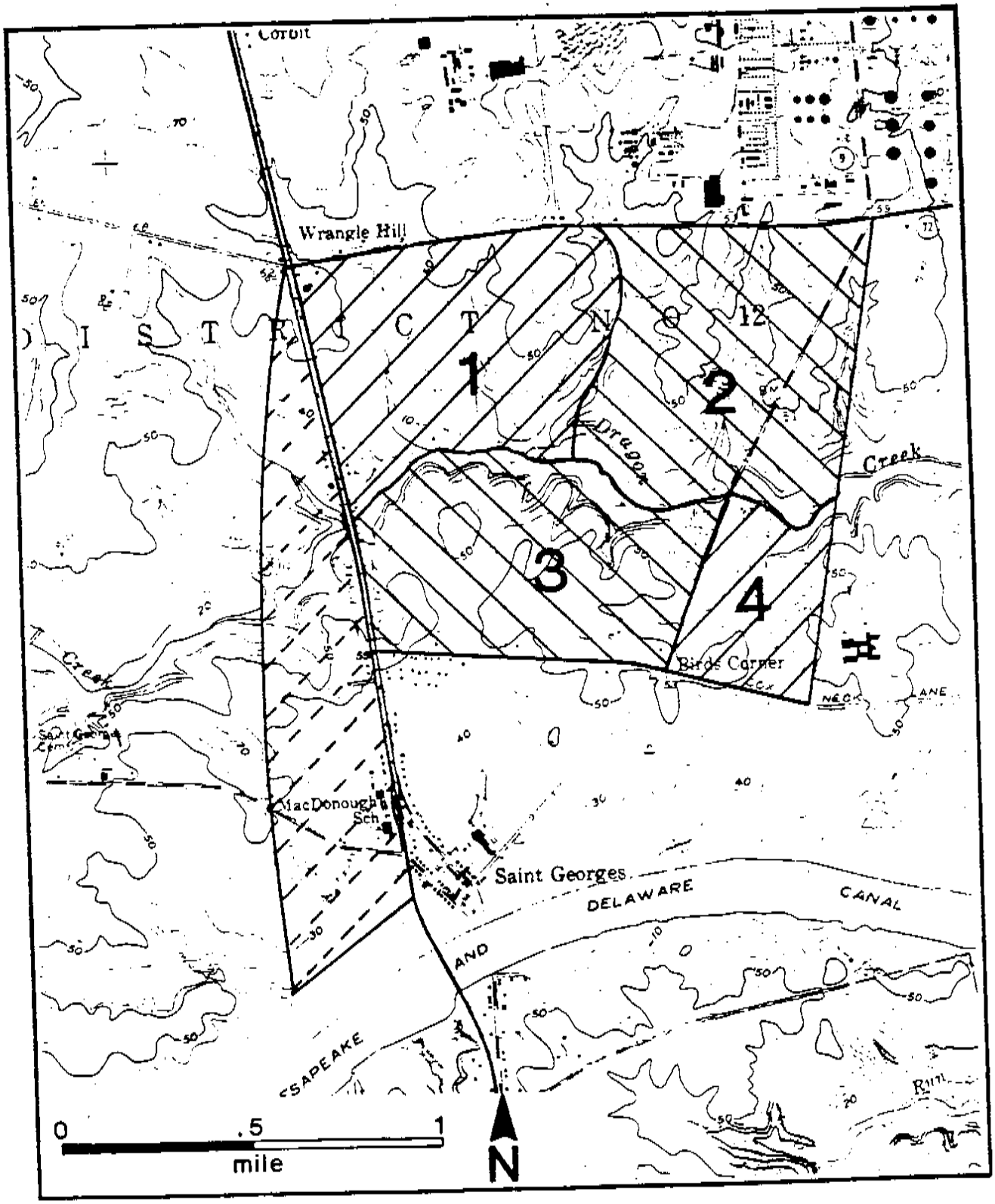


FIGURE 10

Subarea Locations – Appoquinimink Study Area

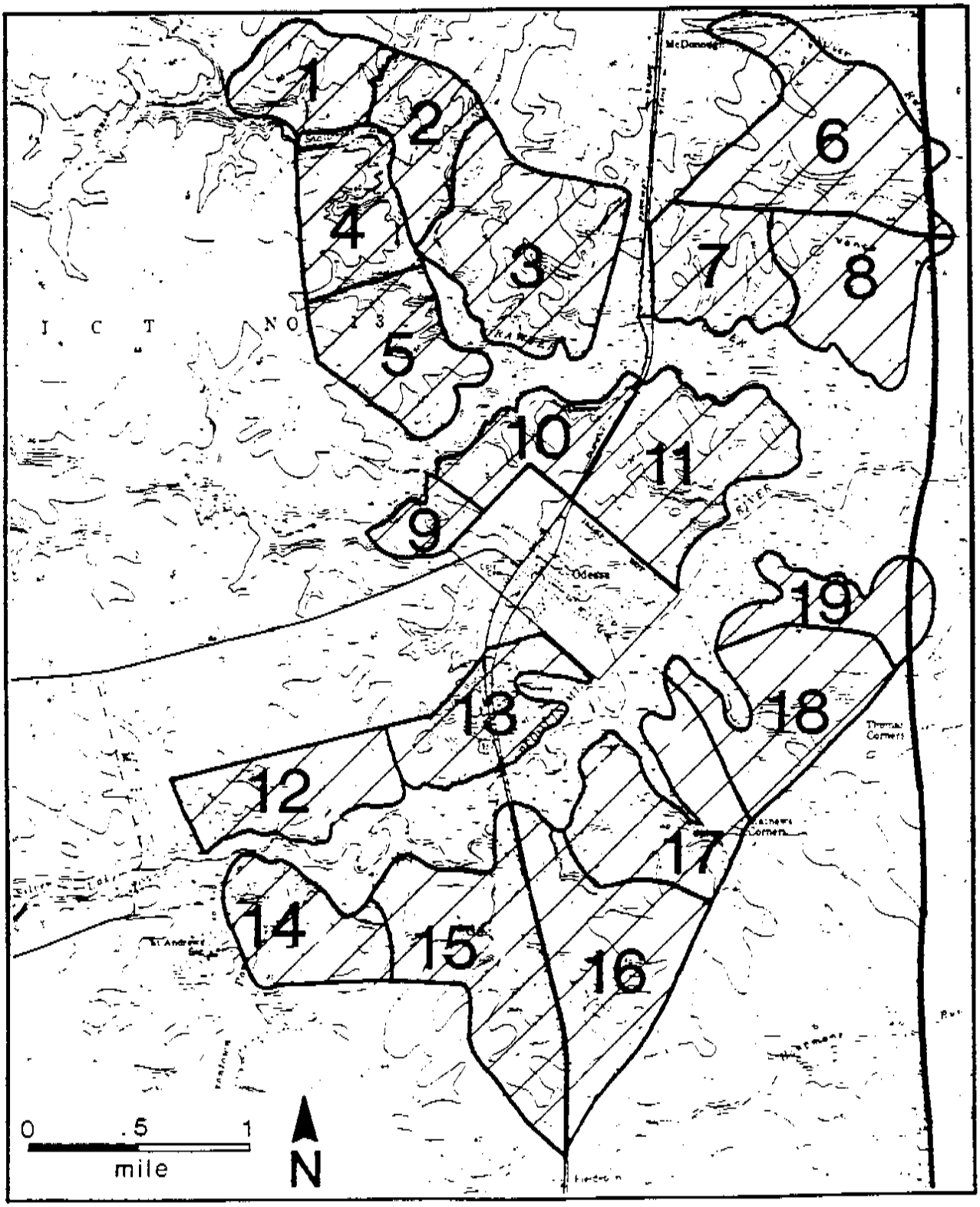
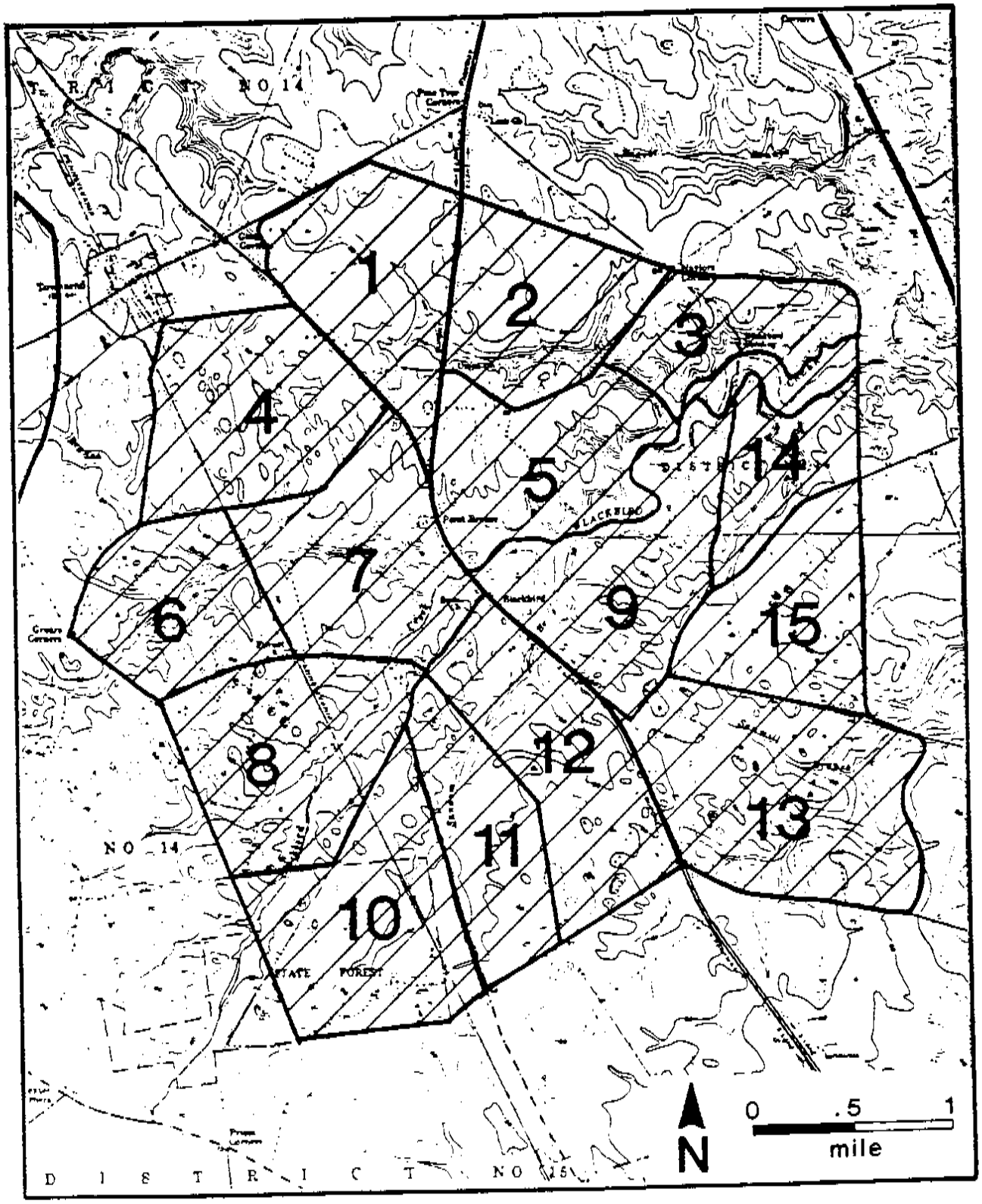


FIGURE 11
Subarea Locations – Blackbird Study Area



Prehistoric fire-cracked rock, debitage, and historic artifacts found during the pedestrian survey were generally not collected. However, these materials were counted and recorded for each locus. Collected were all chipped and ground stone tools, utilized flakes, embossed bottles, and dated coins. No prehistoric ceramics were found during the pedestrian survey.

Following the pedestrian survey, wooded sections of the study areas were examined to see if any might be appropriate locations for subsurface testing. The intent was to overcome any bias in the pedestrian survey introduced by the selectivity of farmers for arable land and to compare wooded and tilled land for prehistoric site selectivity. It was also hoped that the woodlots would produce sites in unplowed contexts. Many of the wooded areas had slopes which were too steep for testing, or were poorly drained and, therefore, unlikely locations for archaeological sites. Nonetheless, many of the wooded areas were possible site locations and subsurface testing produced remains of unplowed prehistoric archaeological sites. Subsurface testing consisted of the excavation of one-by-one meter test units which were numbered consecutively within each subarea. All prehistoric and historic artifacts recovered from the excavated test units were collected.

After all appropriate surface and subsurface testing was completed, an additional survey was made of standing structures and potential historic site locations indicated in the original report (Custer et al. 1984: Attachment II and III). The object of the additional visiting of structures was to see if any of the recorded standing structures has been destroyed since their recording and to ascertain if any historical archaeological resources might be associated with these standing structures. Similarly, potential historical archaeological site locations, which were noted in the original planning study on the basis of analyses of Beers' and Baist's atlases, were visited to see if ruins or other indications of possible historical archaeological sites were present. Field methods for this portion of the study consisted of augering, probing, checking for surface indications of modern disturbance, and simple surface inspection of the terrain looking for artifacts and ruins or foundations.

All sites found during the surface and subsurface phases of the investigation were given State of Delaware Cultural Resource Survey (CRS) numbers and archaeological site numbers and Delaware archaeological survey site forms were completed and filed with the Delaware Bureau of Archaeology and Historic Preservation (BAHP) in Dover. Additionally, Delmarva Archaeological Data System (DADS) forms were completed for all prehistoric sites found so that they could be recorded in the DADS computerized data bank. All artifacts recovered were washed and marked with Island Field Museum accession numbers in accordance with BAHP policies and guidelines on artifact processing and curation.

SPECIAL SAMPLING CONSIDERATIONS - BLACKBIRD AREA

A special sampling program was used for some of the field survey of the Blackbird area due to the large proportion of wooded areas within the Blackbird study area and the large size of this area (Figure 7). All plowed fields within the Blackbird area were subjected to a pedestrian survey; however, only a sample of the wooded areas were subjected to subsurface testing.

A 5% stratified random sample of the wooded areas was undertaken. A stratified random sampling technique was used because this technique has been shown to provide the most accurate and precise estimate of various features of site distributions (Custer 1979). The environmental strata used in the stratified design were based on ten types of surface water associations derived from USGS topographic maps and USDA soil maps:

I - no associated surface water;

II - simple bay/basin association (woodlot is associated with one bay/basin feature);

III - complex bay/basin association (woodlot is associated with 2 or more bay/basin features);

IV - major stream (Blackbird Creek);

V - minor stream (all tributaries to Blackbird Creek and the Sawmill Branch of the Smyrna River);

VI - major/minor stream confluence;

VII - minor/minor stream confluence;

VIII - springhead;

IX - bay/basin-stream association;

X - poorly drained - untestable.

These surface water settings were used as the main basis for the stratification of the wooded portions of the study area because several studies (Eveleigh, Custer, and Klemas 1983; Wells, Custer, and Klemas 1981; Custer, Eveleigh, Klemas, and Wells n.d.) have shown that the presence/absence and type of surface water association explains the largest percentage of the observable site location variation in the Delmarva Coastal Plain. Bay/basin features were of special interest because other studies (Bonfiglio and Cresson 1978) have shown these features to be the foci of prehistoric sites in other parts of the Middle Atlantic and because similar site utilization patterns have been hypothesized for the Delmarva area (Custer 1983a; 1983b; 1984a). It should be noted that in general, USGS 7.5' quadrangle maps and

USDA soil survey maps were useful for locating streams of all orders but were less productive in plotting bay/basin features. Ground examination demonstrated that many bay/basin features were not represented on the available maps. The result was that many of the strata identifications had to be adjusted in the field.

The surface area of all land in each of the ten classifications was calculated using a polar planimeter and a random number generator was used to select a 5% sample of each strata for testing. Appendix II provides the technical data utilized to generate the strata and the sample and Figure 12 shows the sample areas which were subjected to subsurface testing. Appropriate locations within the sampled woodlots were then subjected to subsurface excavation. A total of 56 one-by-one meter test units were excavated to complete the sample.

In addition to the sample subsurface testing, intensive testing was undertaken at two bay/basin features. This intensive testing was undertaken to provide more complete information on the types of archaeological and paleoenvironmental data present at the bay/basin features which are frequent in the Blackbird area. A "wet" bay/basin feature with standing water and a plowed "dry" bay/basin feature were tested with one meter units, two meter units, strata cuts, augering, and pollen coring.

RESULTS

The presentation of the results of the survey will be divided into three parts. First, the results of the general surface and subsurface testing will be noted. Second, the results of the intensive testing of archaeological sites associated two bay/basin features in the Blackbird area will be presented. Finally, results of the specific survey of standing structures and other potential historic archaeological sites will be presented.

GENERAL SURVEY RESULTS

The results of the general survey will be presented for each area. Maps of site locations, tables of locational data, tables of cultural historical data, and summary discussions of some of the more interesting sites will be presented. Appendix III provides a detailed description of the site attributes recorded and listed in the summary tables.

St. Georges Area. Figure 13 shows the archaeological sites recorded and the subareas noted in the St. Georges Area. Locational attributes of the sites are listed in Table 2 and cultural historical data are listed in Table 3. This area as initially defined was bounded by Rt. 72 on the north, U.S. Rt. 13 on the west, Cox Neck Lane on the south, and an arbitrary line east of New Castle 378 on the east. Each of the defined sub-areas and its sites are discussed below.

FIGURE 12
Sample Areas – Blackbird Study Area

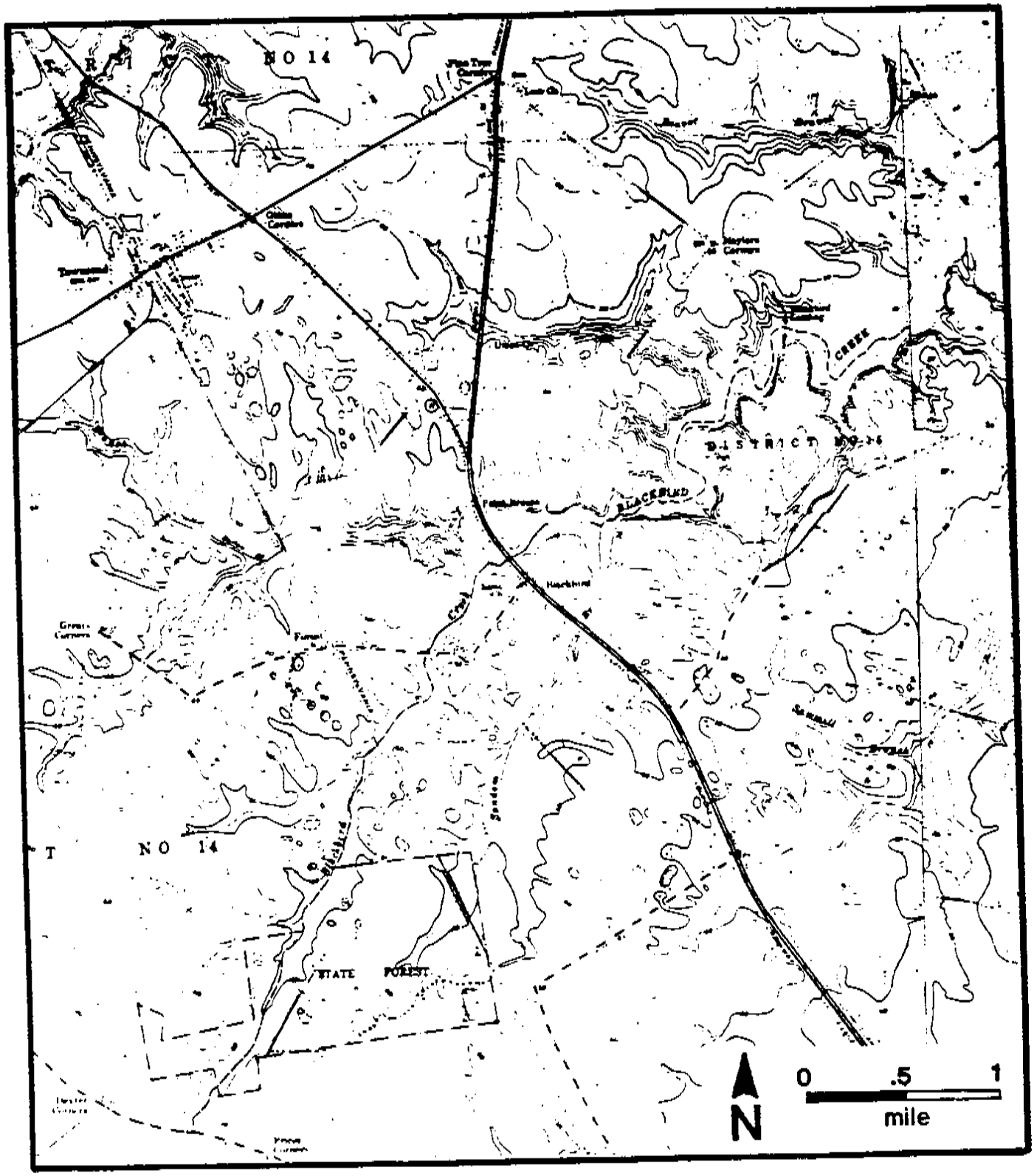


FIGURE 13
Sites and Subareas – St. Georges Study Area

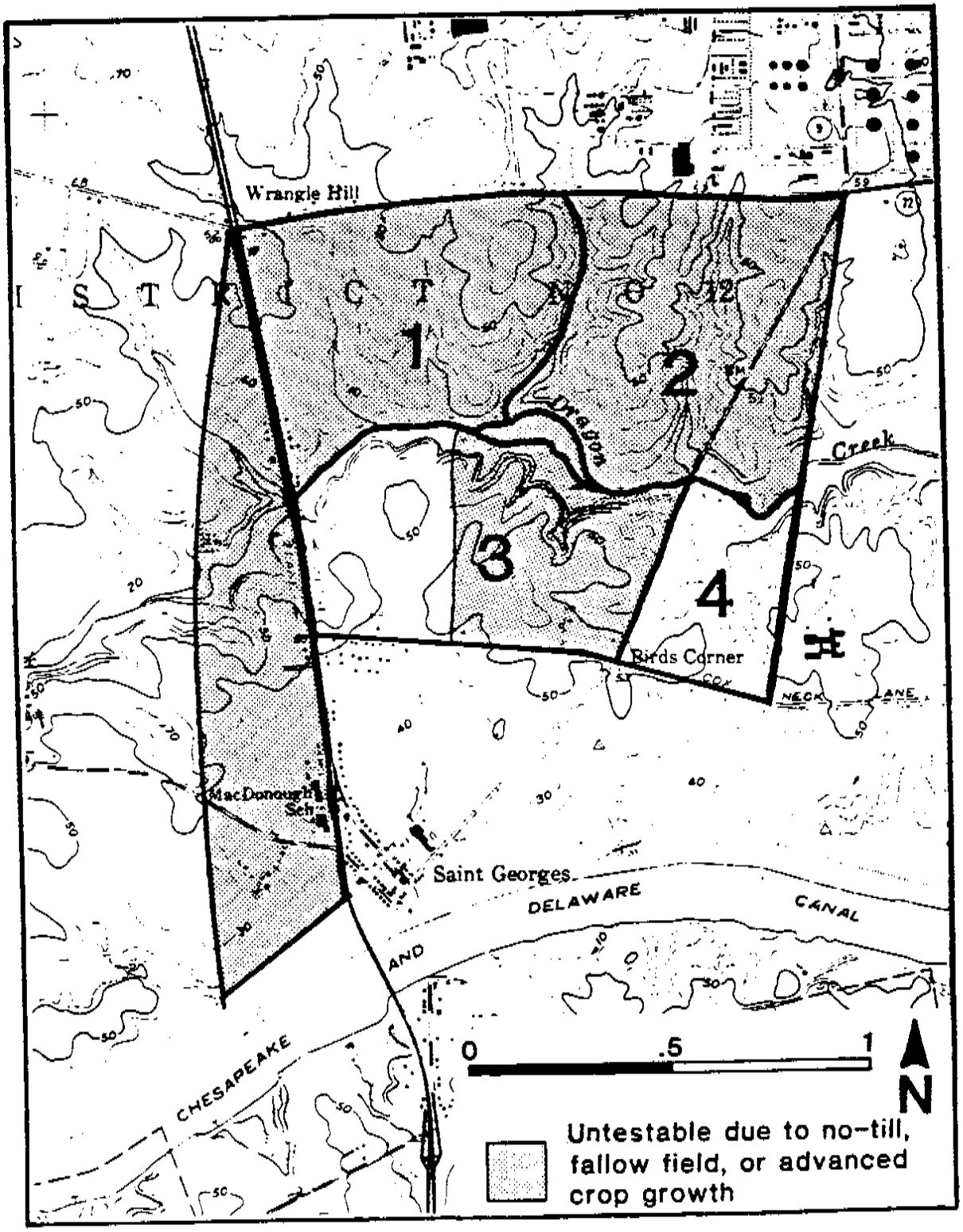


TABLE 2: LOCATIONAL DATA - ST. GEORGES STUDY AREA

SITE NUMBER	CRS NUMBER	USGS QUAD NAME	UTM NORTH	UTM EAST	GEOMORPHOLOGICAL SETTING	PRIMARY SOIL SERIES	SECONDARY SOIL SERIES	DRAINAGE	SURFACE WATER SETTING	CONF.	WATER DISTANCE (METERS)	SLOPE	ASPECT	ELEVATION
7NC-G-93	N9670	ST. GEORGE	4379800	444350	HEADLAND	M*B2	M*C2	DRAGON CREEK	STREAM	N	61	2	NE	12
7NC-G-94	N9671	ST. GEORGE	4379990	444150	HEADLAND	M*B2	M*C2	DRAGON CREEK	STREAM	N	122	2	N	15
7NC-G-95	N9672	ST. GEORGE	4380110	444040	HEADLAND	M*C2	M*D2	DRAGON CREEK	STREAM	Y	61	3	N	12
7NC-G-96	N9673	ST. GEORGE	4379900	444030	HEADLAND	M*B2	M*C2	DRAGON CREEK	STREAM	N	244	2	NW	14
7NC-G-97	N9674	ST. GEORGE	4379890	444630	HEADLAND	M*C2	M*B2	DRAGON CREEK	STREAM	N	18	5	W	6
7NC-G-20	N3790	ST. GEORGE	4379630	445230	HEADLAND	M*C2		DRAGON CREEK	STREAM	N	0	5	N	6
7NC-G-98	N9675	ST. GEORGE	4379300	445200	HEADLAND	M*B2		DRAGON CREEK	STREAM	N	30	2	N	15
7NC-G-99	N9676	ST. GEORGE	4379400	445300	HEADLAND	M*B2		DRAGON CREEK	STREAM	N	130	2	N	15

TABLE 3: CULTURAL-HISTORICAL DATA - ST. GEORGES STUDY AREA

SITE NUMBER	PALEO	ARCHAIC	WOODLAND I	WOODLAND II	CF	BL	WN	CA	WA	DA	DF	SC	MG	HISTORIC	BIFACE	SCRAPER	FLAKE TOOL	CORE	FLAKES	GROUND STONE TOOL	FCR	CERAMICS
7NC-G-93																			Y			
7NC-G-94			Y														Y		Y	Y		
7NC-G-95																			Y		Y	
7NC-G-96																			Y			
7NC-G-97																		Y	Y			
7NC-G-20			Y												Y				Y			
7NC-G-98			Y												Y				Y			
7NC-G-99				Y										Y	Y							

Subareas 1 and 2. Both of these subareas included no-till corn and soybeans, commercial and residential buildings, and untestable floodplain along Dragon Run and no ground surface was visible.

Subarea 3. This subarea included the Siani (western half) and Lester (eastern half) farms on the south side of Dragon Creek. Only the Siani property offered ground visibility at the time of the survey and five sites were located. All were severely eroded with 10%-50% visibility. Most were located on headlands and knoll tops about 60 to 300 meters from the Dragon Creek floodplain. The largest was 7NC-G-97, on the east side of Rt. 13, which contained 35 chert flakes and 1 chert cobble core. Sites 7NC-G-93 through 96 were small scatters of flakes and/or flake tools. No diagnostic artifacts were recovered from any of these sites and their erosion problems likely preclude the possibility of intact subsurface cultural remains.

Subarea 4. Subarea 11-4 included the land south of Dragon Creek and northeast of Birds Corner and contains previously recorded site 7NC-G-20, which produced a large cache of rhyolite and jasper blades, found several years ago by Mrs. Gladys Lester. The ten rhyolite bifaces averaged about 12 to 15 centimeters in length and had width/thickness ratios in the 10:1 and 12:1 range. The jasper bifaces were approximately the same length but had width/thickness ratios of about 5:1. Interestingly, the jasper bifaces exhibited edge crushing characteristic of use, while the rhyolite items did not. The G-20 site was examined during our survey and one rhyolite contracting stem biface (probably early WoodlandI, see Plate 1) and 10 flakes were recovered. Much of the site is heavily eroded due to agricultural activities.

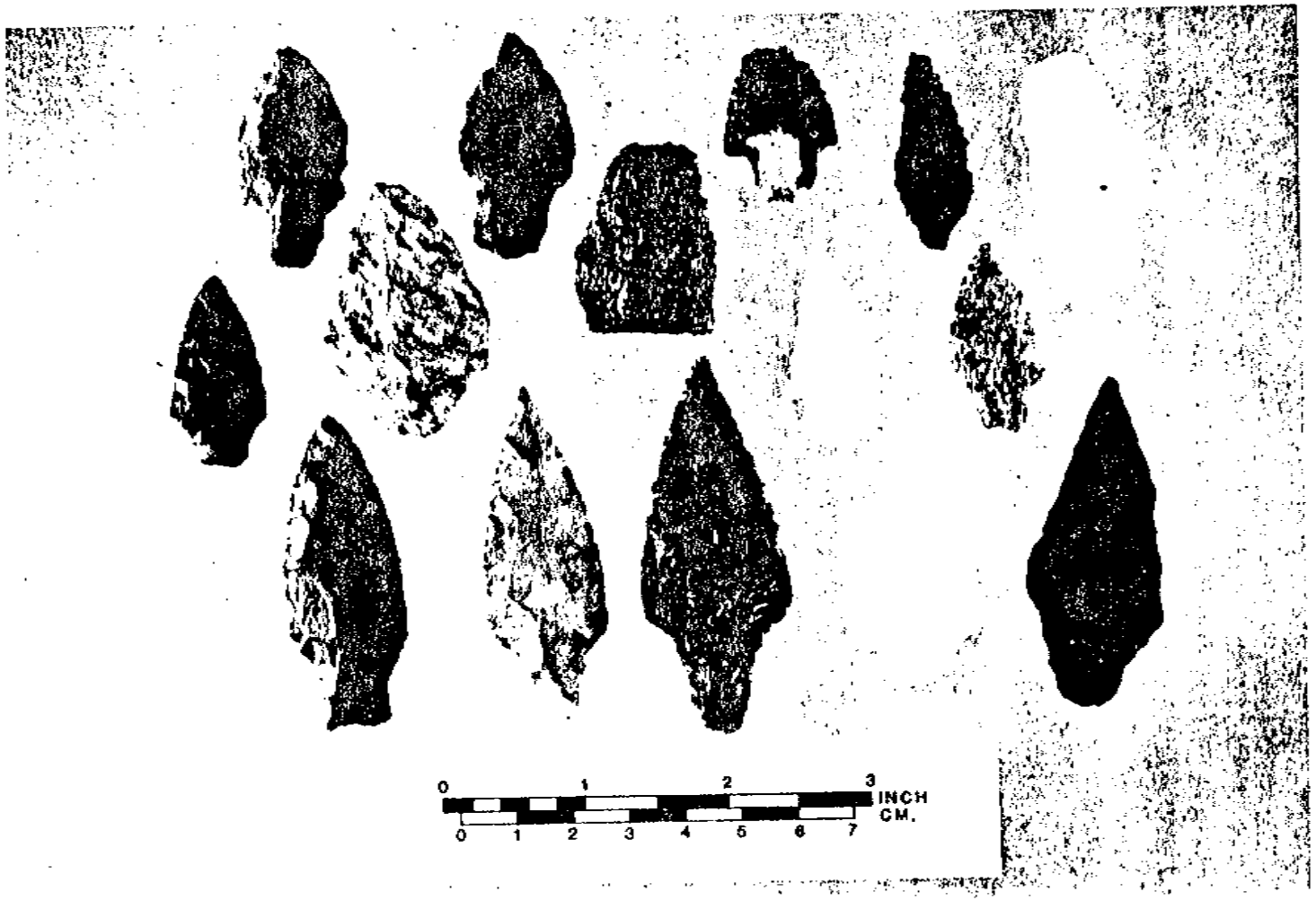
Two other sites were located along the north side of Cox Neck Lane, around the 15 meter contour which forms the divide between Dragon Creek and the former drainage through which was cut the Chesapeake and Delaware Canal. Site G-98 is a small scatter which contained 1 jasper stemmed point and 3 flakes, while G-99 contained a single small quartz triangular point (see Plate 2).

Mrs. Lester, whose family owns all of this subarea, allowed us to view her collection of artifacts from the subarea. These finds included various stemmed, notched, and triangular points of the Woodland I and II periods, but exact provenience of these artifacts was not available. However, she did indicate that most were found in the vicinity of the G-98 and G-99 sites.

After the conclusion of the pedestrian survey, Delaware Division of Highways planners sharply altered the Area 11 survey boundary. Eliminated were subareas 2, 3 (east half), and 4. A section was added on the west side of Rt. 13 from Wrangle Hill to the C & D Canal, which unfortunately could not be surveyed due to excessive crop growth.

PLATE 1

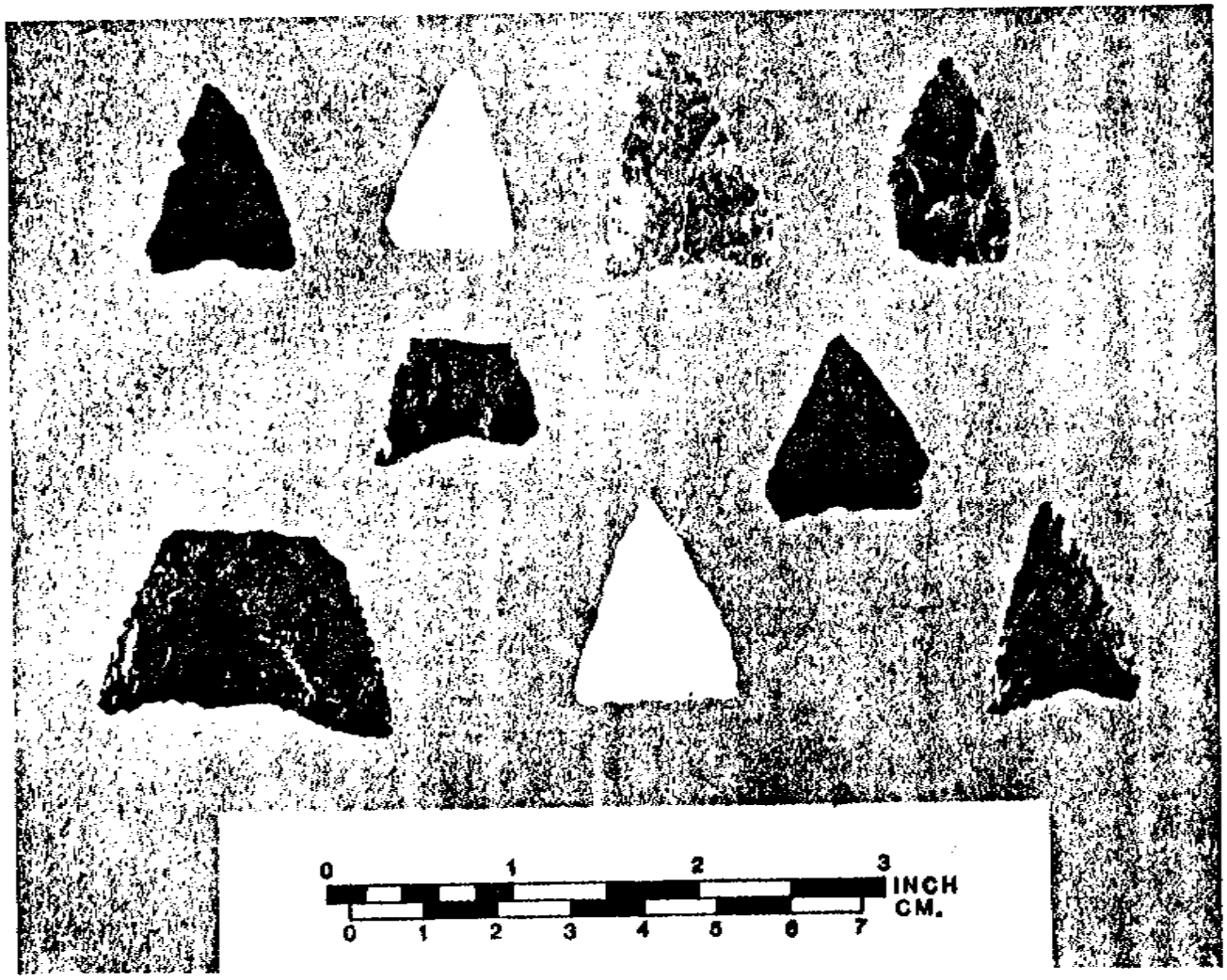
Selected Stemmed Points from Sites in the Route 13 North Survey



TOP ROW, LEFT TO RIGHT: 7NC-F-60, 7NC-J-110, 7NC-H-78, 7NC-J-105,7NC-H-51; MIDDLE ROW, LEFT TO RIGHT: 7NC-J-107, 7NC-G-20, 7NC-G-73, 7NC-G-15, 7NC-J-54; BOTTOM ROW, LEFT TO RIGHT: 7NC-H-18, 7NC-H-14, 7NC-J-90, 7NC-H-64, 7NC-J-107.

PLATE 2

Selected Triangles from Sites in the Route 13 North Survey



TOP ROW, LEFT TO RIGHT: 7NC-G-79, 7NC-G-99, 7NC-J-32, 7NC-J-47; MIDDLE ROW, LEFT TO RIGHT: 7NC-G-82, 7NC-G-81; BOTTOM ROW, LEFT TO RIGHT: 7NC-J-71, 7NC-J-54, 7NC-J-69.

Appoquinimink Area - Surface Survey. Figure 14 shows the subareas noted and the sites recorded in the Appoquinimink study area. Table 4 shows the site locational data and Table 5 shows the cultural-historical data for the these sites. This area included land on both sides of Appoquinimink and Drawyer's Creeks, which join just east of Odessa, Del. Nineteen subareas were defined and all but two (12 and 13) were examined. These were intensively surveyed by Thunderbird Research Corporation for the Middletown-Odessa-Townsend sewer project (Gardner and Stewart 1978) and that survey was considered adequate for this project.

Seventy-seven loci were noted during the pedestrian survey, conducted during March, April, and May of 1984. Seven of these were previously recorded sites that were re-examined to further define their limits. Another 8 of the 77 were determined to be unworthy of "site" designation due to a low artifact count (1 flake) or heavily eroded context. Sixty-two new sites from the pedestrian survey were recorded with the BAHP.

Subarea 1. Site 7NC-F-3, a previously recorded site was re-examined to clarify its limits and expand the range of cultural components present at the site. However, only 1 flake tool and 1 other flake were recovered. Sites 7NC-F-44 through 47 were small flake scatters distributed on the high ground along the north side of Shallcross Lake, an artificial lake created by the damming of Drawyer's Creek. No diagnostic tools were collected from these sites. Auger testing in this area revealed that considerable slopewash had occurred, as 0.50 meter deep organic zones were present in the fields in some places. Buried cultural contexts may be present in this subarea.

Subarea 2. This subarea was found to consist wholly of fallow fields, single family dwellings with associated lawns, and untestable wooded slopes and no surface examination was possible.

Subarea 3. Sites 7NC-G-39 through 45, 48, and 74 were recorded. Most were located on the west side of a small tributary to Drawyer's Creek and each consisted of a broken or discarded tool and a few flakes. They were situated on a series of headlands along the west side of the unnamed tributary and probably represent a series of small procurement sites. No diagnostic tools were recovered from any of these sites.

An historic brick scatter (7NC-G-74) was noted on the west side of the subarea on a slope leading down to another unnamed tributary to Drawyer's Creek. This scatter measured about 9 x 12 meters and contained no other artifacts.

Subarea 4. Three sites were found on the south side of Shallcross Lake Dam in an area of extremely low visibility (7NC-F-49 through 51). Site F-50 contained 1 contracting stem biface, one biface distal end, and five flakes with surface visibility less than 5%. The other two sites were small flake scatters with no diagnostics present. Because the low artifact counts are probably the result of the low visibility, all three sites may

FIGURE 14

Sites and Subareas – Appoquinimink Study Area

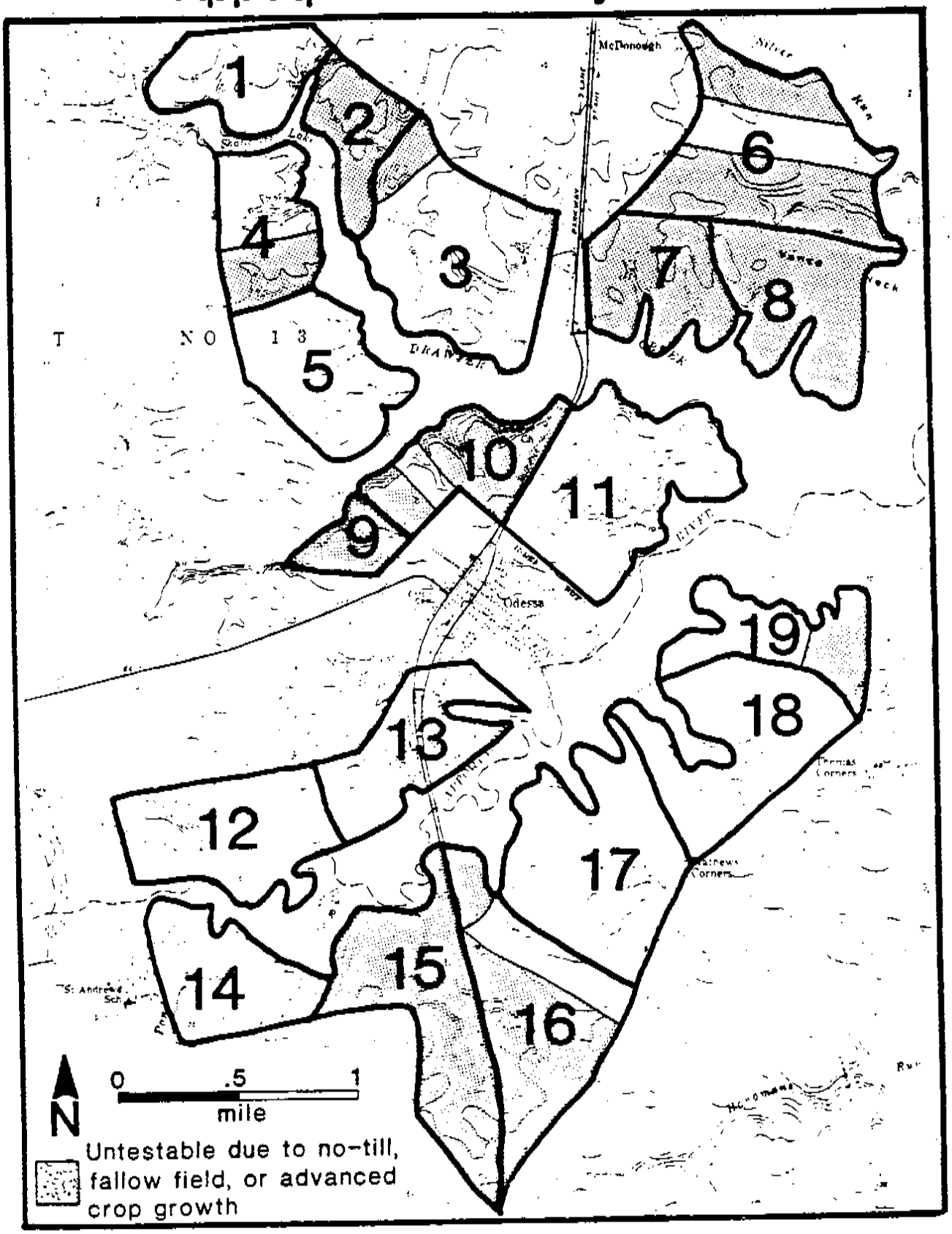


TABLE 4: FOR ADDITIONAL DATA - ARCADIA WETLANDS AREA

SITE NUMBER	CRS NUMBER	USGS QUAD NAME	UTM NORTH	UTM EAST	GEOMORPHOLOGICAL SETTING	PRIMARY SOIL SERIES	SECONDARY SOIL SERIES	DRAINAGE	SURFACE WATER SETTING	CONF.	WATER DISTANCE (METERS)	SLOPE	ASPECT	ELEVATION
ZNE-F-3	N3809	MIDDLETOWN	4370700	441700	HEADLAND	MaD2		DRAWYER CREEK	STREAM	N	244	2	SE	12
ZNE-F-44	N9599	MIDDLETOWN	4370240	441960	HEADLAND	MaD2		DRAWYER CREEK	STREAM	N	61	5	S	12
ZNE-F-45	N9600	MIDDLETOWN	4370960	441480	HEADLAND	MaD2		DRAWYER CREEK	STREAM	N	244	2	S	12
ZNE-F-46	N9601	MIDDLETOWN	4370910	441410	HEADLAND	MaD2		DRAWYER CREEK	STREAM	N	244	2	S	12
ZNE-F-47	N9602	MIDDLETOWN	4370880	441140	HEADLAND	MaD2		DRAWYER CREEK	STREAM	N	122	2	S	9
ZNE-G-39	N9616	MIDDLETOWN	4370170	443710	HEADLAND	MaD2		DRAWYER CREEK	STREAM	N	91	5	SE	12
ZNE-G-40	N9617	MIDDLETOWN	4369940	443640	HEADLAND	MaD2		DRAWYER CREEK	STREAM	N	213	2	S	15
ZNE-G-41	N9618	MIDDLETOWN	4369880	443600	HEADLAND	MaD2		DRAWYER CREEK	STREAM	N	91	2	S	12
ZNE-G-42	N9619	MIDDLETOWN	4369200	443550	HEADLAND	MaD2		DRAWYER CREEK	STREAM	N	198	2	SE	12
ZNE-G-43	N9620	MIDDLETOWN	4369630	443470	HEADLAND	MaD2		DRAWYER CREEK	STREAM	N	244	2	SE	15
ZNE-G-44	N9621	MIDDLETOWN	4369600	443420	HEADLAND	MaD2		DRAWYER CREEK	STREAM	Y	244	2	SE	15
ZNE-G-45	N9622	MIDDLETOWN	4369500	443290	HEADLAND	MaD2		DRAWYER CREEK	STREAM	N	244	2	SE	15
ZNE-F-48	N9603	MIDDLETOWN	4369960	442660	HEADLAND	MaD2		DRAWYER CREEK	STREAM	N	122	2	SW	9
ZNE-G-34	N9651	MIDDLETOWN	4372150	442970	HEADLAND	MaD2		DRAWYER CREEK	STREAM	N	305	2	W	15
ZNE-F-49	N9604	MIDDLETOWN	4370450	442060	HEADLAND	MaD2		DRAWYER CREEK	STREAM	N	183	2	E	14
ZNE-F-50	N9605	MIDDLETOWN	4370100	441940	HEADLAND	MaD2		DRAWYER CREEK	STREAM	N	244	2	SE	15
ZNE-F-51	N9606	MIDDLETOWN	4370010	442150	HEADLAND	MaD2		DRAWYER CREEK	STREAM	N	76	2	NE	15
ZNE-F-52	N9607	MIDDLETOWN	4369960	441620	HEADLAND	MaD2		DRAWYER CREEK	STREAM	N	91	5	N	15
ZNE-F-53	N9608	MIDDLETOWN	4369590	442600	HEADLAND	MaD2		DRAWYER CREEK	STREAM	N	91	2	SE	9
ZNE-F-21	N3808	MIDDLETOWN	4368520	442420	HEADLAND	SaD2		DRAWYER CREEK	STREAM	N	30	5	SE	12
ZNE-F-54	N9609	MIDDLETOWN	4368600	442220	HEADLAND	MaD2		DRAWYER CREEK	STREAM	N	244	5	S	15
ZNE-F-55	N9610	MIDDLETOWN	4369410	442260	HEADLAND	MaD2		DRAWYER CREEK	STREAM	Y	30	2	NE	11
ZNE-F-56	N9611	MIDDLETOWN	4369330	441900	HEADLAND	MaD2		DRAWYER CREEK	STREAM	N	76	2	N	15
ZNE-G-46	N9623	MIDDLETOWN	4370910	441410	HEADLAND	MaD2		DRAWYER CREEK	STREAM	N	244	2	S	12
ZNE-G-47	N9624	MIDDLETOWN	4368290	442880	HEADLAND	MaD2		DRAWYER CREEK	STREAM	N	91	2	N	17
ZNE-G-48	N9625	MIDDLETOWN	4368160	442990	HEADLAND	MaD2		DRAWYER CREEK	STREAM	N	0	10	N	17
ZNE-G-13	N3810	MIDDLETOWN	4368570	443790	HEADLAND	MaD2		DRAWYER CREEK	STREAM	N	23	2	NE	9
ZNE-G-49	N9626	MIDDLETOWN	4368650	443300	HEADLAND	MaD2		DRAWYER CREEK	STREAM	N	91	5	N	15
ZNE-G-50	N9627	MIDDLETOWN	4368570	443390	HEADLAND	MaD2		DRAWYER CREEK	STREAM	N	61	2	N	14
ZNE-G-15	N3811	MIDDLETOWN	4368960	443600	HEADLAND	MaD2		DRAWYER CREEK	STREAM	Y	15	2	N	14
ZNE-G-51	N9628	MIDDLETOWN	4368170	443290	HEADLAND	MaD2		ARCADIA MINK	STREAM	N	91	5	SE	12
ZNE-G-52	N9629	MIDDLETOWN	4368250	443510	HEADLAND	MaD2		ARCADIA MINK	STREAM	N	152	2	SE	11
ZNE-G-53	N9630	MIDDLETOWN	4368100	443420	HEADLAND	MaD2	MaC2	ARCADIA MINK	STREAM	N	152	2	SE	12
ZNE-G-54	N9631	MIDDLETOWN	4368400	443250	HEADLAND	MaD2	MaC2	ARCADIA MINK	STREAM	N	183	2	E	12
ZNE-G-55	N9632	MIDDLETOWN	4367850	443290	HEADLAND	MaD2	MaC3	ARCADIA MINK	STREAM	N	152	2	E	12
ZNE-G-56	N9633	MIDDLETOWN	4367600	443190	HEADLAND	SaD2		ARCADIA MINK	STREAM	N	30	2	SE	12
ZNE-G-57	N9634	MIDDLETOWN	4367610	443690	HEADLAND	SaD2	SaC2	ARCADIA MINK	STREAM	N	61	2	SW	12
ZNE-G-58	N9635	MIDDLETOWN	4367780	443590	HEADLAND	SaD2		ARCADIA MINK	STREAM	N	46	2	SE	12
ZNE-G-59	N9636	MIDDLETOWN	4368760	441140	HEADLAND	SaD2		DRAWYER CREEK	STREAM	N	91	5	N	12
ZNE-G-60	N9637	MIDDLETOWN	4368200	441320	HEADLAND	SaD2		DRAWYER CREEK	STREAM	N	30	5	N	9
ZNE-G-61	N9638	MIDDLETOWN	4368040	441360	HEADLAND	SaD2		DRAWYER CREEK	STREAM	N	23	5	N	9
ZNE-G-62	N9639	MIDDLETOWN	4368670	441430	HEADLAND	SaD2		DRAWYER CREEK	STREAM	N	6	5	N	9
ZNE-G-64	N9641	MIDDLETOWN	4368650	442640	HEADLAND	MaD2		DRAWYER CREEK	STREAM	N	30	2	N	9
ZNE-G-65	N9642	MIDDLETOWN	4368730	442750	HEADLAND	MaD2		DRAWYER CREEK	STREAM	Y	3	2	N	5
ZNE-G-66	N9643	MIDDLETOWN	4368680	443040	HEADLAND	MaD2		DRAWYER CREEK	STREAM	Y	6	2	NE	8
ZNE-G-67	N9644	MIDDLETOWN	4368390	445080	HEADLAND	MaD2		ARCADIA MINK	STREAM	Y	152	2	E	6
ZNE-F-57	N9612	MIDDLETOWN	4364340	441660	HEADLAND	MaD2		ARCADIA MINK	STREAM	N	122	2	W	12
ZNE-F-58	N9613	MIDDLETOWN	4363430	441600	HEADLAND	MaD2		ARCADIA MINK	STREAM	N	152	2	W	12
ZNE-F-59	N9614	MIDDLETOWN	4364900	442060	HEADLAND	SaD2		ARCADIA MINK	STREAM	N	366	2	N	12
ZNE-F-28	N3822	MIDDLETOWN	4365070	441600	HEADLAND	MaD2		ARCADIA MINK	STREAM	N	305	2	N	12

SITE NUMBER	GPS NUMBER	USGS QUAD NAME	UTM NORTH	UTM EAST	GEOMORPHOLOGICAL SETTING	PRIMARY SOIL SERIES	SECONDARY SOIL SERIES	DRAINAGE	SURFACE WATER SETTING	COMP.	WATER DISTANCE (METERS)	SLOPE	ASPECT	ELEVATION
[illegible]	N9615	MIDDLETOWN	4363060	441480	HEADLAND	MaB2		APPOQUINIMINK	STREAM	N	6	2	W	9
[illegible]	N9645	MIDDLETOWN	4364910	441200	BAY/BASIN	SaB2	KaA	APPOQUINIMINK	BAY/BASIN	N	61	2	SE	15
[illegible]	N9646	MIDDLETOWN	4363870	444310	BAY/BASIN	SaB2	EaA	APPOQUINIMINK	BAY/BASIN	N	23	2	SE	15
[illegible]	N9647	MIDDLETOWN	4364950	444050	HEADLAND	SaB2	EaA	APPOQUINIMINK	STREAM	N	61	2	NW	17
[illegible]	N9648	MIDDLETOWN	4363940	443640	INTERTIDAL FLAT	SaB2	SaB2	APPOQUINIMINK	STREAM	N	76	2	SW	15
[illegible]	N9649	MIDDLETOWN	4365040	443700	HEADLAND	SaB	SaB2	APPOQUINIMINK	STREAM	N	610	0	N	14
[illegible]	N9650	MIDDLETOWN	4365190	443440	HEADLAND	KaB2	KpC3	APPOQUINIMINK	STREAM	N	0	2	E	12
[illegible]	N3874	MIDDLETOWN	4365700	443540	HEADLAND	MaC2	MaC3	APPOQUINIMINK	STREAM	N	229	2	W	6
[illegible]	N3899	MIDDLETOWN	4366080	443700	FLOODPLAIN	SaB2	MaC3	APPOQUINIMINK	STREAM	Y	30	2	S	3
[illegible]	N3831	MIDDLETOWN	4366250	444140	FLOODPLAIN	MaB2	MaC2	APPOQUINIMINK	STREAM	N	152	2	SW	5
[illegible]	N9652	MIDDLETOWN	4365860	444320	HEADLAND/IN	MaB2	MaC2	APPOQUINIMINK	STREAM	N	152	2	W	5
[illegible]	N9653	MIDDLETOWN	4365720	444420	HEADLAND	MaB2	MaC2	APPOQUINIMINK	STREAM	N	152	2	W	8
[illegible]	N9654	MIDDLETOWN	4366790	444300	HEADLAND	MaC2		APPOQUINIMINK	STREAM	N	244	5	SW	9
[illegible]	N9655	MIDDLETOWN	4366640	445220	HEADLAND	SaB2		APPOQUINIMINK	STREAM	N	122	2	SW	12
[illegible]	N9656	MIDDLETOWN	4366660	445480	HEADLAND	SaB2		APPOQUINIMINK	STREAM	N	0	2	SW	12
[illegible]	N9657	MIDDLETOWN	4366730	445600	HEADLAND	SaB2		APPOQUINIMINK	STREAM	N	0	2	W	9
[illegible]	N9658	MIDDLETOWN	4366040	445530	HEADLAND	SaB2		APPOQUINIMINK	STREAM	N	0	2	NW	12
[illegible]	N9659	MIDDLETOWN	4366190	444910	HEADLAND	SaB2		APPOQUINIMINK	STREAM	N	152	2	N	14
[illegible]	N9660	MIDDLETOWN	4366100	444930	HEADLAND	SaB2		APPOQUINIMINK	STREAM	N	305	2	W	12
[illegible]	N9661	MIDDLETOWN	4365910	444790	HEADLAND	SaB2		APPOQUINIMINK	STREAM	N	152	5	NW	12
[illegible]	N9662	MIDDLETOWN	4366510	445520	HEADLAND	MaB2		APPOQUINIMINK	STREAM	N	46	2	SW	9
[illegible]	N9663	MIDDLETOWN	4366300	444600	HEADLAND	MaB2		APPOQUINIMINK	STREAM	N	30	2	SW	9
[illegible]	N9664	MIDDLETOWN	4366000	444640	HEADLAND	MaB2		APPOQUINIMINK	STREAM	N	122	2	SW	11
[illegible]	N9665	MIDDLETOWN	4367360	445390	HEADLAND	SaB2		APPOQUINIMINK	STREAM	Y	0	2	S	9
[illegible]	N9666	MIDDLETOWN	4367100	445300	HEADLAND	SaB2		APPOQUINIMINK	STREAM	N	152	2	N	12
[illegible]	N9667	MIDDLETOWN	4367080	444590	HEADLAND	SaB		APPOQUINIMINK	STREAM	N	91	15	W	6
[illegible]	N9668	MIDDLETOWN	4367110	444880	HEADLAND	SaB2		APPOQUINIMINK	STREAM	N	305	2	NW	9
[illegible]	N9669	MIDDLETOWN	4367050	445190	HEADLAND	SaB2		APPOQUINIMINK	STREAM	N	0	2	N	9

TABLE 5: CULTURAL-HISTORICAL DATA - APPOQUINIMINK AREA

SITE NUMBER	PALEO	ARCHAIC	WOODLAND I	WOODLAND II	OF	BL	WN	CA	WB	DA	DP	SU	MG	HISTORIC	BIFACE	SCRAPER	FLAKE TOOL	CORE	FLAKES	GROUND STONE TOOL	FCR	CERAMICS
7NC-E-3																	Y		Y			
7NC-E-44																			Y			
7NC-E-45																			Y			
7NC-E-46																			Y			
7NC-E-47																			Y			
7NC-G-39															Y				Y			
7NC-G-40																			Y			
7NC-G-41																		Y	Y			
7NC-G-42															Y				Y			
7NC-G-43																	Y		Y			
7NC-G-44																			Y			
7NC-G-45																			Y			
7NC-G-46														Y								
7NC-G-74																			Y			
7NC-H-49															Y				Y			
7NC-E-50			Y																Y			
7NC-E-51															Y	Y			Y		Y	
7NC-E-52			Y						Y										Y			
7NC-E-53																			Y			
7NC-E-21																			Y			
7NC-E-54																			Y			
7NC-E-55																			Y			
7NC-E-56															Y							
7NC-G-46																			Y			
7NC-G-47																			Y			
7NC-G-48															Y				Y		Y	
7NC-G-13																			Y			
7NC-G-49															Y				Y		Y	
7NC-G-50															Y							
7NC-G-49			Y						Y						Y				Y			
7NC-G-51			Y																Y			
7NC-G-52															Y				Y			
7NC-G-53																			Y			
7NC-G-54																	Y					
7NC-G-55															Y					Y		
7NC-G-56		Y																Y	Y			
7NC-H-57																			Y			
7NC-H-58																			Y		Y	Y
7NC-H-59				Y									Y						Y		Y	Y
7NC-H-60				Y									Y						Y			
7NC-H-61																			Y		Y	Y
7NC-H-62				Y									Y						Y		Y	Y
7NC-H-63				Y									Y						Y			
7NC-H-65																			Y			
7NC-H-66																			Y		Y	
7NC-G-67															Y				Y			
7NC-E-57																			Y		Y	
7NC-E-58																			Y			
7NC-E-59																			Y			
7NC-E-20																						

TABLE 5 [illegible]

SITE NUMBER	PALEO	ARCHAIC	WOODLAND I	WOODLAND II	CF	DL	WN	CA	WB	DA	DP	SC	MG	HISTORIC	BIFACE	SCRAPER	FLAKE TOOL	CORE	FLAKES	GROUND STONE TOOL	FCR	CERAMICS
ZNC-G-60			Y			Y									Y		Y		Y			
ZNC-G-68																	Y		Y			
ZNC-G-69																	Y		Y			
ZNC-G-70																			Y			
ZNC-G-71																	Y					
ZNC-G-72															Y				Y			
ZNC-G-73			Y			Y									Y		Y		Y		Y	
ZNC-G-74			Y					Y							Y							
ZNC-G-75																			Y			
ZNC-G-76			Y			Y		Y			Y				Y		Y		Y		Y	
ZNC-G-77								Y							Y				Y			
ZNC-G-78																			Y			
ZNC-G-79				Y									Y		Y				Y			
ZNC-G-80																		Y				
ZNC-G-81				Y									Y		Y							
ZNC-G-82				Y									Y		Y			Y	Y		Y	
ZNC-G-83																	Y		Y			
ZNC-G-84																			Y			
ZNC-G-85																	Y		Y			
ZNC-G-86																			Y			
ZNC-G-87																			Y			
ZNC-G-88															Y				Y		Y	
ZNC-G-89																Y			Y			
ZNC-G-90			Y												Y							
ZNC-G-91																			Y			
ZNC-G-92																			Y			

have been intensively occupied.

Subarea 5. Located at the confluence of Drawyer's Creek and an unnamed tributary, this area is almost entirely on the Raymond Burris farm. Sites 7NC-F-52 through 56 and previously recorded site F-21 were found in this subarea. Site F-52 is located on the south side of Drawyer's Creek and contained one Fox Creek-like point, one broken undiagnostic biface, one scraper reworked from a point, 60 flakes, and fire-cracked rock. A few flakes were found around the edge of F-21, which appears to be almost completely destroyed by borrow operations. The remaining sites were flake scatters in fields on the headlands along the creeks.

Subarea 6. Most of this subarea was woodlot, pasture, or subdivision. A large cornfield on the David Reed farm was walked with no finds. The only artifact found in the subarea was a large early stage quartzite biface found on a wooded slope on the south side of Silver Run (7NC-G-46).

Subarea 7. This subarea was comprised entirely of no-till fields and survey could not be conducted.

Subarea 8. This subarea was all no-till cornfield and dairy pasture and offered no surveyable ground.

Subarea 9. Comprised entirely of no-till soybeans and pasture, this subarea also provided no visible ground surface.

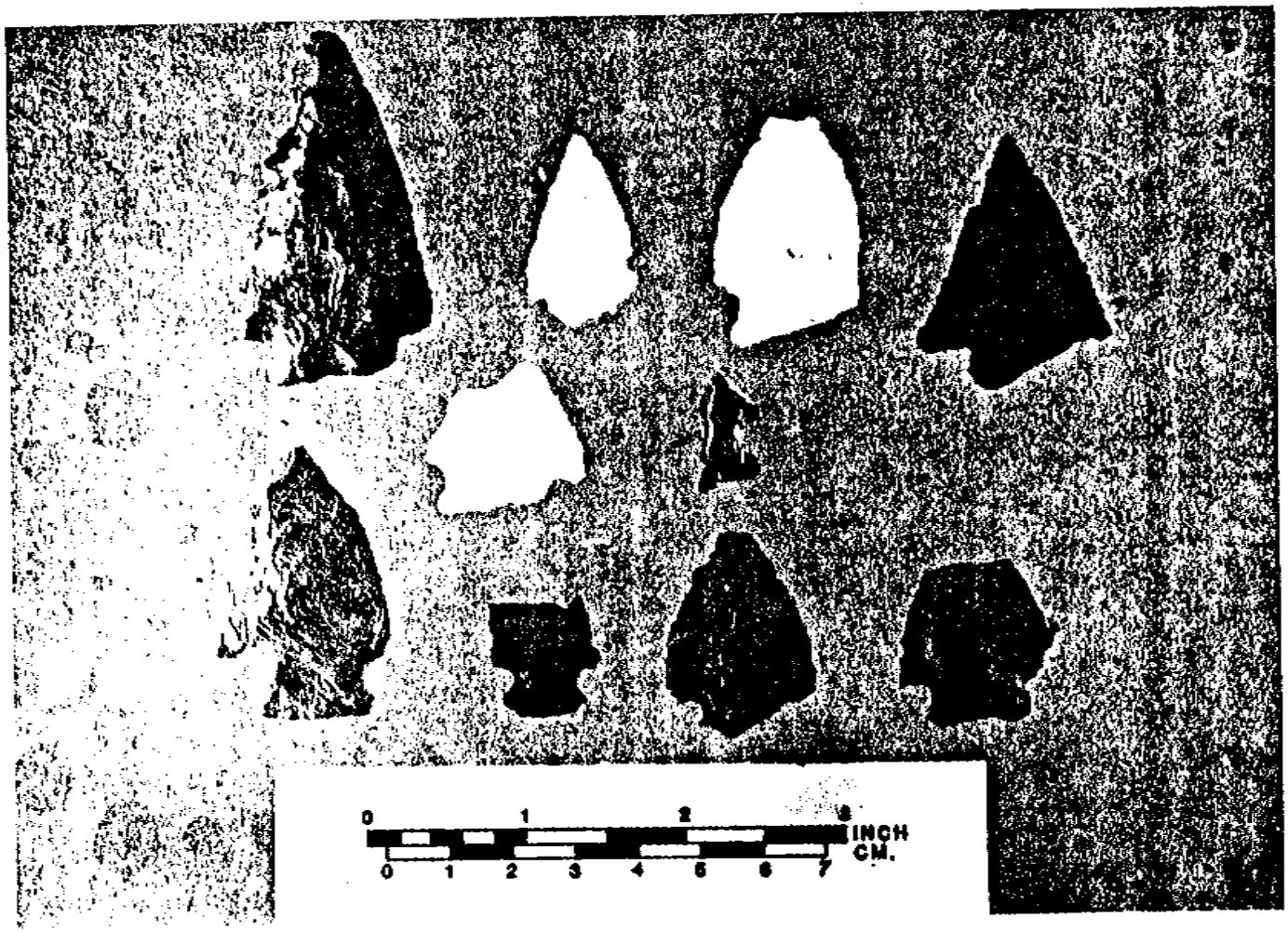
Subarea 10. Site 7NC-G-13, on the grounds of Old Drawyer's Church, offered patchy visibility. Nevertheless, one notched biface fragment, (see Plate 3) 8 flakes, and several pieces of fire-cracked rock were found. The finds were made on the headland on the southeast side of Drawyer's Creek, about 60 meters southwest of the church building. Two other small flake scatters were found in the grain fields northwest of Odessa (7NC-G-47 and 48).

Subarea 11. This subarea yielded 10 new sites (7NC-G-49 through 58) and one previously recorded site was also surveyed (7NC-G-15). A single artifact, a quartz stemmed point, was recovered from G-15 (see Plate 1).

The most notable site within the subarea is 7NC-G-56, which produced one double full-grooved axe (Plate 4), one bifurcated-base point (Plate 5), one quartz early stage biface reject, and 22 flakes. It is located on a rise about 150 meters northwest of Appoquinimink Creek. The bifurcate and the axe were found about 15 meters apart and the latter appeared to be unfinished. However, the crest of the rise, where most of the artifacts were found, was severely eroded and the site is probably no longer intact. The terrace below and southeast of the site was augered and 40 to 55 centimeter deep upper organic zones were encountered. Being too deep for modern plow zones, these figures suggest the presence of old landscapes buried by recent slopewash.

PLATE 3

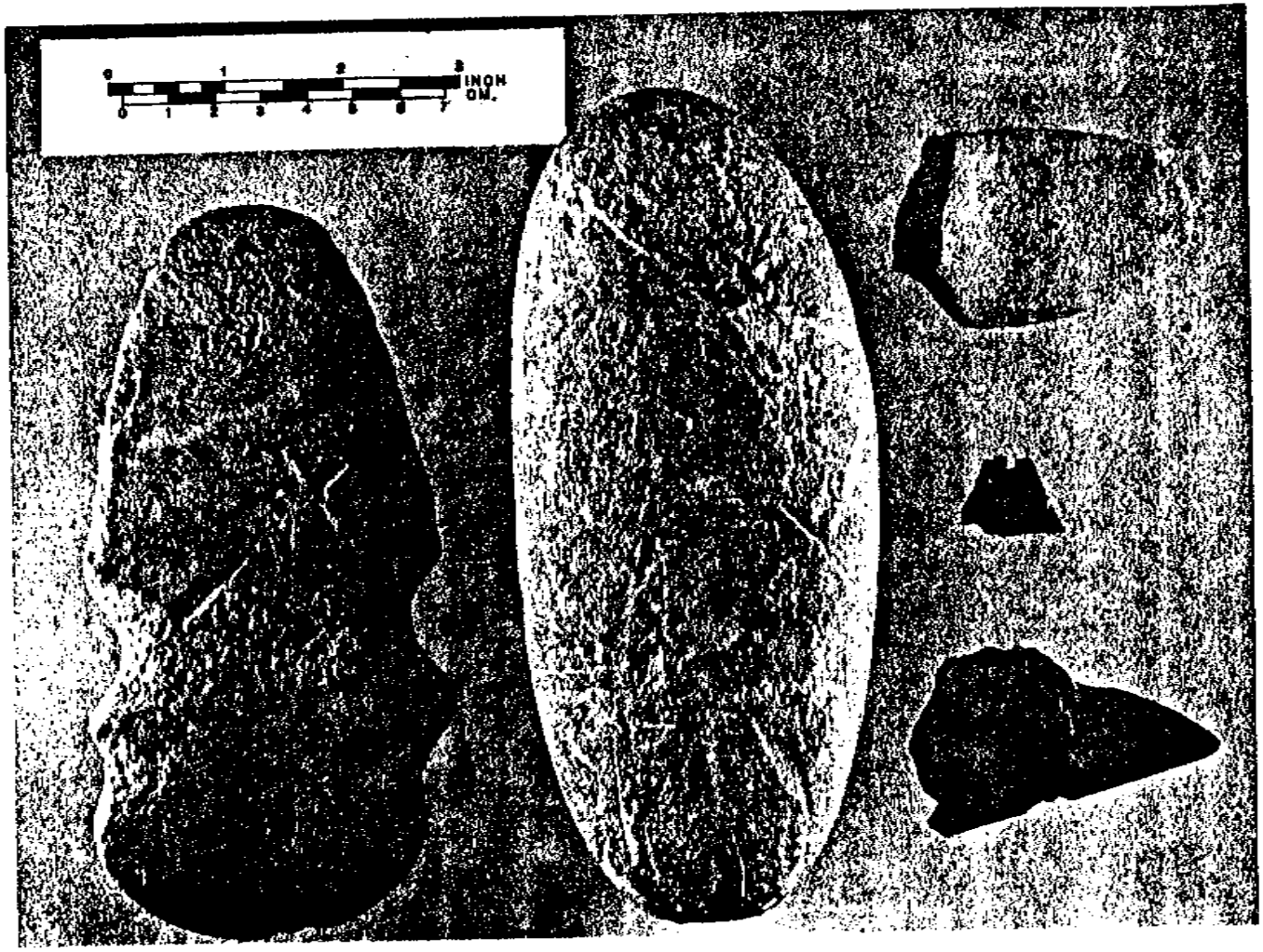
Selected Notched Points from Sites in the Route 13 North Survey



TOP ROW, LEFT TO RIGHT: 7NC-J-91, 7NC-J-61, 7NC-H-32, 7NC-J-81; MIDDLE ROW, LEFT TO RIGHT: 7NC-F-57, 7NC-G-13; BOTTOM ROW, LEFT TO RIGHT: 7NC-H-14, 7NC-J-54, 7NC-J-103, 7NC-J-68.

PLATE 4

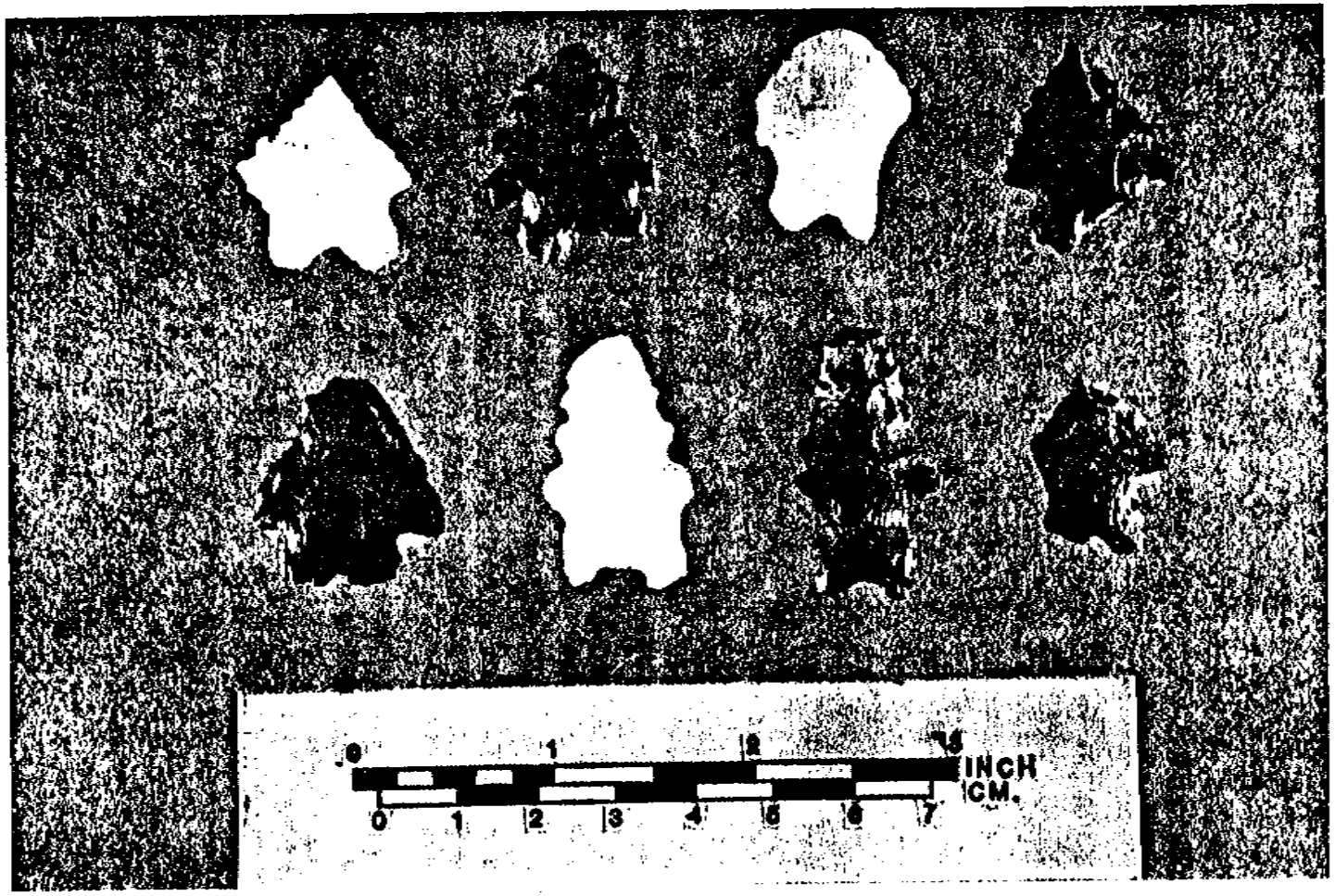
Selected Ground Stone Tools from Sites in the Route 13 North Survey



LEFT: double full-grooved ax from 7NC-G-56; CENTER: hammerstone from 7NC-H-67; RIGHT, TOP TO BOTTOM: atlatl weight fragment from 7NC-J-117, gorget fragment from 7NC-G-73, "boatstone" fragment from 7NC-J-110.

PLATE 5

Selected Bifurcated Base Points from Sites in the Route 13 North Survey



TOP ROW, LEFT TO RIGHT: 7NC-J-105, 7NC-J-105, 7NC-H-60, 7NC-J-99; BOTTOM ROW, LEFT TO RIGHT: 7NC-J-86, 7NC-G-56, 7NC-J-117, 7NC-H-39.

Site 7NC-G-50 arcs around the head of an ephemeral stream to Drawyer's Creek and yielded one non-diagnostic quartz biface distal end, 36 flakes, and several dozen pieces of fire-cracked rock. Given the low average visibility of 5% at this site, the possibility exists that a large site is located here.

Most of the remaining sites were small flake scatters or combinations of broken tools, flakes, and fire-cracked rock in small amounts. These were located in various places throughout the subarea: on headlands overlooking the major streams, along the lengths of ephemeral streams draining to the major streams, and around the springheads. Included are sites 7NC-G-49, 51-55, 57, and 58. All diagnostic artifacts recovered from this subarea during the pedestrian survey indicated Archaic and early Woodland I occupation.

Subarea 12. Gardner and Stewart's report (1978) lists one known site from this subarea, 7NC-F-10, which produced over 500 artifacts. Included are projectile points, scrapers, choppers, and flakes, but temporal data is lacking. It most likely functioned as some sort of base camp.

North and northeast of the F-10 site, Gardner and Stewart reported finds from surface and subsurface testing. This material, found along the 6 meter contour line, included contracting stem bifaces, a Brewerton eared triangle point, a Hell Island pottery fragment, and a steatite bowl fragment. These materials indicate a Woodland I occupation. One-half mile northwest of the F-10 site, they reported finding an undiagnostic lanceolate biface, another broken biface, and numerous flakes. No temporal designation was applied to this site. No historic archaeological remains were reported from their survey.

Subarea 13. Two previously recorded sites lie within this subarea and were not resurveyed as part of this report. Gardner and Stewart (1978) acknowleged the finding of no additional archaeological remains during their survey.

Subarea 14. Four new sites were identified and a previously recorded site was re-examined. Site 7NC-F-28, already known from BAHP files, was found to be a no-till field and visibility was less than 2%. About 8-10 flakes were observed on the surface but no diagnostics were found. Site 7NC-F-60 is located on a bluff on the south side of Appoquinimink Creek and contained one argillite teardrop-shaped biface, one argillite Bare Island/Lackawaxen-like biface (see Plate 1), one chert pebble flake tool, and about 60 flakes. The artifact concentration is fairly dense and is representative of the Woodland I Period. Site 7NC-F-59, on the headland just south of Hell Island, is in a field of no-till and visibility was less than 2%. However, 20 flakes were found, possibly indicating the presence of a large site. Site 7NC-F-57, at the head of an ephemeral stream, contained one quartz corner-notched point (see Plate 3) and about 10 flakes, but has suffered from considerable erosion. Site 7NC-F-58 was a small flake scatter located along

another ephemeral stream to Appoquinimink Creek.

Subarea 15. This subarea is all no-till fields, woodlots, and dwellings and offered no surveyable land. Three previously recorded sites were noted: F-7, F-9, and G-21. The Bell Island Site (F-7) has been reported elsewhere (Wright 1962) and was not examined as part of this survey. It is currently heavily wooded. Site F-9 is in a no-till cornfield and was examined. However, visibility was nil and no artifacts were observed. Site G-21 appears to be completely destroyed by recent housing construction.

Subarea 16. Six sites were recorded from the northern half of this subarea, mostly along the unnamed stream flowing northwest to the Appoquinimink. The southern half is mostly fallow fields and housing subdivisions and no surface areas were visible. The most notable site is 7NC-G-73, a 30 meter by 430 meter continuous scatter along the south side of the above mentioned unnamed tributary. Recovered were one slate gorget fragment (Plate 4), two stemmed bifaces (see Plate 1), two undiagnostic biface distal fragments,two flake tools, over 300 flakes and numerous pieces of fire-cracked rock.

One large "spokeshave"-like jasper flake tool and a jasper chunk with a battered edge were found only three meters apart at site G-71, located on a broad flat area south of G-73. No other artifacts were found at this site. Sites G-68, 69, 70, and 72 were flake scatters located in a poorly-drained area at the head of the unnamed tributary. The largest was G-68, with about 50 flakes, one core, and one flake tool. The other three contained about 8-10 flakes, flake tools, and fire-cracked rock. The G-73 site may be interpreted as a macro-band base camp with the others representing procurement sites.

Subarea 17. The southern two-thirds of this subarea is no-till corn and offered no visibility. Previously recorded sites G-26 through 28 were noted and examined, but visibility was extremely poor. One non-diagnostic rhyolite point fragment was found within the limits of G-26 and a pair of flakes within G-28. Nothing was located at G-27 or anywhere else in that vicinity.

Known site G-11 was surveyed and its limits greatly expanded. It covers at least 10 hectares (25 acres), with the southern boundary likely constrained by agricultural activity in the form of windbreaks and low visibility plowed fields. Artifacts were found in virtually every corner of the field, which was bounded on the north, east, and west by streams. Recovered or observed were 13 stemmed points, 2 early stage biface rejects, 1 late stage biface reject, 2 biface distal end fragments, 7 flake tools, several hundred flakes, and several dozen fire-cracked rock fragments. Visibility was low - only about 20%. The site is comprised of two major geophysical settings: a low terrace on the northern side along the shore of the Appoquinimink, and a 7 meter high eroded knoll in the southeast part of the site. Artifacts were concentrated at these

two locations, although there was no segregation by artifact style or type. The low terrace probably holds greater promise for yielding intact living surfaces and features, as it probably has not been subjected to the same erosion as the knoll above it.

Sites G-75 and 76 each consisted of a broken stemmed point and flakes and were located up the small tributary that passes by the southwest side of the G-11 site. They are probably procurement sites associated with the G-11 occupants.

Subarea 18. One site was previously recorded from this subarea (G-25) and eleven new ones were located during the survey. This subarea contains little land bearing directly on Appoquinimink Creek but contains numerous tributaries, springheads, and ephemeral streams which dissect the headlands and drain to the Appoquinimink. Ten of the eleven sites consisted of a single flake, a single biface, or a few flakes and a biface and were located on small rises or at springheads up to one kilometer from the Appoquinimink. Included in this group are 7NC-G-77 through 81 (see Plate 1) and 83 through 87.

Site G-82, located on a north facing slope along a tributary to the Appoquinimink, appears to be a cobble reduction site, as the surface was littered with numerous cobble cores and debitage. The material was mostly a red and gray quartzite with large, well-cemented grains and a number of large cobbles and decortication flakes were observed.

This subarea was also notable in that three sites produced black chert triangular points, a minority type of this survey: 7NC-G-79, 81, and 82 (see Plate 2).

Subarea 19. Five sites were identified in this subarea, which contained numerous sections of headland overlooking the broad tidal floodplain at the confluence of Appoquinimink and Drawyer's Creeks. Most of the subarea is no-till and pasture and offered limited visibility. Nevertheless, some of the five sites yielded relatively high artifact counts, indicating the presence of intensely occupied sites.

One such site is 7NC-G-88, on a headland about 10 meters above the floodplain. A 4x8 meter patch of ground with 30% visibility produced 2 non-diagnostic biface distal ends, 1 biface basal fragment (either corner-notched or bifurcated base), 5 flakes, and fire-cracked rock. Visibility of the surrounding ground was less than 5% and the extent of the site could not be ascertained.

A large jasper biface was discovered on a small terrace on a slope overlooking the floodplain (7NC-G-90). It was found by kicking away a 0.10 square meter patch of leaf cover at a random spot on the terrace. Sites 7NC-G-89, 90, and 92 are flake scatters found in areas of very low visibility.

Although only 20 total artifacts were recovered from the entire subarea during the pedestrian survey, five were tools. This fact and the apparently high artifact density suggest it probably contains many large, intensely occupied sites.

In sum, the pedestrian survey of the Appoquinimink area resulted in the discovery of 62 new archaeological sites. After the conclusion of the pedestrian survey, Delaware Division of Highways planners sharply reduced the Area 1 survey boundary. Subareas eliminated from future consideration for Rt. 13 Corridor rights-of-way included: 1, 2, 3 (western half), 4, 5, 6 (most), 12, 14, 18, and 19.

Appoquinimink Area - Subsurface Testing. After DelDOT planners had removed these portions of the Appoquinimink area from consideration, subsurface testing was undertaken at many of the areas which were unavailable for surface examination (Figure 15). The results of this testing is noted below. The sites found from subsurface testing are noted on Figure 14 and their attributes are listed in Tables 4 and 5.

Two specific areas were selected for subsurface testing and both are located on the south side of Drawyer's Creek north of Odessa. One of these extended southwesterly from Old Drawyer's Church (Subarea 10) and the other extended due east of the Church on the east side of present Rt. 13 (Subarea 11). Permission could be obtained for the latter parcel only and a total of nine 1x1 meter test units were excavated within it. All test units were excavated by hand tools and all soil sifted through 1/4-inch mesh screen. Excavation was by 10 centimeter arbitrary levels within natural soil horizons and units were taken to culturally sterile soil, usually a heavily clayey silt or loam. Appendix IV provides a summary of the important soil profiles. Cultural materials were found ranging from just below the surface to from 15 to 45 centimeters below the surface.

The woodlots tested in this subarea were located on a series of 2 to 12 meter high bluffs separated by ravines along Drawyer's Creek and were characterized by climax forest growth. Many large maple, oak, and tulip trees were present and undergrowth was minimal. From bluff tops, large expanses of the broad Drawyer's Creek floodplain could be observed.

All nine of the test units contained prehistoric material and, as each was located on a separate headland projection, each was given a separate site number (7NC-G-59 through 67). All but #67 possessed stratigraphies indicating they had never been plowed. All contained lithic debitage and most contained fire-cracked rock. Sites 7NC-G-59, 60, 62, 63, and 64 contained sherds of Minguannan ceramics and 7NC-G-62 also produced a prehistoric pipestem fragment, probably from an elbow pipe (see Plate 6). Bifaces were found in G-59 (non-diagnostic chert) and G-63 (corner-notched jasper). The corner-notched biface was found in direct association with Minguannan ceramics. See Appendix IV for representative profiles and Appendix V for a

FIGURE 15

Sub-surface Test Locations - Appoquinimink Study Area

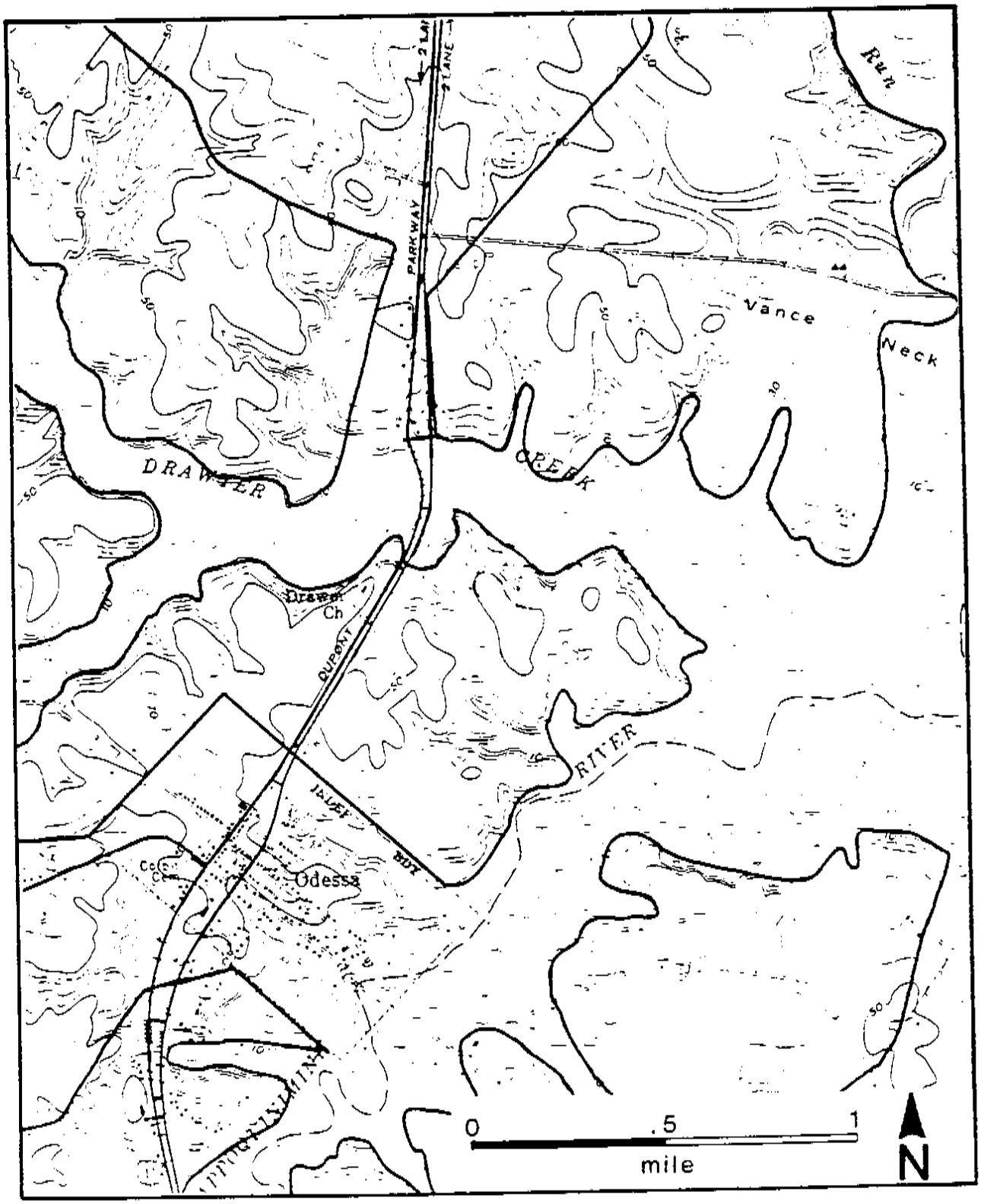
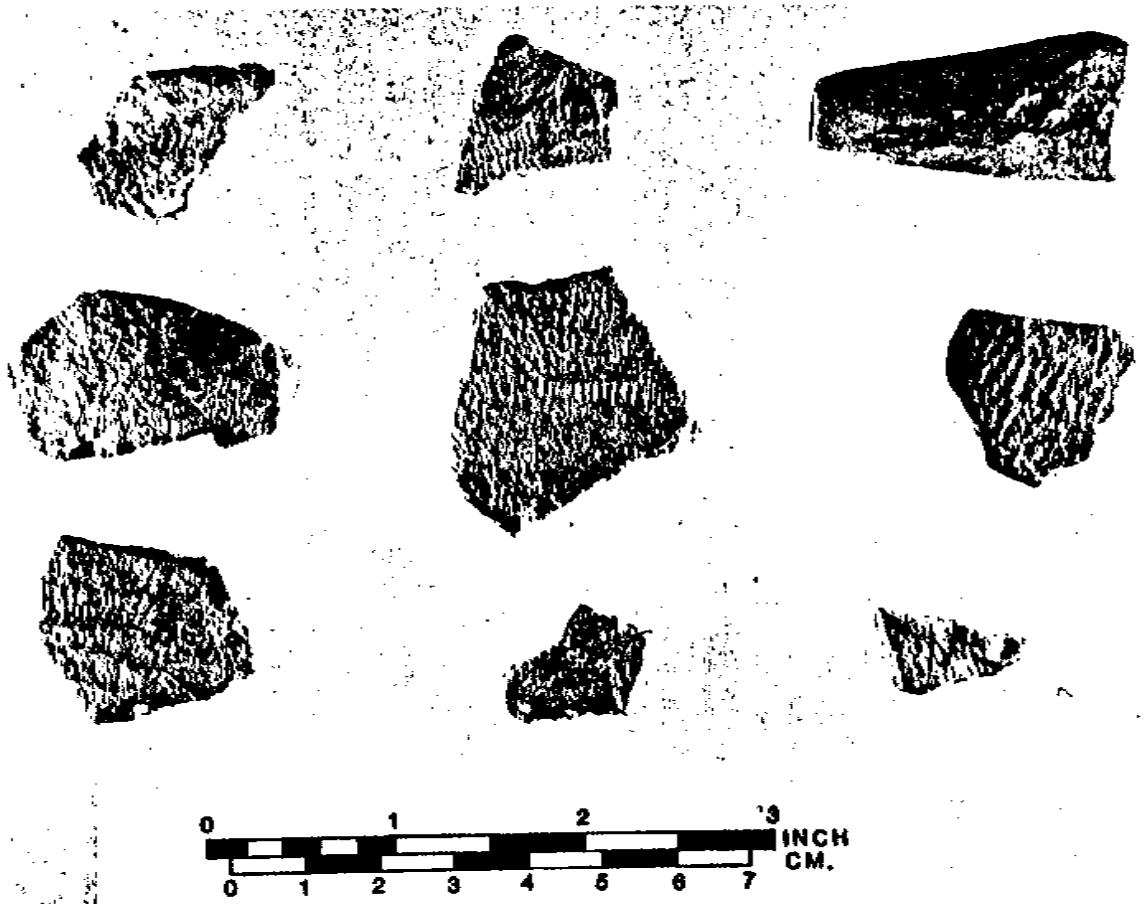


PLATE 6

Selected Prehistoric Ceramics from Sites in the Route 13 North Survey



TOP ROW, LEFT TO RIGHT: Wolfe Neck sherd from 7NC-H-21, Minguannan sherd from 7NC-G-62, Woodland II pipestem from 7NC-G-62; MIDDLE ROW, TOP TO BOTTOM: Minguannan sherd from 7NC-G-60, Minguannan sherd from 7NC-G-63, Minguannan sherd from 7NC-G-60, BOTTOM ROW: Minguannan sherds from 7NC-G-62.

summary of settings and artifacts.

No hearths, storage facilities, or other features were found in any of the test units, but the presence of late stage bifaces, ceramic vessel fragments, and the ceramic pipestem fragment suggest that these sites were probably base camps.

Blackbird Area - Surface Survey. Figure 16 shows the sites discovered in the Blackbird area along with the identified sub-areas. Table 6 shows the locational data for the sites and Table 7 shows the cultural-historical data. The Blackbird area includes the Blackbird drainage between Townsend and Smyrna, Delaware. Included are segments of Barlow, Sandom, and Herring Run Branches, as well as numerous unnamed tributaries. Also present is part of the Sawmill Branch of the Smyrna River. The survey area comprises about 12 square miles and is characterized by headlands along the major streams which are dissected by the branching tributaries.

Current land use includes corn and soybean agriculture interspersed with woodlots and non-subdivision single family housing. Sheet erosion appears less evident here than in the other study areas and perhaps correspondingly no-till farming is less common. The salient topographic feature within the Blackbird area is the bay/basin feature (Rasmussen 1958), a shallow pond-like depression usually oval in outline (although some may be circular or irregular) which may have a maximum width of 40 to 250 meters rim to rim and average depth of 3 meters below the rim (see Plate 7 and 8). Many hold water, even into the very dry times of the year, although it has not been determined what percentage of the impounded water is surface runoff and what is ground water seepage. Several hundred were observed within the Blackbird area, both in cultivated fields and wooded sections, and many held water. Those that did not usually had been tile-drained by farmers so as to provide more arable land. For survey purposes, no distinction was made between wet and dry bay/basin features.

Approximately 87% of the surveyed bay/basin features in the Blackbird area were associated with prehistoric materials and several large sites included clusters of several features within their limits. One hundred and eighty-seven loci were noted during the pedestrian survey. Of these, one was a previously recorded site which had its surface limits expanded (7NC-H-8). Another 18 were determined to be unworthy of "site" designation due to a low artifact count (1 flake) or a heavily disturbed context. One hundred and sixty-eight new sites were recorded with the BAHP.

Subarea 1. This subarea is entirely woodlot with the exception of the DiGiovanni farm on the south side of Herring Run. The farm had been tilled but was observed too late in the season to allow for pedestrian survey. Mrs. DiGiovanni exhibited two corner-notched quartz bifaces (early Woodland I) which she found in her vegetable garden south of the farmhouse.

FIGURE 16

Sites and Subareas – Blackbird Study Area

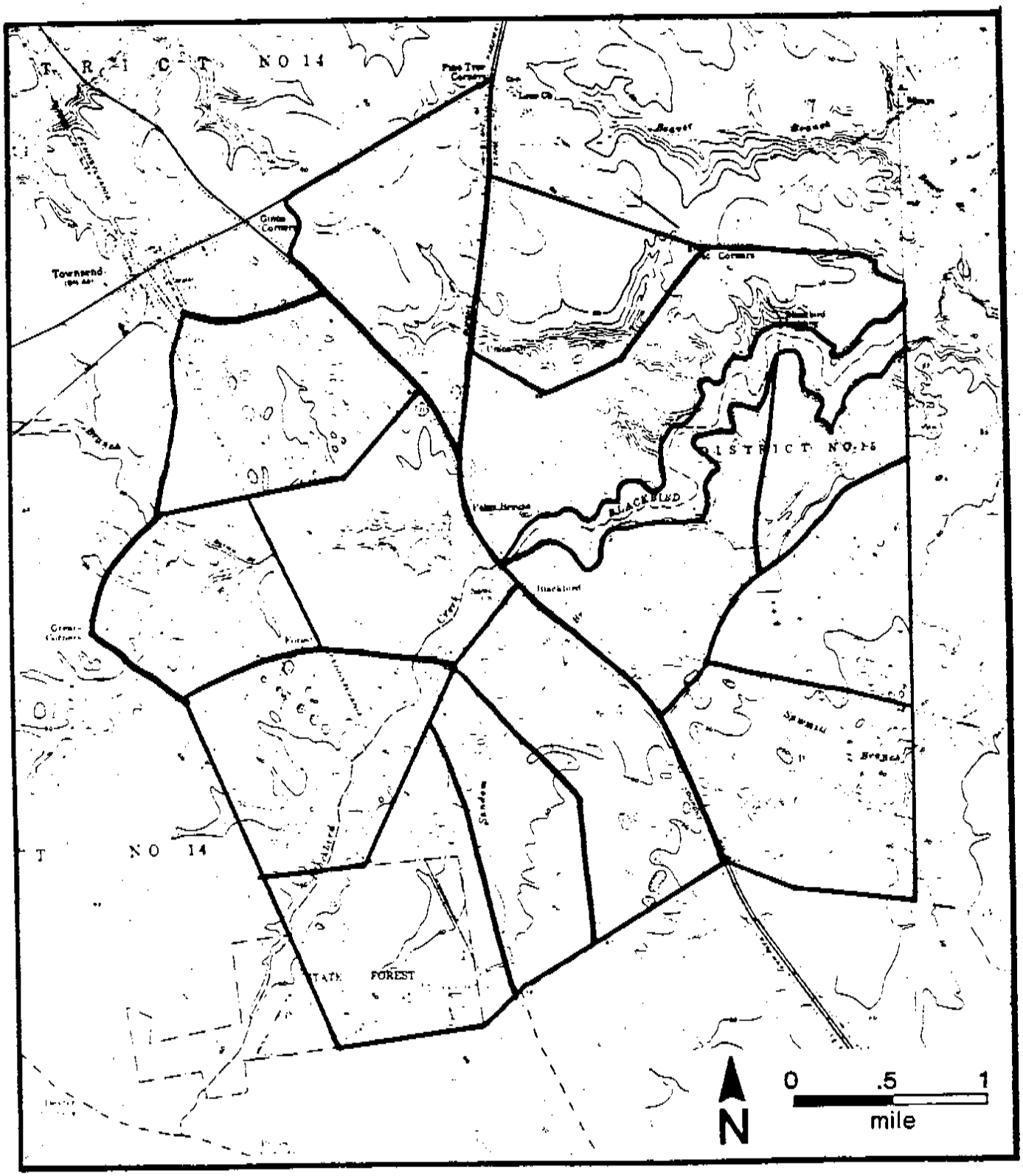


TABLE [illegible] LOCATIONAL DATA - BLACKBIRD FIELD

SITE NUMBER	F3 NUMBER	USGS QUAD NAME	UTM NORTH	UTM EAST	GEOMORPHOLOGICAL SETTING	PRIMARY SOIL SERIES	SECONDARY SOIL SERIES	DRAINAGE	SURFACE WATER SETTING	CONF.	WATER DISTANCE (METERS)	SLOPE	ASPECT	ELEVATION
2NB-[illegible]-11	N9677	MIDDLETOWN	4360580	442270	BAY/BASIN	Fa		BLACKBIRD	BAY/BASIN	N	61	0		18
2NB-[illegible]-12	N9678	MIDDLETOWN	4360420	442940	BAY/BASIN	Fa		BLACKBIRD	BAY/BASIN	N	46	0		18
2NB-[illegible]-13	N9679	MIDDLETOWN	4360400	441400	BAY/BASIN	Fa		BLACKBIRD	BAY/BASIN	N	46	0		18
2NB-[illegible]-17	N9756	MIDDLETOWN	4360050	443220	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN	Y	30	2	S	15
2NB-[illegible]-18	N9757	MIDDLETOWN	4360030	443320	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN	N	152	2	S	15
2NB-[illegible]-19	N9758	MIDDLETOWN	4360230	443220	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN	N	23	2		15
2NB-[illegible]-20	N9759	MIDDLETOWN	4360560	444630	BAY/BASIN	WaB2		BLACKBIRD	BAY/BASIN/STR	N	91	2		15
2NB-[illegible]-21	N9760	MIDDLETOWN	4360430	444500	BAY/BASIN	WaB2		BLACKBIRD	BAY/BASIN/STR	N	12	2		15
2NB-[illegible]-22	N9761	MIDDLETOWN	4360590	444320	HEADLAND	Fa		BLACKBIRD	STREAM	N	61	0	SW	12
2NB-[illegible]-23	N9762	MIDDLETOWN	4360450	444260	HEADLAND	Fa		BLACKBIRD	STREAM	Y	15	0	S	11
2NB-[illegible]-24	N9763	MIDDLETOWN	4360410	444100	HEADLAND	Fa		BLACKBIRD	STREAM	Y	23	0	S	11
2NB-[illegible]-25	N9764	MIDDLETOWN	4360260	444200	HEADLAND	Fa		BLACKBIRD	STREAM	N	12	0	S	9
2NB-[illegible]-26	N9765	MIDDLETOWN	4360320	444160	HEADLAND	Fa		BLACKBIRD	STREAM	N	37	0	S	12
2NB-[illegible]-27	N9766	MIDDLETOWN	4361100	443320	BAY/BASIN	Fa		BLACKBIRD	BAY/BASIN	N	15	0		18
2NB-[illegible]-28	N9767	MIDDLETOWN	4359980	445070	HEADLAND	SaB2		BLACKBIRD	STREAM	N	122	5	E	6
2NB-[illegible]-29	N9768	MIDDLETOWN	4359890	445080	HEADLAND	SaB2		BLACKBIRD	STREAM	N	61	5	SE	6
2NB-[illegible]-30	N9769	MIDDLETOWN	4359900	445020	HEADLAND	SaB2	SaC2	BLACKBIRD	STREAM	N	61	2	S	6
2NB-[illegible]-31	N9770	MIDDLETOWN	4360140	444840	BAY/BASIN	SaB2	WaB2	BLACKBIRD	BAY/BASIN/STR	N	6	2	SE	15
2NB-[illegible]-32	N9771	MIDDLETOWN	4360220	445030	HEADLAND	SaB2	WaB2	BLACKBIRD	STREAM	N	61	2	SE	15
2NB-[illegible]-33	N9772	MIDDLETOWN	4359960	444350	HEADLAND	Sal 3	SaB2	BLACKBIRD	STREAM	N	3	5	SW	9
2NB-[illegible]-34	N9773	MIDDLETOWN	4359750	444560	HEADLAND	Sal 3	WaB2	BLACKBIRD	STREAM	N	122	5	S	9
2NB-[illegible]-35	N9774	MIDDLETOWN	4360120	444580	BAY/BASIN	WaB2		BLACKBIRD	BAY/BASIN/STR	N	122	2	S	15
2NB-[illegible]-36	N9775	MIDDLETOWN	4359840	444700	BAY/BASIN	SaB2	WaB2	BLACKBIRD	BAY/BASIN/STR	N	30	2	SW	15
2NB-[illegible]-37	N9776	MIDDLETOWN	4359620	444910	HEADLAND	SaB2		BLACKBIRD	STREAM	N	0	2	S	3
2NB-[illegible]-38	N9777	MIDDLETOWN	4360080	445190	HEADLAND	SaB2		BLACKBIRD	STREAM	N	30	2	S	9
2NB-[illegible]-39	N9778	MIDDLETOWN	4359950	445100	HEADLAND	SaB2		BLACKBIRD	STREAM	N	79	2	SE	12
2NB-[illegible]-40	N9779	MIDDLETOWN	4359760	445020	HEADLAND	Sal 2		BLACKBIRD	STREAM	N	61	5	E	9
2NB-[illegible]-41	N9780	MIDDLETOWN	4359890	441990	HEADLAND	Sal 2		BLACKBIRD	STREAM	N	9	5	SE	12
2NB-[illegible]-14	N9680	MIDDLETOWN	4361120	440810	BAY/BASIN	SaB2	WaB	BLACKBIRD	BAY/BASIN	N	0	2	SE	18
2NB-[illegible]-15	N9681	MIDDLETOWN	4359960	441080	BAY/BASIN	SaB2	WaB	BLACKBIRD	BAY/BASIN/STR	N	0	2	SE	18
2NB-[illegible]-16	N9682	MIDDLETOWN	4359770	441040	BAY/BASIN	SaB2	CIW	BLACKBIRD	BAY/BASIN/STR	N	0	2	SE	18
2NB-[illegible]-17	N9683	MIDDLETOWN	4359800	441160	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN/STR	N	0	2	E	18
2NB-[illegible]-18	N9684	MIDDLETOWN	4360140	441200	SAND RIDGE	SaB2		BLACKBIRD	SPRINGHEAD	N	6	2	S	18
2NB-[illegible]-19	N9685	MIDDLETOWN	4360030	441320	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN/STR	N	6	2	SW	10
2NB-[illegible]-20	N9686	MIDDLETOWN	4359000	441360	BAY/BASIN	WaB2		BLACKBIRD	BAY/BASIN	N	30	2	SW	17
2NB-[illegible]-21	N9687	MIDDLETOWN	4359890	441780	BAY/BASIN	Fa		BLACKBIRD	BAY/BASIN/STR	N	30	0	SW	14
2NB-[illegible]-12	N9281	MIDDLETOWN	4359970	443060	HEADLAND	SaB2		BLACKBIRD	STREAM	N	30	2	S	12
2NB-[illegible]-13	N9282	MIDDLETOWN	4359770	443290	HEADLAND	KeB2		BLACKBIRD	STREAM	N	61	2	S	12
2NB-[illegible]-14	N9283	MIDDLETOWN	4359960	443290	HEADLAND	KeB2		BLACKBIRD	STREAM	Y	61	2	S	12
2NB-[illegible]-15	N9284	MIDDLETOWN	4359670	443560	HEADLAND	SaB2		BLACKBIRD	STREAM	N	91	2	S	12
2NB-[illegible]-16	N9285	MIDDLETOWN	4359570	443520	HEADLAND	SaB2		BLACKBIRD	STREAM	N	91	2	S	12
2NB-[illegible]-17	N9286	MIDDLETOWN	4359920	443420	BAY/BASIN	WaB	SaB2	BLACKBIRD	BAY/BASIN	N	0	0	S	15
2NB-[illegible]-18	N9287	MIDDLETOWN	4359540	443270	HEADLAND	KeB2	CmB	BLACKBIRD	STREAM	Y	38	2	S	12
2NB-[illegible]-19	N9288	MIDDLETOWN	4358790	442940	BAY/BASIN	KeB2		BLACKBIRD	BAY/BASIN	N	8	2	SE	15
2NB-[illegible]-50	N9289	MIDDLETOWN	4359200	443120	BAY/BASIN	WaB2	SaB2	BLACKBIRD	BAY/BASIN	N	6	2	SW	18
2NB-[illegible]-51	N9290	MIDDLETOWN	4359300	443150	BAY/BASIN	Fa	Ba	BLACKBIRD	BAY/BASIN	N	15	2	SW	18
2NB-[illegible]-52	N9291	MIDDLETOWN	4359200	443240	BAY/BASIN	Fa		BLACKBIRD	BAY/BASIN	N	8	2	S	18
2NB-[illegible]-53	N9292	MIDDLETOWN	4359260	443350	BAY/BASIN	WaB		BLACKBIRD	BAY/BASIN	N	46	0		15
2NB-[illegible]-54	N9293	MIDDLETOWN	4359160	443340	BAY/BASIN	Fa	SaB2	BLACKBIRD	BAY/BASIN	N	46	0	N	18
2NB-[illegible]-55	N9294	MIDDLETOWN	4359350	443360	BAY/BASIN	WaB		BLACKBIRD	BAY/BASIN	N	15	0		18

TABLE 1 (CONT)

SITE NUMBER	CNS NUMBER	USGS QUAD NAME	UTM NORTH	UTM EAST	GEOMORPHOLOGICAL SETTING	PRIMARY SOIL SERIES	SECONDARY SOIL SERIES	DRAINAGE	SURFACE WATER SETTING	CONF.	WATER DISTANCE (METERS)	SLOPE	ASPECT	ELEVATION
ZNC-II-95	N9795	MIDDLETOWN	4359340	443530	BAY/BASIN	MeB2	WaD	BLACKBIRD	BAY/BASIN	N	0	2	SE	15
ZNC-II-97	N9796	MIDDLETOWN	4359060	443530	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN	N	61	2	S	15
ZNC-II-98	N9797	MIDDLETOWN	4359080	443500	BAY/BASIN	WeB2		BLACKBIRD	BAY/BASIN	N	30	0	S	15
ZNC-II-99	N9798	MIDDLETOWN	4359980	443660	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN	N	15	2	S	15
ZNC-II-60	N9799	MIDDLETOWN	4359100	443700	BAY/BASIN	SaB2	WaB	BLACKBIRD	BAY/BASIN	N	0	2	SE	15
ZNC-II-61	N9800	MIDDLETOWN	4359200	443530	BAY/BASIN	WeB	SaB2	BLACKBIRD	BAY/BASIN	N	3	0	S	17
ZNC-II-62	N9801	MIDDLETOWN	4359330	443640	BAY/BASIN	EeB	SaB2	BLACKBIRD	BAY/BASIN	N	76	0	NW	15
ZNC-II-63	N9803	MIDDLETOWN	4359300	444540	HEADLAND	SaB2	EeB	BLACKBIRD	STREAM	Y	91	2	SE	15
ZNC-II-65	N9804	MIDDLETOWN	4359360	444360	HEADLAND	SaB2	EeB	BLACKBIRD	STREAM	N	3	2	SE	15
ZNC-II-66	N9805	MIDDLETOWN	4359350	444180	HEADLAND	EeB		BLACKBIRD	STREAM	N	122	0	SE	15
ZNC-II-67	N9806	MIDDLETOWN	4359550	444020	HEADLAND	SaB2		BLACKBIRD	STREAM	N	183	2	NE	15
ZNC-II-68	N9807	MIDDLETOWN	4359620	444020	INTERIOR FLAT	SaB2		BLACKBIRD	STREAM	N	30	2	N	15
ZNC-II-22	N9668	CLAYTON	4357600	440420	SAND RIDGE	RoB2		BLACKBIRD	STREAM	N	61	2	W	15
ZNC-II-23	N9669	CLAYTON	4357460	440560	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN	N	15	2	W	15
ZNC-II-24	N9690	CLAYTON	4357720	440500	SAND RIDGE	RoB2		BLACKBIRD	STREAMS	N	122	2		12
ZNC-II-25	N9691	CLAYTON	4357580	440550	BAY/BASIN	RoL2		BLACKBIRD	BAY/BASIN	N	122	5	W	17
ZNC-II-26	N9692	CLAYTON	4357640	440590	BAY/BASIN	RoL2		BLACKBIRD	BAY/BASIN	N	244	5	N	15
ZNC-II-27	N9693	CLAYTON	4357660	440700	BAY/BASIN	RoL2		BLACKBIRD	BAY/BASIN	N	244	5	NW	10
ZNC-II-28	N9694	CLAYTON	4357350	440730	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN	N	15	2	W	10
ZNC-II-29	N9695	CLAYTON	4357500	440780	BAY/BASIN	RoL2		BLACKBIRD	BAY/BASIN	N	183	5	W	18
ZNC-II-30	N9696	CLAYTON	4357750	440740	BAY/BASIN	RoL2		BLACKBIRD	BAY/BASIN/STR	N	122	5	NW	18
ZNC-II-31	N9697	CLAYTON	4357800	440800	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN	N	15	2	NW	15
ZNC-II-32	N9698	CLAYTON	4357700	441050	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN	N	76	2	NE	17
ZNC-II-33	N9699	CLAYTON	4357700	440800	HEADLAND	SaB2		BLACKBIRD	STREAM	Y	15	2	E	12
ZNC-II-34	N9700	CLAYTON	4358300	441140	HEADLAND	Jo		BLACKBIRD	STREAM	N	61	0	S	8
ZNC-II-35	N9701	CLAYTON	4357920	441300	BAY/BASIN	Fa		BLACKBIRD	BAY/BASIN	N	3	0	E	10
ZNC-II-36	N9702	CLAYTON	4357980	441760	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN	N	53	2		17
ZNC-II-37	N9703	CLAYTON	4358090	441900	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN	N	30	2		17
ZNC-II-38	N9704	CLAYTON	4358280	441850	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN	N	122	2	N	12
ZNC-II-39	N9705	CLAYTON	4358120	442110	BAY/BASIN	SaB2	WaD	BLACKBIRD	BAY/BASIN	N	0	2	NE	15
ZNC-II-40	N9706	CLAYTON	4358010	441940	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN	N	0	2		17
ZNC-II-41	N9707	CLAYTON	4357840	442280	HEADLAND	SaB2		BLACKBIRD	STREAM	N	183	2	SE	14
ZNC-II-42	N9708	CLAYTON	4357850	442520	HEADLAND	SaB2		BLACKBIRD	STREAM	N	122	2	E	11
ZNC-II-43	N9709	CLAYTON	4357710	442420	HEADLAND	SaB2		BLACKBIRD	STREAM	N	91	2	SE	11
ZNC-II-44	N9710	CLAYTON	4357580	442350	HEADLAND	SaB2		BLACKBIRD	STREAM	N	30	2	E	3
ZNC-II-45	N9711	CLAYTON	4357540	442130	HEADLAND	WeB	SaB2	BLACKBIRD	STREAM	N	30	0	S	12
ZNC-II-46	N9712	CLAYTON	4357660	442150	HEADLAND	SaB2		BLACKBIRD	STREAM	N	152	2	E	15
ZNC-II-47	N9713	CLAYTON	4358260	441360	FLOODPLAIN	SaB2	SaL3	BLACKBIRD	STREAM	Y	9	2	N	9
ZNC-II-48	N9714	CLAYTON	4357960	441440	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN	N	244	2	E	10
ZNC-II-49	N9715	CLAYTON	4357640	441570	BAY/BASIN	Fa		BLACKBIRD	BAY/BASIN	N	0	0	SE	10
ZNC-II-50	N9716	CLAYTON	4358160	441610	BAY/BASIN	WeB		BLACKBIRD	BAY/BASIN/STR	N	122	0	NW	15
ZNC-II-51	N9717	CLAYTON	4358180	441720	HEADLAND	WeB	SaB2	BLACKBIRD	BAY/BASIN/STR	N	122	0	N	15
ZNC-II-52	N9718	CLAYTON	4358040	441730	BAY/BASIN	Fa		BLACKBIRD	BAY/BASIN	N	107	0		17
ZNC-II-53	N9719	MIDDLETOWN	4358240	442550	HEADLAND	Fa		BLACKBIRD	STREAM	N	61	0	S	12
ZNC-II-54	N9720	MIDDLETOWN	4358550	442440	HEADLAND	SaB2		BLACKBIRD	STREAM	Y	122	2	S	12
ZNC-II-55	N9721	MIDDLETOWN	4358680	442240	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN	N	15	2	S	17
ZNC-II-56	N9722	MIDDLETOWN	4358450	442260	HEADLAND	SaB2		BLACKBIRD	STREAM	Y	61	2	S	12
ZNC-II-57	N9723	MIDDLETOWN	4358600	442180	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN	N	0	2	S	15
ZNC-II-58	N9724	MIDDLETOWN	4358560	442180	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN/STR	N	244	2	S	15
ZNC-II-59	N9725	MIDDLETOWN	4358560	442000	HEADLAND	SaB2		BLACKBIRD	SPRINGHEAD	N	15	2	S	12

TABLE [illegible]

SITE NUMBER	GPS NUMBER	USGS QUAD NAME	UTM NORTH	UTM EAST	GEOMORPHOLOGICAL SETTING	PRIMARY SOIL SERIES	SECONDARY SOIL SERIES	DRAINAGE	SURFACE WATER SETTING	CONF.	WATER DISTANCE (METERS)	SLOPE	ASPECT	ELEVATION
ZNC-H-60	N9726	MIDDLETOWN	4358460	441940	HEADLAND	SaB2		BLACKBIRD	STREAM	Y	91	2	S	12
ZNC-H-61	N9727	MIDDLETOWN	4358700	441990	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN	N	6	2	S	17
ZNC-H-62	N9728	MIDDLETOWN	4358700	441130	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN	N	15	2	S	17
ZNC-H-63	N9729	MIDDLETOWN	4358800	441260	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN	N	30	2	S	17
ZNC-H-64	N9730	MIDDLETOWN	4358680	441570	HEADLAND	SaB2		BLACKBIRD	STREAM	N	91	2	S	12
ZNC-H-65	N9731	MIDDLETOWN	4358650	441200	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN	N	15	2	SE	15
ZNC-H-66	N9732	MIDDLETOWN	4358620	441750	HEADLAND	SaB2		BLACKBIRD	STREAMS	Y	15	2	S	11
ZNC-H-67	N9733	MIDDLETOWN	4358460	441800	HEADLAND	SaB2	Fa	BLACKBIRD	STREAM	Y	15	2	S	8
ZNC-H-[illegible]	N9736	MIDDLETOWN	4358460	441860	HEADLAND	SaB2	SaC2	BLACKBIRD	STREAM	Y	15	2	S	9
ZNC-H-68	N9734	MIDDLETOWN	4358630	441820	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN/STR	N	183	2	S	15
ZNC-H-69	N9735	MIDDLETOWN	4358540	441800	HEADLAND	SaB2		BLACKBIRD	BAY/BASIN/STR	N	152	2	SW	14
ZNC-H-88	N9754	MIDDLETOWN	4358420	441260	HEADLAND	Fa		BLACKBIRD	STREAM	Y	244	0	S	15
ZNC-H-89	N9755	MIDDLETOWN	4358620	441100	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN/STR	N	91	2	S	15
ZNC-H-70	N9736	MIDDLETOWN	4358450	442440	HEADLAND	Fa		BLACKBIRD	STREAM	Y	122	0	S	9
ZNC-H-71	N9737	MIDDLETOWN	4358540	442570	HEADLAND	SaC2		BLACKBIRD	STREAM	N	9	5	S	6
ZNC-H-72	N9738	CLAYTON	4357030	440300	BAY/BASIN	BuB2	EmA	BLACKBIRD	BAY/BASIN	N	30	2	S	18
ZNC-H-73	N9739	CLAYTON	4357140	440550	BAY/BASIN	BuB2		BLACKBIRD	BAY/BASIN	N	46	2		18
ZNC-H-74	N9740	CLAYTON	4356500	440580	BAY/BASIN	Fa		BLACKBIRD	BAY/BASIN	N	61	0	N	18
ZNC-H-75	N9741	CLAYTON	4356910	440510	BAY/BASIN	BuB2		BLACKBIRD	BAY/BASIN	N	122	2	N	18
ZNC-H-76	N9742	CLAYTON	4356080	441140	BAY/BASIN	Fa	BuB2	BLACKBIRD	BAY/BASIN/STR	N	0	0	N	15
ZNC-H-77	N9743	CLAYTON	4356130	441520	FLOODPLAIN	BuB2		BLACKBIRD	STREAM	N	61	2	E	14
ZNC-H-78	N9744	CLAYTON	4355850	441470	HEADLAND	BuB2	Fa	BLACKBIRD	STREAM	N	30	2	E	14
ZNC-H-79	N9745	CLAYTON	4355840	441300	BAY/BASIN	BuB2		BLACKBIRD	BAY/BASIN/STR	N	61	2		17
ZNC-H-80	N9746	CLAYTON	4355850	441200	BAY/BASIN	BuB2		BLACKBIRD	BAY/BASIN/STR	N	61	2	E	18
ZNC-H-81	N9747	CLAYTON	4357000	440980	BAY/BASIN	Fa		BLACKBIRD	BAY/BASIN/STR	N	15	0		17
ZNC-H-82	N9748	CLAYTON	4357180	441120	BAY/BASIN	Fa		BLACKBIRD	BAY/BASIN	N	61	0		17
ZNC-H-83	N9749	CLAYTON	4356960	441100	BAY/BASIN	Fa		BLACKBIRD	BAY/BASIN	N	30	0	S	15
ZNC-H-84	N9750	CLAYTON	4357040	441090	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN	N	30	2	S	17
ZNC-H-85	N9751	CLAYTON	4357100	440990	BAY/BASIN	Fa		BLACKBIRD	BAY/BASIN	N	38	0	S	18
ZNC-H-86	N9752	CLAYTON	4357020	440960	BAY/BASIN	BuB2		BLACKBIRD	BAY/BASIN/STR	N	30	2	S	17
ZNC-H-87	N9753	CLAYTON	4356640	441550	HEADLAND	Fa		BLACKBIRD	STREAM	Y	61	2	S	12
ZNC-H-69	N9808	CLAYTON	4358060	441140	HEADLAND	Fa	SaC2	BLACKBIRD	SPRINGHEAD	N	6	0	W	12
ZNC-H-70	N9809	CLAYTON	4357700	441530	BAY/BASIN	Fa	SaB2	BLACKBIRD	BAY/BASIN	N	9	0	S	15
ZNC-H-71	N9810	CLAYTON	4357610	441540	BAY/BASIN	SaC2		BLACKBIRD	BAY/BASIN	N	3	5		15
ZNC-H-72	N9811	CLAYTON	4357600	441210	HEADLAND	SaC2		BLACKBIRD	STREAM	N	91	5	W	12
ZNC-H-73	N9812	CLAYTON	4357620	441440	BAY/BASIN	SaC2		BLACKBIRD	BAY/BASIN	N	30	2	W	15
ZNC-H-74	N9813	CLAYTON	4358240	443900	BAY/BASIN	SaB2	SaC2	BLACKBIRD	BAY/BASIN	Y	0	2	W	9
ZNC-H-75	N9814	CLAYTON	4358130	443800	HEADLAND	SaB2		BLACKBIRD	STREAM	Y	0	2	W	6
ZNC-H-76	N9815	CLAYTON	4358290	443900	BAY/BASIN	SaC2		BLACKBIRD	BAY/BASIN	N	0	5	W	12
ZNC-H-77	N9816	CLAYTON	4358000	443760	HEADLAND	SaC2		BLACKBIRD	BAY/BASIN/STR	Y	0	5		5
ZNC-H-78	N9817	CLAYTON	4357920	440640	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN	N	15	2	W	15
ZNC-H-79	N9818	CLAYTON	4358190	441100	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN	N	6	2	NW	12
ZNC-H-80	N9819	CLAYTON	4358040	441340	BAY/BASIN	Fa	SaC2	BLACKBIRD	BAY/BASIN	N	0	0	NW	15
ZNC-H-81	N9820	CLAYTON	4356300	440080	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN/STR	N	91	2	N	12
ZNC-H-82	N9821	CLAYTON	4357880	441620	BAY/BASIN	Fa		BLACKBIRD	BAY/BASIN	N	12	0	N	15
ZNC-H-83	N9822	CLAYTON	4358020	441500	BAY/BASIN	Wat		BLACKBIRD	BAY/BASIN	N	183	0	N	15
ZNC-H-84	N9823	CLAYTON	4354920	442900	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN	N	15	2	NW	15
ZNC-H-85	N9824	CLAYTON	4354790	442930	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN	N	0	2	N	18
ZNC-H-86	N9825	CLAYTON	4354990	443460	BAY/BASIN	Fa		BLACKBIRD	BAY/BASIN	N	30	0		18
ZNC-H-87	N9826	CLAYTON	4355100	443420	BAY/BASIN	Fa	SaB2	BLACKBIRD	BAY/BASIN	N	0	0		18

TABLE [illegible]

SITE NUMBER	LFD NUMBER	USGS TOPO NAME	UTM NORTH	UTM EAST	GEOMORPHOLOGICAL SETTING	PRIMARY SOIL SERIES	SECONDARY SOIL SERIES	DRAINAGE	SURFACE WATER SETTING	CONF.	WATER DISTANCE (METERS)	SLOPE	ASPECT	ELEVATION
[illegible]	N9627	CLAYTON	4357150	441510	BAY/BASIN	SaB2	Ea	BLACKBIRD	BAY/BASIN	N	46	2	W	15
[illegible]	N9628	CLAYTON	4355630	441880	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN	N	23	2		10
[illegible]	N9629	CLAYTON	4355460	441800	BAY/BASIN	Ea	BaC2	BLACKBIRD	BAY/BASIN	N	8	0	E	10
[illegible]	N9630	CLAYTON	4355210	441820	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN	N	91	2	E	10
[illegible]	N9631	CLAYTON	4358260	441370	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN/STR	N	21	2	SW	12
[illegible]	N9632	CLAYTON	4358160	441260	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN/STR	N	12	2	SW	12
[illegible]	N9633	CLAYTON	4356450	441260	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN/STR	N	15	2	N	15
[illegible]	N9634	CLAYTON	4356260	441200	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN/STR	N	6	2	W	12
[illegible]	N9635	CLAYTON	4356480	441150	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN	N	23	2	N	15
[illegible]	N9636	CLAYTON	4356100	441000	BAY/BASIN	SaB2	Ea	BLACKBIRD	BAY/BASIN	N	15	2	W	10
[illegible]	N9637	CLAYTON	4356330	441920	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN	N	244	2	N	15
[illegible]	N9638	CLAYTON	4356200	441100	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN	N	91	2	N	17
[illegible] 100	N9639	CLAYTON	4356070	444440	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN	N	0	2	SE	15
[illegible] 101	N9640	CLAYTON	4355920	444350	BAY/BASIN	SaB2		BLACKBIRD	BAY/BASIN/STR	N	122	2	SE	15
[illegible] 102	N9641	CLAYTON	4355840	445330	BAY/BASIN	Ea	SaB2	BLACKBIRD	BAY/BASIN/STR	Y	15	0	S	12
[illegible] 103	N9642	CLAYTON	4356060	445500	BAY/BASIN	SaB2	WaA	SMYRNA	BAY/BASIN/STR	N	0	2	E	12
[illegible] 104	N9643	CLAYTON	4355950	445440	BAY/BASIN	WaA	SaB2	SMYRNA	BAY/BASIN/STR	N	30	0	E	12
[illegible] 105	N9644	CLAYTON	4355680	446100	BAY/BASIN	EaA	SaB2	SMYRNA	BAY/BASIN	N	0	0	NW	15
[illegible] 106	N9645	CLAYTON	4355400	446060	BAY/BASIN	SaB2		SMYRNA	BAY/BASIN	N	137	2		15
[illegible] 107	N9646	CLAYTON	4355440	445840	BAY/BASIN	Ea	SaB2	SMYRNA	BAY/BASIN/STR	N	183	0	W	15
[illegible] 108	N9647	CLAYTON	4355200	445600	BAY/BASIN	EaA	SaB2	SMYRNA	BAY/BASIN/STR	N	15	0	W	12
[illegible] 109	N9648	CLAYTON	4355020	445600	BAY/BASIN	SaB2		SMYRNA	BAY/BASIN/STR	N	91	2	W	12
[illegible] 110	N9649	CLAYTON	4355820	445600	BAY/BASIN	SaB2	Ea	SMYRNA	BAY/BASIN	N	3	2		18
[illegible] 111	N9650	MIDDLETOWN	4356860	445650	HEADLAND	SaB2		BLACKBIRD	STREAM	N	244	2	N	12
[illegible] 112	N9651	MIDDLETOWN	4356930	445840	HEADLAND	SaB2		BLACKBIRD	STREAM	N	122	2	W	9
[illegible] 113	N9652	MIDDLETOWN	4356850	445200	HEADLAND	OE		BLACKBIRD	STREAM	N	183	0		5
[illegible] 114	N9653	CLAYTON	4356960	446060	BAY/BASIN	SaB2		SMYRNA	BAY/BASIN	N	61	2	W	15
[illegible] 115	N9654	CLAYTON	4357230	446030	HEADLAND	WaB2		SMYRNA	STREAM	N	30	2	SE	12
[illegible] 116	N9655	SMYRNA	4356400	446030	HEADLAND	Ea		SMYRNA	STREAM	N	30	0	NE	12
[illegible] 117	N9656	SMYRNA	4356900	446250	HEADLAND	MeB2	MeC2	SMYRNA	STREAM	Y	122	2	E	9

TABLE 2: CULTURAL-HISTORICAL DATA - BLACKBIRD AREA

SITE NUMBER	PALEO AGE UNDIF	WOODLAND I	WOODLAND II	CF	DL	WN	LA	WB	DA	DC	SC	MG	HISTORIC	BIFACE	SCRAPER	FLAKE TOOL	CORE	FLAKES	GROUND STONE TOOL	FCR	CERAMICS
2NC-H-11																		Y			
2NC-H-12										Y				Y				Y			
2NC-H-13		Y												Y		Y	Y	Y			
2NC-H-17																		Y			
2NC-H-18																		Y			
2NC-H-19																Y		Y			
2NC-H-20																		Y			
2NC-H-21																		Y			
2NC-H-22													Y								
2NC-H-23													Y					Y			
2NC-H-24													Y					Y			
2NC-H-25													Y								
2NC-H-26																		Y			
2NC-H-27														Y				Y			
2NC-H-28														Y							
2NC-H-29																		Y			
2NC-H-30														Y	Y	Y	Y	Y	Y		
2NC-H-31		Y										Y		Y	Y	Y	Y	Y	Y		
2NC-H-32		Y	Y											Y	Y	Y	Y	Y	Y		
2NC-H-33		Y												Y				Y			
2NC-H-34														Y		Y		Y	Y		
2NC-H-35																Y		Y			
2NC-H-36																		Y			
2NC-H-37													Y						Y		
2NC-H-38													Y					Y	Y		
2NC-H-39															Y			Y			
2NC-H-40													Y					Y	Y		
2NC-H-41														Y	Y	Y	Y	Y			
2NC-H-14	Y			Y										Y		Y		Y			
2NC-H-15	Y															Y		Y			
2NC-H-16																	Y	Y			
2NC-H-17														Y		Y	Y	Y			
2NC-H-18	Y			Y											Y			Y			
2NC-H-19																		Y	Y		
2NC-H-20												Y						Y		Y	
2NC-H-21			Y															Y			
2NC-H-42															Y			Y			
2NC-H-43														Y	Y	Y		Y	Y		
2NC-H-44																		Y			
2NC-H-45														Y			Y	Y			
2NC-H-46												Y		Y		Y		Y			
2NC-H-47	Y		Y												Y			Y			
2NC-H-48													Y					Y			
2NC-H-49													Y	Y	Y	Y		Y	Y		
2NC-H-50																		Y	Y		
2NC-H-51																		Y			
2NC-H-52																		Y	Y		
2NC-H-53												Y		Y	Y		Y	Y	Y		
2NC-H-54	Y		Y															Y			
2NC-H-55																		Y			
2NC-H-56														Y				Y			
2NC-H-57																		Y			
2NC-H-58															Y	Y		Y	Y		
2NC-H-59																Y	Y	Y	Y		
2NC-H-60														Y		Y		Y			
2NC-H-61	Y													Y				Y	Y		
2NC-H-62																		Y			
2NC-H-63														Y				Y	Y		
2NC-H-65	Y																	Y			
2NC-H-66																					

TABLE 2.6.5D

SITE NUMBER	PALEO	ARCHAIC	WOODLAND I	WOODLAND II	OF	BI	WA	CA	WB	DO	OF	SC	MG	HISTORIC	DIFACE	SCRAPER	FLAKE TOOL	CORE	FLAKES	GROUND STONE TOOL	FCR	CERAMICS
ZNC-H-62																			Y			
ZNC-H-63			Y												Y							
ZNC-H-64			Y												Y				Y		Y	
ZNC-H-65																			Y			
ZNC-H-66			Y												Y			Y	Y		Y	
ZNC-H-67																	Y		Y		Y	
ZNC-H-68																			Y			
ZNC-H-69																			Y			
ZNC-H-70															Y				Y			
ZNC-H-71			Y												Y		Y		Y			
ZNC-H-72															Y				Y			
ZNC-H-73			Y												Y			Y	Y			
ZNC-H-74			Y												Y		Y		Y		Y	
ZNC-H-75														Y	Y				Y			
ZNC-H-76														Y	Y				Y			
ZNC-H-77																			Y			
ZNC-H-78																			Y			
ZNC-H-79																			Y			
ZNC-H-80																			Y			
ZNC-H-81																			Y			
ZNC-H-82																			Y			
ZNC-H-83																			Y			
ZNC-H-84																			Y			
ZNC-H-85																			Y			
ZNC-H-86																			Y			
ZNC-H-87																			Y			
ZNC-H-88																			Y			
ZNC-H-89																			Y			
ZNC-H-90																			Y			
ZNC-H-91																			Y			
ZNC-H-92																			Y			
ZNC-H-93																			Y			
ZNC-H-94																			Y			
ZNC-H-95																			Y			
ZNC-H-96																			Y			
ZNC-H-97																			Y			
ZNC-H-98																			Y			
ZNC-H-99																			Y			
ZNC-H-100																			Y			
ZNC-H-101																			Y			
ZNC-H-102																			Y			
ZNC-H-103																			Y			
ZNC-H-104																			Y			
ZNC-H-105																			Y			
ZNC-H-106																			Y			
ZNC-H-107																			Y			
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ZNC-H-109																			Y			
ZNC-H-110																			Y			
ZNC-H-111																			Y			
ZNC-H-112																			Y			
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ZNC-H-114																			Y			
ZNC-H-115																			Y			
ZNC-H-116																			Y			
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ZNC-H-118																			Y			
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ZNC-H-148																			Y			
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ZNC-H-167																			Y			
ZNC-H-168																			Y			
ZNC-H-169																			Y			
ZNC-H-170																			Y			
ZNC-H-171																			Y			
ZNC-H-172																			Y			
ZNC-H-173																			Y			
ZNC-H-174																			Y			
ZNC-H-175																			Y			
ZNC-H-176																			Y			

TABLE 2 (CONT)

SITE NUMBER	PALEO ARCHAIC	WOODLAND I	WOODLAND II	OF	AL	WN	CA	WB	DA	DP	SC	MG	HISTORIC	BIFACE	SCRAPER	FLAKE TOOL	CORE	FLAKES	GROUND STONE TOOL	FCR	CERAMICS
2NB-II-77														Y		Y	Y	Y		Y	
2NB-II-78		Y												Y			Y	Y			
2NB-II-79		Y												Y				Y			
2NB-II-80														Y							
2NB-II-81		Y															Y				
2NB-II-82																		Y			
2NB-II-83																		Y			
2NB-II-84														Y				Y			
2NB-II-85												Y						Y			
2NB-II-86																		Y		Y	
2NB-II-87											Y			Y				Y			
2NB-I-69			Y															Y			
2NB-I-70											Y			Y				Y			
2NB-I-71		Y	Y											Y		Y		Y			
2NB-I-72														Y		Y					
2NB-I-73		Y												Y		Y		Y			
2NB-I-74																		Y			
2NB-I-75																	Y	Y			
2NB-I-76																		Y			
2NB-I-77																		Y			
2NB-I-78																		Y			
2NB-I-79														Y				Y			
2NB-I-80														Y	Y	Y		Y			
2NB-I-81	Y															Y					
2NB-I-82																Y					
2NB-I-83														Y				Y			
2NB-I-84		Y												Y	Y	Y					
2NB-I-85		Y												Y		Y					
2NB-I-86	Y													Y				Y			
2NB-I-87																Y		Y			
2NB-I-88																	Y	Y			
2NB-I-89														Y				Y			
2NB-I-90		Y												Y				Y			
2NB-I-91		Y														Y		Y			
2NB-I-92																Y		Y			
2NB-I-93																	Y	Y			
2NB-I-94														Y				Y		Y	
2NB-I-95		Y														Y		Y			
2NB-I-96														Y			Y	Y		Y	
2NB-I-97														Y							
2NB-I-98														Y		Y	Y	Y		Y	
2NB-I-99	Y														Y			Y			
2NB-I-100																Y		Y			
2NB-I-101														Y	Y	Y		Y			
2NB-I-102														Y	Y	Y	Y	Y		Y	
2NB-I-103		Y												Y	Y	Y		Y			
2NB-I-104														Y		Y	Y	Y		Y	
2NB-I-105	Y Y	Y																Y			
2NB-I-106														Y				Y			
2NB-I-107		Y													Y			Y			
2NB-I-108																		Y			
2NB-I-109												Y		Y		Y		Y	Y	Y	
2NB-I-110		Y																Y		Y	
2NB-I-111														Y							
2NB-I-112		Y										Y						Y		Y	
2NB-I-113																		Y			
2NB-I-114																		Y			
2NB-I-115														Y			Y	Y			
2NB-I-116														Y		Y	Y	Y	Y	Y	
2NB-I-117	Y																				

PLATE 7

Bay/Basin Feature on South Side of Barlow Branch, Blackbird Study Area
Site 7NC-H-39 is in foreground

PLATE 8

Tree-Filled Bay/Basin Feature, West of U.S. 13, Blackbird Study Area

Subarea 2. This subarea is mostly woodlot and contains only two surveyable locations: a fallow field east of Willey's Nursery on the east side of Rt. 13 and a soybean field west of Naylors Corners. Located in the former were 3 sites: 7NC-J-17, 18, and 19. The first two were located on small rises on the north side of Herring Run and contained flakes, flake tools, and a core. These sites were located in stubble fields and were characterized by considerable sheet erosion.

Site 7NC-J-19 is located on a 2 meter rise on the south side of a bay/basin feature and was discovered in a bulldozer scrape intended for topsoil borrow. The site consisted of 6 flakes found in the 2x7 meter scrape, a relatively dense concentration indicating a possibly intensely occupied site. Sites J-20 and 21 were small flake scatters west of Naylors Corners along an unnamed tributary to Herring Run.

Subarea 3. The fields east of Blackbird Landing Road are no-till rye and corn and offered less than 1% visibility. Nothing could be seen of previously recorded site J-15. Small bare patches were located in the rye fields which offered 5%-10% visibility and would occasionally produce a couple of flakes or a flake tool. Three of these were located on the north side of Blackbird Creek west of an unnamed tributary and were designated 7NC-J-28, 29, and 30.

Site 7NC-J-31 is a large sprawling site on the northwest side of Blackbird Creek and south/southeast of Naylors Corners. It is situated on a broad lobate rise perpendicular to the stream which is cut by several ephemeral streams and contains two bay/basin features. Measuring about 450 meters in length and from 100 to 160 meters in width, it is one of the largest sites identified in the survey. Artifacts recovered included 2 stemmed bifaces (one is Rossville-like), 9 non-diagnostic, fragmentary or rejected biface tools, 2 scrapers, 13 flake tools and utilized flakes, 1 chopping tool, 2 cores, 132 flakes, and about 2 dozen pieces of fire-cracked rock.

Site 7NC-J-32 is another large site northeast of J-31 and separated from it by an ephemeral stream. It is also located on a lobate rise and measures about 110x300 meters. Included in this collection are 2 contracting stem bifaces, 1 triangle point (see Plate 2),1 scraper, 2 biface rejects, 7 flake tools and utilized flakes, 3 cores, 1 stone hoe, 30 flakes, and fire-cracked rock. Overall, the artifacts indicate a Woodland I and II occupation.

The J-33 site is located on the north bank of Herring Run in a severely eroded plowed field. It measures roughly 75x300 meters and produced 1 stemmed quartz biface, 2 scrapers, 6 bifacial and unifacial tools, 2 cores, 26 flakes, and fire-cracked rock.

The remainder of the sites in this subarea were small surface scatters on the headlands overlooking Blackbird Creek and

Herring Run and generally yielded one or two flake tools, a few flakes and occasionally some fire-cracked rock. Sites 7NC-J-34 through 37 are included in this group.

Subarea 4. All of this subarea is wooded or broadcast-planted crops (low visibility) except for the Carter/Johnson farm immediately south-southeast of Townsend. This farm was subjected to pedestrian survey and six sites were located.

Site 7NC-H-14 is a sprawling site situated along the crest of a 0.6 meter high rise encompassing a pair of bay/basin features. It is approximately 190x250 meters in size and produced 1square stemmed point (see Plate 1), 2 contracting stemmed points, 1 rhyolite corner-notched biface (see Plate 3), 1 scraper, 1 utilized flake, 2 cores, and 34 flakes. Site 7NC-H-15 is located along the crest of a north-south oriented 2 meter high ridge with a bay/basin feature at its center. Found here were 2 stemmed points, 3 non-diagnostic biface fragments, 4 utilized flakes and flake tools, and 24 flakes. Site 7NC-H-16 was a small scatter located on an eroded rise northeast of a bay/basin feature and produced 9 flakes, one of which exhibited initial bifacial edging. Site 7NC-H-17 was directly east of H-16 and in a similar setting: northeast of a bay/basin feature on a somewhat eroded slope. One biface medial section, 3 cores, and 12 flakes were recovered. Located on a sandy, well-drained ridge at the head of a tributary to Barlow Branch, the H-18 site produced 1 stemmed biface resembling an Orient fishtail or Dry Brook variant (see Plate 1), 2 other biface fragments, 3 flake tools, 1 core, and 19 flakes. Site H-19 contained 51 mostly quartz flakes and 1 chert scraper found on a 2 meter high knoll between two ephemeral streams at the head of an unnamed tributary to Barlow Branch.

The cluster of dense surface scatters on this farm may be related to its position at the well-branched head of a stream, an area which also contains several bay/basin features. Virtually all of the slightly elevated areas on this farm contain sites, which suggests the possibility that presently defined site limits are artificially constrained by the farm's wooded boundaries.

Subarea 5. This is one of the most extensively cultivated subareas in the survey and a total of 26 prehistoric sites and 1 historic site were located. It is situated on the north side of Blackbird Creek and west of the confluence of the Creek and Herring Run.

The overall site pattern is one of extensive utilization of clusters of bay/basin features, which were usually located 0.7 to 1.6 kilometers north of Blackbird Creek, while the headlands adjacent to the floodplain produced generally smaller scatters. Bay/basin clusters were favored over isolated features. An exception to this pattern is site 7NC-J-44, located on a somewhat eroded headland above Blackbird Creek. Recovered were 4 non-diagnostic biface fragments, 1 flake scraper, 3 utilized flakes or flake tools, 49 flakes and fire-cracked rock.

Site 7NC-J-47 is situated on a large multi-lobed ridge which engulfed 3 bay/basin features and lay adjacent to a fourth. The site measured 100x200 meters and produced 2 contracting stem bifaces, 1 triangular point (see Plate 2), 1 biface reject, 1 utilized flake, and 18 other flakes. It is interesting to note that the flake to finished tool ratio present here is a relatively low 18:5, suggesting it is a procurement site. Site 7NC-J-50 is located on a 1 meter high rise situated between a large bay/basin on the west and a cluster of them on the east. Located were 2 biface fragments, 1 side/end scraper, 117 flakes, and 30-40 pieces of fire-cracked rock. Also found was a gunflint of English flint and 19th and 20th century ceramics, probably associated with the nearby farmhouse. Most of the artifacts occurred in a 12x22 meter area in the center of the site.

Site 7NC-J-54 is a horseshoe-shaped site surrounding a 100 meter diameter bay/basin feature and 2 smaller bay/basins. Four different types of bifaces were found here: 1 square stemmed jasper biface (see Plate 1), 1 corner-notched chert biface (see Plate 3), 1 rhyolite side-notched biface, and 1 quartz triangle point (see Plate 2). Also found was a chert scraper, a quartzite core, 30 flakes, and 7 pieces of fire-cracked rock. The site is a continuous scatter along about 80% of the rim, with only the southwest side devoid of artifacts.

Site J-60 is located on the rims surrounding two adjacent bay/basins. One bifacially-worked chert flake, 1 crystal quartz core, 12 flakes, and fire-cracked rock comprised this assemblage. Just west of J-60, on a small sandy rise on the south side of another bay/basin, is the J-61 site. One heavily-resharpened quartz corner notched point (see Plate 3), 1 quartz scraper, and 7 flakes were located here.

Site J-65, located on the Chester Gove farm at the confluence of Herring Run and Blackbird Creek, lies on a prominent ridge and adjacent flat area which is bisected by an ephemeral stream to Blackbird Creek. It produced two non-diagnostic biface fragments, 29 flakes, and fire-cracked rock.

Numerous other small surface scatters were located in subarea 2-5, including 7NC-J-42, 43, 45, 46, 48, 49, 51-53, 55-59, 62, 64, and 66-68. Settings included adjacent to bay/basin features, on the headlands along Blackbird Creek, and at the heads and along the lengths of ephemeral streams. Most consisted of a few flakes and non-diagnostic broken and discarded tools. Figure 16 shows the exact locations of these small surface scatters.

An historic site, J-63, was located just east of the intersection of Union Church Rd. (Rd. 456) and the Collins farm driveway. Noted on the surface were red brick fragments, late 19th and 20th century bottle glass, whiteware, ironstone, and porcelain fragments, and a 2-hole shell button. Conspicuous in their absence were redware sherds, suggesting the site is rather late. No surface features were visible. Mr. Corbit Collins, 62-

year old farmer and owner of the land on which this site is located, provided an oral account of the structure's occupant and subsequent demise. A black tenant farmhand lived in the house in 1930 when an outbreak of typhus occurred. As a preventive health measure, the tenant was evicted, the well filled in, and the house demolished. The site is now under cultivation.

Subarea 6. Subarea 2-6 is comprised of land west of the Conrail tracks and northwest of Forest (formerly Blackbird Station). Two streams, Barlow Branch and an unnamed tributary, course through and join in the eastern end of the subarea. Most of it is wooded and offered no surface visibility. The Robert Foraker farm, on the south side of the unnamed tributary, was the major exception, with eleven sites found on the 44 hectare (109 acre) tract. Several ephemeral streams cut through the field, which also contains several bay/basin features. Separating the water courses are numerous artifact-bearing knolls and ridges, many of which are moderately to severely eroded. Four sites deserve special mention and will be discussed below.

Site 7NC-H-22 is located on a west-facing sandy prong jutting out toward the unnamed tributary. Although now mostly destroyed by borrow operations and dirt motorcycle activity, the site's remnant produced 1 stemmed argillite biface, 14 flakes, and several pieces of fire-cracked rock. One contracting stem biface, 1 core, 30 flakes, and fire-cracked rock were found at 7NC-H-24, a 20x45 meter site on a rise on the south side of the unnamed tributary. Field visibility was only 20% at the time of the survey.

A third notable site on this farm is 7NC-H-29, situated on a 2.5 meter high knoll on the east side of the ephemeral stream. One broadspear-like rhyolite biface, 1 flake tool, and 6 flakes were recovered. Unfortunately this site is quite eroded. Site H-32 lies about 450 meters east of H-29 on an eroded rise on the west side of an ephemeral stream. One corner-notched biface (see Plate 3), one utilized flake, one early stage biface reject, 9 flakes, and about 30 pieces of fire-cracked rock were found. The remaining 7 sites found on the Foraker farm generally consisted of 1 or 2 tools and less than 10 flakes and were scattered about at various locations, mainly along ephemeral streams and around bay/basins. Included in this group are 7NC-H-23, 25-28, 30, and 31.

Site 7NC-H-33 will be discussed later in detail in the section on subsurface testing. It will be noted here that adjacent to the excavated woodlot section of this site, a square stemmed quartz biface and 1 flake were found at the edge of a soybean field. Due to time constraints and crop growth, this field could not be adequately surveyed.

Subarea 7. This subarea includes segments of Barlow Branch and Blackbird Creek and is almost totally composed of land owned by Charlie Carter, Bob Foraker, and William and Edward Powell of Blackbird. The last-named pair denied access to their extensive

landholdings but Carter and Foraker were most cooperative and permission was obtained. Carter and Foraker owned all of the surveyable tracts south of Barlow Branch and Carter all of that on the north side. A total of 35 new sites were recorded during the pedestrian survey and the limits of a previously recorded site, 7NC-H-8, were expanded.

The largest site found was 7NC-H-39, situated on the south side of Barlow Branch (Plate 5 and 8). About 450x100 meters in area extent, it lies on a long ridge parallel to the stream and is sandwiched between 2 bay/basins on the north side (between the ridge and the stream) and 1 on the south (see Plate 7). The ridge itself contains 3 such features. Twenty-one tools were recovered from the site, which exhibited about 30% visibility at the time of the survey. Found were one large jasper bifurcate which more closely resembles a Kirk point (see Plate 9), 1 heavily resharpened small quartzite bifurcate (see Plate 5), 3 contracting stem bifaces (1 of argillite), 1 argillite Lehigh/Koens-Crispin broadpoint, 9 non-diagnostic broken and rejected bifacial tools, 2 flake tools, 1 bifacial scraper, 2 cores, 1 large quartz chopping tool, 153 flakes, and several dozen pieces of fire-cracked rock (see Plate 10). The Kirk and the bifurcate, as well as the largest percentage of other artifacts and fire-cracked rock recovered from the site, were found on a 2 meter high sandy rise in the west central part. The temporal range for the site spans about 9,000 years, from about 8,000 B.C. for the Kirk point (late Paleo-Indian Period) to about 1000 A.D. for the latest occurrence of the stemmed points. Erosion is moderate and the possibility exists of intact subsurface features.

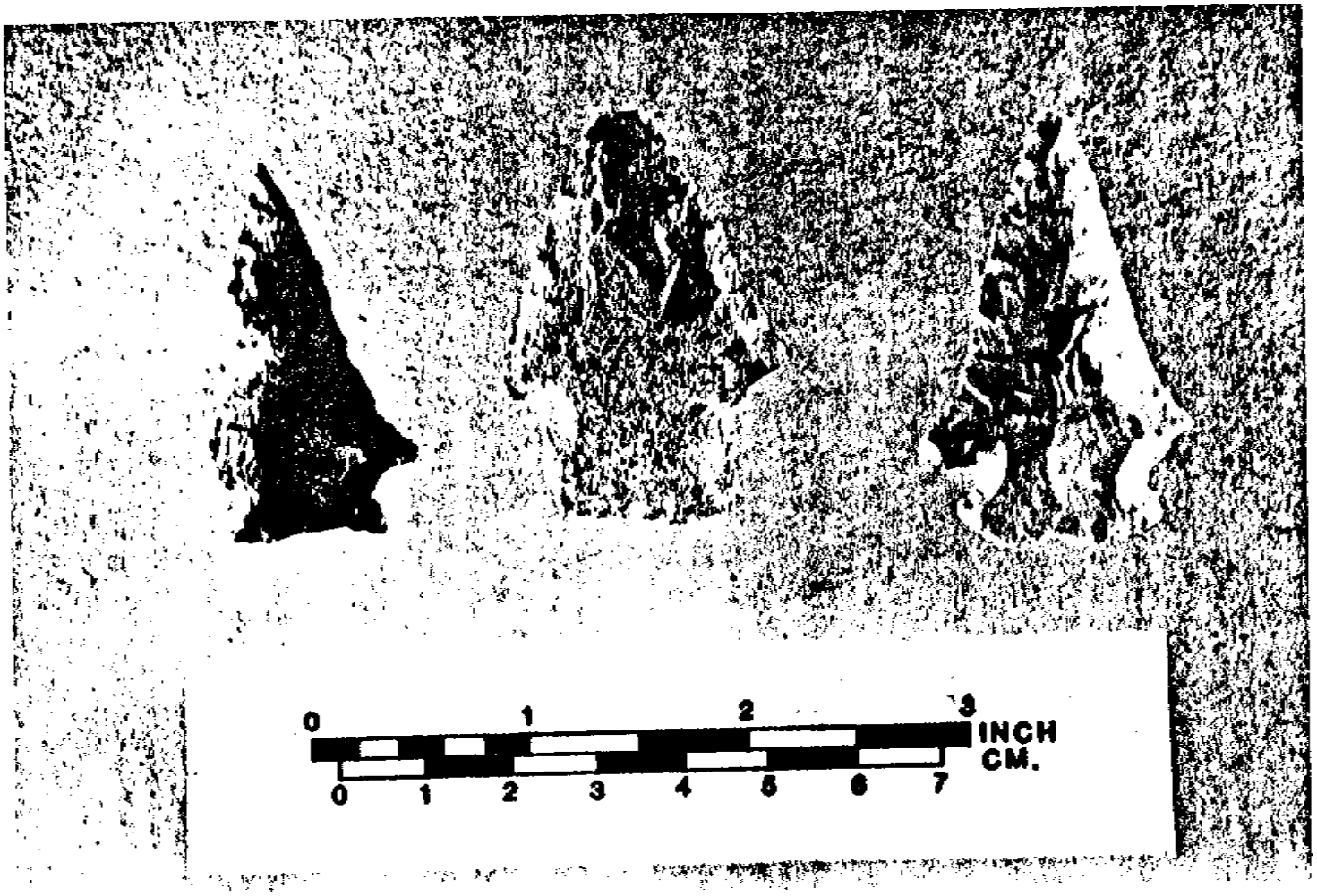
Located southwest of the H-39 site, the H-40 site lies on a rise on the north side of a bay/basin. One contracting stem biface and 15 flakes were found over an area about 15x30 meters. To the west of these sites, the H-47 site lies on a heavily eroded knoll on the south side of Barlow Branch. It measures about 110x200 meters and contained a thin scatter of artifacts including 1 Bare Island/Lackawaxen-like stemmed biface, 1 utilized flake, 1 core, and 10 flakes.

The H-51 site is a continuous scatter located on 3 small parallel ridges which lie on the south side of and perpendicular to Barlow Branch. One stemmed quartz biface (see Plate 1) , 2 non-diagnostic biface fragments, 1 utilized flake, 1 core, and 15 flakes were found (once again note low flake to tool proportion). Site H-54 is located on a south sloping rise on the north side of Barlow Branch. One quartz stemmed point, 1 biface reject, and 3 flakes were thinly scattered over an area about 60x60 meters.

The H-60 site contained the other bifurcate found in the subarea, a small quartz example (LeCroy-like) (see Plate 5), as well as 2 jasper biface fragments, 4 flakes, and fire-cracked rock. The site is located on an eroded knoll on the north side of Barlow Branch. The H-67 site, located on a badly eroded knoll at the confluence of an ephemeral stream and Barlow Branch,

PLATE 9

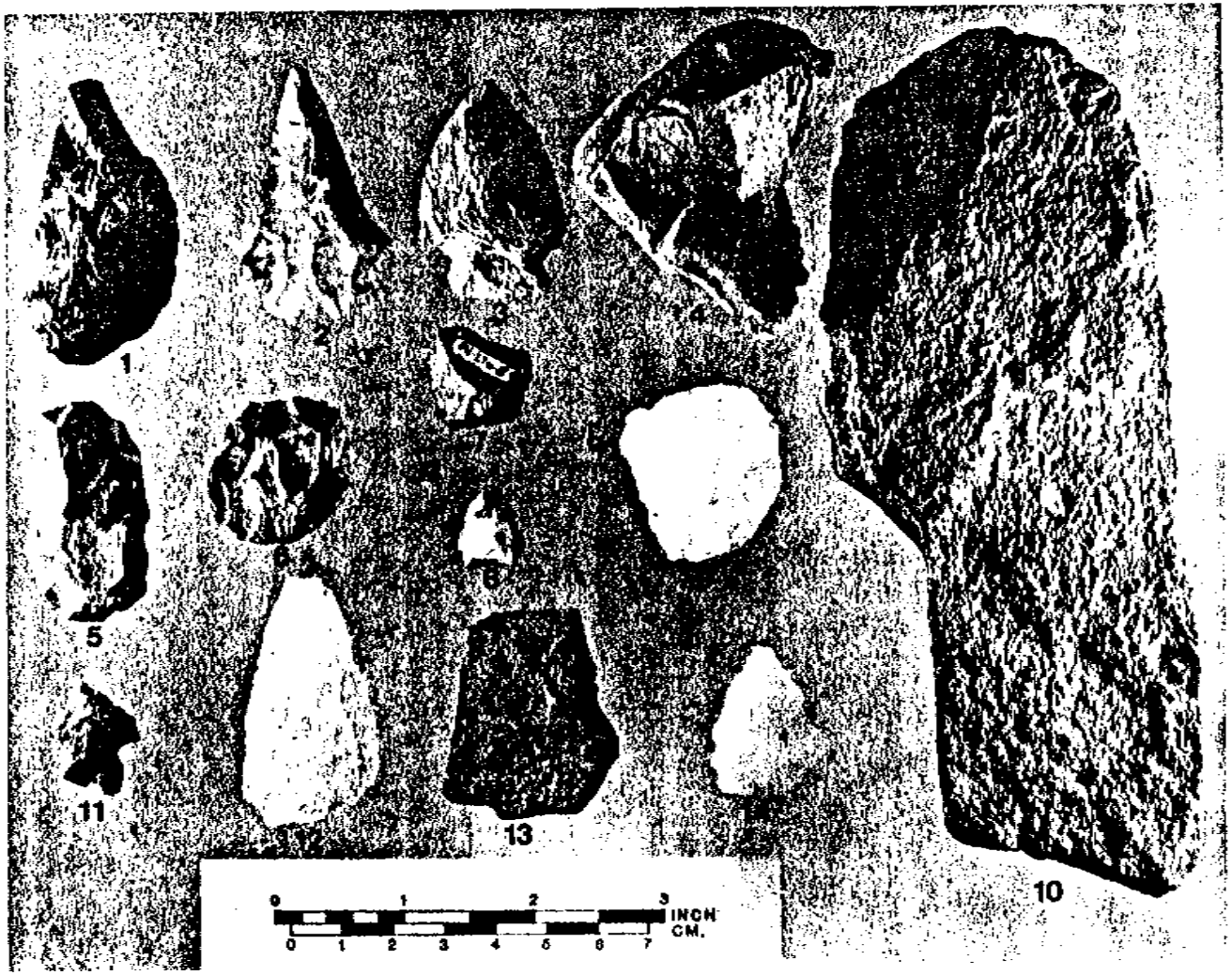
Selected Kirk Points from Sites in the Route 13 North Survey



LEFT TO RIGHT: 7NC-H-73, 7NC-J-105, 7NC-H-39

PLATE 10

Selected Artifacts from 7NC-H-39



1-biface reject
2-Kirk point
3-notched point
4-core
5-biface reject
6-flake tool
7-flake tool
8-point tip
9-early stage biface reject
10-chopper or ax
11-bifurcated base point
12-biface
13-broadpoint
14-biface fragment

produced a hammerstone (see Plate 4), 2 non-diagnostic biface fragments, 7 flakes, and fire-cracked rock. Field visibility was about 40%.

As in previous subareas, this one contained many small sites possessing a few flakes and/or 1 or 2 non-diagnostic bifaces, scrapers, or flake tools, and fire-cracked rock. Various natural settings were exploited, including the headlands along the permanent streams, ephemeral drainages, springheads, and bay/basin features. Sites in this category are 7NC-H-35 through 38, 41-46, 48-50, 52, 53, 55-59, 61-66, 68, and 69.

In addition, 2 previously unrecorded historic sites were located near the Conrail tracks and just south of Ratledge Rd. (Rd. 460). Both contained brick and 19th century ceramics (redware, yelloware, whiteware) and there were no standing structural remains present or indications of subsurface features. Site H-88 is located just east of the Conrail tracks about halfway between Ratledge Rd. and Barlow Branch, while H-89 is situated on a 2 meter high rise about 100 meters east of the Conrail tracks (on the south side of Ratledge Rd.).

Subarea 8. This subarea is located southwest of Blackbird, Delaware and is mostly woodlot. The eastern one-third is cultivated but access was denied by the owner. Two parcels of land were examined: a section of the John Wilson farm due south of the intersection of Rds 459 and 463 (Blackbird Station Rd.), which produced 3 prehistoric and 1 historic sites, and the William K. Kraus property (Yuletide Farm) on the north side of Rd. 472 (Oliver Guessford Rd.), which produced 4 prehistoric sites and one with both prehistoric and historic remains.

The small section of the Wilson property which falls within the project area contains several bay/basin features separated by 1.5 to 2.0 meter high ridges. Site H-72 is a thin scatter of 1 jasper scraper and 6 flakes surrounding a bay/basin feature. Just east of that was found a Kirk corner-notched point on a 2.5 meter rise in the center of 4 bay/basin features (7NC-H-73; Plate 9). The H-74 site contained a few flakes and one rejected quartz tool, while the H-75 site was a scatter of brick chunks, whiteware, and redware covering an area measuring about 20x40 meters. Curiously, the latter site is located near no known historic road and is 200 to 250 meters south of present Blackbird Station Rd.

Site 7NC-H-76, located on the Kraus farm on Rd. 472, is a sprawling site on the south side of a unnamed tributary to Blackbird Creek. An ephemeral stream bisects the site and 2 bay/basin features lie on its southern extremity. The soil is a very well-drained sandy loam. The prehistoric material included one stemmed quartz biface, one contracting stem biface, 7 non-diagnostic rejected and fragmentary bifacial tools, 1 core, 1 flake tool, 49 flakes and 15-20 pieces of fire-cracked rock. The historic material included a white salt-glazed stoneware teacup basal sherd (1725-1775 dates of manufacture), 1 gilt metal

button, 1 glass slag fragment, 1 large lump of ferrous metal, 1 brass sleigh bell fragment, and much 19th and 20th century redware, whiteware, and bottle glass fragments. The prehistoric material was heaviest on the rise about 50 meters west of the standing farmhouse, while the historic material had two foci of concentration. The 19th and 20th century ceramics and glass were concentrated on the knoll northwest of the house, while the brass bell fragment, the stoneware teacup sherd, and other materials were found southwest of the house.

Site H-77 is located on a sandy rise about 100 meters west of Blackbird Creek. Although surface visibility was less than 2% at the time of the survey, 1 biface fragment, 1 utilized flake, 1 core, 16 flakes, and fire-cracked rock were found in a 15x45 meter area. The low visibility coupled with the substantial artifact count suggests the possibility of an intensely utilized site. Site H-78 is located on another sandy rise on the west side of Blackbird Creek. It is further enhanced by a bay/basin feature a few meters to the south. Found were 1 small contracting stem biface (see Plate 1), 1 teardrop-shaped biface, 1 biface reject, and 13 flakes.

Sites H-79 and 80 were found on a rise in a cluster of bay/basins. The former produced a Bare Island-like stemmed biface and the latter just three flakes. Two other sites were found in this subarea, although these were surface finds made during the subsurface testing phase, to be discussed below. They were found on the Charles Owensby property south of Blackbird Station Rd.

Site 7NC-H-81 was on a motorcycle trail in a woodlot and was adjacent to a subsurface test unit designated H-86. One jasper stemmed biface, 2 flakes, redware, whiteware, porcelain, a machine cut square nail, and numerous brick fragments were found on the surface. The site is disturbed by the historic activity and it is unknown if intact subsurface prehistoric remains exist. It is located on a rise with an active stream flowing 50 meters to the south. A large cobble core was found on a very sandy grass-covered rise located between a perennial stream and 2 bay/basins. The core was found in a 0.6 x 0.6 meter bare patch on the crest of the rise, which had an overall visibility of zero. It was designated site 7NC-H-82.

Subarea 9. This large subarea consisted of land east of the confluence of Sandom Branch and Blackbird Creek and downstream along the main trunk of the Blackbird. Due to agricultural practices, no ground surface was visible in the northern half of the subarea, but the southern half contained visible ground and fifteen sites were located. The largest of these is 7NC-J-81, located on a rise at the confluence of Sandom Branch and the Blackbird Creek. It produced 1 corner-notched biface (see Plate 3) 2 biface fragments, 2 scrapers, 2 flake tools, and 37 flakes. The location and artifact types present suggest it may be a macro-band base camp.

Sites 7NC-J-69 through 80, 82, and 83 were small surface scatters located throughout the southern half of the subarea in various environmental settings. These sites produced flakes and isolated tools in small numbers, including several stemmed points and two Woodland II triangles (see Plate 2).

Subarea 10. All but a very small portion of this subarea is forested or no-till soybeans. In its southeast corner, a portion of the George W. Reed, Jr. farm produced two sites, J-84 and 85. The first is located on a small rise south of the head of an ephemeral stream and northeast of a bay/basin feature. Only two artifacts were found: a contracting stem biface and one flake.

The J-85 site is located on a 2-meter rise north/northwest of a bay/basin and produced one stemmed jasper biface reject, a scraper, a utilized flake, and one other flake in a very thin scatter.

Subarea 11. Like Subarea 10, this area is primarily forest and no-till soybeans and offered very little surveyable ground. Only 3 sites were recorded, all of them small surface scatters. Site J-86 contained only 2 artifacts found on a very gentle slope south of a bay/basin. However, one was a LeCroy bifurcated base point (see Plate 5) while the other was a utilized chalcedony flake. The J-87 site is located on the north side of the same bay/basin and produced one biface reject and 5 flakes.

Site 7NC-J-88 was found at the north end of the subarea and is located between Blackbird Creek on the northwest and a bay/basin cluster on the south. One utilized flake and 10 other flakes were found in a 30x100 meter area.

Subarea 12. This subarea is mostly forested and the largest cultivated section, southwest of Blackbird, could not be surveyed due to denial of access by the landowner. Thirteen sites were found in the accessible cultivated areas, eight of which were on the Mrs. J. K. Orrell, Sr. property on the west side of Rt. 13. Three of these contained substantial quantities of diagnostic artifacts and other tools. Site 7NC-J-95 is located on a rise between a bay/basin and an ephemeral stream to Sandom Branch and produced 1 contracting stem biface, 1 biface reject, 1 utilized flake, 18 flakes, and 3 pieces of fire-cracked rock. Field visibility was about 40%.

The J-97 site is situated on a long north-south oriented 4-meter high ridge between an ephemeral stream on the north and several bay/basins on the south. Found were 1 biface fragment, 1 core, 1 large chunk of worked siltstone or argillite, 12 flakes, and fire-cracked rock. Just east of this on a parallel ridge lies J-99, which produced 1 bifurcated base point (see Plate 5), 1 biface reject, 1 utilized flake, 1 core, 18 flakes, and fire-cracked rock.

Sites J-94, 96, 98, 100, and 101, also on the Orrell farm, were small surface scatters found on knoll tops at the heads of ephemeral streams and around bay/basin features. Three small sites, all adjacent to bay/basin features, were found in cultivated sections on the east side of Massey Church Rd. One corner-notched chert biface, 1 stemmed biface fragment, and one flake were found at J-91 (see Plate 3); 1 contracting stem biface and 3 flakes at J-90 (see Plate 1); and a core and 4 flakes at J-89. Two small flake scatters, J-92 and J-93, were found near bay/basins west of existing Rt. 13 across from the truck weigh station.

Subarea 13. This large subarea lies on the east side of Rt. 13 and contains the Sawmill Branch to Smyrna River. Most of it is wooded and at the time of the survey, much of it was also in cultivation and could not be surveyed. Three properties were examined and produced archaeological sites: the Shane and Knotts farms on the north side of Rd. 469 and the Mrs. W. B. Faggart property east of the intersection of Rds. 5 and 495.

Three large sites were found on the Shane property on 3 parallel ridges on the west side of an unnamed tributary to Sawmill Branch. An unnamed active stream passes along the south side and the landscape is dotted with numerous bay/basins and ephemeral streams. The southernmost of the three, J-102, contained 2 chert biface fragments, 2 scrapers, 1 flake tool, and 19 flakes. A bay/basin feature separated this from the next site north, the J-104 site, which contained 1 biface reject, 2 scrapers, 2 utilized flakes, and 19 flakes. The northernmost of the three, J-103, was also the largest, and was separated from 104 by an ephemeral stream. It yielded 1 corner-notched chert biface (see Plate 3), 1 contracting stem biface, 6 non-diagnostic broken or rejected bifacial tools, 3 scrapers, 8 utilized flakes, 1 core, 211 flakes, and 3 pieces of fire-cracked rock. The site measured approximately 60x300 meters.

Five sites were found on the Knotts farm directly east of Shane's. The J-105 site, approximately 150x450 meters in size, is a sprawling continuous scatter south of the confluence of 2 unnamed tributaries to Sawmill Branch. It includes 4 bay/basin features and 2 ephemeral streams and yielded 2 bifurcated base points (one of jasper with cortex and the other of quartz) (see Plate 5), 1 rhyolite Kirk stemmed biface (see Plate 9), 7 non-diagnostic biface rejects, 3 flake tools, 2 cores, 151 flakes, and fire-cracked rock. Southwest of J-105 lies the J-107 site, located on a 2 meter high rise about 220 meters east of an unnamed tributary to Sawmill Branch. Two contracting stem chert bifaces (see Plate 1), 1 other biface (broken, but probably stemmed), and 2 flakes were found. The other 3 sites on the Knotts farm, 7NC-J-106, 108, and 109, were small surface scatters of flakes and a quartz end/side scraper (J-108).

The farmhouse on this property, which was standing on the 1955 USGS quadrangle of this area (Clayton) is now demolished and a heap of rubble marks the location. It is structure #351 on the

historic structure survey completed for this project. There is no trace whatever of structure #353, which sat on the property near Rd. 469.

The 7NC-J-110 site on the Faggart property is situated on a 2 meter high well-drained rise surrounded by bay/basin features on the north, south, and east. It is located in a small soybean field about 125x160 meters and extends to the limits of the cultivated area. Numerous flakes were also found in bare patches in the lawn to the rear of Mrs. Faggart's house. The entire distribution suggests that the size is artificially constrained by modern land use and may be much larger. Recovered were 2 stemmed bifaces (see Plate 1), 1 biface fragment (possibly a reworked triangle point), 4 other non-diagnostic biface rejects or fragments, 1 scraper, 3 flake tools, 1 core, 57 flakes, and several pieces of fire-cracked rock. Also found on the rise was a fragment of a ground stone artifact, most likely a "boatstone" (see Plate 4). A 1909 Indian head cent was also found, although there is no documented evidence of any structure ever standing at this intersection. Mrs. Faggart's house post-dates 1969.

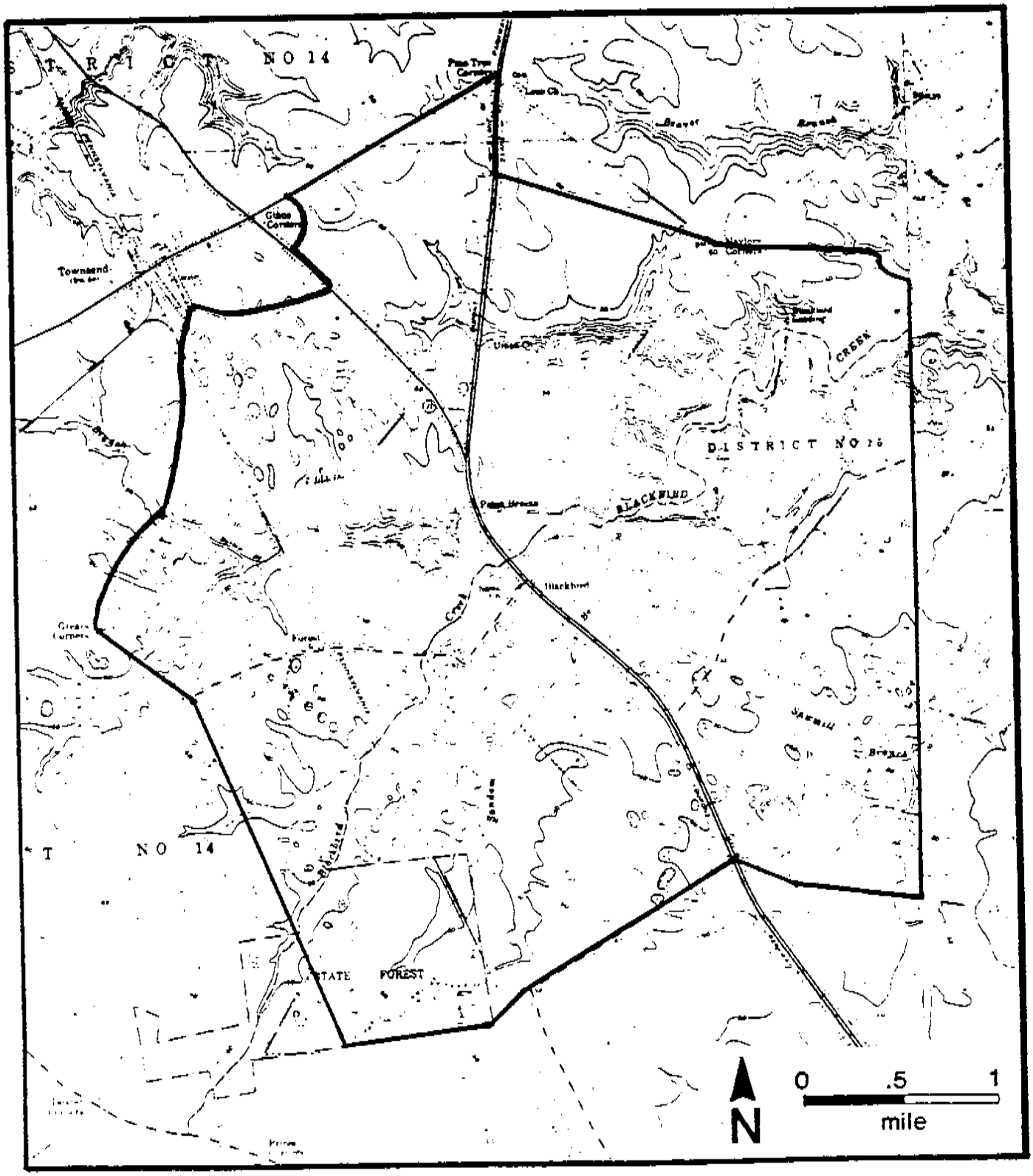
Subarea 14. Almost all of this subarea is no-till agriculture, woodlot, and residential and only 2 sites were recorded. Both were incidental finds made as a result of the later subsurface testing program. Site J-111 was found at the edge of a soybean field overlooking a deeply cut unnamed tributary to Blackbird Creek. One contracting stemmed biface and 2 quartz flakes were the only finds. The J-112 site, which produced two flakes and fire-cracked rock, lay on the opposite side of the ravine from J-111. It was exposed by a bulldozed borrow scrape and its integrity is suspect.

Subarea 15. Almost all of this subarea is woodlot, no-till corn, or residential structures. The only accessible plowed land was the farm on the north side of Rd. 465 (Eagles Nest Landing Rd.) owned by Jack Ellingsworth of Clayton.

Four sites were located within this subarea, three of which (7NC-J-114, 115, and 116) were small flake scatters along perennial or ephemeral streams. Site J-117 is located on a severely eroded steep slope and an adjacent upland flat area on the west side of Sawmill Branch. Recovered were 1 drilled atlatl weight fragment (see Plate 4), 1 chert bifurcated base point (similar to Broyles (1971) St. Albans type) (see Plate 5), 3 non-diagnostic biface fragments, 3 flake tools, 1 "potlid" jasper fragment with apparently worked edges, 1 hammerstone, 24 flakes and fire-cracked rock.

Blackbird Area - Subsurface Testing. Extensive subsurface testing was also undertaken for a sample of the Blackbird area (Figure 17). The sites found during the subsurface testing phase are noted on Figure 16 and are listed in Tables 6 and 7. Forty-three 1x1 meter units were excavated as part of this phase of the subsurface testing. Appendix IV shows representative profiles and Appendix V summarizes locational and artifact data.

FIGURE 17
Sub-surface Test Locations - Blackbird Study Area



Three types of woodlots were investigated in Subarea 1: type I - no associated surface water; type II - single bay/basin association; and type III - complex bay/basin association. The first named was located adjacent to the DiGiovanni farm west of present Rt. 13. Ground investigation demonstrated that the tract actually contained two active streams and four bay/basin features not represented on the maps. Five test units were placed in the woodlot at selected locations, mainly small rises adjacent to the water sources. Stratigraphic profiles varied from yellow-brown sandy loam to gray clayey loam and several of them had never been plowed historically. However, only one artifact, a quartz flake, was found in all five units. This was located in an excavation on the north side of a bay/basin and was designated 7NC-H-11.

The type II study area (simple bay/basin association) in the northeast corner of the subarea was found to contain 3 bay/basin features and a single test unit was placed on a 1.5 meter rise in the center of the cluster. The soil was a well-drained fine yellow sand. No cultural material was recovered.

The third test area investigated was east of Rt. 896 and southeast of Ginns Corner and contained 13 bay/basins ranging in size from 30 to 200 meters (long axis). Seven test units were placed at selected locations and two produced artifacts. Both were on rises adjacent to bay/basins and each produced a single artifact: a biface. The first was a jasper rounded stem biface (7NC-H-12) and the second was an argillite distal fragment (7NC-H-13). No other artifacts were recorded from this test area.

A type I and a type V setting were investigated in subarea 2, with three units placed in the former and six in the latter. The type I was located on the east side of Rt. 13 and was found to be actually a type III (complex bay/basin association). Only one unit produced cultural material: site 7NC-J-27 on the south side of a pair of bay/basins. The unit was placed on a 1.5 meter high knoll and debitage was found to a depth of 80 centimeters below the surface. The soil was a fine yellow-brown silt similar to wind-blown deposits (Appendix IV).

The type V test area was located on the west side of a south flowing unnamed tributary to Herring Run. Several ephemeral streams course through the test area and served to transform it into a type VII (minor/minor stream confluence). Six units were excavated in the woodlot along the length of the stream and at the mid-stream confluence and only one failed to produce cultural material. That unit was placed in an apparently disturbed location. Of the five productive units (designated as sites 7NC-J-22 through 26), four contained small amounts of prehistoric lithic debitage and the fifth produced quantities of brick, 19th century ceramics and bottle glass, and coal. All except the disturbed unit were characterized by plowzones over tan-yellow silty loam, which was in turn underlain by mottled orange and gray sterile clay.

One woodlot was tested in subarea 3, a type VI on the northwest side of Blackbird Landing. Four test units were placed on high spots adjacent to the confluence and all four produced cultural material. The initial unit (7NC-J-38) was placed in the northern part of the test area on a headland between a deeply cut ravine and an overgrown dirt road of undetermined age. Several pieces of embossed clear bottle glass, all from the same vessel, were found.

The second unit (7NC-J-39) was placed on the headland about 20 meters back from Blackbird Creek and produced prehistoric lithic debitage and large amounts of brick, 19th century ceramics, and oxidized nail fragments. All of the material was found in the plowzone and the yellow-brown clayey subsoil was sterile. Thus it appears that a prehistoric site has been disturbed by plowing and other historic activity. The quantities of historic domestic and architectural artifacts suggest that a dwelling may have stood near the spot.

The other two units were placed on the bluffs along an ephemeral stream draining southeasterly to the Blackbird and both were in undisturbed contexts (no plowzone). Site 7NC-J-40 contained five flakes and a chert scraper (Appendix IV) while 7NC-J-41 produced flakes, fire-cracked rock, and small amounts of whiteware and coal.

Two initial test units were placed in a type IX setting, a bay/basin - stream association in Subarea 4. This setting contained a cluster of 5 bay/basins on the east side of an unnamed tributary to Barlow Branch and a unit placed on a rise in the center of the 5 features produced several flakes and fire-cracked rock in an historically unplowed context. This was designated 7NC-H-20 (Appendix IV; Plates 11 and 12). The second unit was placed on a one meter rise just east of the tributary and also had never been plowed. It produced flakes and one sherd of Wolfe Neck ceramics and was designated 7NC-H-21 (see Plate 6).

Two different settings were explored in Subarea 6. One was a small type V north of Barlow Branch and the other a type VII at the confluence of Barlow Branch and an unnamed tributary. Most of the first setting had been destroyed by borrow operations but a test unit placed in a remnant section produced one chert early stage biface reject, 3 quartz flakes, whiteware and glass (site 7NC-H-34). All of this material was found in the plowzone, which overlaid an orange clayey subsoil.

The type VII setting produced flakes and fire-cracked rock in all three excavated test units. Although small amounts of glass and coal were recovered from these units as well, the stratigraphic profiles did not indicate the woodlot had ever been plowed (Appendix IV). Together these three units were designated 7NC-H-33.

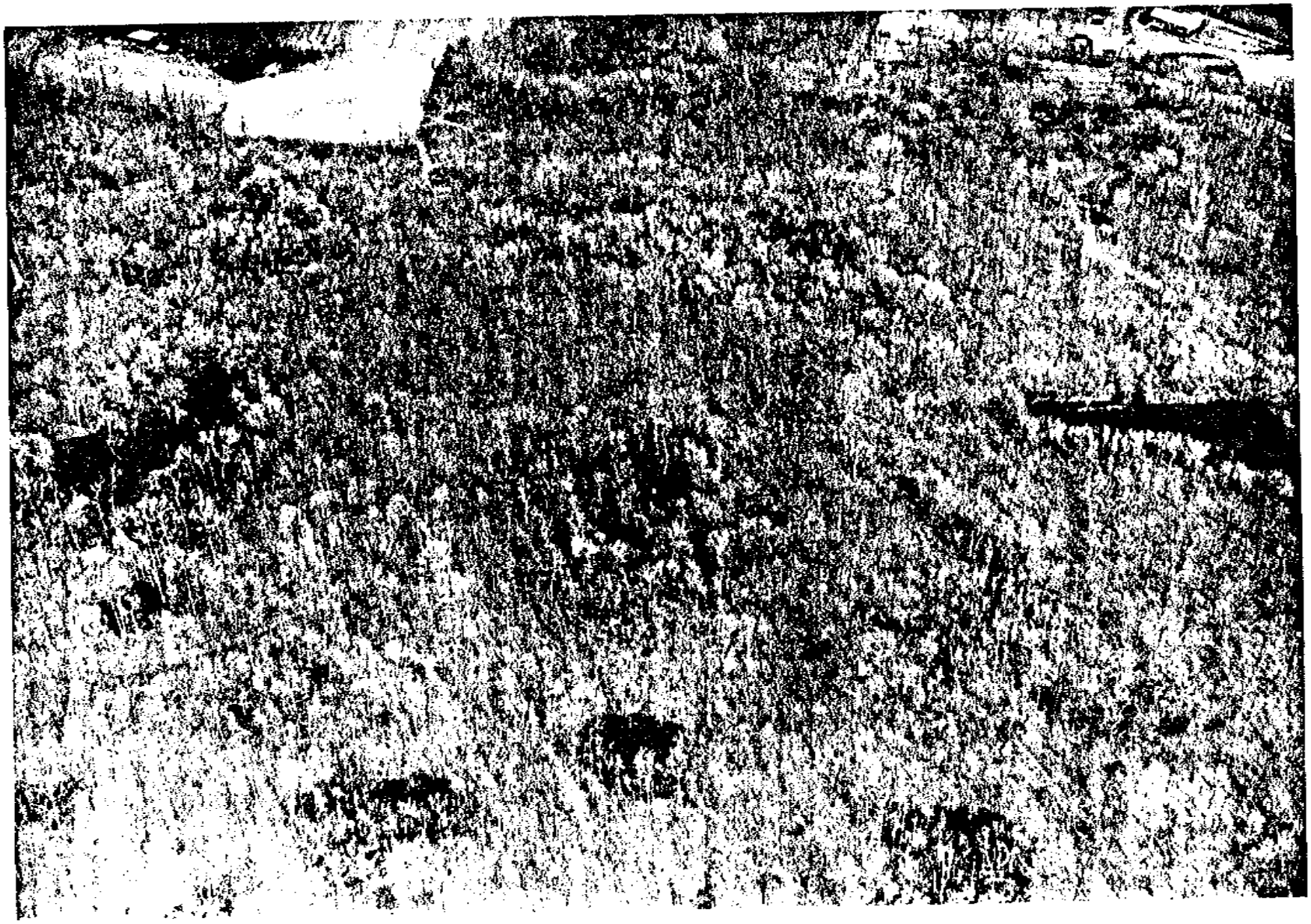
Two units were placed in another type VII setting along Barlow Branch in Subarea 7. One produced quartz flakes in a

PLATE 11

Bay/Basin Feature Near Site 7NC-H-20, Blackbird Study Area

PLATE 12

Aerial View of Site 7NC-H-20, Blackbird Study Area



heavily disturbed context (7NC-H-70) while the other produced flakes in the plow zone only (7NC-H-71).

One large type VIII location was investigated in Subarea 8 and seven units were excavated. The setting was found to contain several bay/basin features and ephemeral streams and more closely resembled a type IX. All seven units were placed on high ground adjacent to stream courses or bay/basin features and five produced cultural material. The first four were placed in the western section and produced low numbers of flakes from the subsoil, which was a yellow-brown sandy loam. Of the three units placed in the eastern section, only one, on a piece of high ground above a tributary to Blackbird Creek, produced cultural material. Thirty-three flakes and a piece of fire-cracked rock were recovered to depths of 54 centimeters into a yellow-brown sandy loam subsoil (Appendix IV). This site, which had never been plowed, was designated 7NC-H-87, while the other four were labeled H-83 through H-86.

The H-86 unit lay in the vicinity of surface site H-81, discussed above in the section on pedestrian survey. All of the artifacts recovered from H-86, which included several pounds of brick fragments, 19th century ceramics and bottle glass, pipestem fragments, and lamp chimney glass, as well as lithic debitage, were found in the 37 centimeter deep upper organic level. The owner informed us that a shallow brick foundation, only a few meters from our test unit, had been mostly destroyed when a trail was bulldozed through the woodlot several years ago. However, some historic artifacts were saved at that time and were shown to us by the owner. This collection included sherds of manganese- and lead-glazed redware, whiteware, ironstone, underglaze blue hand-painted porcelain (probably early 19th century), gray salt-glazed stoneware, underglaze polychrome hand-painted pearlware (1795-1835), cut nail fragments, and several other oxidized nail fragments. To sum up the data from the vicinity of H-86 and H-81, it appears that an early- to mid-19th century structure of unknown size, possibly related to domestic activities, stood on a Woodland I prehistoric site of unknown function. Historic documentation revealed no clue to the origin of this structure.

The final setting to be examined as part of the subsurface testing scheme was a type V (minor stream) in Subarea 14. One unit was placed on each side of the deeply dissected stream. The first, on the east side, was completely sterile, but the second was productive. Set in an historically unplowed woodlot, it yielded 36 flakes and fire-cracked rock to a depth of 40 centimeters below the surface and was designated 7NC-J-113 (see Appendix IV for profile). This unit was located about 50 meters from 7NC-J-111 (contracting stem quartz biface) and the two sites may be related.

No excavation was conducted in Subareas 5, 9, 10, 11, 12, 13, and 15 as part of this phase of subsurface testing because they were not included in the random sample of wooded areas

selected for subsurface testing.

INTENSIVE TEST EXCAVATION RESULTS

Intensive test excavations were undertaken at two bay/basin features as a part of the field research (Figure 18). These excavations included intensive testing of an unplowed wooded area adjacent to a bay/basin complex containing standing water and excavations in the center of a dry bay/basin feature. The goal of the excavations in the unplowed site was to determine the extent of sites associated with bay/basin features and to see if such sites would be eligible for listing on the National Register of Historic Places. The goal of testing the dry bay/basin feature was to determine the extent of preserved plant remains and pollen which could shed light on paleoenvironmental conditions in southern New Castle County. The results of this testing program are described below.

Thirteen 1x1 meter test units were excavated at site 7NC-H-20, which is located on a sandy knoll in the center of a cluster of bay/basin features containing standing water. Figure 19 shows the site map and grid plot and Figure 20 shows a composite profile of the main site area. None of the units contained plowzones, indicating that, although the woodlot had been logged, it had never been plowed. In general, the soils at the site were very fine grained silts and silty sands which may have been of wind blown origin. Artifacts were buried by up to 55 centimeters of these soils.

Figure 21 shows a contour map of the artifact density at the site. Table 8 provides a summary catalogue of the artifacts recovered. All but two of the excavation units produced prehistoric lithic materials, with the crest of the rise showing the greatest concentration of artifacts. One unit (N0W5) produced one quartzite early stage biface reject, 1 biface distal end fragment, and 156 flakes (primarily quartzite), an assemblage suggesting a chipping feature. Unit S4W6 yielded 104 flakes and a contracting stem biface. The range of artifacts recovered suggests the presence of a small base camp or procurement/staging site similar to the Hawthorn Site (Custer and Bachman 1983).

Four additional excavation units were placed on high ground surrounding a bay/basin directly east of the above mentioned units and were intended to clarify the site limits. Three of the four units were sterile, but unit 2-4-4, on the northeast side of the bay/basin, produced 16 flakes and one utilized jasper flake down to a depth of 52 centimeters below the surface. The soils encountered in these units generally consisted of yellow-brown and orange-brown sandy loams and clayey sands with occasional pockets of gravel.

In addition to the test excavation units a small trench was dug across the rim of the bay/basin feature to gather soil and pollen samples and to record the soil stratigraphy of the bay/basin edge area. It was hoped that these data would help to

FIGURE 18
Location of Intensive Excavations

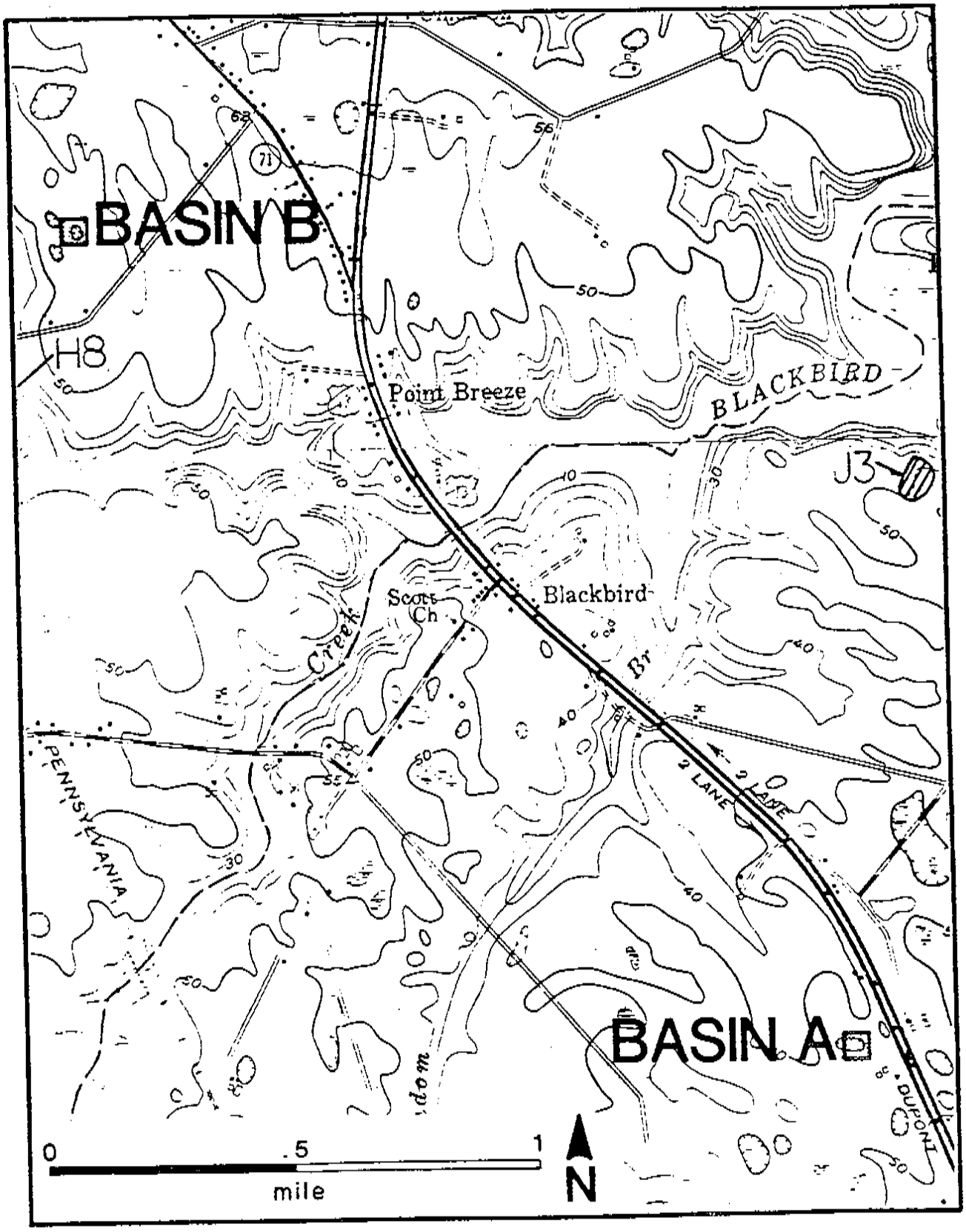


FIGURE 19

Site Map - 7NC-H-20

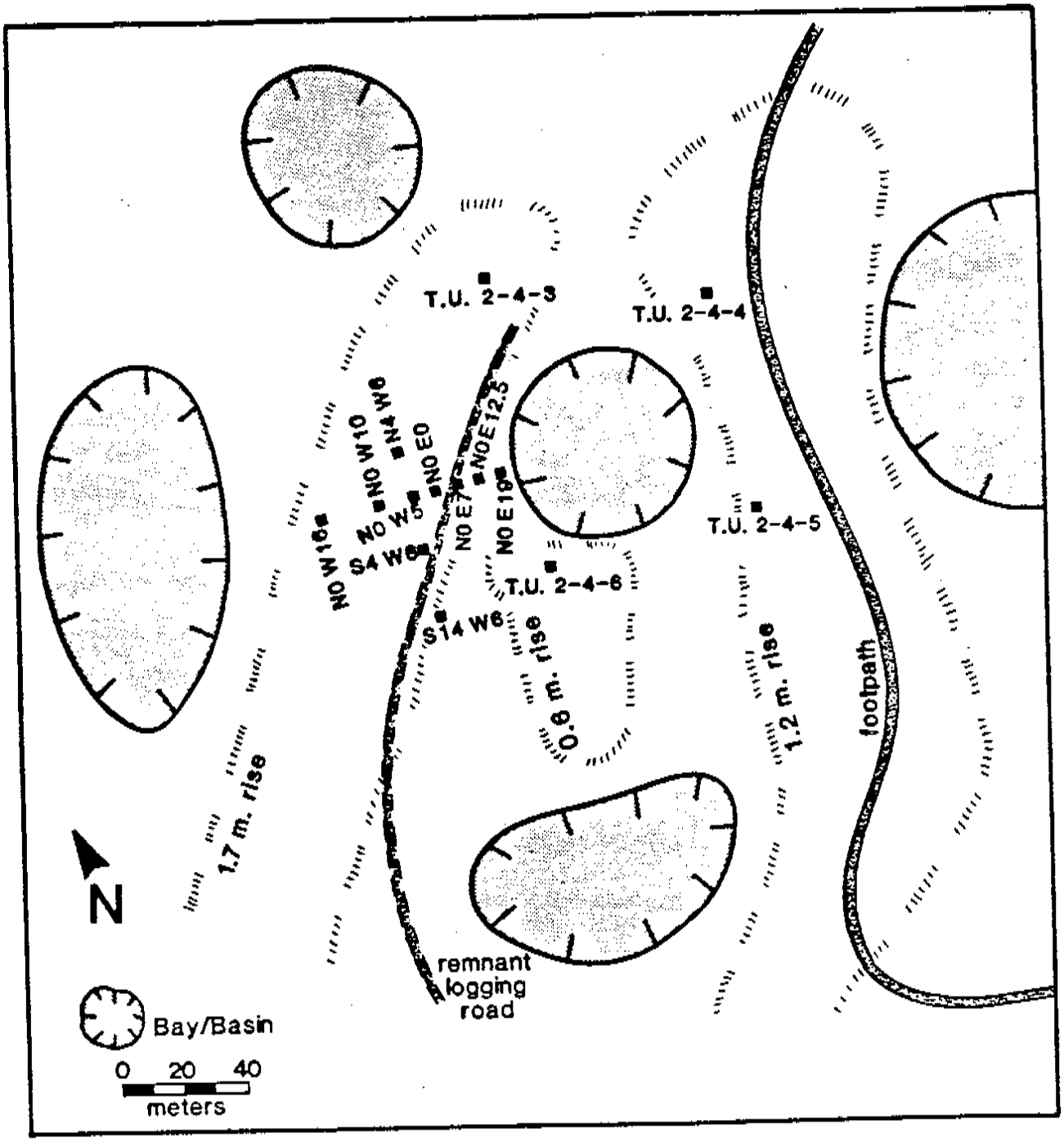


FIGURE 20

Composite Profile - 7NC-H-20

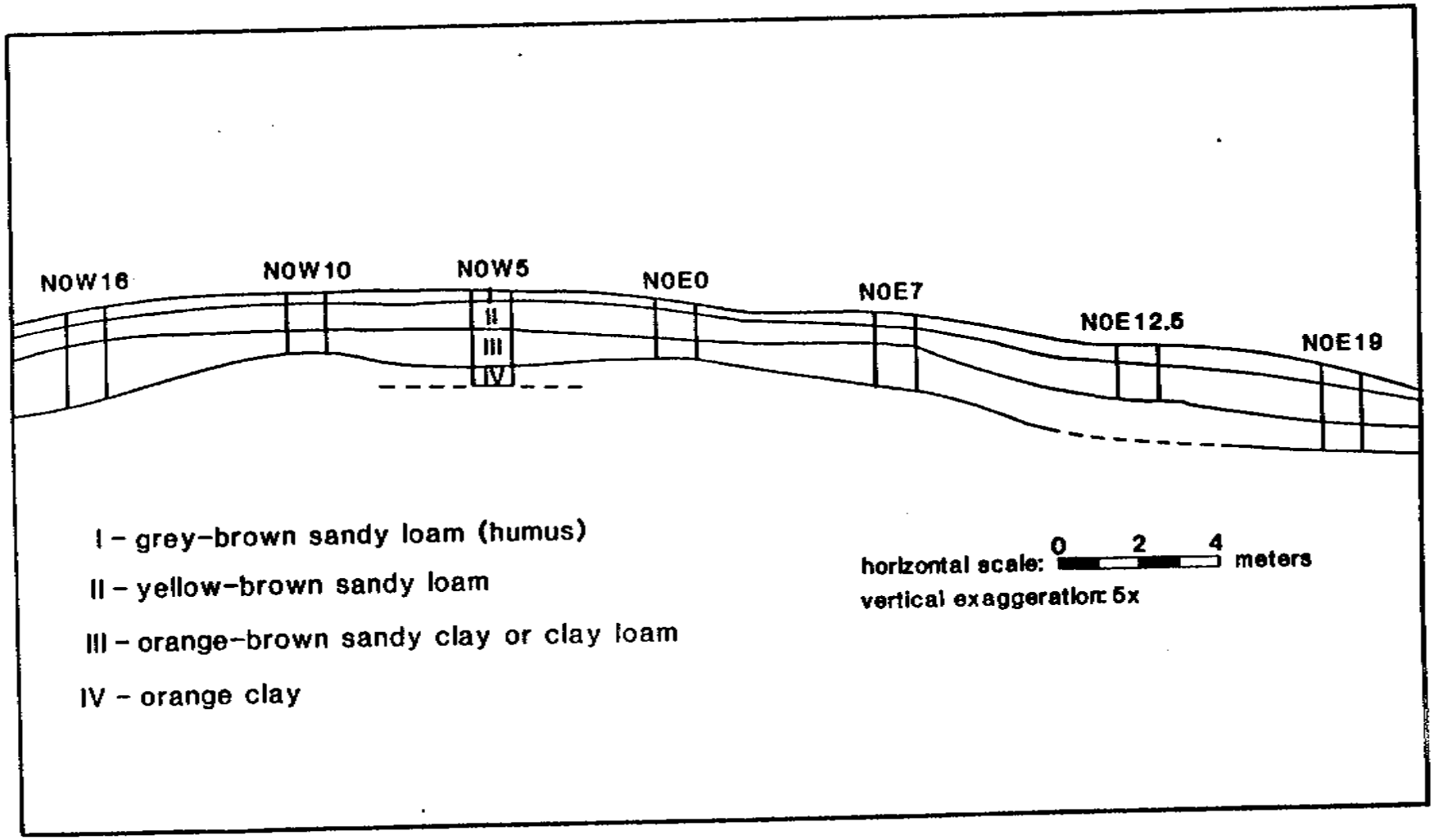


FIGURE 21

Artifact Density Map - 7NC -H-20

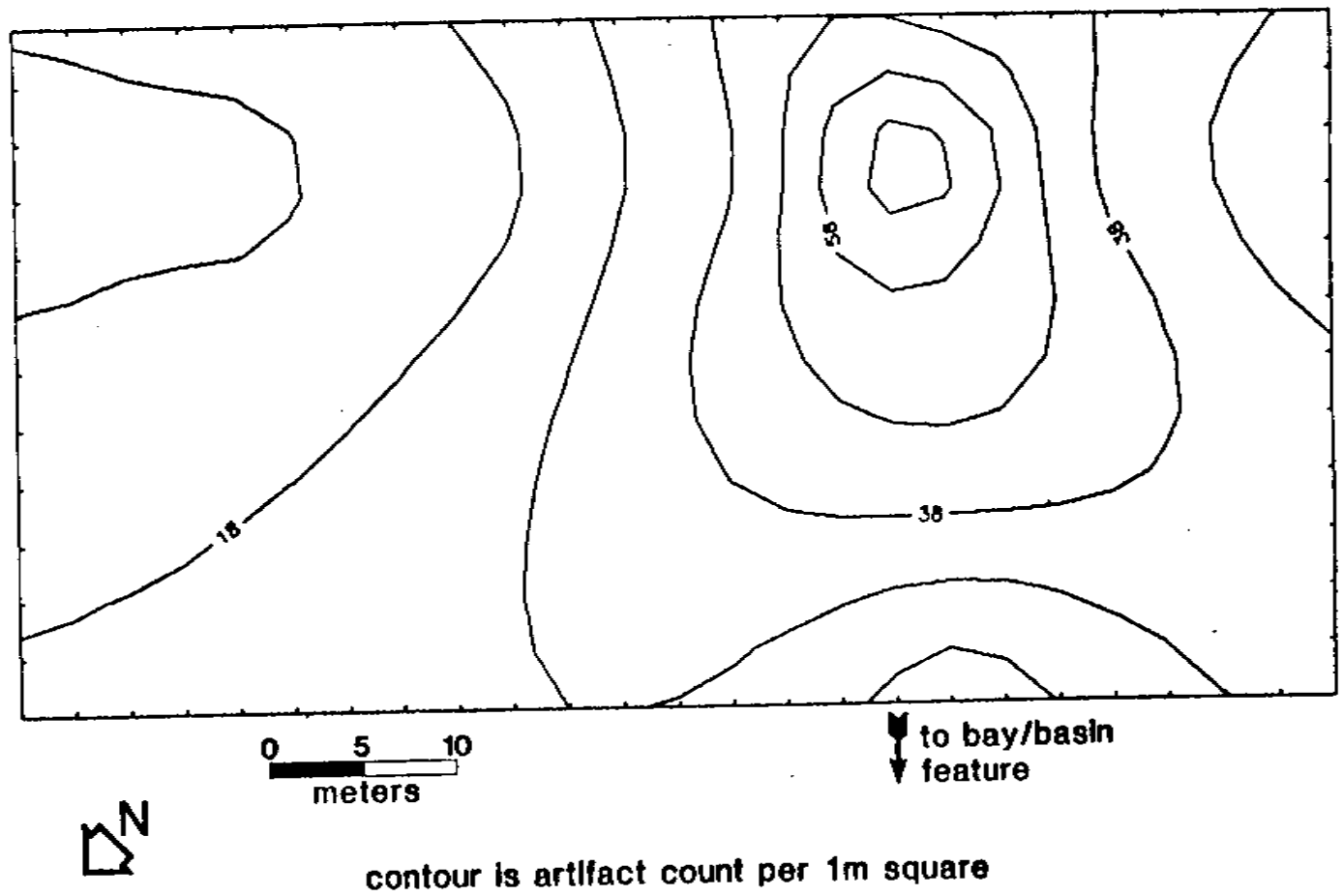


TABLE 8:

SUMMARY CATALOGUE - 7NC-H-20

Chipped Stone Artifacts

site: 7NC-H-20 location: All Units level: All

	quartzite	quartz	chert	jasper	rhyolite	argillite	ferroue quartzite	chalcedony	other	TOTAL
flakes (cortex)	53(13)	190(26)	54(13)	16(6)	2		1	5(1)		321(59)
flake tool										
pebble tool										
ESBR		1								1
LSBR										
LSBD										
LA/WL I points				1						1
WL II points										
other points			1							1
FCR		5(4)								5(4)
TOTAL	53(13)	196(30)	55(13)	17(6)	2		1	5(1)		329(63)

determine the origins of bay/basin features and to help understand their depositional history as it related to human exploitation of these features. Figure 22 shows the profile of the test trench and reveals that the size and water level of the bay/basin feature had changed dramatically through time.

In order to better understand the relationship of changing bay/basin size and water level, palynologists from Brown University cored the bay/basin to analyze the sediments for pollen and potential radiocarbon dates. Analysis of these data is not yet complete, but the preliminary results are included in Appendix VI. The core from the bay/basin was 4 meters deep and contained abundant pollen in most sections. Some sedimentary breaks were present including a sand lens at a depth of approximately 3.5 meters and a series of rhythmites below the sand lense. For the most part, the core does not suggest any dramatic changes in deposition within the bay/basin, except for the sand lense and the rhythmites. Preliminary analysis of the pollen shows some high concentrations of spruce pollen (*Picea*) from 60 cm on down through the core. A depositional hiatus may also be present down to 90 cm and may represent a Pleistocene/early Holocene boundary. Radiocarbon samples from the vicinity of the hiatus have been submitted and should reveal the chronology of the core's stratigraphy. A more complete report on the pollen and core stratigraphy will be submitted when the analysis is finished.

In sum, the results of the intensive testing of 7NC-H-20 indicate that significant archaeological sites are associated with the bay/basin features. This is especially true of unplowed settings, of which there are many in the Blackbird project area. The excellent preservation of pollen and other organic remains in the bay/basin features and the complicated history of their development present a situation where a detailed study of the interaction of human societies and their surrounding environment is possible at these sites. Consequently, these sites are clearly eligible for listing on the National Register of Historic Places and archaeological data recovery projects will be required for any of these sites which are impacted by the Route 13 project. A further discussion of the possible data recovery programs is presented in the management section of this report.

A second bay/basin feature (Basin A) (Plate 13), which is associated with sites 7NC-J-94, 95, 96 was also selected for intensive study. Excavations were undertaken at this site primarily to collect a series of pollen and macro-fossil samples and column soil samples from a deep intact profile within the bay/basin feature. Situated in a soybean field, the feature had been historically plowed but contained no crops or standing water at the time of the survey. Figure 23 shows a contour map of the site and Figures 24-27 show contour surface views of the feature.

One 2x2 meter test unit and seven auger holes were placed in a transect extending across the bay/basin feature from rim to rim (Figure 28). From these excavations, a stratigraphic profile of

FIGURE 22

Test Trench Profile - 7NC-H-20

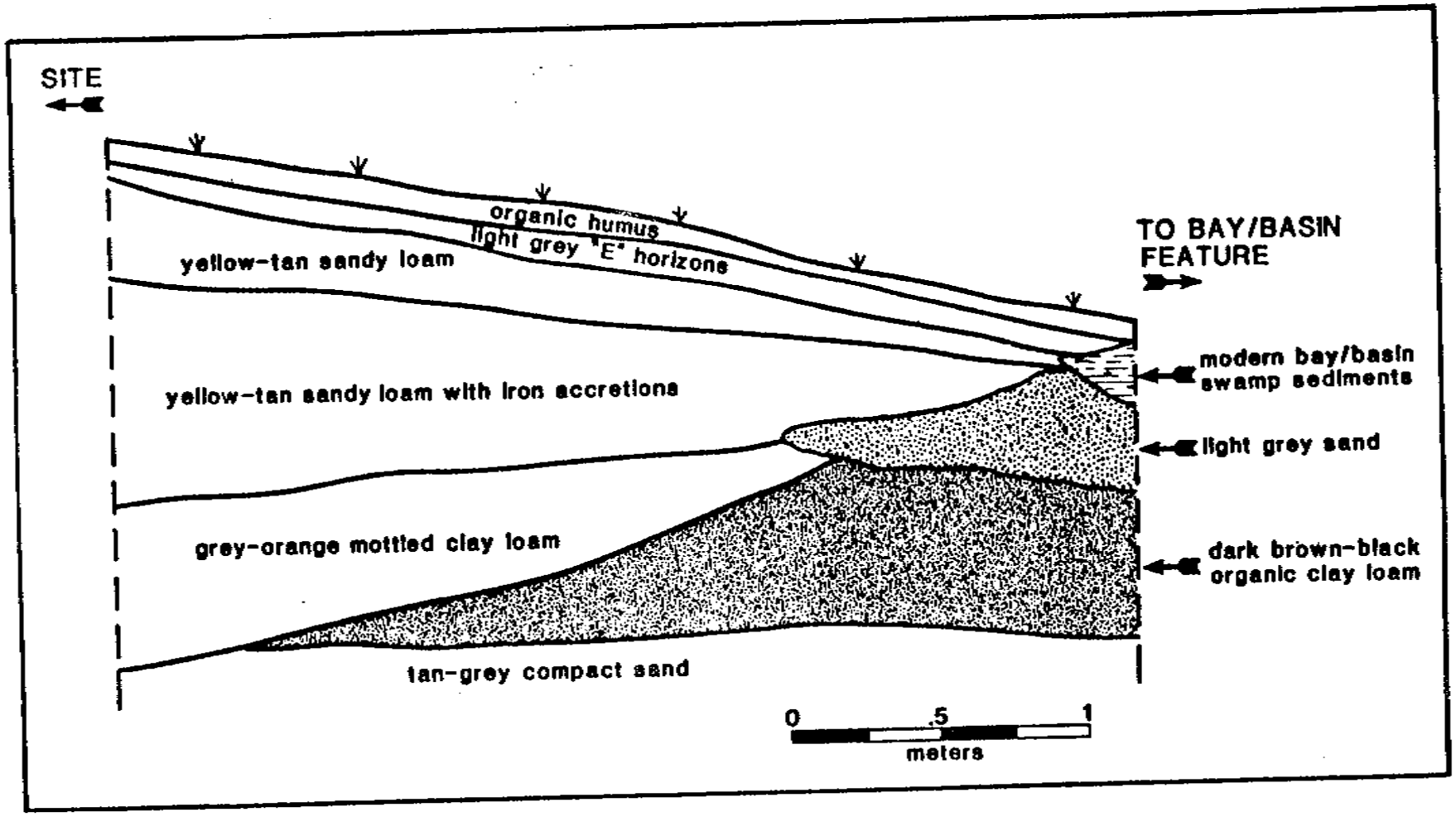


PLATE 13

Aerial View of "Basin A", Blackbird Study Area

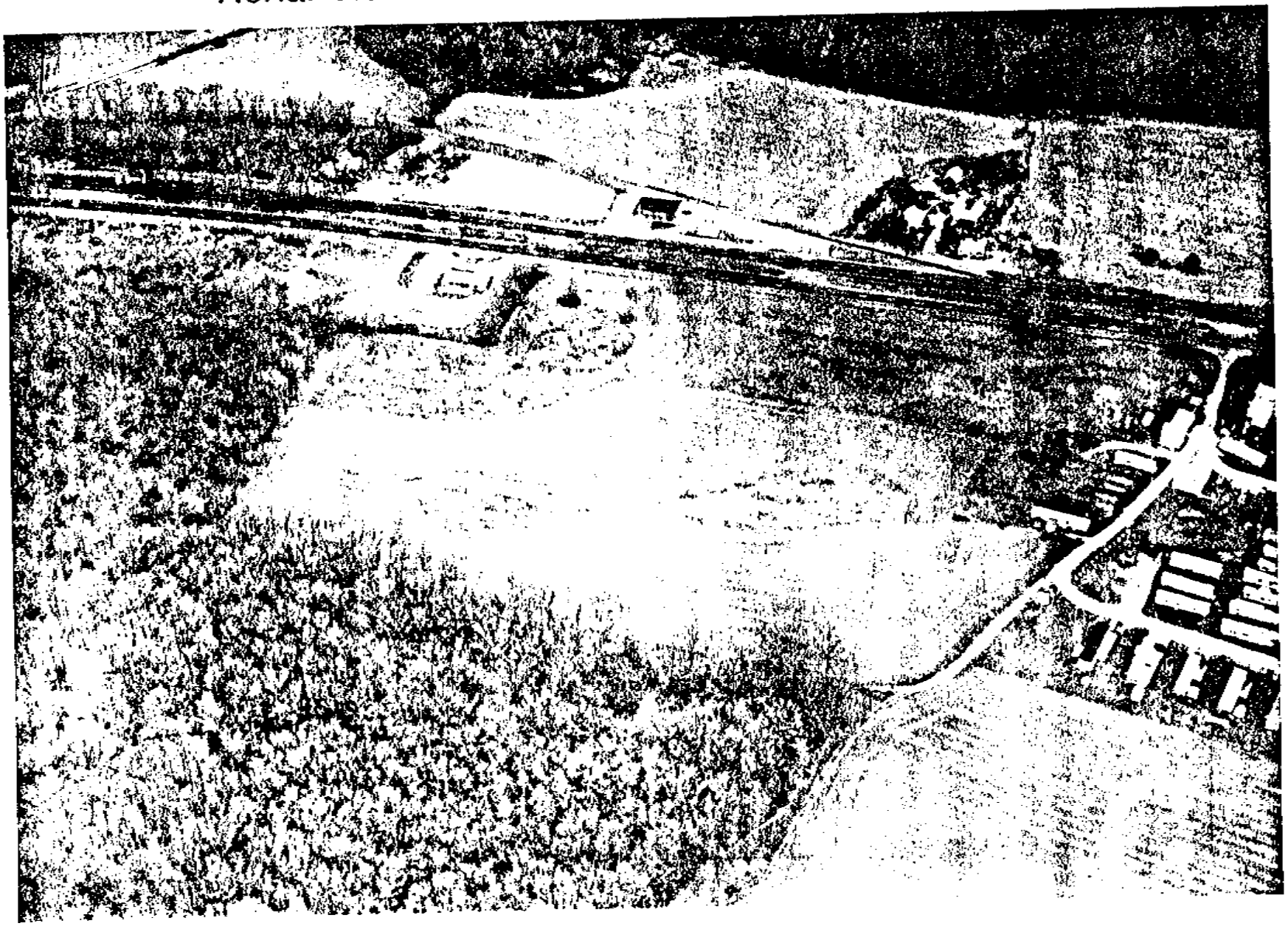


FIGURE 23

Topographic Map – Basin A

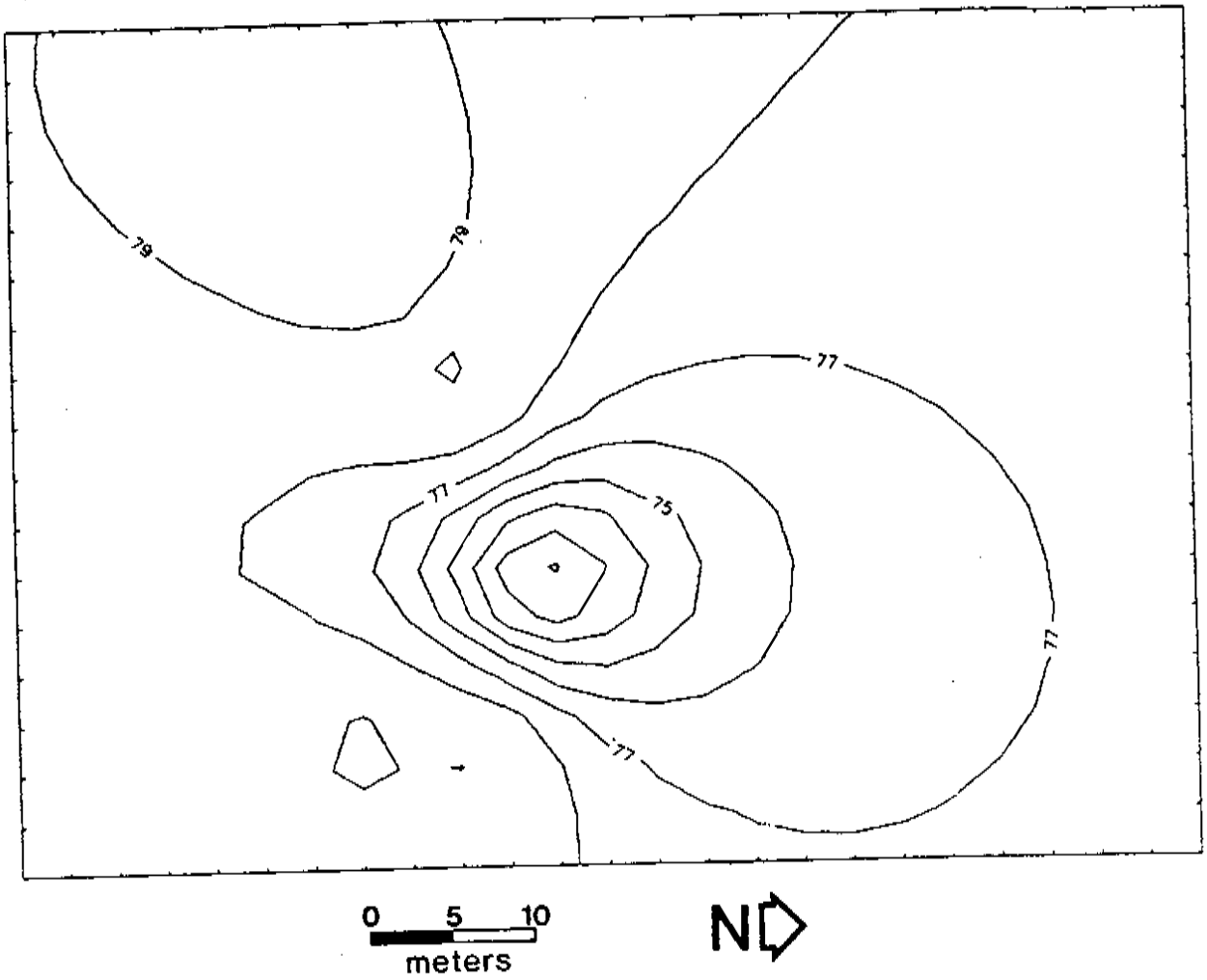


FIGURE 24

Surface View No. 1 – Basin A

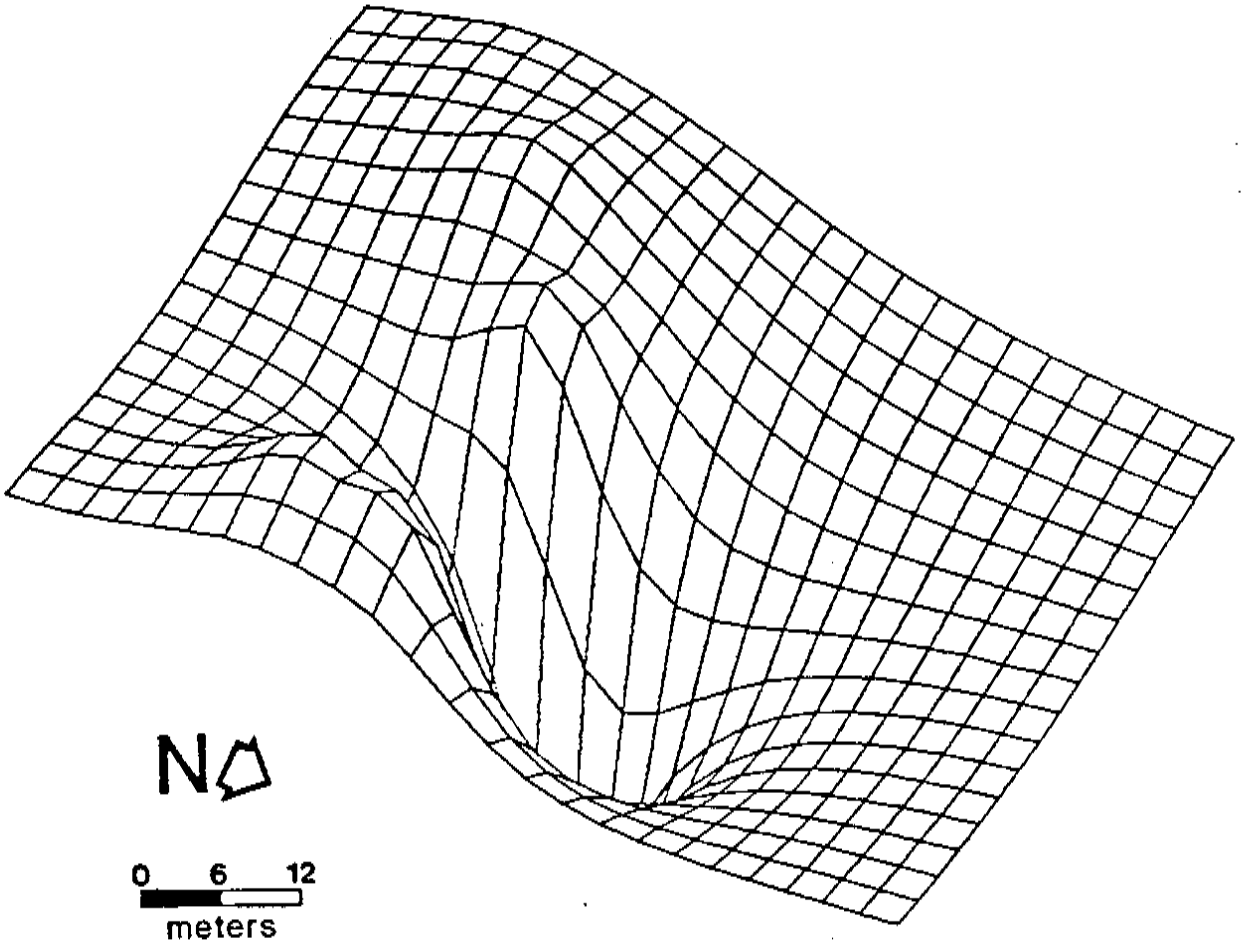


FIGURE 25

Surface View No. 2 – Basin A

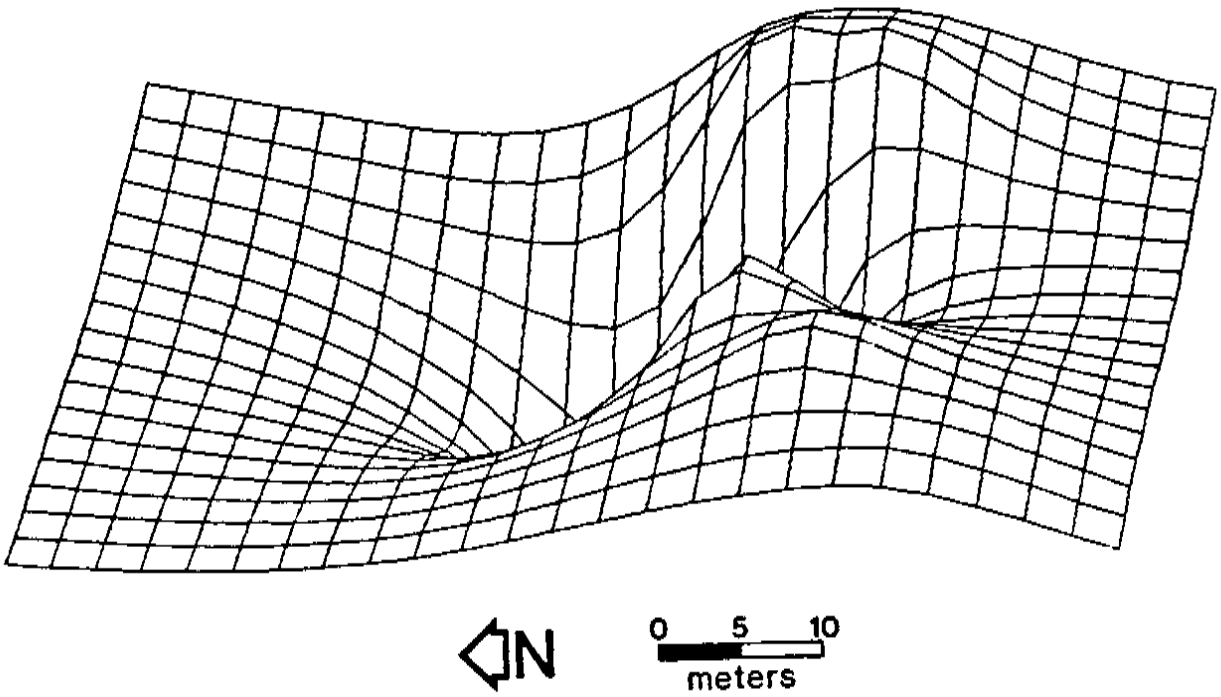


FIGURE 26

Surface View No. 3 - Basin A

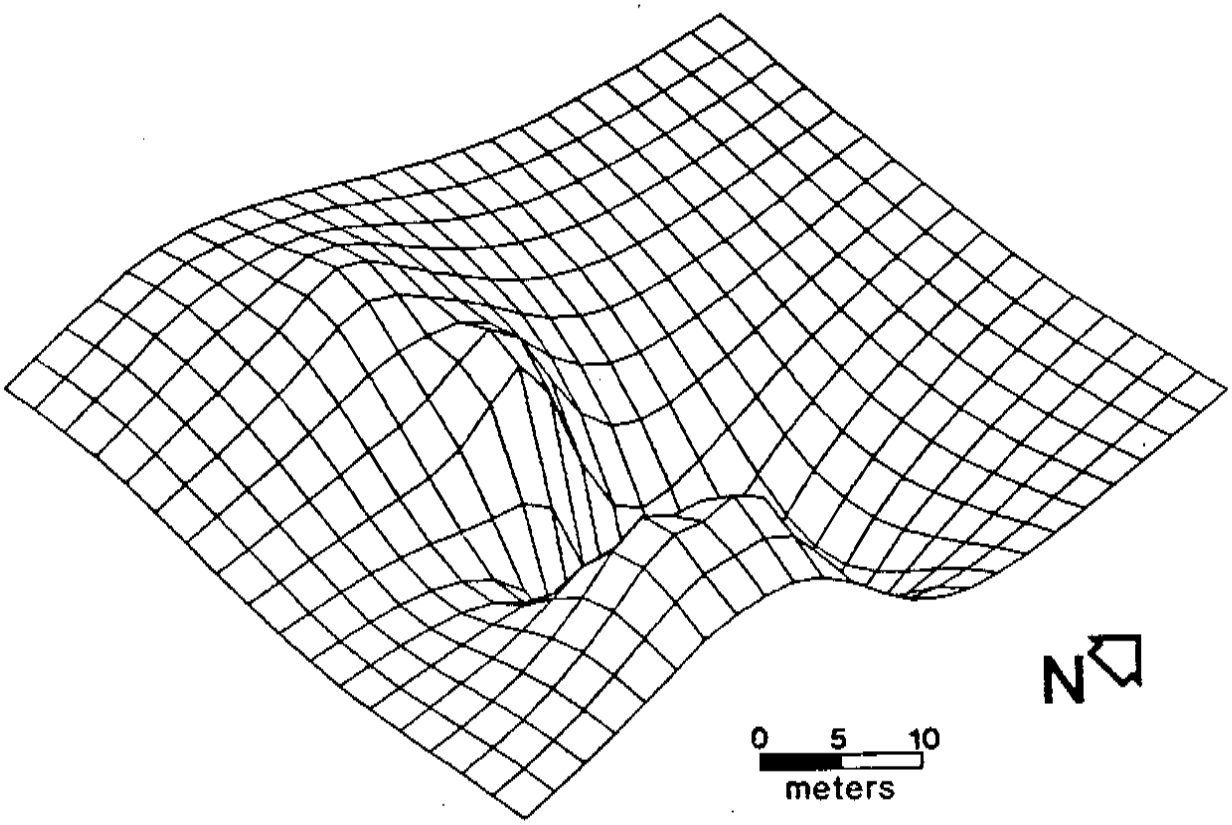


FIGURE 27

Surface View No. 4 – Basin A

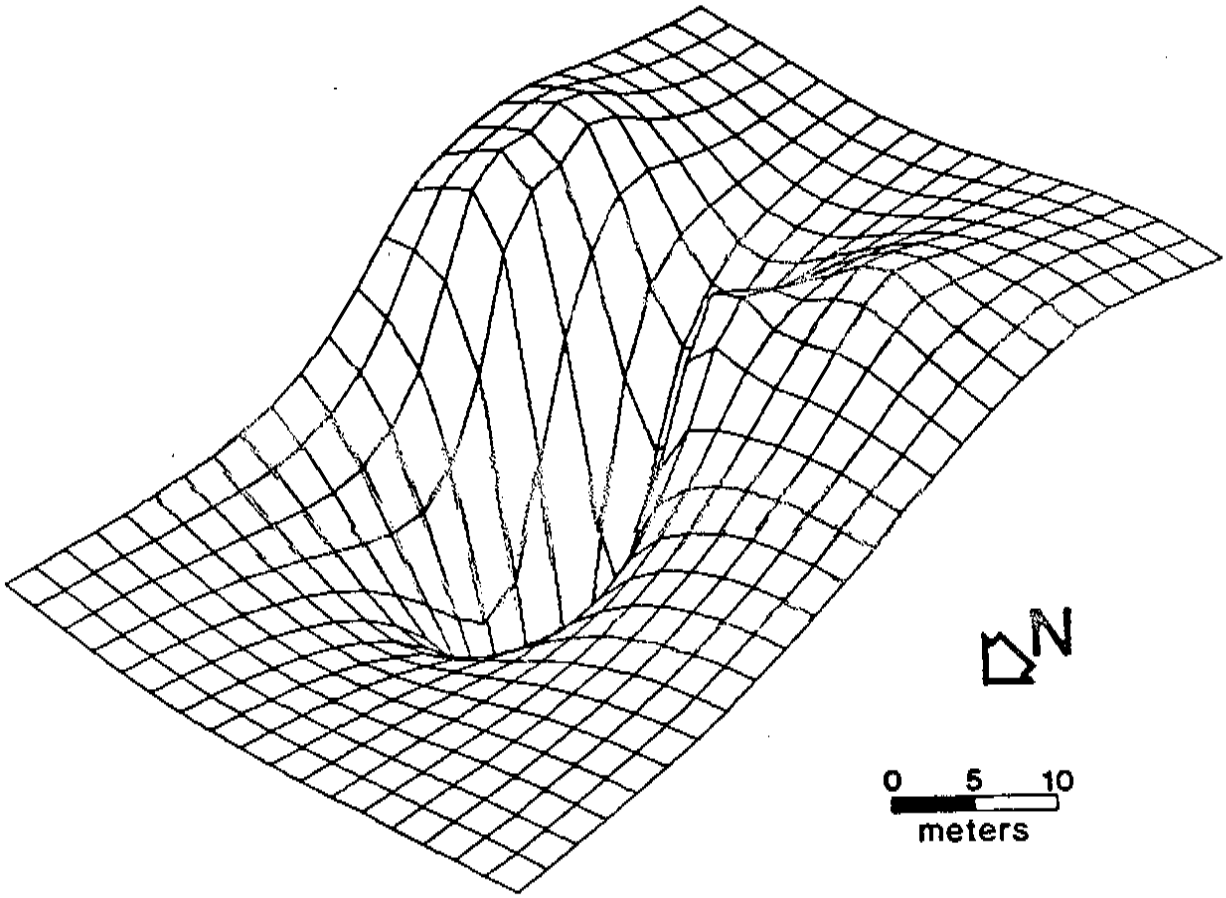
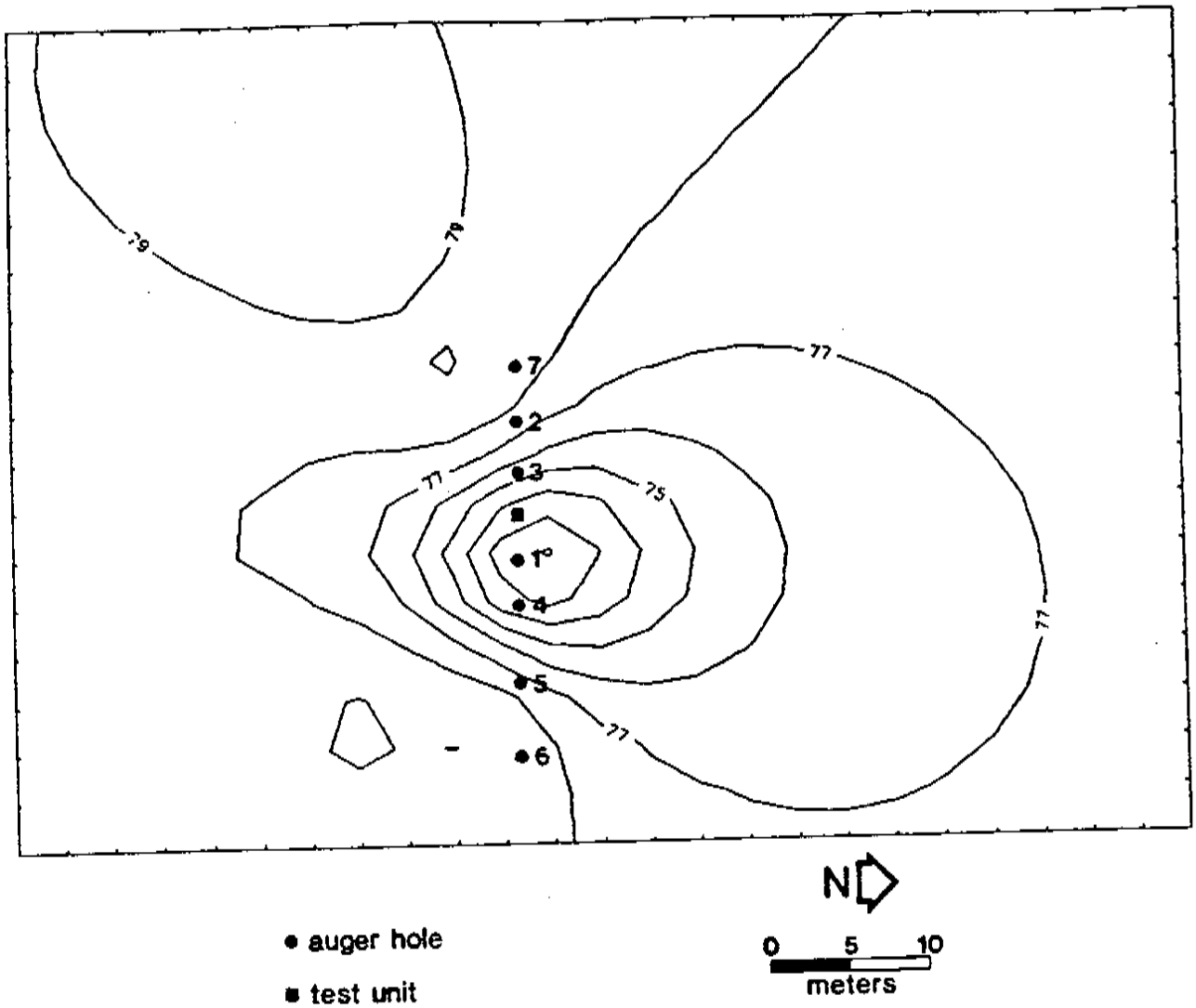


FIGURE 28

Test Unit Placement – Basin A



the feature was reconstructed (Figure 29). Figure 30 shows the profile of the test unit in the center of the bay/basin feature. Beneath a plow zone and slope wash layer approximately 55 cm thick lay a dark organic swamp layer approximately 10 centimeters thick. This organic layer was in turn underlain by light gray mottled sandy clay layer which extended a depth of 230 centimeters below the surface. Excavations were terminated at this depth due to ground water. Portions of the soil in the unit were screened, but no artifacts were recovered. The sandy clay contained much visible organic material, mostly plant root fragments, throughout its depth, and samples were taken for soil and pollen analysis. Results of these analyses are noted in Appendix VI.

Analyses of soil samples shows some significant changes in deposition. Changes in soil chemistry and clay size particle distributions are related to normal pedogenic profile development. However, silt and sand-sized particles show more varied distributions. From 40 cm to 140 cm in depth, there is a dramatic decrease in sand-sized particles and an increase in silt-sized particles. At 140 cm below surface there is a sand lense underlain by more silty sediments. Preliminary scans of pollen samples show abundant pollen, more than 11,000 grains per cc from the lower soil horizons below 130 cm. The abundant pine pollen at these depths suggest an early Holocene age for these sediments. The abundant silt-sized soil particles post-dating these materials may be equated with an early-middle Holocene episode of wind-blown deposition within the bay/basin. A similar depositional sequence is noted at another bay/basin by Rasmussen (1958) and at a sinkhole feature in northern Delaware (Custer and Griffith 1984).

In sum, the excavations at Basin A show that there are abundant preserved plant remains and pollen in the bay/basin features in cultivated fields. Because these features are drained it is possible to excavate deep units and expose deep profiles. These deep profiles are especially instructive because the pollen samples can be compared to column soil sample data to more completely understand the development of the bay/basin features. Exposure of such deep profiles is not possible in the bay/basin features which contain standing water. Unfortunately, cultivation of these features removes the top portion of the developmental soil sequence, especially at the bay/basin rim and makes it difficult to understand the changing size of the bay/basin features through time. However, these attributes of bay/basin features can be studied at the unplowed features. Thus in future data recovery programs it will be important to consider the pollen and soil data both from "dry" bay/basin features in cultivated fields and "wet" bay/basin features in unplowed settings.

FIGURE 29

Stratigraphic Profile – Basin A

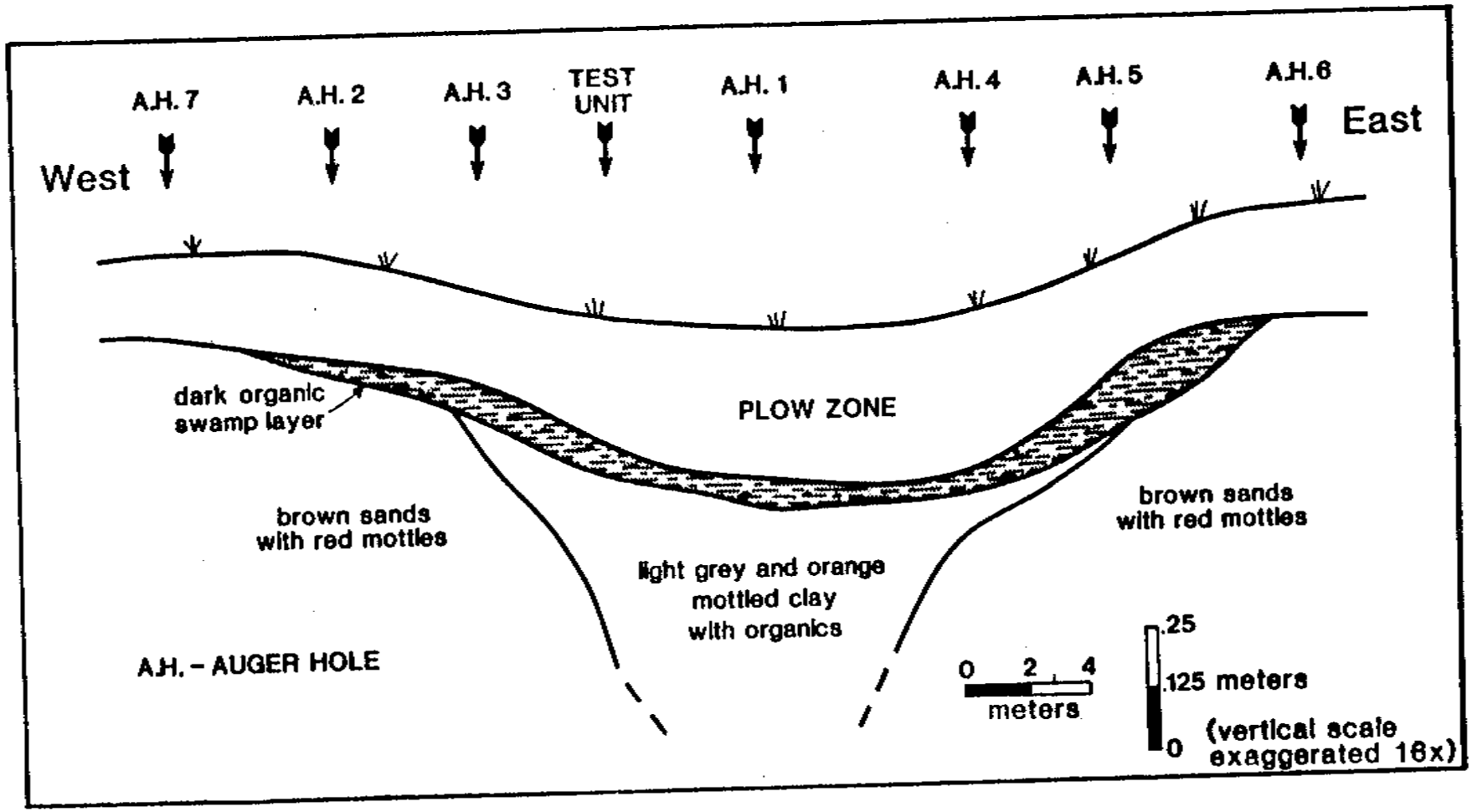
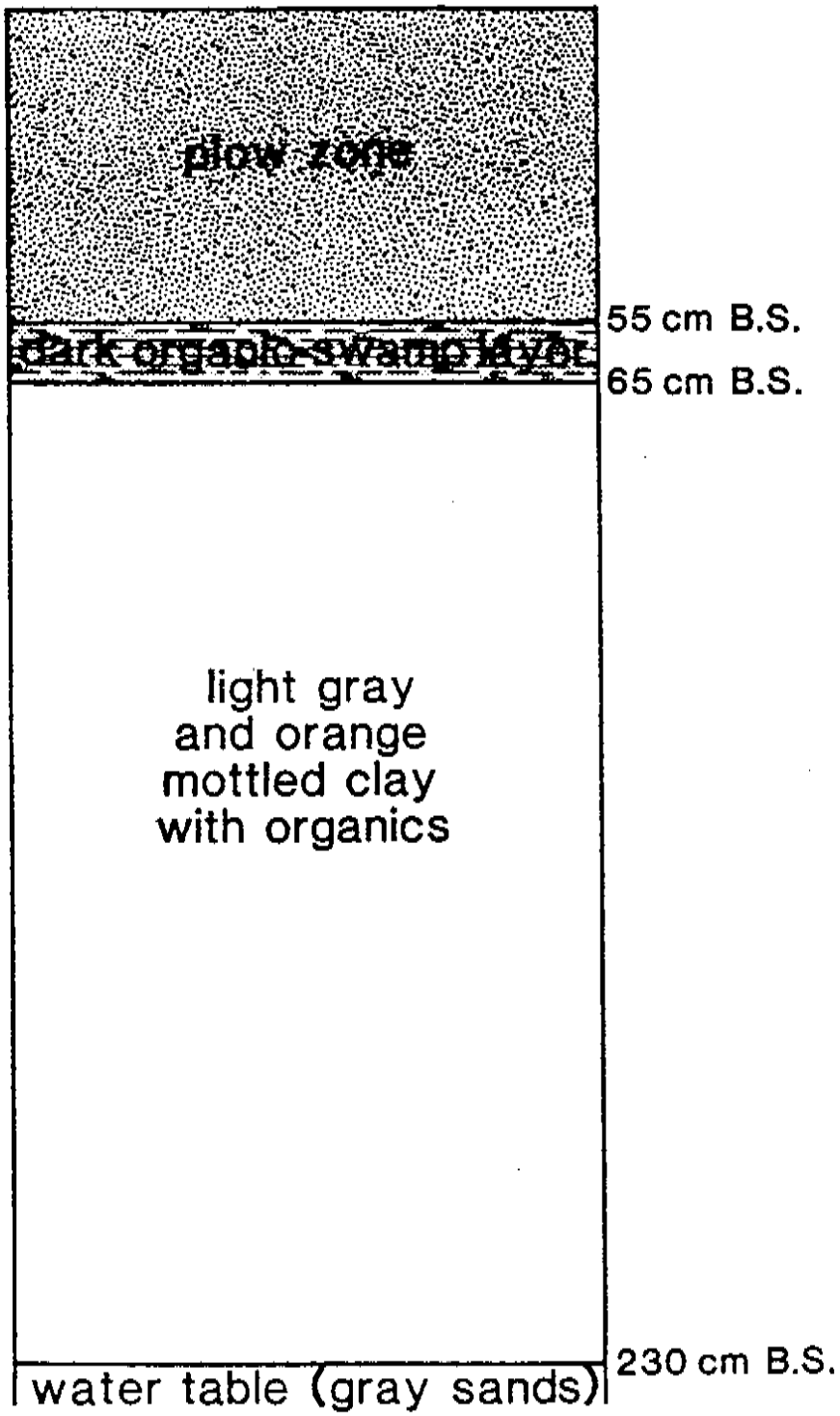


FIGURE 30

Basin A Unit Profile



HISTORIC SITE SURVEY RESULTS

This section of the report provides a description of the survey of standing structures and potential historical archaeological sites in each of the three project areas. The specific sites tested were those noted in the original Route 13 Planning Study (Custer et al. 1984: Appendix II, Appendix III). The purpose of this survey was to assess the archaeological potential of each standing structure and potential historic archaeological site as indicated by historic maps. These types of sites were field checked because the initial planning study only noted the presence of a mapped structure, or set of structures on a historic map or the presence of a standing structure in the BAHP inventory files.

As noted in the initial description of the field research methods, a series of variables were recorded in order to indicate the state of site preservation, the possibility of the site having multiple functions, and the size and density of the archaeological resources. Specific variables recorded included 1) the number and type of original outbuildings extant, which was assumed to reflect the degree to which a site had multiple functions and exhibited a range of well-defined activity/functional loci; 2) the visible disturbance levels at the site which were assumed to indicate the degree of preservation of the archaeological site; and 3) the number and type of archaeological features present, which was assumed to reflect the size and density of the material culture present at the site. The archaeological potential was derived from a subjective weighting of these three variables. The tables presented below list the results of the field check including the archaeological potential of each location visited. Historic significance data contained were obtained from Appendices II and III of the initial planning report (Custer et al. 1984). The values for the historic significance and the archaeological potential were then averaged to produce an overall cultural resource potential. This assessment was considered to be most important for the planning aspects of the present project.

St Georges Area. Table 9 provides a summary description of the historic sites surveyed in the St. Georges area and Figures 31 and 32 show their locations. In general, the sites within this area were the most poorly preserved within the present project area. The survey found that the locations had been heavily disturbed through soil erosion or machine disturbance. However, what undisturbed sites exist in the area such as N-5044 (agricultural complex, Plate 14), generally offer a high potential for intact subsurface features. Within the entire area, only two sites were given a high overall cultural resource potential. Historic resource locations #26 (agricultural complex) and #27 (agricultural tenant residence) in Subarea 3 both contained deep archaeological features and offer the potential for the recovery of material culture in a good context. The data recovered would provide significant comparative data for analysis with similarly dated materials from both rural and urban

KEY TO TABLES 9-11

Site Number - CRS Number assigned by the SHPO (N####), or archaeological resource number from Custer et al. (1984: Appendix III)

Hundred - Hundred within which the site is located

USGS Quad - USGS 7.5' quadrangle within which the site is located

Date - Estimated date of the structure

Functions - One or more functions of the structure

AGBLG	-	Agricultural Outbuilding
AGCX	-	Agricultural Complex
AGMCX	-	Agricultural-Mill Complex
AGTEN	-	Agriclutural Tenant Dwelling/Farm
ALMHSE	-	Almshouse
BANK	-	Bank
BRID	-	Bridge
BSSH	-	Blacksmith/Whitesmith Shop
CAUWY	-	Causeway
CCBLG	-	Canal Company Building
CEM	-	Cemetary
CHUR	-	Church
COMM	-	Commerical Structure
DWCX	-	Dwelling Complex
EST	-	Estate
GMCX	-	Gristmill Complex
GOVBLG	-	Government Building
HISTD	-	Historic District
HOT	-	Hotel
INDTEN	-	Industrial Tenant
LANOP	-	Landing Operation
LMKILN	-	Lime Kiln
LTHSE	-	Lighthouse
MANUFY	-	Manufactory
MMCX	-	Multiple-Mill Complex
MWHSE	-	Migrant Worker House
PEACH	-	Peach House
PEAORC	-	Peach Orchard
PHYS	-	Physician's Office
PLANT	-	Plantation
PO	-	Post Office
RR	-	Railroad Bed
RRR	-	Railroad-related
RRSTA	-	Railroad Station
RT	-	Racetrack
SCH	-	School
SCOSTA	-	Stagecoach Station
SERVST	-	Service Station
SLAVQ	-	Slave Quarters
SMCX	-	Sawmill Complex
SOMCX	-	Sorghum Mill Complex

STO	-	Store
STRUC	-	Structure
TAV	-	Tavern, Inn
TENANT	-	Tenant House
VESSEL	-	Vessel(sunken)
WARE	-	Warehouse
WKDW	-	Worker Dwelling
WKSH	-	Workshop

Historic Signif. - Historic Significance of the Site

Primary Disturb. - Primary Disturbance to the Site

Number of Outbuildings - Number of Outbuildings on the Site

Number of Features - Number of Features on the Site

Archaeo. Potent. - Archaeological Potential of the Site

Total Resource Potent. - Total Resource Potential is the combined average of the Historic Significance and Archaeological Potential of the Site.

TABLE 4: ST GEORGE HISTORIC SITES - SUMMARY DESCRIPTION

SITE NUMBER	HUNDRED	USGS QUAD	DATE	FUNCTIONS	HISTORIC SIGNIF.	PRIMARY DISTURB.	NUMBER OF OUTBUILDINGS	NUMBER OF FEATURES	ARCHAEO. POTENT.	TOTAL RESOURCE POTENT.
31	RED LION	SAINT GEORGES	P1849	SCH	M	REMOVL STRCT	0	-1	H	2
32	RED LION	SAINT GEORGES	P1849	ROCK	H	REMOVL STRCT	0	2	M	2
33	RED LION	SAINT GEORGES	P1868	DGTEN	H	REMOVL STRCT	0	-1	M	2
34	RED LION	SAINT GEORGES	P1849	DGTEN	H	REMOVL STRCT	0	-1	L	3
35	RED LION	SAINT GEORGES	P1849	DGTEN	H	REMOVL STRCT	0	-1	L	3
36	RED LION	SAINT GEORGES	P1849	DGTEN	H	REMOVL STRCT	0	-1	L	3
39	RED LION	SAINT GEORGES	P1849	ROCK	H	REMOVL STRCT	0	0	L	4
50	RED LION	SAINT GEORGES	1849-1868	ROCK	H	TOTAL PLOW	0	0	L	4
26	RED LION	SAINT GEORGES	P1849	ROCK	H	REMOVL STRCT	4	2	H	1
27	RED LION	SAINT GEORGES	1849-1868	DGTEN	H	REMOVL STRCT	0	1	H	1
28	RED LION	SAINT GEORGES	P1849	DGTEN	H	TOTAL PLOW	0	0	L	4
1027	RED LION	SAINT GEORGES	1868-1893	DWLK	M	TOTAL PLOW	0	0	L	4
N4991	RED LION	SAINT GEORGES	1920	RPID	L	MOTORE DISTU	0	0	L	4
N5044	RED LION	SAINT GEORGES	A1893	DWLK	M	UNDISTURBED	7	-1	H	2
21	RED LION	SAINT GEORGES	P1849	ROCK	H	REMOVL STRCT	0	0	L	4
22	RED LION	SAINT GEORGES	1849-1868	DGTEN	H	REMOVL STRCT	0	0	L	4
25	RED LION	SAINT GEORGES	1849-1868	DGTEN	H	TOTAL PLOW	0	0	L	4

FIGURE 31

Standing Structure Data from BAHP Files – St. Georges Area

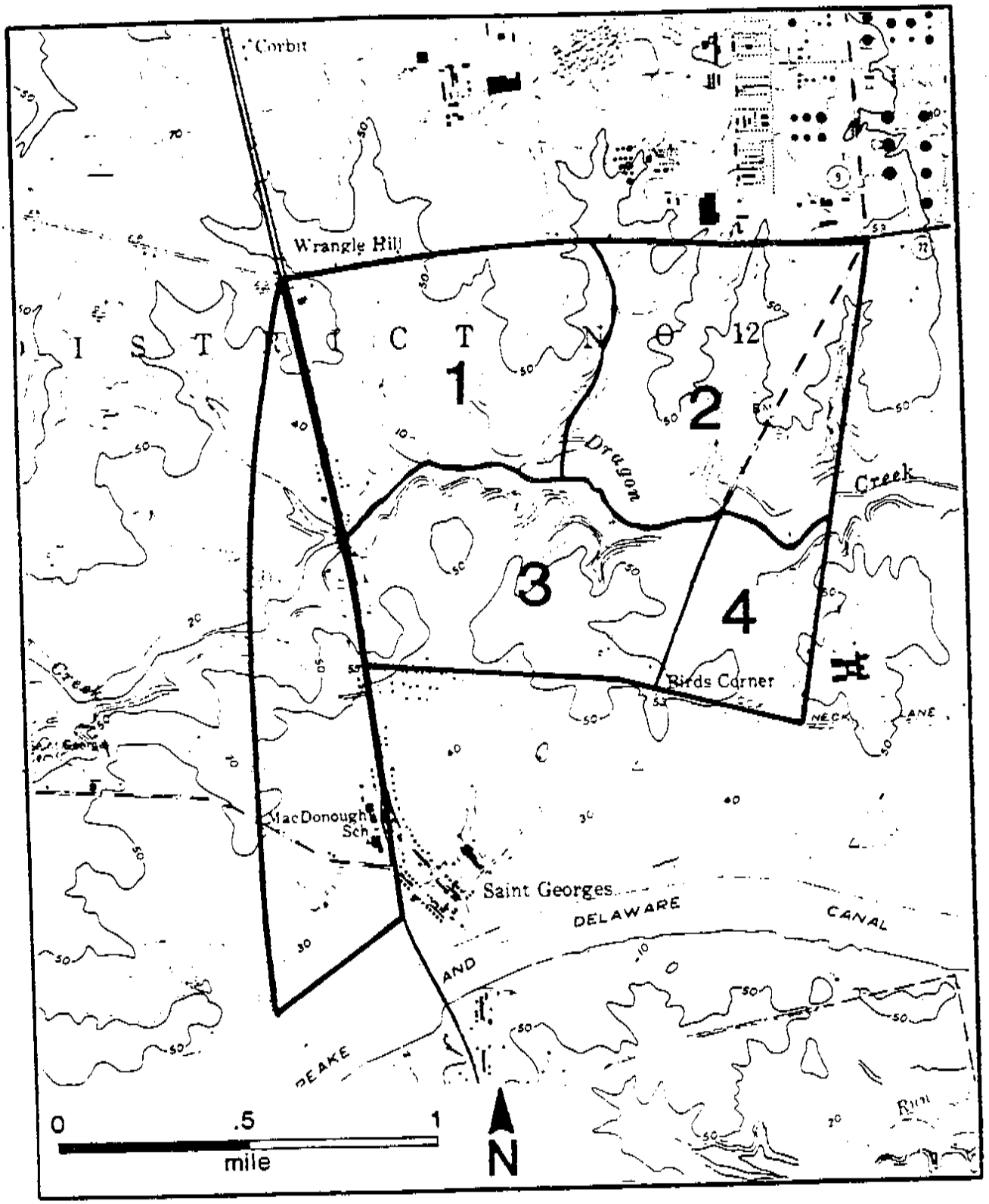


FIGURE 32
Historic Archaeological Resources Data – St. Georges Area

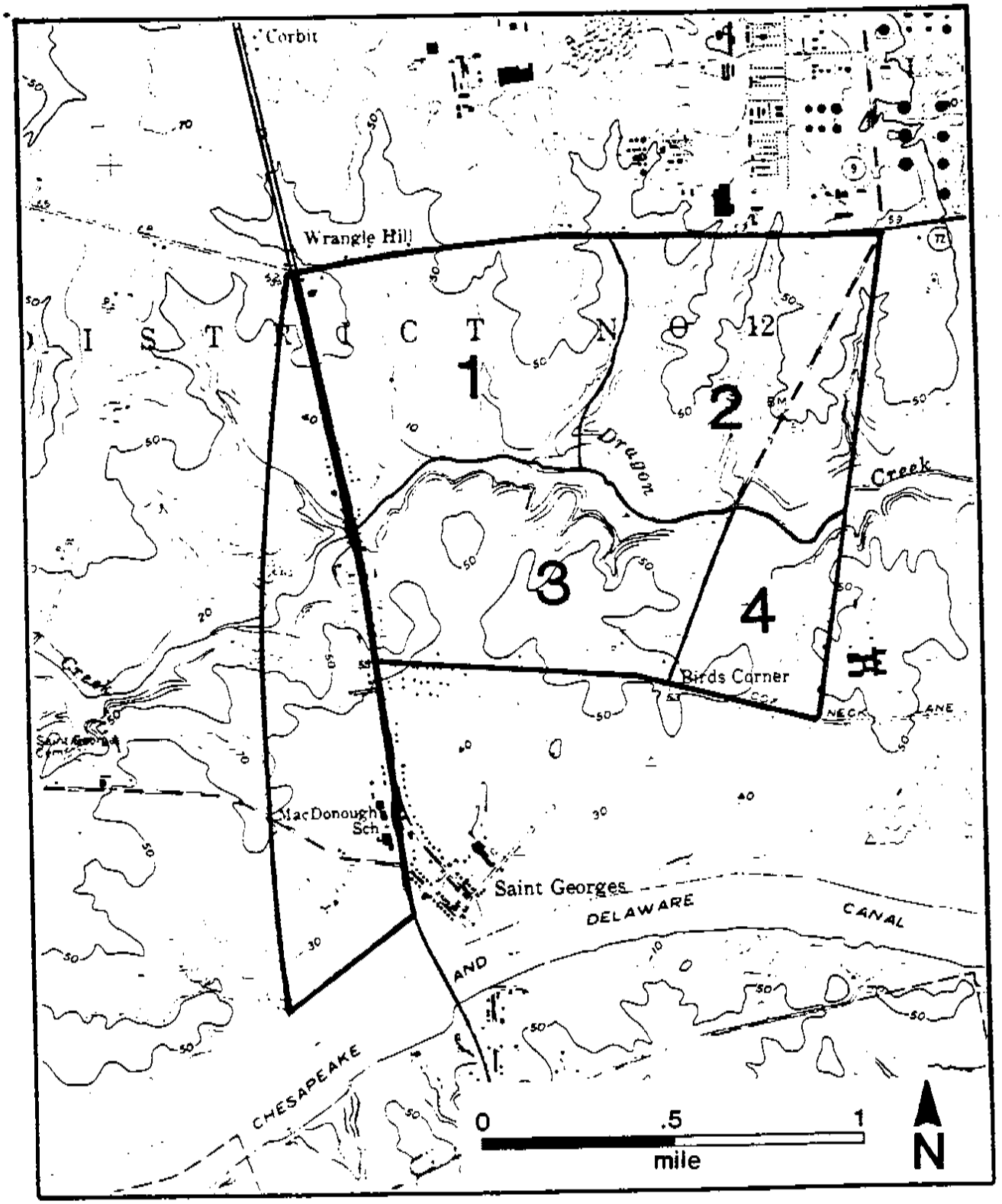


PLATE 14

Structure N-5044, Looking North from Cox Neck Lane

contexts within Delaware.

Appoquinimink Area. Table 10 provides a summary description of the sites surveyed in the Appoquinimink area and Figures 33 and 34 show their locations.

The present survey identified one of the best preserved "Peach Boom" period sites within the entire planning corridor. The location, N-432, known as "Monterey" (Subarea 6), contains an undisturbed assemblage of the original mid-19th century support buildings associated with the estate. Since no sites from this period or socio-economic level have been excavated in Delaware, it offers tremendous potential to yield information on the material culture of this period of Delaware history.

The "industrial" historic site type was well represented in the area. The intersection at Matthews Corner, southeast of Odessa, comprised a mid-18th century to mid-19th century manufacturing/industrial hamlet. The Duncan Beard site, N-417, the residence and shop of a well-known Delaware silversmith and cabinetmaker, presents a unique opportunity to examine the archaeological evidence from this site type. The data recovered from the excavation could be compared to sites of this period and function already excavated in New England and Williamsburg and would provide a foundation for future work in Delaware and surrounding states. Also contained within this hamlet was location #255, a mid-19th century tile manufactory, and #259, a mid-19th century schoolhouse. The range of site types at Matthews Corner provides a settlement pattern very similar to that already investigated in the Delaware Route 4 Corridor and the data recovered could be effectively compared to the Wilson-Slack Agricultural Complex (Coleman et. al. 1984).

Delaware's agricultural history is also well represented in the Appoquinimink area. One site, N-5141 (agricultural complex, Plate 15), is a particulary well-preserved standing structure and offers the potential for the recovery of significant architectural and material culture information. The only sites attributable to the Colonial Settlement Period (1638-1681) were also found in this area. Within the present study area, only N-1309, Drawyer's Causeway, was included in the planning subareas. While of only medium archaeological potential, the location is invaluable to our knowledge of early transportation in Delaware.

Blackbird Area. Table 11 provides a listing of historic sites surveyed in the Blackbird area and Figures 35 and 36 shows site locations. In general, the historic resources within the Blackbird area have suffered the most disturbance of the three study areas as a result of increased agricultural production. The result has been the removal of numerous structures and the plowing of previously undisturbed sites. Nevertheless, several historic cultural resources have been singled out for special mention.

TABLE 19: APPOQUINIMINK HISTORIC SITES - SUMMARY DESCRIPTION

SITE NUMBER	HUNDRED	USGS QUAD	DATE	FUNCTIONS		HISTORIC SIGNIF.	PRIMARY DISTURB.	NUMBER OF OUTBUILDINGS	NUMBER OF FEATURES	ARCHAEO. POTENT.	TOTAL RESOURCE POTENT.
N9961	SAINT GEORGES	MIDDLETOWN	P1802	AGCX		H	REMOVL STRCT	4	1	H	1
160	SAINT GEORGES	MIDDLETOWN	1849-1868	INDTEN		H	REMOVL STRCT	0	-1	M	2
161	SAINT GEORGES	MIDDLETOWN	P1802	GNCX		H	REMOVL STRCT	0	-1	M	2
162	SAINT GEORGES	MIDDLETOWN	P1849	AGLX		H	REMOVL STRCT	0	-1	M	2
163	SAINT GEORGES	MIDDLETOWN	P1849	AGLX		H	REMOVL STRCT	0	-1	L	3
N1702	SAINT GEORGES	MIDDLETOWN	P1849	DGLX		H	MCHINE DESTU	0	0	L	3
N1709	SAINT GEORGES	MIDDLETOWN	1681	BRIO		H	MCHINE DESTU	0	-1	M	2
164	SAINT GEORGES	MIDDLETOWN	1849-1868	INDTEN		H	REMOVL STRCT	0	-1	H	1
165	SAINT GEORGES	MIDDLETOWN	1849-1868	INDTEN		H	REMOVL STRCT	0	-1	H	1
N5141	SAINT GEORGES	MIDDLETOWN	A1849	DWCX		H	PRIOR FLOW	1	-1	H	1
179	SAINT GEORGES	MIDDLETOWN	P1849	AGLX			PRIOR FLOW	5	2	H	1
183	SAINT GEORGES	MIDDLETOWN	P1849	DGLX		H	REMOVL STRCT	0	0	M	2
184	SAINT GEORGES	MIDDLETOWN	1849-1868	DWCX		H	REMOVL STRCT	0	0	H	1
915	SAINT GEORGES	MIDDLETOWN	1849-1868	DSTEN		H	REMOVL STRCT	0	0	L	3
916	SAINT GEORGES	MIDDLETOWN	1849-1868	DSTEN		H	REMOVL STRCT	0	0	L	3
917	SAINT GEORGES	MIDDLETOWN	1849-1868	DSTEN		H	REMOVL STRCT	0	0	L	3
918	SAINT GEORGES	MIDDLETOWN	1849-1868	ASTEN		H	REMOVL STRCT	0	0	L	3
920	SAINT GEORGES	MIDDLETOWN	1868-1893	DWCX		M	REMOVL STRCT	0	0	M	3
926	SAINT GEORGES	MIDDLETOWN	1868-1893	ASTEN		M	REMOVL STRCT	0	0	L	4
927	SAINT GEORGES	MIDDLETOWN	1868-1893	DSTEN		M	REMOVL STRCT	0	0	L	4
N432	SAINT GEORGES	MIDDLETOWN	1850	FDOCH	FDORC	H	UNDISTURBED	8	2	H	1
N5150	SAINT GEORGES	MIDDLETOWN	P1849	AGLX		H	UNDISTURBED	6	-1	H	1
N5159	SAINT GEORGES	MIDDLETOWN	P1849	AGLX		H	UNDISTURBED	6	-1	H	1
N5160	SAINT GEORGES	MIDDLETOWN	1849-1868	AGLX		H	MCHINE DESTU	3	-1	M	2
190	SAINT GEORGES	MIDDLETOWN	1849-1868	TENANT		H	MCHINE DESTU	0	-1	L	3
191	SAINT GEORGES	MIDDLETOWN	1849-1868	TENANT		H	REMOVL STRCT	0	-1	M	2
914	SAINT GEORGES	MIDDLETOWN	1868-1893	DSTEN		M	REMOVL STRCT	0	0	L	4
N5178	SAINT GEORGES	MIDDLETOWN	P1849	AGLX		H	LNDSCAPNG	4	-1	H	1
N5179	SAINT GEORGES	MIDDLETOWN	P1849	DGLX		H	UNDISTURBED	8	1	H	1
N5177	SAINT GEORGES	MIDDLETOWN	P1849	AGCX		H	REMOVL STRCT	5	-1	M	2
N154	SAINT GEORGES	MIDDLETOWN	1770	LHUE	TEM	H	UNDISTURBED	0	-1	H	1
N9909	SAINT GEORGES	MIDDLETOWN	1671	AGLX		H	REMOVL STRCT	0	-1	M	2
215	SAINT GEORGES	MIDDLETOWN	P1849	AGLX		H	LNDSCAPNG	7	2	H	1
216	SAINT GEORGES	MIDDLETOWN	P1849	AGCX		H	SOIL EROSN	3	1	H	1
N110	SAINT GEORGES	MIDDLETOWN	1846	FDOCH	FDORC	H	REMOVL STRCT	3	-1	H	2
229	APPOQUINIMINK	MIDDLETOWN	P1802	GNCX		H	REMOVL STRCT	0	-1	M	2
230	APPOQUINIMINK	MIDDLETOWN	P1849	INDTEN		H	REMOVL STRCT	0	-1	M	3
231	APPOQUINIMINK	MIDDLETOWN	1849-1868	INDTEN		H	LNDSCAPNG	7	-1	H	1
232	APPOQUINIMINK	MIDDLETOWN	1849-1868	STEW		H	LNDSCAPNG	3	-1	H	1
821	APPOQUINIMINK	MIDDLETOWN	1849-1868	AGLX		H	MCHINE DESTU	0	2	M	2
N9999	APPOQUINIMINK	MIDDLETOWN	1883	AGLX		H	LNDSCAPNG	3	1	M	2
N9991	APPOQUINIMINK	MIDDLETOWN	P1849	AGLX		H	LNDSCAPNG	4	1	M	2
251	APPOQUINIMINK	MIDDLETOWN	P1849	AGTEN		H	TOTAL FLOW	0	0	L	4
253	APPOQUINIMINK	MIDDLETOWN	1849-1868	AGTEN		H	TOTAL FLOW	0	0	L	4
255	APPOQUINIMINK	MIDDLETOWN	1849-1868	AGCX		H	TOTAL FLOW	0	0	L	4
256	APPOQUINIMINK	MIDDLETOWN	1849-1868	AGTEN		H	TOTAL FLOW	0	0	L	4
260	APPOQUINIMINK	MIDDLETOWN	1849-1868	ASTEN		H	TOTAL FLOW	0	0	L	4
262	APPOQUINIMINK	MIDDLETOWN	1849-1868	ASCX		H	TOTAL FLOW	0	0	L	4
N9902	APPOQUINIMINK	MIDDLETOWN	P1849	AGBLDG		H	UNDISTURBED	4	1	H	1
N9913	APPOQUINIMINK	MIDDLETOWN	1836	AGLX		H	LNDSCAPNG	2	-1	M	2

see key on page 96 for terminology descriptions

TABLE 10 (CTD.)

SITE NUMBER	HUNDRED	USGS QUAD	DATE	FUNCTIONS	HISTORIC SIGNIF.	PRIMARY DISTURB.	NUMBER OF OUTBUILDINGS	NUMBER OF FEATURES	ARCHAEO. POTENT.	TOTAL RESOURCE POTENT.
N3965	APPOQUINIMINK	MIDDLETOWN	1820-1850	AGCX	H	REMOVL STRCT	3	3	H	1
254	APPOQUINIMINK	MIDDLETOWN	1849-1868	AGTEN	H	TOTAL PLOW	0	0	L	4
255	APPOQUINIMINK	MIDDLETOWN	1849-1868	MANUFY	H	REMOVL STRCT	0	0	L	3
256	APPOQUINIMINK	MIDDLETOWN	P1849	AGTEN	H	PRTIAL PLOW	0	1	H	1
257	APPOQUINIMINK	MIDDLETOWN	1849-1868	AGTEN	H	TOTAL PLOW	0	0	L	4
259	APPOQUINIMINK	MIDDLETOWN	1849-1868	SCH	M	TOTAL PLOW	0	0	L	4
266	APPOQUINIMINK	MIDDLETOWN	P1849	AGTEN	H	TOTAL PLOW	0	0	L	4
N417	APPOQUINIMINK	MIDDLETOWN	C1767	MANUFY DWCX	H	REMOVL STRCT	0	-1	H	1
262	APPOQUINIMINK	MIDDLETOWN	1849-1868	AGTEN	H	REMOVL STRCT	0	0	L	4
263	APPOQUINIMINK	MIDDLETOWN	1849-1868	AGTEN	H	REMOVL STRCT	0	0	L	4
863	APPOQUINIMINK	MIDDLETOWN	1868-1893	STRUC	M	REMOVL STRCT	0	0	L	4
820	APPOQUINIMINK	MIDDLETOWN	1868-1893	STRUC	M	REMOVL STRCT	0	0	L	4
N214	APPOQUINIMINK	MIDDLETOWN	1773	AGCX	H	UNDISTURBED	2	1	H	1
N119	APPOQUINIMINK	MIDDLETOWN	P1849	AGCX PTAORC	H	UNDISTURBED	7	-1	H	1
N5872	APPOQUINIMINK	MIDDLETOWN	1849-1868	AGCX	H	REMOVL STRCT	0	-1	M	3
N5922	APPOQUINIMINK	MIDDLETOWN	1849-1868	AGTEN	H	REMOVL STRCT	1	-1	L	3
264	APPOQUINIMINK	MIDDLETOWN	1849-1868	AGTEN	H	REMOVL STRCT	0	-1	M	2
N5873	APPOQUINIMINK	MIDDLETOWN	P1849	AGCX	H	UNDISTURBED	8	-1	H	1

see key on page 96 for terminology descriptions

FIGURE 33

Standing Structure Data from BAHP Files – Appoquinimink Area

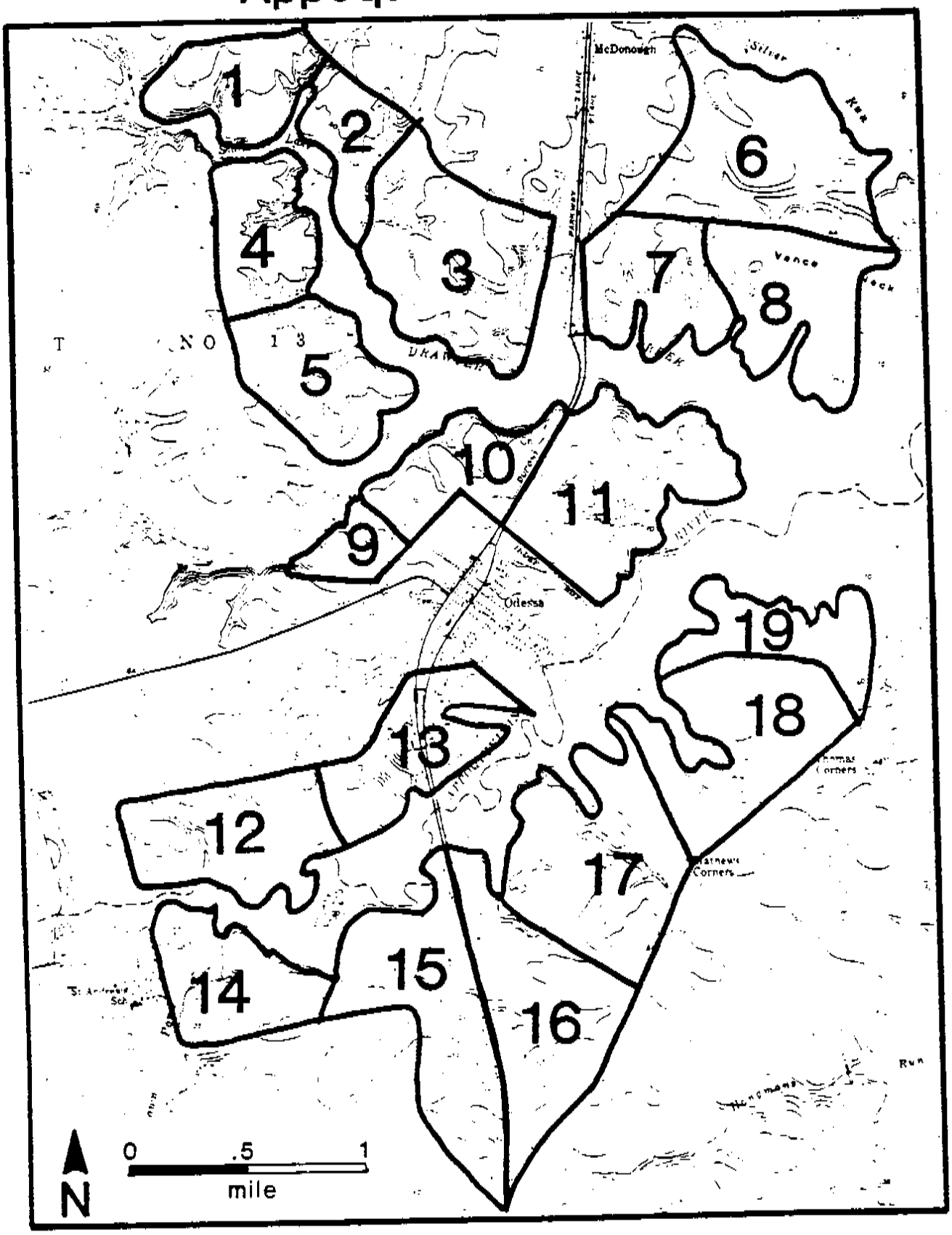


FIGURE 34

Historic Archaeological Resources Data – Appoquinimink Area

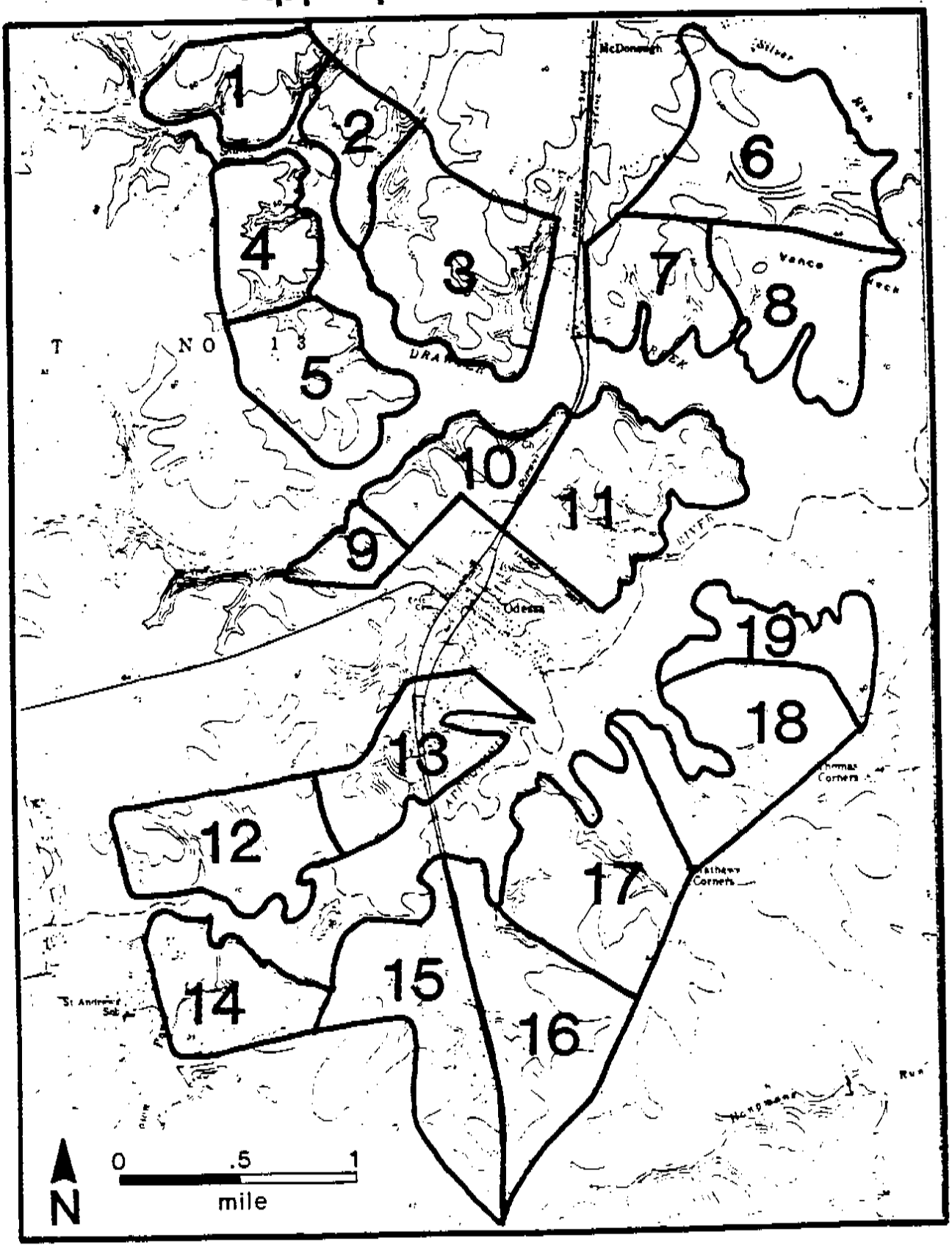


PLATE 15

Structure N-5141, Looking West from Road 428

TABLE 11: BLACKBIRD HISTORIC SITES - SUMMARY DESCRIPTION

SITE NUMBER	HUNDRED	USGS QUAD	DATE	FUNCTIONS		HISTORIC SIGNIF.	PRIMARY DISTURB.	NUMBER OF OUTBUILDINGS	NUMBER OF FEATURES	ARCHAEO. POTENT.	TOTAL RESOURCE POTENT.
N5919	APPOQUINIMINK	MIDDLETOWN	P1849	AGCR		H	UNDISTURBED	4	-1	H	1
284	APPOQUINIMINK	MIDDLETOWN	P1849	AGCR		H	UNDISTURBED	2	1	H	1
872	APPOQUINIMINK	MIDDLETOWN	1868-1893	AGCR		H	REMOVL STRCT	0	0	H	4
879	APPOQUINIMINK	MIDDLETOWN	1849-1868	DWCR		H	REMOVL STRCT	0	1	H	1
880	APPOQUINIMINK	MIDDLETOWN	1868-1893	STRUC		M	REMOVL STRCT	0	0	M	4
882	APPOQUINIMINK	MIDDLETOWN	1849-1868	AGCR		H	DETERIORATED	4	-1	H	1
886	APPOQUINIMINK	MIDDLETOWN	1849-1868	AGCR		H	REMOVL STRCT	0	-1	H	1
N423	APPOQUINIMINK	MIDDLETOWN	1847	CHUR	CEM	H	UNDISTURBED	2	1	H	1
N5857	APPOQUINIMINK	MIDDLETOWN	P1849	AGCR		H	UNDISTURBED	2	1	H	1
N5858	APPOQUINIMINK	MIDDLETOWN	C1940	AGCR		M	UNDISTURBED	0	-1	M	2
281	APPOQUINIMINK	MIDDLETOWN	1849-1868	AGCR		H	DETERIORATED	3	-1	H	1
283	APPOQUINIMINK	MIDDLETOWN	1849-1868	DWCR		H	REMOVL STRCT	0	0	L	4
285	APPOQUINIMINK	MIDDLETOWN	P1849	AGTEN		H	REMOVL STRCT	0	-1	L	4
357	APPOQUINIMINK	MIDDLETOWN	1849-1868	DWCR		H	UNDISTURBED	2	-1	H	1
843	APPOQUINIMINK	MIDDLETOWN	1868-1893	DWCR		H	REMOVL STRCT	0	-1	M	3
844	APPOQUINIMINK	MIDDLETOWN	1868-1893	DWCR		H	REMOVL STRCT	0	-1	M	3
N3918	APPOQUINIMINK	MIDDLETOWN	P1849	LANDP		H	SOIL EROSN	3	0	H	1
N3919	APPOQUINIMINK	MIDDLETOWN	P1849	AGCR		H	UNDISTURBED	4	-1	H	1
N3920	APPOQUINIMINK	MIDDLETOWN	C1690	AGCR		H	MCHINE DISTU	3	-1	M	2
N3921	APPOQUINIMINK	MIDDLETOWN	1849-1868	AGTEN		H	REMOVL STRCT	0	-1	H	1
282	APPOQUINIMINK	MIDDLETOWN	P1849	AGCR		H	REMOVL STRCT	2	1	L	4
841	APPOQUINIMINK	MIDDLETOWN	1849-1868	DWCR	LANDP	H	REMOVL STRCT	0	-1	M	2
N5878	APPOQUINIMINK	MIDDLETOWN	P1849	AGCR		H	UNDISTURBED	4	-1	M	3
N5879	APPOQUINIMINK	MIDDLETOWN	1849-1868	AGTEN		H	REMOVL STRCT	4	1	H	1
N5887	APPOQUINIMINK	MIDDLETOWN	P1849	AGCR		H		6	1	H	1
N5896	APPOQUINIMINK	MIDDLETOWN		STRUC		H	PRTIAL PLOW	0	-1	U	3
286	APPOQUINIMINK	MIDDLETOWN	P1849	AGCR		H	PRTIAL PLOW	3	1	M	2
287	APPOQUINIMINK	MIDDLETOWN	1849-1868	AGTEN		H	REMOVL STRCT	0	-1	M	2
288	APPOQUINIMINK	MIDDLETOWN	1849-1868	WKSH	STO	H	REMOVL STRCT	0	-1	L	4
891	APPOQUINIMINK	MIDDLETOWN	1868-1893	DWCR		M		0	2	H	1
892	APPOQUINIMINK	MIDDLETOWN	1849-1868	AGCR		H	MCHINE DISTU	0	-1	L	4
N5855	APPOQUINIMINK	MIDDLETOWN	P1849	AGCR		H		6	-1	H	1
N5856	APPOQUINIMINK	MIDDLETOWN	P1849	AGTEN		H	REMOVL STRCT	4	-1	M	2
889	APPOQUINIMINK	CLAYTON	1849-1868	AGCR		H	MCHINE DISTU	0	-1	M	2
1156	APPOQUINIMINK	MIDDLETOWN	1868-1893	AGTEN		H	TOTAL PLOW	0	1	M	2
N5846	APPOQUINIMINK	CLAYTON	P1849	AGCR		H	UNDISTURBED	6	1	H	1
N5888	APPOQUINIMINK	MIDDLETOWN	1868-1893	AGCR		H	UNDISTURBED	3	1	H	1
290	APPOQUINIMINK	CLAYTON	1849-1868	AGCR		H	REMOVL STRCT	1	-1	M	2
833	APPOQUINIMINK	CLAYTON	1868-1893	AGCR		M	UNDISTURBED	3	-1	H	1
838	APPOQUINIMINK	CLAYTON	1849-1868	DWCR		H	MCHINE DISTU	2	-1	M	2
N5848	APPOQUINIMINK	CLAYTON	1849-1868	ERSTA	PO	H	MCHINE DISTU	0	-1	L	4
N5851	APPOQUINIMINK	CLAYTON	P1868	ERSTA	STO	H	UNDISTURBED	2	1	H	1
N5852	APPOQUINIMINK	CLAYTON	1868-1893	DWCR		M	MCHINE DISTU	3	-1	M	3
N5854	APPOQUINIMINK	CLAYTON	P1849	HGCR		H	UNDISTURBED	3	-1	H	1
388	BLACKBIRD	CLAYTON	P1849	STRUC		U	PRTIAL PLOW	0	-1	L	4
889	APPOQUINIMINK	MIDDLETOWN	1868-1893	AGTEN		M	REMOVL STRCT	0	0	M	4
890	APPOQUINIMINK	MIDDLETOWN	1849-1868	AGTEN		H	REMOVL STRCT	0	0	M	4
N131	APPOQUINIMINK	CLAYTON	1849-1868	HGCR		H	UNDISTURBED	4	-1	H	1
N5847	APPOQUINIMINK	CLAYTON	1880	DWCR		M	MCHINE DISTU	3	-1	M	2
N5849	APPOQUINIMINK	CLAYTON	LATE 19TH C.	DOIDER		M	UNDISTURBED	0	1	M	2

see key on page 96 for terminology descriptions

TABLE 11 (CONT.)

SITE NUMBER	NAMED	MAP NAME	DATE	CONDITIONS	HISTORIC SIGNIF.	PRIMARY DESIGN.	NUMBER OF OUTBUILDINGS	NUMBER OF FEATURES	ARCHAEO. POTENT.	TOTAL RESOURCE POTENT.
[illegible]	APPOMOTENMINK	CLAYTON	P1860	DWEX	H	REMOVL STRCT	0	-1	L	4
[illegible]	APPOMOTENMINK	CLAYTON		DWEX	H	MOBILE DWELG	2	-1	M	2
[illegible]	APPOMOTENMINK	CLAYTON	1849-1868	AGEX	H	LNDSCAPNG	1	1	M	2
[illegible]	BLOCKERED	CLAYTON	P1849	GMEX	H	REMOVL STRCT	0	-1	H	1
[illegible]	BLOCKERED	CLAYTON	P1849	SMEX	H	UNDISTURBED	1	1	H	1
[illegible]	BLOCKERED	CLAYTON	P1849	AGEX	H	REMOVL STRCT	0	-1	H	1
[illegible]	BLOCKERED	CLAYTON	1849-1868	AGEX	H	REMOVL STRCT	0	1	M	2
[illegible]	BLOCKERED	CLAYTON	P1849	INDTEN	H	REMOVL STRCT	0	0	M	4
[illegible]	BLOCKERED	CLAYTON	1849-1868	DWEX	H	UNDISTURBED	6	1	H	1
[illegible]	BLOCKERED	CLAYTON	1868-1893	STRUC	M	LNDSCAPNG	2	-1	M	2
[illegible]	APPOMOTENMINK	CLAYTON	1849-1868	AGEXC	H	REMOVL STRCT	1	-1	M	3
[illegible]	APPOMOTENMINK	CLAYTON	1868	AGEX	H	REMOVL STRCT	1	1	M	2
[illegible]	BLOCKERED	CLAYTON	P1849	AGEX	H	UNDISTURBED	4	-1	H	1
[illegible]	BLOCKERED	MIDDLETOWN	1849-1868	AGTEN	H	TOTAL FLOW	0	0	M	4
[illegible]	BLOCKERED	MIDDLETOWN	1849-1868	DSTEN	H	TOTAL FLOW	0	0	M	4
[illegible]	BLOCKERED	CLAYTON	P1849	AGEX	H	REMOVL STRCT	2	-1	H	2
[illegible]	BLOCKERED	CLAYTON	P1849	AGEX	H	REMOVL STRCT	0	0	M	4
[illegible]	BLOCKERED	CLAYTON	1849-1868	DWEX	H	UNDISTURBED	4	-1	H	1
[illegible]	BLOCKERED	CLAYTON	P1849	AGEX	H	DETERIORATED	0	1	H	1
[illegible]	BLOCKERED	CLAYTON	1868-1893	DWEX	H	UNDISTURBED	2	1	M	2
[illegible]	BLOCKERED	CLAYTON	P1849	AGEX	H	UNDISTURBED	0	-1	M	3
[illegible]	BLOCKERED	CLAYTON	P1849	AGEX	H	REMOVL STRCT	1	-1	L	4
[illegible]	BLOCKERED	CLAYTON	P1849	AGEX	H	REMOVL STRCT	0	-1	L	4
[illegible]	BLOCKERED	CLAYTON	1849-1868	AGEX	H	REMOVL STRCT	0	-1	L	4
[illegible]	BLOCKERED	CLAYTON	1849-1868	DWEX	H	REMOVL STRCT	0	-1	L	4
[illegible]	BLOCKERED	CLAYTON	1868-1893	DWEX	H	REMOVL STRCT	0	0	M	4
[illegible]	BLOCKERED	CLAYTON	P1849	AGEX	H	DETERIORATED	1	1	H	1
[illegible]	BLOCKERED	CLAYTON	P1849	AGEX	H	PARTIAL FLOW	4	-1	M	2
[illegible]	BLOCKERED	CLAYTON	P1849	AGEX	H	UNDISTURBED	0	2	M	2
[illegible]	BLOCKERED	CLAYTON	1849-1868	AGTEN	H	UNDISTURBED	0	-1	H	1
[illegible]	BLOCKERED	CLAYTON	P1849	SOIL	H	UNDISTURBED	0	-1	H	1
[illegible]	BLOCKERED	CLAYTON	P1849	DWEX	H	UNDISTURBED	4	-1	H	1
[illegible]	BLOCKERED	CLAYTON	1849-1868	AGEX	H	UNDISTURBED	4	-1	H	1
[illegible]	BLOCKERED	CLAYTON	1868-1893	AGEX	H	REMOVL STRCT	0	-1	L	4
[illegible]	BLOCKERED	CLAYTON	1849-1868	AGTEN	H	REMOVL STRCT	0	0	L	4
[illegible]	BLOCKERED	CLAYTON	P1849	DWEX	H	REMOVL STRCT	0	-1	M	3
[illegible]	BLOCKERED	CLAYTON	P1849	AGEX	H	LNDSCAPNG	0	-1	M	2
[illegible]	BLOCKERED	CLAYTON	1849-1868	AGTEN	H	REMOVL STRCT	0	1	M	3
[illegible]	BLOCKERED	CLAYTON	1849-1868	AGEX	H	TOTAL FLOW	0	0	L	4
[illegible]	BLOCKERED	CLAYTON	1849-1868	DWTEN	H	UNDISTURBED	3	-1	H	2
[illegible]	BLOCKERED	CLAYTON	1868-1893	DWEX	H	REMOVL STRCT	1	-1	L	3
[illegible]	BLOCKERED	MIDDLETOWN	P1849	DWTEN	H	SOIL EROSN	3	-1	L	3
[illegible]	BLOCKERED	CLAYTON	1849-1868	AGEX	H	REMOVL STRCT	0	-1	H	1
[illegible]	BLOCKERED	CLAYTON	P1849	AGEX	H	TOTAL FLOW	0	0	L	4
[illegible]	BLOCKERED	TAYLORS BRIDGE	1868-1893	AGEX	H	REMOVL STRCT	3	-1	M	3
[illegible]	BLOCKERED	CLAYTON	1849-1868	AGTEN	H	REMOVL STRCT	0	0	L	4
[illegible]	BLOCKERED	CLAYTON	1849-1868	AGTEN	H	REMOVL STRCT	0	0	L	4
[illegible]	BLOCKERED	CLAYTON	P1849	AGEX	H	UNDISTURBED	2	-1	H	1
[illegible]	BLOCKERED	CLAYTON	1849-1868	AGEX	H	UNDISTURBED	4	1	H	1
[illegible]	APPOMOTENMINK	MIDDLETOWN	1849-1868	AGTEN	H					

see key on page 96 for terminology descriptions

FIGURE 35

Standing Structure Data from BAHP Files – Blackbird Area

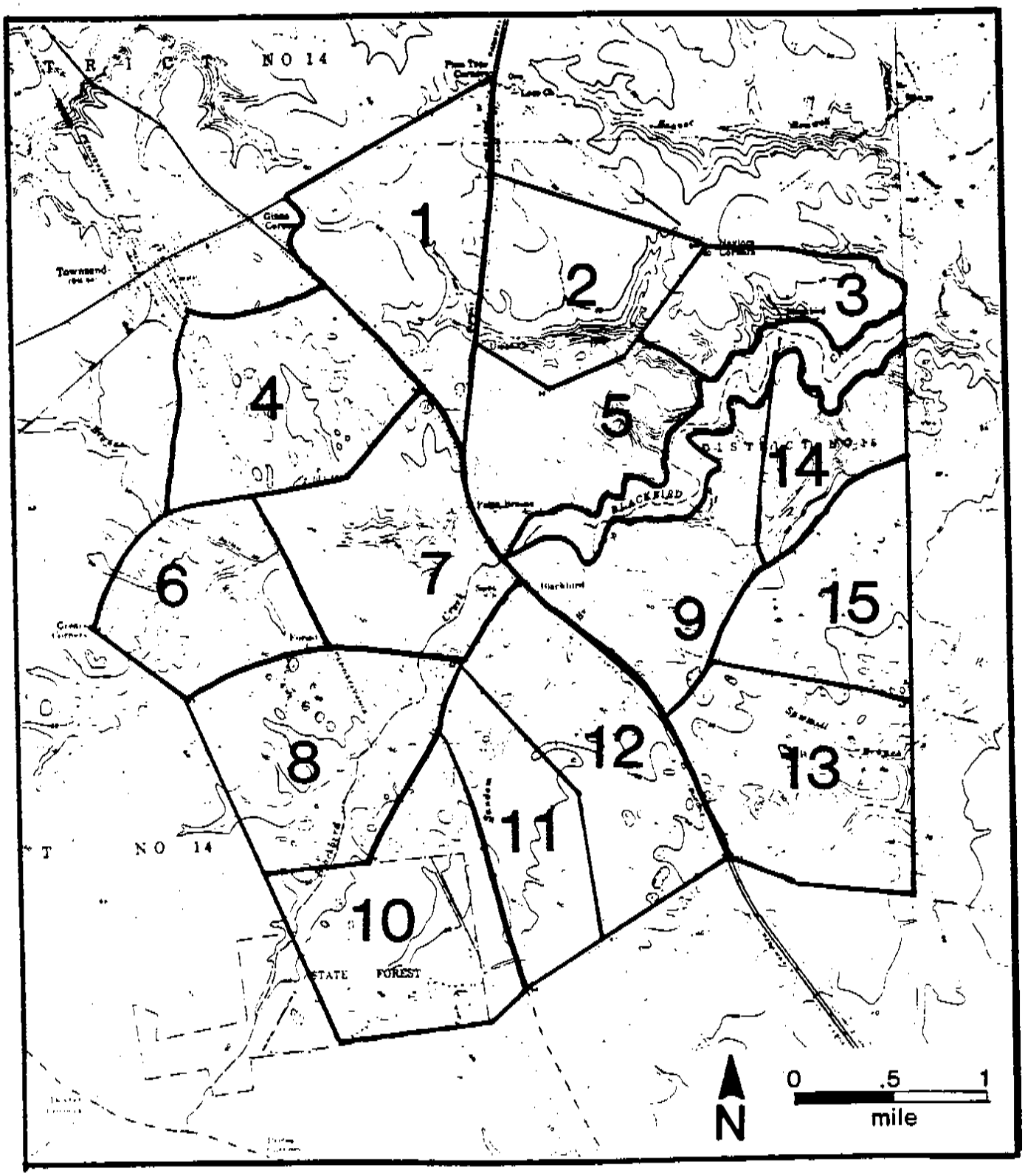
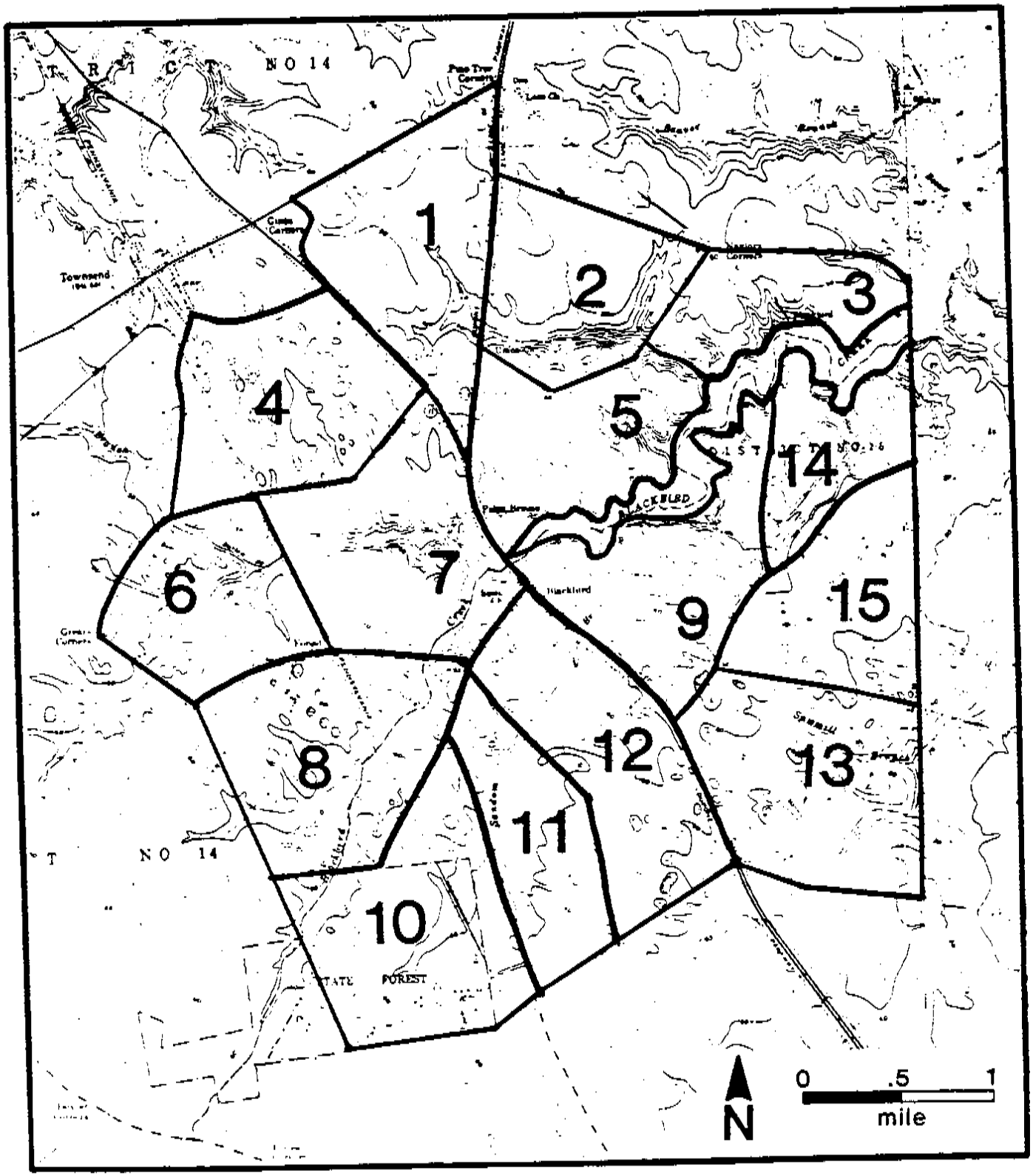


FIGURE 36

Historic Archaeological Resources Data - Blackbird Area



Subarea 3 includes a structure with a 17th century date of construction, N-3920, a dwelling just southeast of Naylors Corners. It is partially of log construction, although later additions and siding had obscured the original structure. It is the only well-documented standing 17th century structure within the area.

Apparently little is known about the history of Blackbird Landing (N-3918) and only unidentified wharf remnants remain at the location today. It should be pointed out that the potential exists for both terrestrial and underwater archaeological remains, although the present stream configuration suggests that the northern bank may have been scoured by the stream. However, recent sedimentation has probably altered the stream's course and energy level and thus it is difficult to assess the potential for archaeological remains.

The historic black community along Rt. 71 below Ginns Corner, known locally as "New Discovery" (Subareas 1, 4, and 6) holds considerable promise for the study of a rural ethnic agrarian population spanning a time from the late 19th century to the present.

The small hamlet of "Forest" (formerly Blackbird Station) at the intersection of the present Conrail tracks and Blackbird Station Road, contains a former railroad station (N5848), a former hotel for railroad passengers (N5849), and several dwellings, all dating from the 19th century. Although the specific functions through time for all of these structures is still unknown, it is likely that this junction superseded Blackbird Landing as a transshipment center and thus was important to the local economy of the 19th and 20th centuries.

Nearby, also in Subarea 7, is a pre-1849 farmhouse on the south side of Barlow Branch (N5854). Several original outbuildings remain and the entire complex is quite isolated and appears remarkably undisturbed. Thus the potential for pre-1849 archaeological remains is very high. The potential for intact subsurface features is also high for N-5938 (Plate 16), another pre-1849 agricultural complex in Subarea 7.

East of Blackbird Station is the mill complex and associated hamlet at the junction of Blackbird Station Road and Blackbird Creek. Only the fieldstone foundation (#294, Plate 17) remains of the mill, but the mill owners house (#794) and several other 19th century dwellings remain. Also in the immediate vicinity is the former site of an industrial tenants dwelling (#387).

The farmhouse north of Rd. 472 (N-131) in Subarea 8 is noteworthy because its building material is unusual for this area. The walls of the main part of the house are fieldstone, while the overwhelming majority of structures in this area are of brick or frame. The stones were almost certainly imported from some distance and suggest an added investment by the builder or owner in time or money.

PLATE 16

Structure N-5938, Northwest Face of House

PLATE 17

Archaeological Site #294, Foundation Associated with pre-1849 Mill Complex Looking Southwest from Road 463

When the original Rt. 13 was constructed some sixty years ago, the construction generally followed existing thoroughfares through this area. However, some older sections were bypassed. One of these older sections near Blackbird is still intact and contains an arched ashlar masonry bridge with an intact deck. It is no longer used for vehicular traffic.

In sum, it can be noted that the impact of farming on historic archaeological sites in the project area has been quite pronounced. Nonetheless, many significant archaeological resources are still present.

ANALYSIS OF PREHISTORIC SITE SURVEY RESULTS

This section of the report will describe various analyses of the results of the prehistoric site survey. The first analysis described is a comparison of the predictive model's expected results and the observed results of the field survey. The goal of this analysis was to provide an evaluation of the prehistoric predictive model. Other analyses sought to provide a broader cultural perspective for survey results and consisted of: 1) a general analysis of locational variables; 2) a factor analysis of site location variables; 3) a statistical analysis of site characteristics; and, 4) a discussion of human utilization of bay/basin features. All of these analyses include comparisons to other survey results from the Middle Atlantic region. Special comparisons with data from controlled survey results from the High Coastal Plain region of the Patuxent drainage of Maryland (Steponaitis 1980; 1983a; 1983b; 1984) will also be included due to the Patuxent region's environmental similarities to the Route 13 High Coastal Plain setting. Finally, a general discussion of the survey results for each of the major time periods is included.

EVALUATION OF PREHISTORIC PREDICTIVE MODEL

The following provides a discussion of the relationship between the present survey's results and the prediction of prehistoric site locations provided in the original Route 13 Project Planning report (Custer et al. 1984: 76-90; Attachment V). Although the predictive model derived from logistical regression analysis of LANDSAT data has been successfully tested, in a preliminary manner, in southern and central Kent County (Eveleigh, et al. 1983; Custer, et al. n.d.; Eveleigh 1984), and although a similar logistical regression model was successfully tested in south central New Castle County (Wells, et al. 1981; Wells 1981), continued testing, and subsequent refinement, of predictive models is always desirable. Therefore, the survey results of this project were used to test the local predictions generated from the logistical regression analysis. Special consideration of testing of the predictive model's results is also presented here because several recent articles (Berry 1984; Tainter 1984) have questioned the use of predictive models derived from multivariate statistical analyses of site locations,

such as logistical regression and discriminant analysis (Kvamme 1981; Burgess et al. 1980), in cultural resource management situations. Because many of the criticisms focus on the models' accuracy, it was hoped that an analysis of the accuracy of the results of the LANDSAT model used for the Route 13 Corridor would support its use as a cultural management tool.

The best field test of the models' predictions would be a survey based on a stratified random sample. Stratification could be based on two factors: 1) predicted probability zone, and 2) environmental factors used in the development of the model, such as surface water setting, presence/absence of modern and ancient marshes, and local soils. Initial tests of the logistical model's predictions incorporated some of these features, but relied mainly on previously recorded sites rather than new field data. The present Route 13 fieldwork incorporates some of these aspects as well; however, only a portion of one study area's survey, the Blackbird area subsurface testing, contained a randomized sample component. The remainder of the fieldwork represents a non-random and uncontrolled "grab sample" with many inherent biases.

Probably the most important bias in the sample is introduced by the fact that the study areas were chosen for field survey because they included high concentrations of cultural resources. Consequently, the high and medium probability zones are over-represented in the samples studied. This over-representation means that tests of model predictions are more likely to detect errors of inclusion rather than errors of ommission. In other words, we will be able to detect errors where the model says a site is present and a site is <u>not</u> present. However, we will not be able to study as effectively errors where the model says a site is not present and a site truly <u>is</u> present. The nonproportional representation of some kinds of probability and environmental zones also introduces numerous sources of sampling error, especially in the absence of a random component in the sampling design.

Because of the non-random nature of the sample, non-normality of some of the data and the various uncontrolled sources of sampling error and biases, complex statistical tests of goodness-of-fit between model predictions and field results were not used. Rather, simple descriptive statistics and simple difference-of-proportion and difference-of-mean tests were used. These techniques were applied to the survey data from the Appoquinimink and Blackbird study areas. The St. George study area data were not considered due to the small size of the study area and the low number of sites found within it. However, it can be noted that all sites discovered in the St. Georges study area, except for one, were located within the high and medium probability zones.

As a final introductory note it should be pointed out that all fieldwork within the three study areas was carried in a "blind test" setting. Although the field crews, including the

project manager, knew that they were surveying within areas that were likely to find sites, ie. that they were in "problem areas", none knew exactly where the high, medium, and low probability zones were located. Therefore, all areas were field inspected with the same intensity and coverage. "Likely areas" within the study areas did not recieve special treatment.

The first tests of model predictions focused on measures of site occurrence. These tests considered the goodness-of-fit between expected site counts and densities within the varied probability zones, based on predictive models, and the observed field results. Tables 12 - 14 list the data used from field observations for the Appoquinimink area, the Blackbird area, and both areas combined. Examination of the first row of Tables 12 - 14 shows the over-representation of high and medium probability zones in the test data. Consequently, figures for low probability zones are somewhat suspect.

TABLE 12

DENSITY MEASURE TEST DATA - APPOQUINIMINK AREA

Variable	Probability Zones		
	High	Medium	Low
TotalArea (ha)	311.40 (35%)	476.28 (53%)	104.76 (12%)
# of sites	54	27	8
# of 400m grid cells	15	17	7
# of cells w/ sites	13	9	2
% of cells w/ sites	0.87	0.53	0.29

TABLE 13

DENSITY MEASURE TEST DATA - BLACKBIRD AREA

Variable	Probability Zones		
	High	Medium	Low
Total Area (ha)	91.80 (11%)	496.08 (58%)	274.32 (31%)
# of sites	23	127	30
# of 400m grid cells	4	20	12
# of cells w/ sites	4	18	5
% of cells w/ sites	1.00	0.90	0.42

TABLE 14

DENSITY MEASURE TEST DATA - COMBINED AREAS

Variable	Probability Zones		
	High	Medium	Low
Total Area (ha)	403.20 (23%)	972.36 (55%)	379.08 (22%)
# of sites	77	154	38
# of 400m grid cells	19	37	19
# of cells w/ sites	17	27	7
% of cells w/ sites	0.89	0.73	0.36

The first comparison of observed and expected results utilized a simulated 400m grid cell data base. This grid cell data base was utilized for a number of reasons. First, the 400m grid matched the grid system used for the development of the initial predictive model (Custer et al. 1984:76-90). Also, a 400m grid was used in the initial testing of the predictive model (Eveleigh 1984; Eveleigh et al. 1983; Custer et al. n.d.). Most importantly, application of the 400m grid allowed the generation of comparable measurements of site occurrence for analysis. The predictive model for site locations generated a series of probability values for the occurrence of sites within specified units of area. Field observations generate counts of sites within specified units of area. In order to directly compare results of field testing with the model predictions, some kind of data transformations must be undertaken. Statistical distributions which transform site densities into probability values, such as the Poisson, are of limited utility (see Custer 1979; 1980) because archaeological data do not clearly meet the necessary requirements of independence-of-events (Thomas 1975). In fact the logistical regression of distribution was used to avoid the problems encountered in applying the Poisson distribution. Consequently, it is easier to transform the probability values into expected frequencies of sites and then directly compare the expected site frequencies within different probability zones with the observed frequencies generated from sample survey data.

The transformation of the model's probability values was accomplished by first overlaying a 400m grid template on maps of the project areas. The number of 400m cells falling within each of the three probability zones was then recorded. The number of cells which contained archaeological sites was also recorded. In order to calculate the expected number of 400m cells containing sites, the midpoint value of each probability class was multiplied by the number of cells within that probability zone. The observed number of cells with archaeological sites was simply a count of the cells which contained archaeological sites.

Table 15 lists the observed and expected values for all three data sets. The observed and expected values were then compared using the chi-square distribution and the test values, degrees-of-freedom, and probability values are all included in Table 15. The test statistics all indicate no statistically significant differences between the observed and expected frequencies of grid units containing archaeological sites.

TABLE 15

OBSERVED AND EXPECTED SITE COUNTS FOR 400m GRID UNITS

Area	Prob. Zone	Expect.	Observ.	Chi-sq.	D-o-F	p-Val.
Appoquin.	High	13	13			
	Medium	10	9			
	Low	1	2	1.10	2	.5<p<.75
Black.	High	4	4			
	Medium	13	18			
	Low	4	5	2.17	2	.25<p<.5
Total	High	17	17			
	Medium	23	27			
	Low	5	7	1.50	2	.25<p<.5

Probability values from Parsons (1974:824)

As an additional test of the model's predictions using the 400m grid data, the grid counts noted in Table 15 were converted to percentages and the expected and observed percentages were compared using the difference-of-proportion test. The percentages and test statistics are noted in Table 16. Only one combination of values, the Blackbird area medium probability zone, shows a significant difference between the expected and observed results. To summarize to this point, on the whole, the observed site frequency data seem to fit well with the expected results. In the case of the Blackbird medium probability zone, however, there are significantly more sites observed, compared to the expected results. This anomaly will be discussed later in conjunction with other test results.

Data on site size and site function were also used to test logistical regression model predictions. The initial model applications (Eveleigh et al. 1983:30-35; Custer et al. 1984:87-91, 100-102; Custer et al. n.d.) all indicated that the high probability areas were most likely to contain large macroband base camps when compared to other probability zones. Furthermore, it was noted that microband base camps were most likely to be found in high and medium probability zones. Procurement sites were found in all three zones, but were the major site component of the low probability zones.

TABLE 16

OBSERVED AND EXPECTED SITE PERCENTAGES FOR 400m GRID UNITS

Area	Prob. Zone	Expect.	Observ.	Test Value	p-Value
Appoquin.	High	.87	.87	0	1.00
	Medium	.58	.53	.38	.70
	Low	.14	.29	.65	.52
Black.	High	1.00	1.00	0	1.00
	Medium	.65	.90	1.89	.06
	Low	.33	.42	.42	.68
Total	High	.89	.89	0	1.00
	Medium	.62	.73	.99	.32
	Low	.26	.36	.70	.48

Probability values from Parsons (1974:818)

Before considering the site size and function data, the temporal settings of the sites needs to be discussed. Table 17 shows the distribution of components at sites for the Appoquinimink and Blackbird areas as well as for the total survey area. It is clear that most sites with identifiable components (73%) date to the Woodland I period. The Blackbird area provides data on all but one of the Archaic sites, and Woodland II sites are present, but not common, in all study areas. Consequently, the tests of model predictions, including the previously discussed density measures, primarily pertain to the Woodland I period. This bias matches the bias in the data base used to develop the initial model (Eveleigh et al 1983: 30-32).

TABLE 17

FREQUENCY OF DATABLE COMPONENTS IN STUDY AREA

Area	Prob. Zone	Archaic	Woodland I	Woodland II
Appo.	High	1	9	3
	Medium	0	1	3
	Low	0	1	1
Black.	High	0	6	0
	Medium	4	28	6
	Low	2	8	0
Total	High	1	16	3
	Medium	4	30	10
	Low	2	10	1

Two kinds of site data were analyzed to see if there is a differential distribution of functional site types among the probability zones: data on site area and data on functional site classifications. Table 18 shows a series of descriptive statistics for site area measures among the varied study areas and probability zones. The very high values for the standard deviation, coefficient-of-skewness, and coefficient-of-kurtosis indicate that the area measures are not normally distributed. Non-normality of the area measure distribution for all study areas and probability zone combinations is also indicated by the Q-Q correlation statistics (Johnson and Wichern 1982:151-160) presented in Table 19. Because the site area measures are not normally distributed, standard difference-of-mean or t-tests cannot be used to assess the differences of site areas between varied probability zones.

An alternative approach is to consider a variety of non-parametric range statistics which are listed in Table 20. The

TABLE 18

DESCRIPTIVE STATISTICS - SITE AREA MEASURES

Area	Prob.Zone	N	Mean	Std.Dev.	Skewness	Kurtosis
Appo.	High	28	6235.29	15146.50	4.42	22.05
	Medium	17	1366.76	859.26	1.38	4.03
	Low	6	5398.67	10174.90	1.73	4.08
Black.	High	16	5074.50	5613.67	1.73	4.84
	Medium	87	9371.03	13350.00	2.88	13.45
	Low	21	8909.23	18116.60	3.27	13.26
Total	High	44	5813.18	12464.50	5.08	30.54
	Medium	108	7868.87	12363.90	3.23	16.18
	Low	28	7871.96	16317.90	3.51	15.69

TABLE 19

Q-Q STATISTICS - SITE AREA MEASURES

Data Set	Prob. Zones			Total Area
	High	Medium	Low	
Total	.6198	.7758	.6961	.7292
Appo.	.6000	.9041	.7549	.5368
Black.	.8558	.8081	.6988	.7746

No significant values noted based on comparison with Q-Q statistics in Johnson and Wichern (1982:156).

TABLE 20

NON-PARAMETRIC RANGE STATISTICS - SITE AREA MEASURES

Area	Prob. Zone	Min.	25th	Med.	75th	Max.	Tot. Range	Med-75th Range
Total	L	18	784	1974	6968	80904	80886	4994
	M	177	1276	2787	8622	82914	82737	5835
	H	446	1029	2085	5144	80359	79913	3059
Appo.	L	409	428	904	1414	26012	25603	1510
	M	446	697	1263	1582	3361	2915	319
	H	446	981	1574	4709	80359	79913	3135
Black.	L	18	1161	2323	10219	80940	80886	7896
	M	177	1626	4181	12542	82914	82737	8361
	H	698	1490	2845	6015	20032	19334	3170

very high values for total range show a wide spread of the the distribution of site areas and the large differences between the 75th percentile and maximum values are the cause of the non-normality of the area distribution. Consideration of the range statistics also provides some insights on differential site size among the varied probability zones. Within the Appoquinimink area, the range statistics support the contention that site size generally increases moving from the low probability zones, through the medium probability zones, into the high probability zones. Except for the minimum values and the 75th percentile values, there is a constant increase in all values moving from the low to the high probability values.

In contrast, the range statistics for the Blackbird area do not show such a pattern. In general, the 25th percentile, median, 75th percentile, and maximum value statistics are all largest in the medium probability zone of the Blackbird area. Furthermore, the 75th percentile and maximum value statistics of the low probability zone are larger than the values for the high probability zone. The total range values for the Blackbird medium and low probability zones are also more than four times as large as the range for the high probability zones. A similar relationship is seen for the median-75th percentile range values. These observations of the range statistics all indicate that the medium and low probability zones of the Blackbird area contain more larger sites than would be expected based on other applications of the predictive model.

Cross-tabulation of functional site types and probability zones shows the same pattern as that shown by the analysis of site area statistics. Table 21 shows these cross-tabulations. For the Appoquinimink area, there are insufficient data to apply a chi-square test for dependence of variables; however, the general trend of the site frequencies show more macroband base

TABLE 21

CROSS-TABULATION OF SITE TYPES AND PROBABILITY ZONES

	Probability Zones		
	Low	Medium	High
Appoquinimink Area			
Procurement	5	16	21
Macroband Base Camp	1	1	11
Microband Base Camp	1	1	1
Base Camp	0	1	1
Blackbird Area			
Procurement	20 (19)	67 (69)	14 (13)
Macroband Base Camp	3 (2)	6 (7)	1 (1)
Microband Base Camp	2 (3)	12 (10)	1 (2)
Chi-square=2.39 D.o.F.=6 .50<p<.75			
Total Area			
Procurement	26 (25)	87 (85)	35 (38)
Macroband Base Camp	4 (4)	7 (14)	13 (6)
Microband Base Camp	3 (3)	14 (11)	2 (5)
Base Camp	1 (2)	8 (6)	1 (2)
Chi-square=16.05 D.o.F.=6 p<.01			

Expected values for chi-square test in parentheses

camps in the high probability zone as is predicted by the logistical regression model. Table 22 shows a series of difference-of-proportion test statistics for comparisons of percentages of site types among the probability zones. Two significant differences are noted: 1)there are significantly more procurement sites in the medium probability zone compared to the high probability zone; and, 2) there are significantly more macroband base camps in the high probability zone compared to the medium probability zone. These differences match the previous interpretations of the predictive model fairly closely.

Table 21 also shows the cross-tabulation of site types and probability zones for the Blackbird area. The chi-square test was applied and the low values for the test statistic indicates that the two variables are independent. In other words, the frequencies of any given site type within the probability zones are not larger or smaller than would be expected by chance alone. Therefore, the Blackbird area site type distribution among

TABLE 22

DIFFERENCE-OF-PROPORTION TESTS - SITE TYPES AND PROBABILITY ZONES

Variable	Zones	Proportions		Test Statistic	Prob.
Procurement	L-M	L-.714	M-.842	.734	.48
	M-H	M-.842	H-.618	1.707*	.09
	L-H	L-.714	H-.618	.483	.64
Macroband BC	L-M	L-.142	M-.052	.766	.46
	M-H	M-.052	H-.324	2.260*	.04
	L-H	L-.142	H-.324	.957	.34
Microband BC	L-M	L-.142	M-.052	.766	.46
	M-H	M-.052	H-.029	.425	.68
	L-H	L-.142	H-.029	1.269	.22
Base Camp	L-M	L- 0	M-.052	.619	.56
	M-H	M-.052	H-.029	.425	.68
	L-H	L- 0	H-.029	.459	.66

* - Significant Values (p<.10)
Probability values from Parsons (1974:818)

probability zones does not match the predictions of the logistical regression model.

A cross-tabulation of site types and probability zones for the entire study area is also included in Table 21. Sufficient data are present to apply the chi-square test and the probability value indicates that there is a dependent relationship between the two variables. Comparison of the expected and observed values shows that there are higher than expected frequencies of macroband base camps in the high probability zones and that there are higher than expected frequencies of microband base camps and generalized base camps in the medium probability zone. These results match the interpretations of the predictions of the logistical regression model almost exactly and very closely approximate other logistical regression model test results (Eveleigh et al. 1983:23-33, Tables 5 and 6). It is important to note that the higher than expected values of the total data match the results of the difference-of-proportion tests for the Appoquinimink area (Table 22). The close match of the Appoquinimink data, total area data, and expected results occurs in spite of the fact that the Blackbird data, which was included in the total data, did not match model predictions in several instances. When the fact that the Blackbird data accounts for more that 67 percent of the total cross-tabulation data is added, it becomes apparent that the incongruences between the Blackbird site type data and model results are rather minor. Even though the Blackbird data represent an important part of the data base,

the incongruences are outweighed by the instances where the survey data do match model predictions.

A final statistical analysis applied to test the validity of the predictive model was a discriminant analysis. Discriminant analyses consider the differences between two or more sets of observations based on a series of measured variables (Overall and Klett 1972:243-280). Usually, continuous variables are used in the analysis and for the Route 13 data three variables were used: distance to water, slope, and elevation. The two groups studied were the high and medium probability zone sites. These two zones' sites were considered because some of the data noted earlier showed that not all of the predicted differences in site locations between these zones were present. If sites from each of the two probability zones are truly different, as the predictive model would indicate, the discriminant analysis should produce a set of discriminant coefficients which generate discriminant function group means which are significantly different in a statistical sense. The discriminant analysis used here is the two-group discriminant function analysis included in the STATPRO software package (Wadsworth Professional Software 1984). A discriminant function was produced and took the following form:

.0038(Distance-to-Water)+.1651(Slope)-.2358(Elevation)

The high probability group mean was 16.10 and the medium probability group mean was 57.06. The total chi-square value comparing the two group means was 24.86 (degree-of-freedom=6, $p<.005$) which shows a statistically significant difference between the two groups. Thus, a discriminant analysis shows significant differences between site location characteristics in the high and medium probability zones. These findings indicate that the predictive model is effectively separating different site locations in the high and medium probability zones. In conclusion, it can be noted that in general the field data do match the predictions generated by the logistical regression model and the model is sufficiently accurate to use as a basis for cultural resource management decisions and applications. The only incongruences which arise occurred in the medium probability zone of the Blackbird area. These zones have more sites than would be expected from the model predictions and also have more larger sites than the model would predict. It is useful to compare the Blackbird area with areas where the model was successfully tested in order to determine why the model was less accurate in the Blackbird area. Areas of successful testing included the Appoquinimink area noted in this study, and earlier studies (Wells et al. 1981; Wells 1981), and the lower St. Jones/Murderkill drainage areas (Eveleigh et al. 1983; Eveleigh 1984; Custer et al. n.d.). These areas are similar in that they fall within the mid-drainage physiographic setting (Custer 1984a:27) and include the oligohaline zone of the drainages. Furthermore, the major drainages and their higher order

tributaries provide the only sources of fresh surface water. The Blackbird area is similar to a certain extent in that it includes the oligohaline setting of the Blackbird Creek. However, it differs significantly from the other areas with its high incidence of bay/basin features. These features represent an additional source of fresh water in interior areas away from the major drainages and also represent game-attractive settings.

As was noted in the original Route 13 report (Custer et al. 1984: 100-102, 217-218, Attachment V), the predictive model did recognize some of the bay/basin features as loci of high and medium probability settings. However, the comparison of model predictions and survey data indicate that the model did not recognize enough of these settings as high probability settings. It is suggested here that this recognition problem is related to the problem of recognition of the bay/basin features themselves with the LANDSAT multispectral scanner data. During our fieldwork we found that many of the bay/basin features encountered on the ground were not mapped on either the USGS 7.5' quadrangle maps or on the USDA soil survey maps (see Table 23). In some cases, bay/basin features were on the USGS quad maps, but not on the USDA maps, and vice versa. The resolution of the air photo base maps for both the USGS and USDA maps is 2-3 meters, yet these air photos still missed many of the bay/basin features. The resolution of the LANDSAT multispectral scanner data is 80m, and even with the added discrimination capacity of the four color bands, it is not surprising that the LANDSAT data missed some of the bay/basin features. The data in Table 23 also seems to indicate that the bay/basin recognition problem is greater in wooded areas compared to cultivated areas. Consequently, the bay basin recognition problem is not only related to their size and the resolution of the remote sensing device. It is also related to the masking of the features by dense tree growth. This masking problem is especially acute in the Blackbird area where many of the wood lots have been previously logged and are presently composed of dense secondary tree stands 50 to 100 years old.

TABLE 23

BAY/BASIN MAPPING ERRORS

Surface Condition	Ground Truth Total	USGS Maps Only	USDA Maps Only	Both USGS and USDA
Wooded	36	17	1	1
Cultivated	106	29	23	8

Given these problems in the Blackbird area, it is suggested here that the medium and high probability zones be combined into a single high probability zone ($p<.50$), which contrasts with all

other probability settings. It is also suggested that no non-proportional sampling be undertaken for proposed rights-of-way in the Blackbird area until the site predictions can be upgraded and revised. This recommendation will be discussed more completely in the management section of this report.

It should be noted that several options exist for refining the predictive model in the Blackbird area. Essentially, the problem is not with the synoptic logistical regression technique. Rather, it is a problem of specific remote sensing of a culturally relevant environmental feature. One option would be to develop a new geographic data base of environmental variables for the Blackbird area using the newly available thematic mapper (TM) data from LANDSAT 4. The TM data has a 30-meter resolution, which as a great improvement over the 80-meter resolution of the older LANDSAT data. Also, the TM data records seven color bands instead of four, thereby increasing the ability to discriminate environmental features, such as bay/basins (see discussion in Eveleigh 1984:146-148). In addition to the thematic mapper, traditional air photo data and low altitude helicopter photography could be used to supplement the satellite data to develop a more accurate environmental data base.

SETTLEMENT PATTERN AND SITE LOCATION ANALYSIS

The data collected for prehistoric archaeological sites during this survey of the northern portion of the Route 13 corridor can be analyzed to provide numerous insights into the lifeways of the prehistoric cultures of the High Coastal Plain area of the Delmarva Peninsula. The data from the present survey are especially useful for site location analysis because for some areas, such as the Appoquinimink study area, the data base is the closest approximation of a complete survey of a large area that will ever be available in Delaware. The Blackbird area data are also especially interesting because they are derived from a combination of broad surface survey area coverage, similar to that of the Appoquinimink area, and a stratified random sample of wooded areas requiring sub-surface testing. Indeed, the addition of an extensive sub-surface testing program for many wooded settings of the varied survey settings, which are often ignored in regional surveys, provides much of the more interesting site data. Furthermore, the Route 13 survey collected especially good data on site size and context with regard to environmental settings, and relationships to predictive models, which are not availible in other archaeological data bases such as the Delmarva Archaeological Data System (DADS).

A series of cross-tabulations of site location variables and site characteristics and simple tabulations of frequencies of sites by environmental variables will be presented. Variables chosen correspond to those seen as important in other regional site location analyses (Custer 1980, 1984a; Cavallo and Mounier 1980; Gardner 1978, 1982; Stewart 1980; Grossman and Cavallo

1982; Galasso 1983). Where possible, the study area data was compared to the wider data base for the Delmarva Peninsula High Coastal Plain included within the Delmarva Archaeological Data System.

Surface Water Type. The first site location variable to be studied was the surface water type associated with each site. Table 24 shows the frequency of sites associated with each type of surface water setting for the Route 13 Corridor, the entire High Coastal Plain data base as recorded in DADS (exclusive of the Route 13 sample), and for the Route 13 Corridor and the DADS High Coastal Plain data combined. It can be noted that the Route 13 sample provides coverage of bay/basin features that is not included in the DADS data base. On the other hand, marsh/swamp and estuarine bay settings are not present in the Route 13 sample due to the corridor placement. Thus, the Route 13 corridor data provides a sample of mainly interior site settings and the DADS sample is oriented more toward coastal environments. This interior/coastal dichotomy is also apparent considering the fact that the bulk of the Route 13 data come from the interior bay/basin settings of the Blackbird area and the majority of the DADS High Coastal Plain sample comes from the Wilke-Thompson (1977) survey of coastal Kent County, MD. When the total data are combined, a representative cross-section of High Coastal Plain site data is provided. This feature of the total data base makes further analysis of site locations more meaningful. The data in Table 24 show that the most prominent surface water setting is composed of major and minor streams for both interior and coastal areas. In the total data base, streams account for 71% of the site locations. Bay/basins are important in the interior settings and account for 32% of the site locations. In light of these figures it is not surprising that surface water setting variables account for the greatest amount of site location variance in the logistical regression models (see Wells

TABLE 24

SURFACE WATER TYPE FREQUENCIES

Surface Water Type	Route 13 Sample	High Coastal Plain Sample	Total
Stream	144	295	439
Bay/Basin	84	16	100
Bay/Basin/Stream	35	0	35
Marsh/Swamp	0	9	9
Estuarine Bay	0	37	37

1981:41-43). Steponaitis (1983a, 1983b, 1984) notes similar results in the Patuxent region.

Within the stream category of surface water settings, approximately 20% of the sites are located at stream confluences (Route 13 data - 31 sites out of a total of 144 - 21%; DADS data for High Coastal Plain - 57 sites out of a total of 295 - 19%; combined data bases - 88 sites out of a total of 439 - 20%). This percentage value is somewhat lower than would be intuitively expected from traditional non-quantitive settlement pattern analyses (Gardner 1978; 1982). The lower percentage value for the High Coastal Plain data probably is indicative of the fact that the juxtaposition of several environmental variables, such as wetlands, well-drained soils, <u>and</u> surface water, is more important for determining site locations than the effect of any single resource as shown by the logistical regression model. Also, the general presence of surface water is more important than the presence of stream confluences.

In order to further investigate the role of surface water settings in site location analysis, the various surface water types were cross-tabulated with sites' time periods of occupation (Table 25). In general,the data in Table 25 indicate that stream settings are the most important surface water settings for all time periods and show an increasing relative frequency of use through time. Bay/basin features begin to show some utilization in Archaic times, show peak utilization in Woodland I Period times, and show declining frequency of utilization in Woodland II Period times. (A special discussion of bay/basin utilization is presented later in this section.) Marsh/swamp and estuarine bay settings show increasing utilization through time with a climax in Woodland II times. This pattern of increasing frequency of coastal utilization through prehistoric time may be a function of destruction of sites by the Post-Pleistocene sea level transgression (Kraft et al. 1976); however, there are arguments, based on sound survey data and radiocarbon dates from throughout the Middle Atlantic Coast, which suggest that intensive utilization of bay coastal resources is a relatively late (post - 3000 BC) phenomenon in the Delmarva region (Custer 1984a: 63-64; Custer 1984b; Custer and Stewart 1983; Waselkov 1982; Potter 1982), and the Middle Atlantic Coast in general.

Tables 26 and 27 show cross-tabulations of the surface water settings and site types. For the Route 13 sample (Table 26), there are sufficient data on datable site components to do separate cross-tabulations of site types and surface water settings for the Archaic, Woddland I, and Woodland II periods. For the total Route 13 area data there are sufficient data to apply the chi-square test (chi-square = 13.31, degrees-of-freedom = 9, $.10<p<.25$). The probability values very marginally indicate that there is no dependent relationship between the site functions and surface water settings. The combined data base

TABLE 25

CROSS-TABULATION OF SURFACE WATER TYPE AND TIME PERIOD

Route 13 Sample

Time Period	Stream	Bay/Basin	Bay/Basin/Str.	Springhead
Archaic	3	4	1	0
Woodland I	26	29	9	1
Woodland II	9	4	1	1

High Coastal Plain Sample

Time Period	Stream	Bay/Basin	Marsh/Swamp	Estuarine Bay
Paleo-Indian	2	0	1	0
Archaic	9	0	2	0
Woodland I	24	1	4	0
Woodland II	33	2	5	5

Route 13 and High Coastal Plain Samples Combined

Time Period	Stream	Bay/Bas.	Bay/Bas./Str.	Spr.	Mar./Sw.	Est. Bay
Paleo.	2	0	0	0	1	0
Archaic	12	4	1	1	2	0
Wood. I	50	30	9	1	4	0
Wood. II	42	6	1	1	5	5

cross-tabulation in Table 27 (bottom) also contains sufficient data to apply a chi-square test (chi-square = 11.67, degrees-of-freedom = 9, $.05<p<.10$) and the values here do show a dependent relationship between site types and surface water setting. The following significant differences are noted between the expected and observed results: 1) there are more procurement sites associated with bay/basin features than would be expected by chance alone; 2) there are fewer procurement sites associated with streams than would be expected by chance alone; 3) there are more macroband base camps and generalized base camps associated with streams than would be expected by chance alone; and, 4) there are fewer macroband base camps and generalized base camps associated with bay/basins than would be expected by chance alone. Thus, base camps, especially the earlier ones, are more commonly found at stream settings in the High Coastal Plain while bay/basin features are more commonly associated with the more emphemeral procurement sites. Steponaitis (1983a: Fig. 4) notes similar results from the Patuxent region.

TABLE 26

CROSS-TABULATION OF FUNCTIONAL SITE TYPES AND SURFACE WATER SETTING - ROUTE 13 DATA

	Stream	Bay/Basin	Bay/Basin/Stream	Springhead
All Time Periods				
Procurement	73	59	18	2
Macro-band B.C.	18	3	3	0
Micro-band B.C.	8	6	4	1
Base Camp	4	3	3	0
Archaic Period				
Procurement	0	1	0	0
Macro-band B.C.	1	1	0	0
Micro-band B.C.	1	0	0	0
Base Camp	0	0	1	0
Woodland I Period				
Procurement	9	12	1	0
Macro-band B.C.	8	3	2	0
Micro-band B.C.	4	4	2	1
Base Camp	3	0	2	0
Woodland II Period				
Procurement	4	1	0	1
Macro-band B.C.	5	0	1	0
Micro-band B.C.	0	2	0	0
Base Camp	0	0	0	0

TABLE 27

CROSS-TABULATION OF FUNCTIONAL SITE TYPES AND SURFACE WATER SETTING - DADS HIGH COASTAL PLAIN DATA AND TOTAL DATA

	Stream	Bay/Basin	Marsh/Swamp
DADS High Coastal Plain Data			
Procurement	8	1	2
Macro-band B.C.	1	0	1
Micro-band B.C.	2	0	0
Base Camp	12	0	2
Total Data - DADS HCP and Route 13 Combined			
Procurement	81 (89)	80 (72)	2 (2)
Macro-band B.C.	19 (14)	6 (11)	0 (0)
Micro-band B.C.	10 (12)	11 (10)	1 (0)
Base Camp	16 (12)	6 (10)	0 (0)

Values in parentheses indicate expected values for the chi-square test.

Distance to Water. Another variable recorded for the sites found in the Route 13 Corridor is distance to water source. Figure 37 shows a frequency distribution for water distance for both the Route 13 data and the DADS High Coastal Plain data. The frequency distribution shows that the data are so highly skewed toward smaller values that it is meaningless to consider this variable for the total data base any further. Descriptive statistics (mean = 77.27, standard deviation = 85.05, coefficient of skewness = 1.86, coefficient of kurtosis = 8.62) and the water distance Q-Q statistic (.8985, .25>p>.10) also indicate a non-normal distribution. The most that can be said from looking at Figure 37 is that almost all (90%) of the interior Route 13 sample sites are within 100m of water. On the other hand, for the more coastal DADS High Coastal Plain data base, the distance within which 90% of the sites fall is 175m. The statistical significance of this difference is not easily assessed, given the non-normality of the data base. However, the difference may indicate slightly different settlement patterns in the two areas. It may be that people living in the coastal settings are more willing to sacrifice accessibility of surface water in order to maximize accessibility of other resources. The closer association of sites and surface water settings in the more interior Route 13 sample sites may also be mirroring the very close correspondance between bay/basin game-attractive locales and procurement sites.

Although the total water distance data are not particularly amenable to analysis, water distance data from the Route 13 area

TABLE 28

WATER DISTANCE DESCRIPTIVE STATISTICS BY TIME PERIODS

Time Period	N	Mean	Std. Dev.	Skew	Kurtosis	Test Q-Q	Q-Q(p<.10)
Archaic	7	65.00	44.63	-.25	1.61	.95	.88
Woodland I	56	53.43	64.85	1.21	3.56	.90	.97
Woodland II	14	41.79	49.97	1.14	3.04	.91	.91

TABLE 29

DIFFERENCE-OF-MEAN TEST - WATER DISTANCE

	Archaic	Woodland I	Woodland II
Archaic	------		
Woodland I	.61(.54)	------	
Woodland II	1.07(.28)	.73(.46)	------

p-values from Parsons (1974:818) in parentheses

for the individual periods were more useful. Table 28 shows a series of descriptive statistics for water distance during various time periods and although the distributions are skewed and leptokurtic, the Q-Q statistics indicate normal distributions. Because the data are normally distributed, difference-of-mean tests were applied to see if there were significant differences in distance to surface water between time periods. Table 29 shows the test statistics and none show significant differences. Therefore, sites from all time periods in the Route 13 area are located approximately the same distance from surface water sources.

Elevation. The elevation of sites was also analyzed. Figure 38 shows the frequency distribution for the Route 13 and DADS High Coastal Plain sample which is bimodal. About all that can be said about the elevation of sites based on the total data, is that either sites are very close to the estuarine sea-level water sources (the low elevations), or they are located on higher elevation bluffs or interior areas. There is no in-between.

Table 30 shows a series of descriptive statistics for site elevation for each time period. These values all indicate normal

FIGURE 37

Frequency Distribution – Water Distance

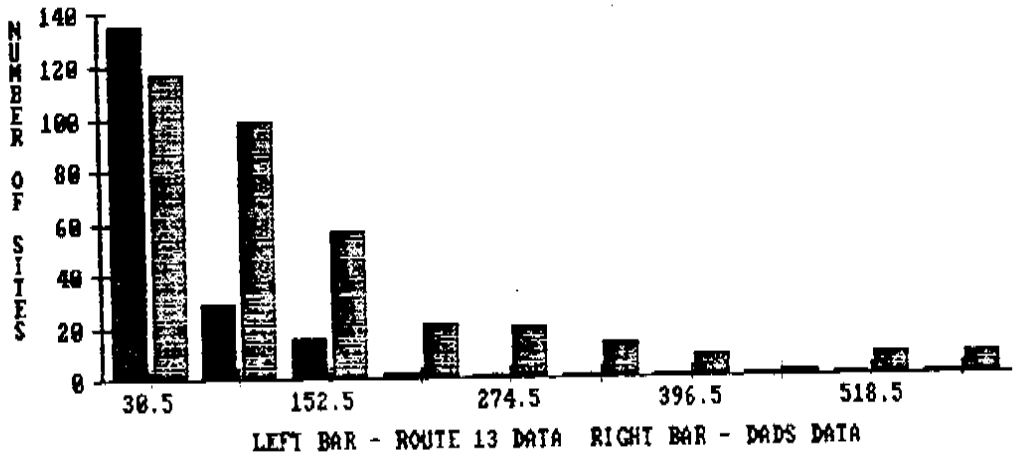


FIGURE 38

Frequency Distribution – Elevation

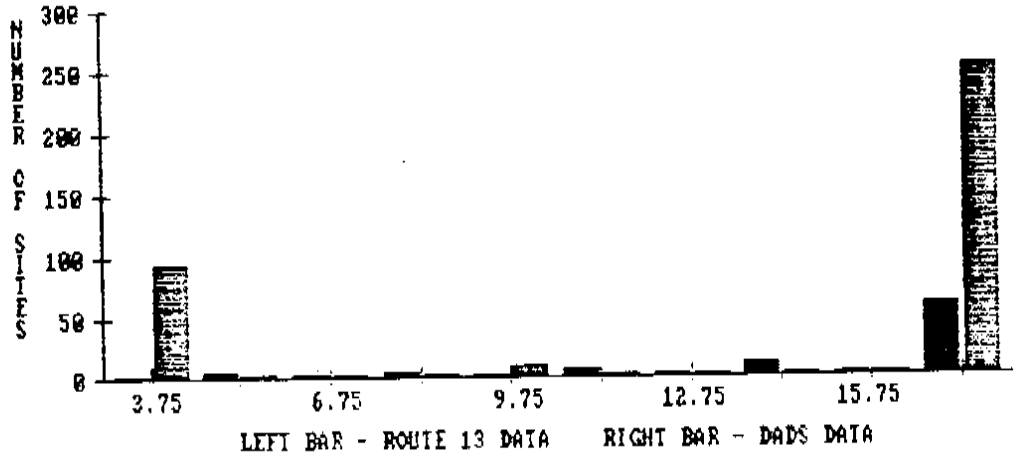


TABLE 30

ELEVATION DESCRIPTIVE STATISTICS BY TIME PERIOD

Time Period	N	Mean	Std. Dev.	Skew	Kurtosis	Test Q-Q	Q-Q(p<.10)
Archaic	7	13.57	3.21	.12	1.80	.96	.88
Woodland I	56	13.89	3.71	-.98	3.06	.93	.97
Woodland II	14	12.86	2.82	-.19	2.33	.96	.91

distributions. The very similar mean values and standard deviations all show no difference in site placement with regard to elevation through time.

Geomorphological Setting. The geomorphological setting of sites was also considered as part of the analysis of site location variables. Table 31 shows the frequencies of the

TABLE 31

GEOMORPHOLOGICAL SETTING FREQUENCIES

Setting	Route 13	DADS HCP	Total
Headland	138	112	250
Bay/Basin	112	2	114
Interior Flat	1	7	8
Sand Ridge	3	0	3
Floodplain	4	225	229
Upland Slope	0	12	12
	258	358	616

geomorphological setting of sites in the Route 13, DADS High Coastal Plain, and combined data bases. The previously noted focus of sites on major water courses, first, and bay/basin features, second, is supported by the high numbers of sites associated with headland, floodplain, and bay/basin geomorphological settings for all time periods of occupation for the Route 13, DADS High Coastal Plain, and combined data bases (Table 32). Given the low numbers of sites with datable components in the DADS High Coastal Plain data base, the Route 13 and combined data bases are the most interesting for analysis. In all but one case, there is a trend of increasing frequency of utilization of all geomorphological settings, for which there are sufficient site data for analysis, through time. The only exception is Woodland II bay/basin utilization which shows a

TABLE 32

CROSS-TABULATION OF GEOMORPHOLOGICAL SETTING AND TIME PERIODS

DADS High Coastal Plain Data

Period	Headland	Bay/Basin	Int. Flat	Sand Ridge	Flood	Up Sl
PI	0	0	1	0	2	0
Archaic	2	1	1	0	8	0
Wood. I	8	0	1	0	19	1
Wood. II	17	0	2	0	25	1
Route 13 Data						
Archaic	3	4	0	0	0	0
Wood. I	22	28	1	3	2	0
Wood. II	10	4	0	0	0	0
Combined Data						
PI	0	0	1	0	2	0
A	5	5	1	0	8	0
WI	30	28	2	3	21	1
WII	27	4	2	0	25	1

TABLE 33

CROSS-TABULATION OF GEOMORPHOLOGICAL SETTING AND SITE TYPE

DADS High Coastal Plain Data

Site Type	Headland	B/B	Int. Flat	Sand Rid.	Flood.
Procure.	5	1	1	0	4
Macro.	1	0	0	0	1
Micro	2	0	0	0	0
Base Camp	4	0	2	0	8
Route 13					
Procure.	74	76	1	1	0
Macro.	17	6	0	0	1
Micro.	6	10	0	2	1
Base Camp	4	6	0	0	0
Combined					
Procure.	79	77	2	1	4
Macro.	18	6	0	0	2
Micro.	8	10	0	2	1
Base Camp	8	6	2	0	8

FIGURE 39
Site Frequencies and Geomorphological Settings

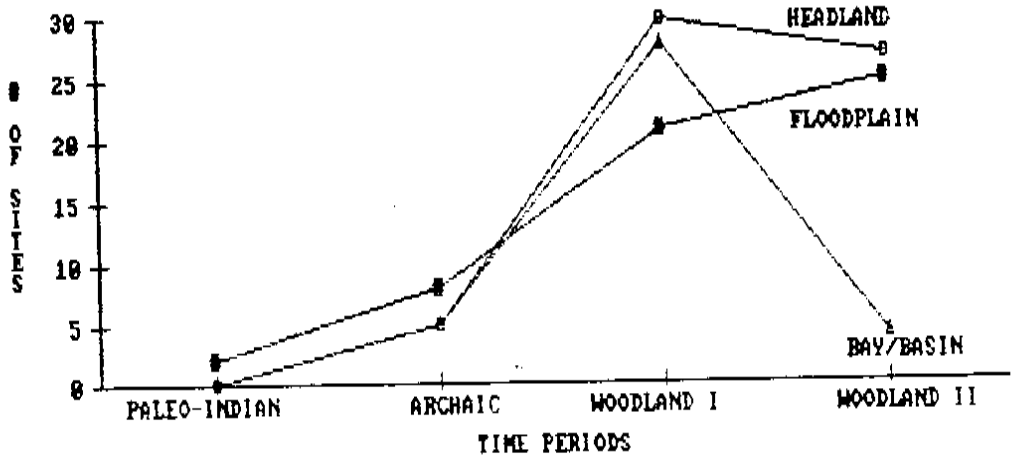
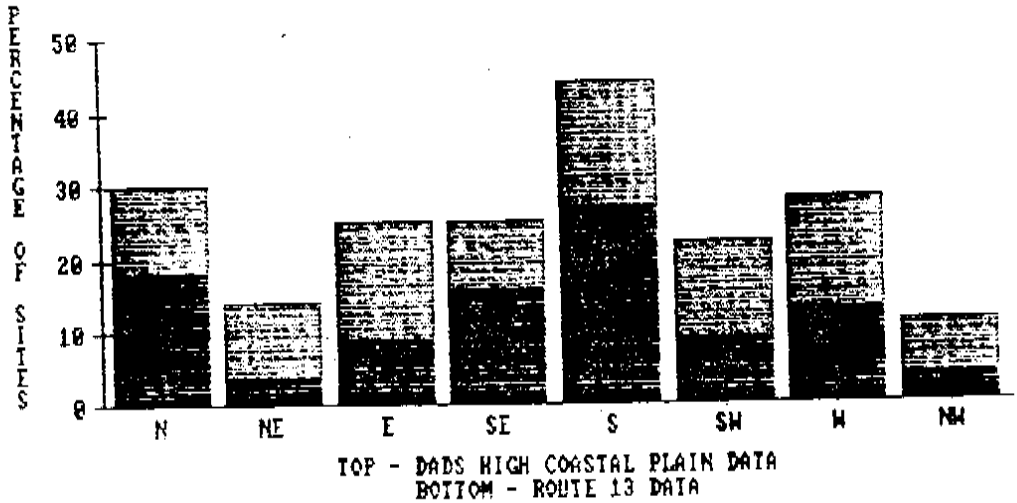


FIGURE 40
Aspect Frequencies



decline rather than an increase (see Figure 39). A similar pattern was noted during the analysis of surface water settings. Table 33 shows cross-tabulations of site types and geomorphological settings and again, given low numbers of sites with identifiable frequencies in the DADS High Coastal Plain data, the Route 13 and combined data bases are the most useful for analysis. Procurement sites show a strong association with bay/basin sites, as was noted in the analysis of surface water settings. Micro-band base camps also may be found in association with these features, while the larger base camps are more commonly associated with the major drainage floodplains and headlands.

Aspect. Site aspect was considered because several previous studies (Gardner 1978; 1982) noted this variable as a significant factor in prehistoric site locations. Table 34 shows the frequencies of sites for each of eight compass directions in the varied data bases and Figure 40 shows these same data in a bar graph. The southern exposure shows the greatest site frequency as would be expected from Gardner's models, but certainly not by the overwhelming percentage seen in other areas (Stewart 1980; Gardner and Boyer 1978; Wall 1981). Further analysis of site aspect included development of frequency distributions of aspect for varied time periods using the Route 13 data. There were insufficient data to analyze aspects of Archaic sites, but Woodland I and II data are noted in Figure 41. Neither the Woodland I or Woodland II data show any pronounced aspect preference.

TABLE 34

ASPECT FREQUENCIES

Aspect	Route 13	DADS High Coastal Plain	Total
N	42(.18)	42(12%)	84(14%)
NE	9(.04)	35(10%)	46(8%)
E	20(.09)	59(16%)	79(13%)
SE	36(.16)	31(9%)	67(11%)
S	63(.27)	61(17%)	124(21%)
SW	20(.09)	48(13%)	68(12%)
W	30(.13)	55(15%)	85(14%)
NW	12(.04)	27(7%)	39(6%)
	232	358	590

Frequency of varied aspects were also tabulated for functional site types. Figure 42 shows the data for macroband and microband base camps among the Route 13 data. The macroband base camps are primarily characterized by northern aspects. On the other hand, microband base camps are primarily characterized by

FIGURE 41
Woodland Aspect Frequencies

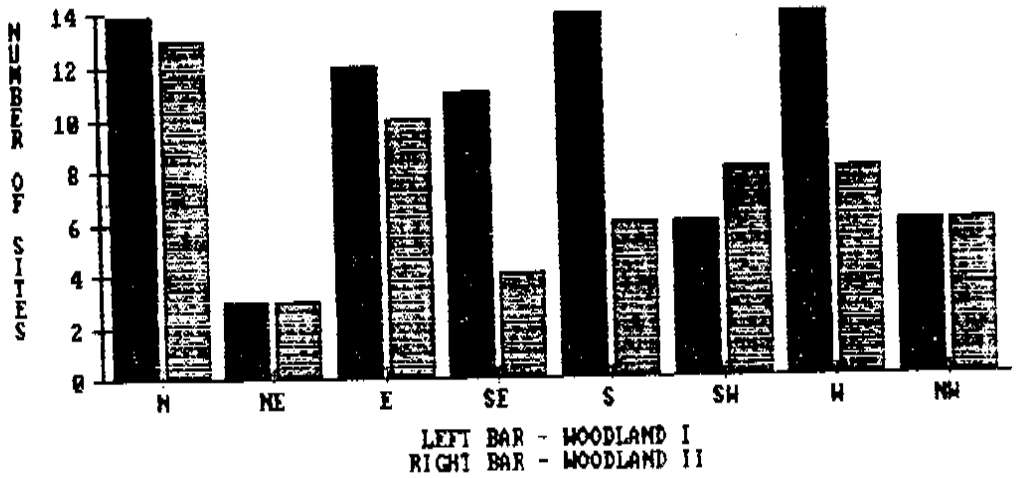


FIGURE 42
Base Camp Aspect Frequencies

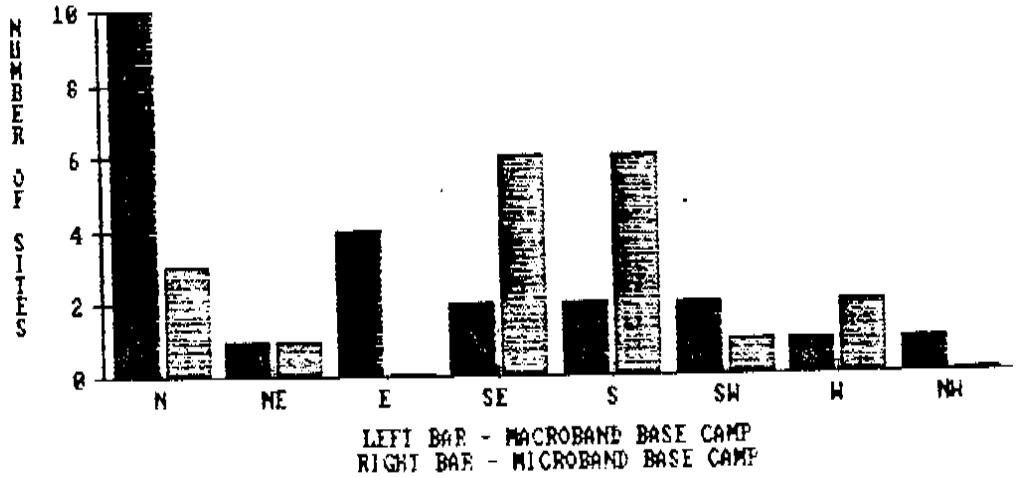
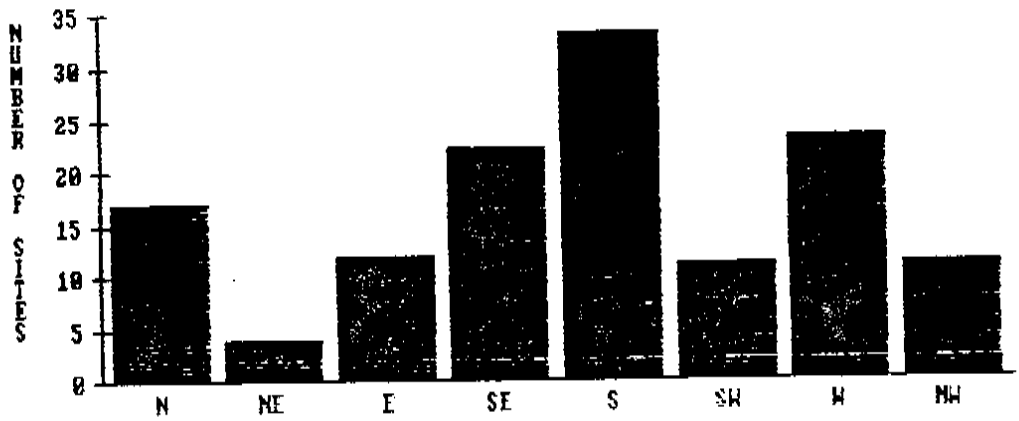


FIGURE 43
Procurement Site Aspect Frequencies



southern and southeastern aspects. Figure 43 shows the aspect frequencies for procurement sites. Southern exposures are most common, but not by a very large margin. It is interesting to note that these results are almost completely opposite compared to those reported by Steponaitis (1983a: Figs. 7 and 8) for the Patuxent drainage. The Patuxent data show that low density lithic scatter sites, here considered to be analagous to procurement sites, show no clear association with a southern aspect. Furthermore, other larger sites show a southern exposure. The differences between the Patuxent and Delmarva High Coastal Plain are <u>not</u> due to sampling differences and must be explained by other factors. Numerous researchers (Gardner and Stewart 1978; Wells 1981) have noted that large sites along the Appoquiniminik River tend to be located on its southern shore rather than the northern. The predictive model shows a similar pattern (Custer et al. 1984: Attachment V, 125). It is suggested here that the focus on the southern side of the drainage is due to the fact that most of the lower-order stream tributaries and well-drained headlands, which are the loci of the large base camp sites, are found on the southern side of the Appoquinimink and Blackbird drainages. Most likely, proximity to the tributaries and headlands was more important than site aspect for prehistoric groups. Furthermore, if house features were present at the larger Woodland I sites (see Custer 1984a:100-101 for examples), aspect would not be an important consideration for site location. In the Patuxent region, the drainage runs north and south so that the pattern of resource distributions and aspects is different. With regard to smaller procurement sites

and lithic scatters, it is suggested here that the absence of any clear-cut aspect preference in the Patuxent area is due to the very ephemeral nature of these sites' utilization. On the other hand, the Route 13 data, with its large number of bay/basin related sites and preference for southern aspects, may indicate a less ephemeral utilization of procurement sites. The critical factor in the differences in procurement site utilization between the Patuxent and Delmarva High Coastal Plain is the presence of the large number of bay/basin features in the Delmarva area. These environmental settings may be so productive that their use is more protracted and intensive than the use of interior areas without bay/basin features such as the Patuxent.

Soil Series. The final site location variable considered was soil setting. Fourteen separate soil series were associated with sites in the Route 13 area making cross-tabulations difficult. DADS High Coastal Plain data were not used because an even greater variety of soil settings were present. Table 35 provides a summary of the soil frequencies. Four series (Matapeake, Woodstown, Fallsington, Rumford) account for 43% of the sites. All of these soil series, except for the Fallsington

TABLE 35

SOIL SERIES FREQUENCY

	Soil Series				
	Matapeake	Woodstown	Fallsington	Rumford	Other
#	60	10	26	15	151
%	23%	4%	10%	6%	57%

series, are well-drained (Matthews and Lavoie 1970). The Fallsington series is poorly drained and found on upland flats (Matthews and Lavoie 1970:22). The association of sites with Fallsington soils generally occurs in the bay/basin settings and usually the sites themselves are located on small, well-drained sandy and/or silty knolls within the zones mapped as part of the Fallsington series. Thus, the most that can be said about associations of sites and soil series is that the sites tend to be on well-drained soils and the mapped USDA soil series are not necessarily good indicators of where well-drained soils may be located. As a sidelight it should be noted that the LANDSAT-generated soil data used in the logistical regression model (Eveleigh 1984: 78-81) are more useful than the USDA data for understanding site distributions.

In sum, it can be noted that analysis of site location data show some common features for all site functions and time periods while for others, there is diachronic and synchronic function

variation. For the most part, the analyses presented here support existing models. However, consideration of local edaphic factors requires some modification of the models.

FACTOR ANALYSIS - LOCATIONAL VARIABLES

A factor analysis of locational variables was undertaken to see how the various measured variables overlapped. Factor analyses use variable correlation matrices and extract large scale variables, or factors, with which the original variables may or may not be correlated (Rummel 1970:13-19). Correlations of the original variables with the factors show the degree to which the original variables overlap and also may have intuitive interpretive meaning (Rummel 1970:19-21). A factor analysis of the Route 13 data was undertaken because factor analyses of site location variables have been undertaken in the Middle Atlantic region (Hughes and Weissman 1982) and have yielded interesting results.

Results of factor analyses can be presented in numerous ways and for the purpose of simplification the zero-one cluster-centroid transformation matrices (Overall and Klett 1972:134-136) are presented for each factor analysis (Table 36). Six separate factor analyses were undertaken; one each for quantitative site

TABLE 36

ZERO-ONE CLUSTER-CENTROID TRANSFORMATION MATRICES

	Matrix I		Matrix II		Matrix III	
	Fac.1	Fac.2	Fac.1	Fac.2	Fac.1	Fac.2
water distance	0	1	1	0	0	1
slope	1	0	1	0	1	0
elevation	1	0	0	1	1	0

	Matrix IV		Matrix V		Matrix VI	
	Fac.1	Fac.2	Fac.1	Fac.2	Fac.1	Fac.2
water distance	0	1	0	1	0	1
slope	0	1	0	1	0	1
elevation	1	0	1	0	1	0
geomorph. set.	1	0	1	0	1	0
water type	1	0	1	0	1	0
aspect	1	0	1	0	1	0

Matrix I - all sites - quantitative variables
Matrix II - Bay/Basin sites - quantitative variables
Matrix III - Non-Bay/Basin sites - quantitative variables
Matrix IV - all sites - all variables
Matrix V - Bay/Basin sites - all variables
Matrix VI - Non-Bay/Basin sites - all variables

location variables for all sites, and non-bay/basin sites, and one each for quantitative and qualitative site location variables for all sites, bay/basin sites, and non-bay/basin sites. Comparison of matrices IV,V and VI in Table 36 shows that all three are identical. One factor correlates with water distance and slope while the second factor correlates with elevation, geomorphological setting, water type, and aspect. The first factor may be interpreted as a measure of proximity to major water sources. Slope is included because the lower slopes in the project area are found on headlands close to water while the more rolling topography is found in the bay/basin and stream tributary area away from the major drainages. The second factor may be interpreted as a general type of surface water/geomorphological setting indicator. The correlation of these variables is understandable given the previous analysis of locating variables. There is considerable overlap of the surface water type and geomorphological setting variables as well as aspect and elevation. Given the nature of these variables and their overlap, it is most likely that the second factor primarily measures the distinction between major drainage and bay/basin settings.

The analysis of strictly quantitative site location variables (Table 36; Matrices I,II, and III) shows more internal variability and also differs from the combined quantitative and qualitative results. The combined site data and the non-bay/basin data (Matrices I and II) show two factors: one correlated with water distance and a second correlated with slope and elevation. These two factors may be interpreted as being similar to those noted above for the combined quantitative and qualitative variables. However, the second factor in the analysis of quantitative sites is probably not as good an indicator of site setting as is the second factor in the combined quantitative and qualitative analysis.

The factor analysis of quantitative variables for bay/basin sites provides results which are different from the other factor analyses of quantitative data. In the bay/basin case, water distance and slope are correlated with one factor and elevation alone is correlated with the second factor. These results are more similar to the factor loadings seen in matrices IV,V, and VI, which considered both qualitative and quantitative variables. The bay/basin factor results may also indicate that slope is more closely related to water distance in the interior bay/basin settings than it is along the major drainages.

The results of the factor analyses presented here may be compared to the results reported by Hughes and Weissman (1982) using site data from Western Maryland. Hughes and Weissman considered five variables (proximity to water, slope, height above water, distance to stream confluence, and soil drainage) which mixed quantitative and qualitative data. Consequently, their results are best compared to Matrix IV in Table 36. Two factors were isolated using the Western Maryland data. The first factor consisted of proximity to water, height above water, and

distance to confluence. The second factor consisted of slope and soil drainage. The composition of these factors is similar to the composition of the Route 13 factors, although some differences are present due to the use of different original variables. Nonetheless, both of the factor analyses show a factor related to surface water, which accounts for much of the variance in site locations (up to 60% in the Route 13 data and up to 78% in the Western Maryland data), and an additional factor, related to landforms, which accounts for some of the remaining site location variance. These factor analyses nicely match Well's (1981:41-43) analyses of site location variables which noted that surface water settings accounted for the greatest proportion of site location variance.

SITE AREA ANALYSIS

Site area was considered earlier as part of the evaluation of the predictive model; however, it will be considered again with regard to changes in site size through time. This variable's changes through time will be considered because many of the current settlement pattern models (Custer 1984a:94-97) note significant changes in site size through time. Also, comparable data on changes in site size through time are available from the Patuxent drainage (Steponaitis 1980, 1983a; 1983b; 1984).

Table 37 shows a series of descriptive statistics for site area during the Archaic, Woodland I, and Woodland II periods. The values for the Q-Q statistics indicate that only the Woodland II values are normally distributed. Therefore, traditional parametric statistical comparisons could not be used. Table 38

TABLE 37

DESCRIPTIVE STATISTICS - SITE AREA BY TIME PERIODS

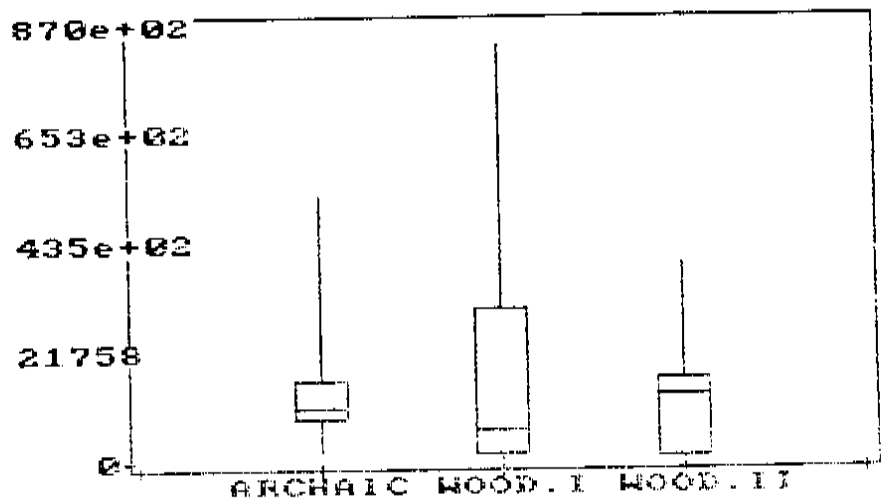
Time Period	N	Mean	Std.Dev.	Skew	Kurtosis	Test Q-Q	Q-Q p<.10
Archaic	7	16436.30	16786.20	1.66	4.37	.85	.88
Woodland I	42	17981.10	22537.30	1.64	5.05	.87	.96
Woodland II	6	14000.86	13943.80	.91	2.85	.92	.88

TABLE 38

NON-PARAMETRIC RANGE STATISTICS - SITE AREA BY TIME PERIODS

Time Period	N	Min	25th%	Med	75th%	Max	Total Range	75th% Max Range
Archaic	7	2323	7200	10684	18901	52721	50398	33820
Woodland I	42	523	1481	6631	28509	82914	82391	54405
Woodland II	6	697	980	13413	15242	39018	38321	23776

FIGURE 44
Site Area Box Plots by Time Periods



shows a variety of nonparametric range statistics for site area during each time period. It can be seen that the largest range in site size occurs during the Woodland I time period, although all time periods show a large range of site sizes. Nevertheless, the Woodland I range is 56% larger than the Archaic range, which is the next largest. Comparison of the 75th percentile-maximum value range also shows the Woodland I range to be the greatest.

Figure 44 is a box plot of the Archaic, Woodland I, and Woodland II data which shows the median values as a horizontal line within a box whose height reflects the range of values around the median which includes 50% of the values (Velleman and Hoaglin 1981:65-70). The length of the lines extending from the boxes reflects the total range of the values. The box plot clearly shows that the largest range of values is found in the Woodland I period. Not only is the box larger, but it includes a larger range of values. Also, the total range of Woodland I values includes more larger values than those of the other two time periods. These data indicate that there are more larger sites present during the Woodland I time period compared to all other time periods. Previous studies (Custer 1984a:77, 92-94; 1984c) have noted similar trends based on more impressionistic data and the Route 13 data support this contention.

Even more interesting is the reduction in site size moving from the Woodland I into the Woodland II Period. In most other areas of the Middle Atlantic region, including the southern Delmarva Low Coastal Plain, site size increases moving into the Woodland II Period (Custer 1984a:157-171; Custer and Griffith n.d.). However, the northern Delmarva region shows a decrease in social complexity, sedentism, and settlement pattern diversity

(Stewart et al. n.d.; Custer 1984a:155-157). The High Coastal Plain portion of the Route 13 study area falls within the Minguannan Complex boundary and the reduction in site size fits with known late prehistoric settlement pattern trends (Stewart et al. n.d.).

The Route 13 data on site size can be compared to the Patuxent data. Steponaitis (1983a: Fig.7) used box plots to show site size changes through time and found an increase in site size starting in the Late Archaic Period (early Woodland I) moving through to the Late Woodland (Woodland II) period. It should be noted that the criteria used by Steponaitis to separate Late Archaic, Early Woodland, and Middle Woodland components are suspect (see discussion in Custer 1983c). Nonetheless, even if the Late Archaic through Middle Woodland data for the Patuxent are combined, the Late Woodland Patuxent data still shows more larger sites. Therefore, the comparison of the Route 13 and Patuxent data reinforces the previous results of comparisons of the Upper Delmarva late prehistoric cultures to other similarly dated cultures of the Middle Atlantic region.

A related topic which may have been considered was the analysis of site frequencies through time. However, there were insufficient data in the Route 13 sample with identifiable components to make such an analysis useful.

BAY/BASIN UTILIZATION

Human utilization of bay/basin features has already been discussed in numerous contexts in this report. However, this topic is sufficiently important to merit its own special discussion. The Route 13 survey, especially the survey of the Blackbird area, provided one of the most comprehensive surveys of bay/basin sites in the Middle Atlantic region. The stratified random sample with subsurface testing also enhanced the research value of the survey sample.

Bay/basin features have been recognized as important loci of archaeological sites for a number of years. The first consideration of their role in prehistoric settlement subsistence systems was provided by Bonfiglio and Cresson (1978) who studied sites associated with bay/basin features in New Jersey. Ever since then their importance has been recognized in numerous overviews especially for the pre-3000 B.C. time period (Custer 1984a; 58-59, 72; Kraft and Mounier 1982). Although most researchers agree about the importance of these sites for prehistoric peoples, there is not complete agreement as to their origin. Bonfiglio and Cresson (1978) feel that these features are of periglacial origin and refer to them as "pingoes". However, it is not clear that bay/basin features are truly periglacial features. For one thing, bay/basin features are found not only in New Jersey, where they may be found within 50m of the Pleistocene ice front, but they are also found as far south as the South Carolina Coastal Plain where they are referred to as "Carolina Bays". It is very unlikely that these more

southern features, which appear to be similar in morphology to the New Jersey features (Rasmussen 1958), were formed under periglacial conditions with frozen soil and ground water. Furthermore, in a comprehensive study of bay/basins features in central and southern Delaware, Rasmussen (1958) rejected the hypothesis that they had a periglacial origin. However, Rasmussen was unable to effectively explain their origin by other geomorphological processes.

The current research on bay/basins in the Route 13 provided data on both human utilization of bay/basin features and their geomorphology. The various data gathered on the bay/basin feature's geomorphology shows that their size and shape have changed dramatically over the course of the Late Pleistocene and the Holocene. Sedimentary data from the bay/basin features studied here do not support the hypothesis that these features have a periglacial origin. If anything, the bay/basin sediments are more similar to those seen in sinkhole settings from the northern Delaware area (Custer and Griffith 1984). Probably the most that can be said at present is that bay/basin features are open waterfilled depressions that were acting as sediment and pollen traps at least since the end of the Pleistocene and through the Holocene. During this time they may have grown and contracted in size in response to local climatic changes. The most important point is that, no matter what their origin, these features were sources of fresh water which were very attractive for the game animals hunted by the prehistoric inhabitants of the Delmarva Coastal Plain throughout the Holocene.

The Route 13 survey showed some interesting patterns in human utilization of these bay/basin features. Probably the most interesting observation to make concerns the extent to which these features were used. A total of 148 bay/basin features were studied by either surface reconnaissance or subsurface testing. Of these, 128 features (90%) had associated archaeological sites. Diagnostic artifacts were found at 49 of these sites. Of these 49 sites, 5 have Archaic components, 38 have Woodland I components, and 5 have Woodland II components.

It is important to note that no Paleo-Indian components were discovered in association with these features during the Route 13 survey. In contrast, Bonfiglio and Cresson (1978:18) note that of 94 bay/basin features, 7 (7%) contained fluted point components in the New Jersey sample. There is no general shortage of Paleo-Indian fluted point sites in the upper Delmarva Peninsula and quite often these sites are associated with poorly drained, swampy settings (Custer 1984a:48-60; 1984d; Custer, Cavallo and Stewart 1983; Custer, Catts, and Bachman 1982). However, the known fluted point sites of the Delmarva Coastal Plain are associated with freshwater interior swamps fringing drainages within the mid-peninsular drainage divide, not bay/basin features. There are several explanations of this difference in Paleo-Indian utilization of bay/basin features between the Delmarva and New Jersey Coastal Plain. A simple

explanation may be that bay/basin features are not large enough during the late Pleistocene in the Delmarva to be attractive hunting locales. This explanation could easily be tested by obtaining a series of radiocarbon dates on bay/basin sediments in a variety of settings where there are associated archaeological sites of different ages. A second explanation may be based on sampling factors. Although the Delmarva sample is large in number and, due to its random component, less biased than the New Jersey data, the New Jersey data come from a wider geographic area than does the Delmarva sample which is drawn from a smaller, more concentrated area. If a sampling bias is involved, additional survey of bay/basin features in other areas of the Delmarva Peninsula should reveal associated Paleo-Indian sites.

Assuming that there are no sampling errors and that bay/basin features are present in the Delmarva Peninsula throughout the Late Pleistocene and early Holocene, additional behaviorial explanations of the differences between the New Jersey and Delmarva data are necessary. The Paleo-Indian utilization of bay/basin features in New Jersey may be due to the fact that the bay/basin features of the New Jersey High (or Inner) Coastal Plain are often associated with either the cuesta, or other concentrations of secondary lithic resources (Cavallo 1981; Marshall 1982:24,32). Custer, Cavallo, and Stewart (1983) and Gardner (1974;1977) have noted the important role of lithic resource locations in Paleo-Indian settlement patterns and the juxtaposition of the lithic resources and game-attractive hunting locales may have made the New Jersey bay/basin settings very attractive settlement locations during Paleo-Indian times. No similar juxtaposition of resources is seen in the Delmarva region (Custer and Galasso 1980; Custer 1984a:59) and this may be why there was little or no Paleo-Indian utilization of these features in Delaware. This explanation could be tested by looking for bay/basin locations in Delaware that may have hitherto unknown associated lithic sources. These features should have some signs of Paleo-Indian utilization if the above explanation is correct. An alternative test would be to consider bay/basin locations in New Jersey which do <u>not</u> have associated lithic sources. These sites should not have associated Paleo-Indian occupations.

Utilization of bay/basin features in the study area seems to begin early in the Holocene. There are five bay/basins associated with sites with bifurcate-base points, which are the only really reliable indicators of the Archaic period (Custer 1984a:61-62). The presence of a Kirk-like point at one of these bay/basin sites may indicate that the utilization of these sites began quite late in the Paleo-Indian Period. Generally, the sites seem to be small, ephemerally utilized hunting/processing sites. Five sites may not seem like a large number; however, prior to the Route 13 survey, only 79 sites with bifurcate points are listed in DADS (Custer n.d.). Of these, only 12 were located in the High Coastal Plain and only 7 Archaic sites in the entire DADS, including adjacent areas of southeastern Pennsylvania, are associated with bay/basin features. The Archaic bay/basin sites from the Route 13 survey are, therefore, an important addition to

the Archaic site data base.

Because the Archaic Period of Delmarva prehistory is so poorly known, it is difficult to assess the meaning of the Archaic bay/basin sites. However, some observations can be made. The beginning of bay/basin utilization seems to occur at the same time as a series of rather dramatic environmental changes. During the period from 8500-6000 BC there is evidence from numerous sites indicating dry climatic conditions (Custer 1984a:47-48; Custer and Griffith 1984; Carbone et al. 1982). Environments seemed to have changed from a mosaic of grasslands, swamps, boreal forests, and deciduous forests to a closed boreal forest with fewer poorly drained settings. The presence of wind-blown sediments (Foss et al. 1978) and evidence pronounced changes in stream channel morphology (Custer and Griffith 1984: Fig. 5) also indicate potential dramatic changes in the patterns of surface water availability. The beginnings of bay/basin utilization may be related to these environmental changes. It is possible that changes in stream channel morphology altered the distribution of swampy settings in the mid-peninsular drainage divide, as evidenced at the Dill Farm Site (Custer and Griffith 1984), and caused late Paleo-Indian and Archaic groups to seek out new swampy hunting stations, such as the bay/basin features. Another factor which may have been contributed to a shift to new procurement sites locations, including bay/basins, during the Archaic Period is the fact that during late Paleo-Indian and Archaic times the emphasis on high grade cryptocrystalline lithic materials seems to have disappeared (Custer 1984a:59-60). If association of bay/basins and lithic sources was no longer a critical factor in site selection, then the bay/basin sites of the study area may have become a more attractive settlement option. Once these bay/basin procurement sites became part of the settlement pattern in interior areas, their utilization continued into warm-wet climatic conditions of the post-6000 B.C. time period (Custer 1984a:62-64).

The time period of most intensive bay/basin utilization occured in the Woodland I period, between 3000 B.C. and A.D. 1000. During the beginning portions of this time period, and possibly during later periods as well, the Delmarva Peninsula and Middle Atlantic region, in general, experience the warmest and dryest climatic conditions of the entire Holocene (Custer 1984c). The mesic forests of the Archaic time period are replaced by open xeric oak-hickory woodlands and grasslands (Custer 1984a:89-91) and very dramatic changes in surface water availability occurred (Curry and Custer 1982). One of the major settlement pattern changes seen in the coastal plain area is the utilization of a wide variety of interior environmental settings on an ephemeral basis (Custer and Galasso 1983:12-14). The increase in bay/basin utilization during this time period is part of this trend. The data from 7NC-H-20 indicate that in areas of multiple bay/basin clusters there may also be more permanent sites dating to the Woodland I Period. These more permanent interior sites are probably similar to the Hawthorn Site (Custer and Bachman 1984).

Utilization of bay/basin sites dropped moving into the Woodland II Period. Amelioration of the climatic stress of the Woodland I Period may have contributed to the reduced bay/basin utilization.

In conclusion, bay/basin features are an integral part of prehistoric human adaptations in the Delmarva High Coastal Plain for varied time periods. The study of the large number of bay/basin features in the Route 13 project area has the potential to add appreciably to our knowledge of prehistoric human adaptations.

DISCUSSION OF GENERAL PREHISTORIC SURVEY RESULTS

In addition to contributing to the development of settlement models for bay/basin areas, the Route 13 survey data contributes to the development of general settlement subsistence models for the High Coastal Plain. A summary discussion of the total survey results is presented below for each time period.

Paleo-Indian Period. No Paleo-Indian sites were discovered in the Route 13 survey. As was noted in the discussion of the utilization of the bay/basin features, the absence of Paleo-Indian Period sites in the specific study areas may be due to the absence of flowing surface water associated with bay/basin features, or may be due to the absence of an association of high quality lithic sources and bay/basin features. Nevertheless, it is somewhat surprising that no Paleo-Indian materials were recovered from the large areas surveyed along the Appoquinimink River. Although the Appoquinimink River drainage is outside the known, and predicted, concentrations of Paleo-Indian sites (Custer 1983a:38-47), the occurrence of some kind of small procurement sites, such as 7NC-D-70 (Custer, Catts, and Bachman 1982), associated with a springhead or small swamp would be expected. It could be possible that older sites have been destroyed on the heavily eroded landscapes of the Appoquinimink. Or, Paleo-Indian site densities outside of the known and predicted concentration zones are truly quite low.

Archaic Period. The importance of the Archaic bay/basin sites has already been discussed; however, it should be noted that 3 Archaic sites associated with stream floodplain sites were also discovered. Only 9 Archaic sites were previously recorded in DADS for the Delmarva High Coastal Plain. Therefore, the 8 Archaic sites discovered in this survey almost double the number of known Archaic sites in the High Coastal Plain. In all of Delaware there are only 40 Archaic sites recorded in DADS, making the additional 8 sites discovered here a 20% increase in the Archaic site data base.

The Archaic sites associated with stream settings seem to be similar to others described for the Delmarva Coastal Plain (Wise 1983; Kavanagh 1979; Custer and Galasso 1983; Galasso 1983) and are primarily small procurement sites. These sites probably represent hunting and procurement sites which support other base

camp sites. Some of the larger base camp sites have been tenatively identified elsewhere in Delaware (Custer 1984a:69-72): however, none were identified in this survey. It may be possible that there are no large Archaic base camps in the Coastal Plain areas away from the large interior swamps. Some of the Archaic sites found in this survey may be small base camps rather than procurement sites and the present survey methods were unable to distinguish the differences between the two site types. Both Wise (1983) and Galasso (1983) have suggested that the Delaware Coastal Plain Archaic settlement pattern is characterized by small habitation and procurement sites and Kraft and Mounier (1982) note similar patterns in the New Jersey Coastal Plain. The data on Archaic sites from the Route 13 survey seem to support this model.

Woodland I Period. The Woodland I Period sites of the study are the largest and most numerous of all time periods. The analysis of site size showed that not only are most of the Woodland I sites larger than sites from other time periods, but several very large Woodland I sites were present (Figure 44). These very large sites are identified here as macroband base camps and are located primarily along the Appoquinimink River, the highest order stream in the study area. Current models of Woodland I settlement patterns and adaptations (Custer 1982; 1984a:94-98; 1984c; Catlin et al. 1982) all note a shift of large base camp sites to major drainage floodplain and headland settings and a general increase in local population densities in these areas during Woodland I times. The Route 13 survey data support this model. Similarly, it was noted in the discussion of bay/basin sites that the Route 13 Woodland I site data supported those site models which noted a widespread, but ephemeral use of interior areas. Interior Woodland I sites other than those associated with bay/basin features from the Route 13 data also support this model and the distribution of sites in the interior areas is quite similar to that noted for the Upper Chester drainage in Kent and Queen Annes Counties Maryland (Kavanagh 1979).

Non-local lithic materials, such as rhyolite, argillite, steatite, and ironstone, are present at many of the sites recorded in the Route 13 survey as was noted in the site descriptions. These non-local materials tend to be found at the larger Woodland I base camp sites. The presence of these "exotic" materials in the study area indicates that local Woodland I groups were participating in trade and exchange networks as noted in several studies (Ward and Doms 1984; Custer 1984e). Participation in trade and exchange networks at the larger Woodland I sites indicates increasing social complexity at these sites.

It would be useful to discuss the site locations and assemblage characteristics at a time level smaller than the period, such as the archaeological complexes which are used to divide the Woodland I period in terms of time and space (Custer 1984a:28-30,78,89). However, there are insufficient data on

diagnostic artifacts from the Route 13 survey to develop any counts of sites at the level of the archaeological complex. Nevertheless, one observation that can be made is that few, if any, Woodland I ceramics were recovered during the Route 13 survey, even from the very large Woodland I sites. Although ceramics are not often preserved at highly eroded sites, it does not seem unreasonable to expect that there would be a few ceramics present among the approximately 2400 artifacts found at Woodland I sites during the Route 13 survey. If the absence of Woodland I ceramics is not due to sampling errors or differential artifact preservation, then it is possible that the bulk of the Woodland I settlement in the study area predates 1200 B.C. Some large Woodland I sites post-dating 1200 B.C., such as the Hell Island Site (Thomas 1966), are present, nonetheless.

Woodland II Period. Woodland II settlement patterns in central Delaware are a topic of some controversy. For many years, numerous authors have suggested that there is a relative absence of Woodland II sites in southern New Castle County and northern Kent County. By the same token, up until 1980 the nature of the northern New Castle Woodland II occupations were also very poorly refined. Nonetheless, the southern New Castle County and northern Kent County area was viewed as a "buffer zone" or "fever belt" (Withoft 1984) separating two distinctive ethnic groups. The original Route 13 planning study analyzed extant artifact collections and noted numerous Woodland II sites in the supposed "buffer zone" making the whole concept somewhat invalid (Custer et al. 1984:220-221). The "discovery" of these sites was due to the fact that previous analyses had not recognized the Woodland II Minguannan ceramics in the collections because the type was not defined in the literature prior to 1981 (Custer 1981).

The discovery of Woodland II sites in the present survey reveals a similar bias in previous studies which caused Woodland II sites to be under-represented in the data base. Most of the Woodland II sites, and all of the sites with Minguannan pottery, were discovered during sub-surface testing of wooded areas dividing plowed fields from bluffs along the major drainages. The sites are small and appear along most of the major stream headlands studied. Furthermore, they are almost all unplowed and would have been, and were, missed in previous studies which focused primarily on surface survey of cultivated fields. Thus, there really is no absence of Woodland II sites in the study area and there is no need to invent a "buffer zone".

It can be noted that Woodland II sites in the study area are generally smaller than the Woodland II sites found farther south on the Delmarva Peninsula (Custer 1984a:157-171; Custer and Griffith n.d.). However, the Woodland II sites of the study area fall well within the range of site sizes seen among Woodland II sites of the Minguannan Complex (Custer 1984a:155-157; Stewart et al. n.d.).

In conclusion, analysis of prehistoric site survey data from the Route 13 project area reveals that existing settlement-subsistence models are generally accurate although some adjustments are necessary. Also, the analysis shows that the logistical regression predictive model accurately predicts locations of various types of sites: however, the models could be improved by the development of more accurate remote sensing of bay/basin features. Most importantly, the survey data open several questions which can be answered by future research. These potential avenues for future research will be discussed in the management section of this report.

ANALYSIS OF HISTORIC SITE SURVEY RESULTS

SITE LOCATION ANALYSIS

The first type of analysis undertaken using the historic site location data for the Route 13 corridor was to consider the placement of historic sites in relation to natural and cultural features of the landscape. Many studies in historical geography have considered the relationship between historic site locations and natural and cultural geographic features; however, most of the studies have considered either limited time periods or limited types of sites (eg. - Carr and Menard 1979; Earle 1975; Earle and Hoffman 1976; Main 1976; Menard 1975). However, the most useful and applicable study, which can be used to guide the analysis of Route 13 data, is James T. Lemon's, The Best Poor Man's Country: A Geographical Study of Early Southeastern Pennsylvania (1972). Lemon's study considers a broad range of criteria which conditioned people's use of space in Lancaster County during the period between 1689 and 1800. Generally, Lemon's analysis proceeds by using broad historical data on population, land use, economics, and ethnic affiliation, from townships in Delaware, Bucks, Northampton, Berks, Lancaster, York, and Cumberland counties to document different patterns of land use. These varied patterns are then related to government land policies, developing economic systems, ethnic-related "cultural" decisions, and the natural environment. Lemon pays much attention to the historic context of historic settlement patterns, such as William Penn's land development plans, ethnic preferences for maintaining contiguous settlements and communities, and the developing pan-Atlantic market economy. However, his analysis of empirical site location data is usually limited to summaries of data at the township level. Site-specific patterns are usually mentioned only as limited examples of trends noted in the analysis of the township data (for an example see Lemon 1972:208-217). Nonetheless, the settlement patterns noted by Lemon can be used to guide the analysis of Delaware site location patterns.

Before utilizing Lemon's study, some comments about the limitations of its applicability should be noted. First, much of the settlement data analyzed by Lemon pertains to Pennsylvania German groups, including the Anabaptist sects whose social

structure greatly affected settlement patterns (Lemon 1972:67-69), and these groups are not present in large numbers in Delaware. Nevertheless, southeastern Pennsylvania was a large scale multi-ethnic community (Lemon 1972:43-49) as was much of northern Delaware (Schwartz 1982). However, the southern Coastal Plain areas of Delaware were more ethnically homogeneous with English and Scotch-Irish being the most numerous (Munroe 1984:55-57). An additional limitation of the applicability of Lemon's analysis is based on the pronounced physiographic and geologic differences between the Piedmont Uplands and Lancaster-Fredrick Lowlands of southeastern Pennsylvania and the High Coastal Plain setting of the Route 13 project area. Because of the complex local geology of the Piedmont, the soils of Lancaster County are very diverse in terms of their morphogenesis and their agricultural productivity. Futhermore, the limestone/dolomite soils of the Lancaster Plain are some of the most fertile on the continent. In contrast, as a whole, the soils of the Delaware High Coastal Plain are less diverse and less productive given the agricultural technologies of the 18th and 19th centuries (Craven 1925; Gray 1933). It should also be noted that the lower amount of topographic relief in the Delaware Coastal Plain lowers the variability of terrestrial natural resources. However, this reduced variability is counter-balanced by the productive marshlands of the Delaware Coastal Zone. In sum, there are some important cultural and natural differences between Lemon's study area and the Route 13 study area. Nevertheless, Lemon's results can be used as a guide for exploratory analysis of Delaware historic settlement patterns. In fact, the analysis of the Route 13 data can be looked upon as a test of Lemon's description of general factors which have affected historic settlement patterns.

Lemon (1972:69) makes the following statement regarding settlement choices in southeastern Pennsylvania:

> By 1760 settlers had occupied most of southeastern Pennsylvania westward and northward from Philadelphia, the chief point of arrival from Europe. These colonists on land not previously occupied by white men responded to several forces in choosing sites. The distribution of national and denominational groups suggests that many settlers sought holdings next to those of the same regional background in Europe, and persons of the same theological persuasion. But substantial parts of the area contained a variety of groups; thus, other factors were also at work, notably actions of the proprietors and their agents, soil quality, availability of land, access to markets, and immigrants' time of arrival.

Because Delaware was not a part of Penn's proprietorship for as long as southeastern Pennsylvania was, and because Penn's system of control of land grants was notoriously ineffective (Lemon

1972:69), the effects of the proprietorship will not be considered in this study. Futhermore, the role of ethnic affiliations will not be considered because the particular study area is relatively ethnically homogeneous and because, as Lemon notes, other factors seem to be more important. The factors which will be considered are soil quality, access to markets via transportation networks, and immigrants' time of arrival. Consideration of time of arrival will also account for availability of land, for availability should obviously decrease through time.

The specific goal of this analysis will be to consider the variation of historic settlement patterns with respect to the following variables; soil setting, surface water setting, and transportation access. These attributes were recorded for each historic site location in the Route 13 study area and then crosstabulated with the site attributes recorded in Tables 9-11 by time periods. In many ways, the analyses described here are an exploration of possible sources of variation rather than an explicit test of hypotheses. In a certain sense, the analysis presented here will seek to see if any of these variables are "culturally relevant" (Chenhall 1975) with regard to historic settlement patterns. The methods used will focus on the empirical site data and will look for changes in site attribute relationships through time and at different functional site types. These methods are similar to those applied to prehistoric site location data (Custer 1979; 1980). Before the results of the exploration are presented, a more detailed discussion of the attributes is presented below.

Soil Settings. Consideration of soil productivity is an integral part of Lemon's analysis and will be included here. Lemon primarily considers the agricultural productivity of varied soils in his analysis, but it is usually done on a limited basis. This analysis of the Route 13 data will consider four aspects of soil settings: agricultural productivity, grazing productivity, woodlot productivity, and hunting/trapping/fishing productivity.

The USDA soil capability rating series for New Castle County (Matthews and Lavoie 1970:40-50) was used to measure agricultural productivity. Capability ratings show the suitability of various soil series for field crops, primarily corn and grains. Because wheat, corn and other grain crops, are important crops in the 18th and 19th centuries (Munroe 1984:58; Main 1973), the USDA capability ratings may be meaningfully applied to the analysis of historic settlement patterns. A total of eight different soil capability classes are noted in the USDA survey. For this study, the percentage of Class I soils within a 100 acre circle around the agricultural sites was recorded. Class I soils were considered because only these soils have few limitations that restrict their use. Given the low level of agricultural technology during much of the 18th and part of the 19th century (see discussion in Coleman et al 1984:28-43 and Craven 1925) these would have surely been the most productive settings for agriculture. For the High Coastal Plain, Class I soils include

the Mattapeake, Mattapex, and Sassafras soil series all of which are deep and well-drained. A 100 acre catchment was used because this size area corresponds to the average size of farms in the region during the 18th and 19th centuries (Munroe 1954:19; Ball and Walton 1976:105).

Because animal husbandry was part of most agricultural enterprises in New Castle County (Bidwell and Falconer 1941: 84), soil productivity for grazing within a 100 acre catchment was also considered. Assessment of soil productivity for grazing was accomplished using the USDA wildlife capability ratings (Matthews and Lavoie 1970:52-57). One set of ratings considers the capacity of soils for supporting grasses and legumes such as lespedeza, alfalfa, clover, tall fescue, broomgrass, bluegrass, and timothy. Lemon (1972:159) notes the use of these grazing covers during the 18th and 19th century underscoring the validity of the use of this rating system. The percentage of any of the following soil series, which are all well-suited to grasses and legumes, was noted: Butlertown, Collington, Keyport, Mattapeake, Mattapex, Sassafras, or Woodstown.

Soil productivity for woodlots was also considered because firewood and building lumber were important resources during the 18th and 19th centuries (Munroe 1984:58). USDA woodland suitability ratings (Matthews and Lavoie 1984:50-52) were used for analysis and the percentage of Woodland Suitabiliby Group 10 within the 100 acre catchment was recorded. This group includes the Butlertown, Keyport, Mattapeake, Mattapex, Rumford, and Sassafras series which are well drained and moderately well-drained soils. These series are the best suited for oak, other hardwoods and loblolly pine, which are preferred sources of lumber and firewood.

The final group of soils considered included soils that would be most productive for hunting, trapping, or fishing. Some studies (Lafferty et al. 1981) have considered this aspect of historic subsistence, and some historic archaeological studies from the Southeastern United States (Lewis 1984; Otto 1984) and the Middle Atlantic (King and Miller 1984) have suggested that hunting, trapping and fishing might have been an important component of rural subsistence economies which could have affected historic settlement patterns. In order to measure wildlife productivity, the USDA wildlife capability ratings (Matthews and Lavoie 1970:52-57) were utilized. A preliminary analysis of the various wildlife ratings showed that almost all soils in the study area had a high rating for woodland and openland wildlife. However, wetland wildlife ratings showed more variability and were, therefore, used in the analysis. The percentage of the following soil series within the 100 acre catchment was noted: Bayboro, Elkton, Fallsington, Mixed alluvial land, Othello, Pocomoke, or tidal marsh.

Before considering the relationship of historic site locations to soils of varying productivity, it is important to know the natural distribution of soil types within the study

area. For example, it may be seen that farmstead sites contain high percentages of highly productive soils. However, if these highly productive soils are common throughout the study area, their association with site locations may be entirely fortuitous. Table 39 shows the total acreage and percentage within all New

TABLE 39

TOTAL STUDY AREA HISTORIC SOIL TYPE FREQUENCIES

	Acres	%
Agricultural		
Class I	87,959	42
Others	122,825	58
Grazing		
Highest Prod.	112,347	53
Others	98,437	47
Woodlot		
Highest Prod.	105,482	50
Others	105,302	50
Hunting, etc.		
Highest Prod.	80,914	38
Others	129,870	62

Total High Coastal Plain soil acreage - 210,784

Castle County High Coastal Plain soils for each soil grouping of interest. It can be seen that there is a fairly even distribution of soils of interest and others in the study area, except in the case of the hunting/trapping/fishing case. These soils have a slightly more restricted ditribution.

An additional prerequisite to analysis of the soil distributions was a consideration of the statistical distribution of the soil percentage frequencies. Table 40 shows Q-Q correlation statistics for all four percentages and each has a normal, or near-normal, distribution. Therefore, parametric analytical techniques can be used.

The first soil capacity considered in this analysis is for agricultural crops. Table 41 shows a series of descriptive statistics of the percentage of Class I (highly productive) soils found at historic sites of various data sets. The data sets noted include the total sample of agricultural related sites,

TABLE 40

Q-Q STATISTICS - HISTORIC SOIL DATA

Variable	n	Q-Q	P
WoodLot	144	.9561	.05<p<.10
Crops	144	.9669	.05<p<.10
Grazing	144	.9338	.10<p<.15
Hunting	144	.9214	.01<p<.05

four ranges of dates, three rural site functional classes, and each site functional type for each time period. The functional site types are based on the historic site function typology used in the original report (Custer et al. 1984:22-24). The age classes are derived from the atlas entries for sites and can be roughly equated with pre-19th century, first half of the 19th century, middle third of the 19th century, and final quarter of the 19th century. Although these age ranges do not necessarily correspond with significant historical periods, they do provide a rough measure of changes through time for historic site locations without requiring an undue amount of archival research to date sites and structures.

The first analysis undertaken was to see if high quality agricultural soils were indeed preferred by historic peoples. Almost all of the mean values (Table 41) show more than half of the 100-acre agricultural catchments composed of Class I soils. However, Table 39 shows that Class I soils account for almost half of the area of the Delaware High Coastal Plain. It is important to know if the mean percentage values noted in Table 41 could have arisen by chance alone, given the wide distribution of Class I soils, or if they were the result of human selection. Put another way, did historic people actually seek out productive agricultural soils, or did they just happen to settle on areas with lots of Class I soils because lots of places had Class I soils? A difference-of-proportion test was used to compare the various site percentage values for Class I soils with the total distribution percentage of Class I soils within the Delaware High Coastal Plain. The percentage values which show a significant difference are marked with an asterisk in Table 41. In all but one case, dwelling complexes (non-agricultural) of the period between 1849-1868, there are significantly high percentages of Class I soils among the historic sites. This pattern suggests that historic settlers sought out productive agricultural land.

Given that historic groups did indeed seek out high quality agricultural soils, the data in Table 41 can be used to investigate changes in site selection with respect to Class I soils through time. Also, differences among varied functional classes of sites, such as the one just noted, may be investigated more thoroughly.

TABLE 41

AGRICULTURAL SOIL CAPACITY - DESCRIPTIVE STATISTICS

Data Set	N	Mean	Std. Dev.	Skew	Kurtosis
Total	144	66.01	25.75	-.80	3.01
p1802	4	64.13*	37.10	-.61	1.82
1802-1849	54	70.72*	21.57	-.62	2.98
1849-1868	66	63.65*	27.66	-.77	2.70
1868-1893	15	66.57*	26.14	-1.12	3.88
AGCX	83	65.65*	23.28	-.58	2.93
DWCX	17	49.60*	36.50	-.15	3.50
AGTEN	42	73.20*	22.68	-1.18	3.80
AGCX, P1802	4	64.13*	37.10	-.61	1.82
AGCX, 1802-1849	46	71.73*	20.19	-.39	2.48
AGCX, 1849-1868	23	58.90*	23.81	-.63	2.90
AGCX, 1868-1893	6	59.23*	18.55	-.27	2.32
DWCX, P1802	0	-----	-----	-----	----
DWCX, 1802-1849	0	-----	-----	-----	----
DWCX, 1849-1868	11	43.69	37.08	.09	1.47
DWCX,1868-1893	5	62.91*	39.66	-.79	2.29
AGTEN, P1802	0	-----	-----	-----	----
AGTEN, 1802-1849	7	67.73*	30.41	-1.11	2.96
AGTEN, 1849-1868	31	73.29*	22.23	-.94	4.16
AGTEN, 1868-1893	4	82.15*	8.11	-.71	2.09

* - significant difference

Table 42 shows a series of difference-of-mean test statistics for changes in Class I soil percentages through time. Changes through time are noted for all site types, agricultural

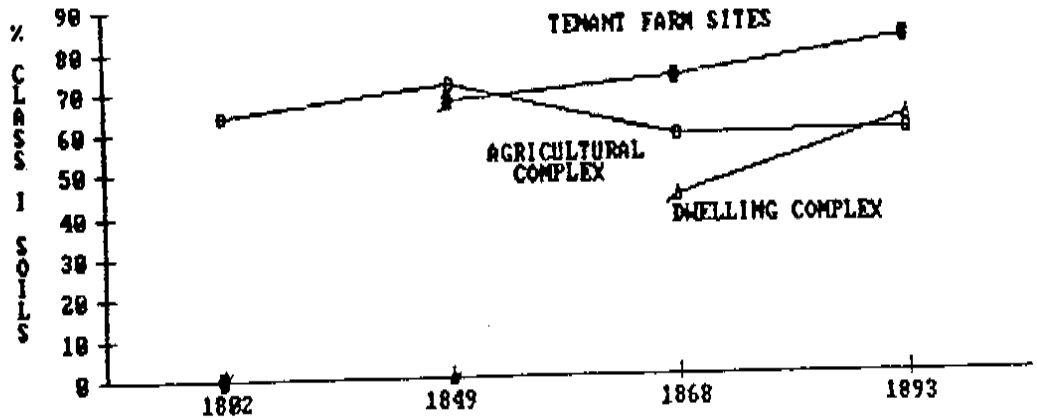
TABLE 42

SIGNIFICANCE TESTS FOR CLASS I AGRICULTURAL SOILS PERCENTAGES THROUGH TIME

Time Period Comparison	Total Data	AGCX	DWCX	AGTEN
p1802 and 1802-1849	.351	.404	----	-----
1802-1849 and 1849-1868	1.572	2.216*	----	.457
1849-1868 and 1868-1893	.386	.004	.917	1.557

---- - No Data
* - Significant Difference (p <.10)

FIGURE 45
Class I Soils Percentages Through Time



complexes, non-agricultural dwelling complexes, and agricultural tenant sites. Figure 45 shows the same changes through time. Values for agricultural complexes show minimal change through time; however, a significant reduction in percentages of high productivity soils is seen around the middle of the 19th century (ca. 1850-1860). The limited data on non-agricultural dwelling complexes show no significant differences. Similarly, there are no significant changes through time for tenant farm complexes.

Significant differences can also be noted when comparing the varied site types' Class I soil percentages for different time periods (Table 43). When the total data are considered, the dwelling complexes show significantly lower percentages of Class I soils compared to tenant farm locations, as was noted earlier and as would be expected. For the 1802-1849 time period, the limited data show no significant differences. Between 1849 and 1868, the non-agricultural dwelling complexes show lower percentages of Class I soils than all other site types. For the 1868-1893 time period, non-agricultural dwelling complexes continue to show a lower percentage of Class I soils than agricultural tenant complexes and agricultural sites.

These data show that there are some interesting trends in historic site distributions with respect to agricultural soils of high productivity. The reduction in Class I soil percentages seen at agricultural sites through time probably reflects the simple reduction of availability of areas with high quality soils. As populations grew through the 19th century, availability of good land decreased. The data studied here indicate that a critical point was reached in southern New Castle County during the 1850's. Non-agricultural dwelling complexes

TABLE 43

SIGNIFICANCE TESTS FOR CLASS I AGRICULTURAL SOILS PERCENTAGES BY SITE TYPES

Total Data

AGCX	----		
DWCX	1.741	-----	
AGTEN	1.742	2.479*	------
	AGCX	DWCX	AGTEN

1802-1849

AGCX-AGTEN	.337

1849-1868

AGCX	----		
DWCX	2.259*	----	
AGTEN	1.243	2.493*	----
	AGCX	DWCX	AGTEN

1868-1893

AGCX	----		
DWCX	1.057	----	
AGTEN	.191	2.668*	----
	AGCX	DWCX	AGTEN

* - significant difference (p <.10)

originally have significantly lower percentages of highly productive soils; however, later non-agricultural dwelling sites do have high percentages of Class I soils. This pattern suggests that the earliest peoples coming into the area for non-agricultural pursuits did not select productive land for settlement. Either only small-scale subsistence farming, which did not require extensive use of Class I soils, was practiced by these peoples, or, these people had sufficient capital to buy food beyond what was grown at home. Nonetheless, after 1868 the non-agricultural dwelling complexes do show significantly higher proportions of Class I soils. Either a change in subsistence activities, or a change in the availibility of cash among later settlers who were not involved in agriculture could explain this pattern for southern New Castle County. Similar patterns are noted in a study of agricultural production and soil fertility in New Hampshire (Hamburg 1985).

Location of historic sites in relation to soils which are highly productive for woodlots was analyzed in a manner similar to that used for agricultural soils. Table 44 shows the mean percentages of soils of high woodlot productivity for various data sets. A difference of proportion test was applied to all of the percentages to see if the values were significantly higher than the natural distribution of high productivity woodlot soils. All of the percentages are significantly higher than the natural distribution percentage indicating that the historic sites are correlated with the high productivity woodlot soils.

TABLE 44

WOODLOT SOIL CAPACITY - DESCRIPTIVE STATISTICS

Data Set	N	Mean	Std. Dev.	Skew.	Kurtosis
Total	144	72.53*	23.61	-.90	3.09
p1802	4	64.13*	37.10	-.61	1.82
1802-1849	54	76.11*	20.57	-.95	3.38
1849-1868	66	71.86*	23.89	-.87	2.98
1868-1893	15	71.58*	24.38	-.68	2.43
AGCX	83	71.07*	22.67	-.70	2.83
DWCX	17	59.28*	29.54	-.36	2.09
AGTEN	42	79.57*	20.39	-1.47	4.69
AGCX, P1802	4	64.13*	37.10	-.61	1.82
AGCX, 1802-1849	46	76.54*	19.19	-.73	2.80
AGCX, 1849-1868	23	67.49*	22.01	-.32	2.16
AGCX, 1868-1893	6	62.08*	20.23	-.40	2.12
DWCX, P1802	0	----	----	----	----
DWCX, 1802-1849	0	----	----	----	----
DWCX, 1849-1868	11	54.66*	30.53	-.25	1.98
DWCX, 1868-1893	5	68.27*	31.49	-.51	1.89
AGTEN, P1802	0	----	----	----	----
AGTEN, 1802-184	7	69.81*	28.87	-1.07	2.80
AGTEN, 1849-186	31	80.43*	18.77	-1.28	4.02
AGTEN, 1868-189	4	90.00*	10.91	-.79	2.13

* - significant difference ($p < .10$)

Trends through time and differences among varied site types were analyzed and Table 45 shows the difference-of-mean tests for changes through time. No significant changes through time are indicated.

TABLE 45

SIGNIFICANCE TESTS FOR WOODLOT SOILS PERCENTAGES THROUGH TIME

Time Period Comparison	Total Data	AGCX	DWCX	AGTEN
p1802 and 1802-1849	.639	.661	----	-----
1802-1849 and 1849-1868	1.047	1.679	----	.930
1849-1868 and 1868-1893	.004	.573	.809	1.492

---- - No Data

Table 46 shows the distributions of woodlot soil percentages for various site classes during different time periods. The total data show some significant differences among site classes. The percentage of high quality woodlot soils among tenant sites

TABLE 46

SIGNIFICANCE TESTS FOR WOODLOT SOILS PERCENTAGES BY SITE TYPES

	Total Data		
AGCX	----		
DWCX	1.555	----	
AGTEN	2.119*	2.593*	------
	AGCX	DWCX	AGTEN

	1802-1849
AGCX-AGTEN	.597

	1849-1868		
AGCX	----		
DWCX	1.247	----	
AGTEN	2.272*	2.639*	----
	AGCX	DWCX	AGTEN

	1868-1893		
AGCX	----		
DWCX	.379	----	
AGTEN	2.821*	1.439	----
	AGCX	DWCX	AGTEN

* - significant difference

is significantly higher than for either non-tenant agricultural dwelling sites or non-agricultural dwelling sites. A similar pattern is noted for sites dating to the 1849-1868 time period and the high productivity woodlot soils percentages for tenant sites are also high during the 1868-1893 period. Because there is a large amount of overlap among the high productivity wood lot and agricultural soil types, it is not clear how closely these patterns of wood lot soil proportions are related to agricultural site selection patterns. A discussion of these relationships will be deferred until later when the results of a factor analysis can be presented.

Table 47 shows the descriptive statistics for proportions of high productivity grazing soils. All but one proportion that for 1849-1868 non-agricultural dwellings, are significantly higher than the total proportions for the High Coastal Plain according

TABLE 47

GRAZING CAPACITY - DESCRIPTIVE STATISTICS

Data Set	N	Mean	Std. Dev.	Skew.	Kurtosis
Total	144	73.89*	24.51	-1.22	3.91
p1802	4	71.41*	26.05	-.37	1.61
1802-1849	54	78.88*	19.34	-1.09	3.50
1849-1868	66	72.02*	26.46	-1.18	3.56
1868-1893	15	72.02*	27.40	-1.30	4.08
AGCX	83	72.95*	23.08	-1.05	3.63
DWCX	17	56.04*	34.40	-.45	1.86
AGTEN	42	81.82*	18.44	-1.50	4.56
AGCX, P1802	4	71.41*	26.05	-.37	1.61
AGCX, 1802-1849	46	78.60*	19.08	-1.06	3.53
AGCX, 1849-1868	23	66.89*	26.06	-.83	3.12
AGCX, 1868-1893	6	67.06*	21.18	-.89	2.55
DWCX, P1802	0	----	-----	----	----
DWCX, 1802-1849	0	----	-----	----	----
DWCX, 1849-1868	11	53.11	35.11	-.36	1.63
DWCX, 1868-1893	5	63.93*	39.22	-.82	2.34
AGTEN, P1802	0	----	-----	----	----
AGTEN, 1802-1849	7	77.66*	22.23	-1.14	3.09
AGTEN, 1849-1868	31	81.76*	18.45	-1.51	4.63
AGTEN, 1868-1893	4	89.57*	11.71	-.84	2.15

* - significant difference

to difference-of-proportion tests. Table 48 shows results of significance sites for changes in grazing soils percentages through time. Only one significant difference, a decrease ca.

TABLE 48

SIGNIFICANCE TESTS FOR GRAZING SOILS PERCENTAGES THROUGH TIME

Time Period Comparison	Total Data	AGCX	DWCX	AGTEN
p1802 and 1802-1849	.562	.540	----	-----
1802-1849 and 1849-1868	1.638	1.913*	----	.454
1849-1868 and 1868-1893	0.000	.017	.528	1.161

---- - No Data
* - Significant Difference

TABLE 49

SIGNIFICANCE TESTS FOR GRAZING SOILS PERCENTAGES BY SITE TYPES

	Total Data		
AGCX	----		
DWCX	1.939*	-----	
AGTEN	2.328*	2.925*	------
	AGCX	DWCX	AGTEN
	1802-1849		
AGCX-AGTEN	.106		
	1849-1868		
AGCX	----		
DWCX	1.158	----	
AGTEN	2.336*	2.582*	----
	AGCX	DWCX	AGTEN
	1868-1893		
AGCX	----		
DWCX	.166	----	
AGTEN	2.155*	1.387	----
	AGCX	DWCX	AGTEN

* - significant difference

1850 for agricultural complex sites, is noted. Table 49 shows test statistics for different site types during different time periods. For the total data, there are significant differences among all site types. Tenant sites have the highest proportions and non-tenant agricultural sites have a higher proportion than non-agricultural dwelling complexes. For the 1849-1868 data, tenant sites have significantly higher percentages of grazing soils than any other site types. A similar pattern is noted for the 1868-1893 time period. Again, the overlap of grazing and agricultural soils is high and a discussion will be deferred until later.

The final soil data considered were those associated with high productivity wildlife settings. Table 50 shows the descriptive statistics for various data sets and difference-of-

TABLE 50

HUNTING CAPACITY - DESCRIPTIVE STATISTICS

Data Set	N	Mean	Std. Dev.	Skew.	Kurtosis
Total	144	20.54*	20.52	1.36	4.37
p1802	4	28.59*	26.05	.37	1.61
1802-1849	54	16.47*	16.54	1.48	4.81
1849-1868	66	20.61*	20.53	1.21	3.78
1868-1893	15	21.92*	23.86	1.29	3.59
AGCX	83	21.66*	20.25	1.24	4.22
DWCX	17	32.08*	25.78	.73	2.53
AGTEN	42	13.22*	16.12	1.96	6.41
AGCX, P1802	4	28.59*	26.05	.37	1.61
AGCX, 1802-1849	46	17.60*	17.48	1.32	4.16
AGCX, 1849-1868	23	22.78*	18.03	.82	3.12
AGCX, 1868-1893	6	29.18*	22.73	.98	2.77
DWCX, P1802	0	----	----	----	----
DWCX, 1802-1849	0	----	----	----	----
DWCX, 1849-1868	11	34.12*	26.05	.68	2.43
DWCX, 1868-1893	5	27.21*	30.32	.91	2.51
AGTEN, P1802	0	----	----	----	-- --
AGTEN, 1802-1849	7	11.39*	6.39	.11	1.44
AGTEN, 1849-1868	31	14.77*	18.23	1.63	4.78
AGTEN, 1868-1893	4	17.70*	3.12	-.82	2.03

* - significant difference

proportion tests show that all of the observed proportions are lower than the natural proportions of the High Coastal Plain. This finding would seem to indicate that selection of high productivity wildlife soils was not an important factor in historic site selection for the study area. Table 51 shows significant test data on wildlife soils through time and no significant differences are noted. Table 52 shows the same data for functional site types. The total data show that tenant sites

TABLE 51

SIGNIFICANCE TESTS FOR WILDLIFE SOILS PERCENTAGES THROUGH TIME

Time Period Comparison	Total Data	AGCX	DWCX	AGTEN
p1802 and 1802-1849	.917	.828	----	-----
1802-1849 and 1849-1868	1.223	1.136	----	.831
1849-1868 and 1868-1893	.197	.639	.441	.808

---- - No Data

TABLE 52

SIGNIFICANCE TESTS FOR WILDLIFE SOILS PERCENTAGES BY SITE TYPES

	Total Data		
AGCX	----		
DWCX	1.570	-----	
AGTEN	2.530*	2.803*	------
	AGCX	DWCX	AGTEN
	1802-1849		
AGCX-AGTEN	1.758		
	1849-1868		
AGCX	----		
DWCX	1.302	----	
AGTEN	1.607	2.274*	----
	AGCX	DWCX	AGTEN
	1868-1893		
AGCX	----		
DWCX	.120	----	
AGTEN	1.220	.697	----
	AGCX	DWCX	AGTEN

* - significant difference

types of rural sites. Changes in soil correlations through time reveal some interesting trends which seem to be restricted to agricultural soils. Where there are other changes in soil proportions through time, such as in wood lot or grazing soils, they are not as clear-cut and only mirror trends in the agricultural soils proportions. The absence of a correlation with wildlife soils suggests that hunting, trapping, and/or fishing were not important subsistence activities during the 19th century. At least, these activities were not important enough to affect site selections. Furthermore, the absence of game animals in 19th century rural faunal assemblages from northern Delaware (eg. Coleman et al. 1984) supports this contention.

One of the most interesting sidelights of this analysis is the fact that the high productivity soil settings are similar to those used to map edaphic soil zones in analyses of prehistoric site locations (Eveleigh et al. 1983; Wells 1981). These soil zones have been mapped using LANDSAT multispectral scanner data and it is possible that the correlations between soil types and site locations could be used to develop historic site prediction models using LANDSAT data.

Surface Water Setting. Although water collection technologies of the European settlers of the historic period were more advanced than those of the prehistoric groups, access to fresh water was an important factor in settlement. Lemon (1972:63) notes that in southeastern Pennsylvania most settlers were probably more concerned with accessible water supplies than with soil qualities and that most settlers wanted to avoid digging wells. Consequently, springs and permanent streams were preferred site locations. In the Delaware Coastal Plain, fresh water is an even more critical resource given the brackish nature of the major watercourses and the low moisture-retention capacity of some of the major soil associations (Brush 1982). In order to measure the effects of surface water setting three variables were measured: type of surface water setting, presence/absence of stream confluences, and distance to nearest fresh water.

Four basic types of surface water setting were recorded for historic site locations: flowing stream, ephemeral stream, bay/basin, and bay/basin/stream. Flowing streams and bay/basin-related settings represent extant surface water available to sites' occupants. Ephemeral streams of the High Coastal Plain can be used as indicators of springheads. Tables 54 and 55 show crosstabulations of the varied surface water settings with site age and site function. The chi-square test statistics show that there are no dependent relationships between the variable combinations. The crosstabulations do show that flowing and ephemeral streams are the most common surface water settings associated with historic sites. Although bay/basins are at times associated with historic sites, they are not commonly associated with historic sites and, presumably, they are not preferred historic settlement locations. The absence of dependent relationships in the crosstabulations indicates that these trends in location are constant through time among all functional site types.

have significantly lower percentages of wildlife soils than either of the other site types.

As was noted earlier, there is overlap of the constituent soil series that make up the varied soil capability classes used in this analysis. A factor analysis was undertaken to ascertain the degree of this overlap before the analytical results can be discussed. Table 53 shows the results of the factor analysis. The principal factor loadings matrix shows that in general all four soil classifications correlate with a single factor. However, grazing and wildlife soils show negative correlations with the second factor. The negative correlation with Factor II is highest for the high productivity wildlife soils. The zero-one cluster-centroid matrix, which highlights differential factor correlations among the variables shows that Woodlot and Agricultural soils are most closely correlated while grazing and wildlife soils are correlated.

TABLE 53

FACTOR MATRICES - HISTORIC SITE SOIL DATA

	Zero-One Cluster-Centroid Matrix		Principal Factor Loadings Matrix	
Soil Types	Factor I	Factor II	Factor I	Factor II
Wood Lot	0	1	.9868	.2005
Agricultural	0	1	.9752	.2390
Grazing	1	0	.9706	-.0969
Wildlife	1	0	.9229	-.3650

The factor analysis shows that there is a high degree of similarity among all the soil capability ratings; however, woodlot and agricultural soils are most closely related as are grazing and wildlife soils. The high productivity woodlot and agricultural soils are generally the best-drained while grazing soils are somewhat more poorly drained. High productivity wildlife soils are the most poorly drained. The correlations of historic site locations and high productivity agricultural and woodlot soils are probably monitoring the same soil characteristics; namely, well drained (but not excessively well-drained) soils with high degree of moisture retention and high organic content. High proportions of high quality grazing soils represent a similar selection factor, but the discrimination is not as distinctive. High productivity wildlife soils with low proportions show an avoidance of the poorly drained soils.

In sum, of the soil data considered high productivity agricultural soils are the most restrictive soils that can be correlated with rural historic site locations of all periods. Except for a few instances, the correlations hold for almost all

TABLE 54

CROSSTABULATION OF HISTORIC SITE AGE AND SURFACE WATER TYPE

Age	Surface Water			
	Flow.Stream	Eph.Stream	Bay/Basin	Bay./Basin/Str.
p1802	5	4	0	0
1802-1849	35	20	5	7
1849-1868	41	19	7	9
1868-1893	9	8	1	6

Chi-square=5.90 d.o.f.=3 p>.10

TABLE 55

CROSSTABULATION OF HISTORIC SITE AGE AND SURFACE WATER TYPE

Function	Surface Water			
	Flow. Stream	Eph. Stream	Bay/Basin	Bay./Basin/Stream
Agricultural	59	43	10	16
Non-agricultural	31	8	3	6

0 = 3 $X^2 = 5.90$ p > .10

A related variable is the presence/absence of stream confluences at historic site locations. Table 56 shows crosstabulations of stream confluences and site function and date. No dependent relationships are noted and most historic sites (97%) are not associated with stream confluences.

In order to more carefully consider the importance of surface water for historic site locations, the distance to nearest fresh water source was recorded and analyzed for all historic site locations. Before any analysis, water distance measures were examined for normality using the Q-Q test. Table 57 shows the Q-Q statistics for various sets of water distance data and, for the most part, the data sets are not normally distributed. Consequently, parametric analytical techniques cannot be used.

Table 58 shows a series of non-parametric range statistics for various data sets. The very large value of the 75th percentile-maximum range for the total data set indicates that the non-normality of the distributions is caused by a series of outlying, and very high, distance values. When range statistics

TABLE 56

CROSSTABULATIONS OF STREAM CONFLUENCES AND HISTORIC SITE AGE AND FUNCTION

Function	Confluence: Absent	Confluence: Present
Agricultural	124	4
Non-agricultural	46	2
	$0 = 1$	$X^2 = .11$ $p > .10$
Age		
p1802	9	0
1802-1849	63	4
1849-1868	74	2
1868-1893	24	0
	$0 = 3$	$X^2 = 2.64$ $p > .10$

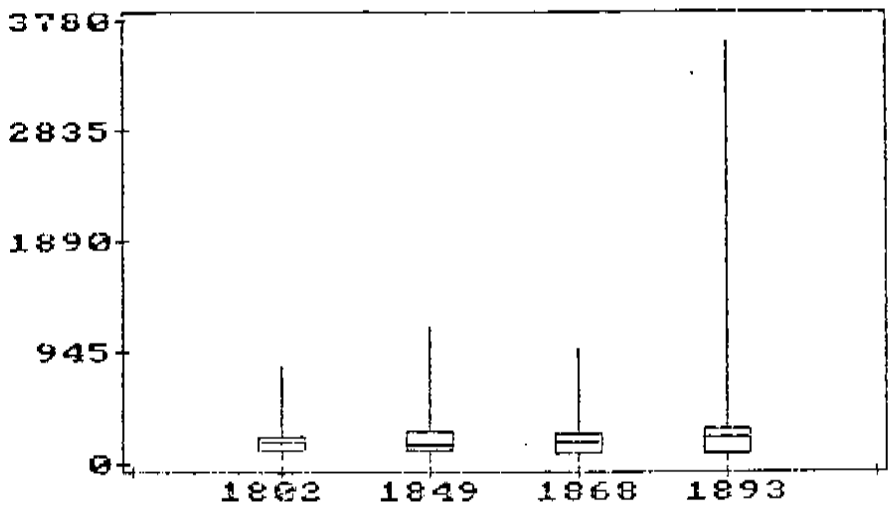
TABLE 57

Q-Q STATISTICS FOR WATER DISTANCE DATA

Data Set	Q-Q Statistic	Probability Value
Total Data	.6946	$p > .10$
p1802	.8596*	$.05 < p < .10$
1802-1849	.8695	$p > .10$
1849-1868	.9103	$p > .10$
1868-1893	.5686	$p > .10$
Agricultural	.6879	$p > .10$
Non-Agricultural	.9358*	$.05 < p < .10$
Flowing stream	.9026	$p > .10$
Ephemeral stream	.8649	$p > .10$
Bay/basin	.9102*	$.05 < p < .10$
Bay/basin/stream	.5558	$p > .10$

* - normal distribution

FIGURE 46
Box Plot of Water Distance by Time Period for Historic Sites



for the varied time periods are considered, some trends in the data are apparent. Median values are relatively constant up to 1868; however, for the period from 1868 - 1893 there is a significant increase in the median distance value indicating that more sites are located further away from water during this time period. Furthermore, the box plot of water distances by time period categories noted in Figure 46 shows a marked increase in the overall value ranges for the 1868-1893 time period. This trend may indicate that post-1868 groups had to use less favorable site locations with regard to surface water settings; or, post-1868 groups were more dependent on wells than natural surface water sources. However, even during the post-1868 period, 50% of the historic sites are located within 250 meters of surface sources of fresh water. Therefore, the role of natural surface water seems to be an important part of historic site locations decisions. Wells were important, as evidenced by the increased number of sites in later time periods which are far from surface water sources, but access to fresh surface water was important throughout the 19th century.

FIGURE 47

Box Plot of Water Distance by Site Function for Historic Sites

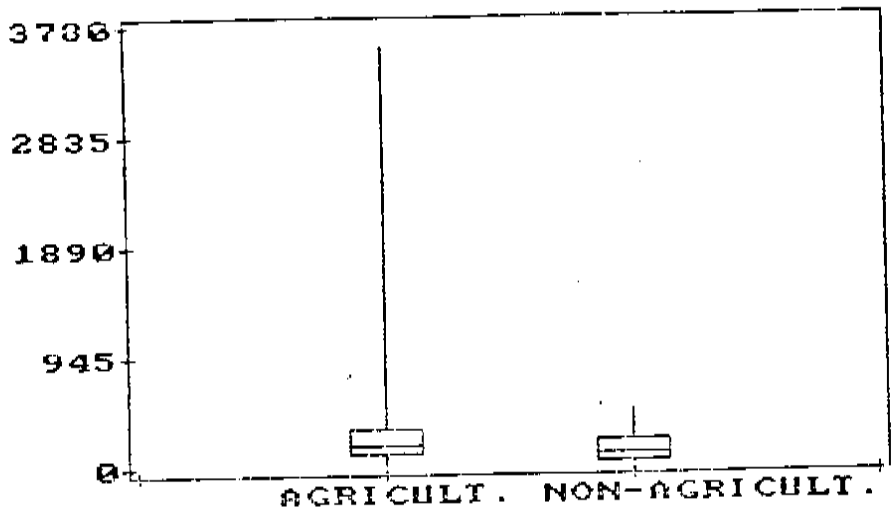


FIGURE 48

Box Plot of Water Distance by Surface Water Type for Historic Sites

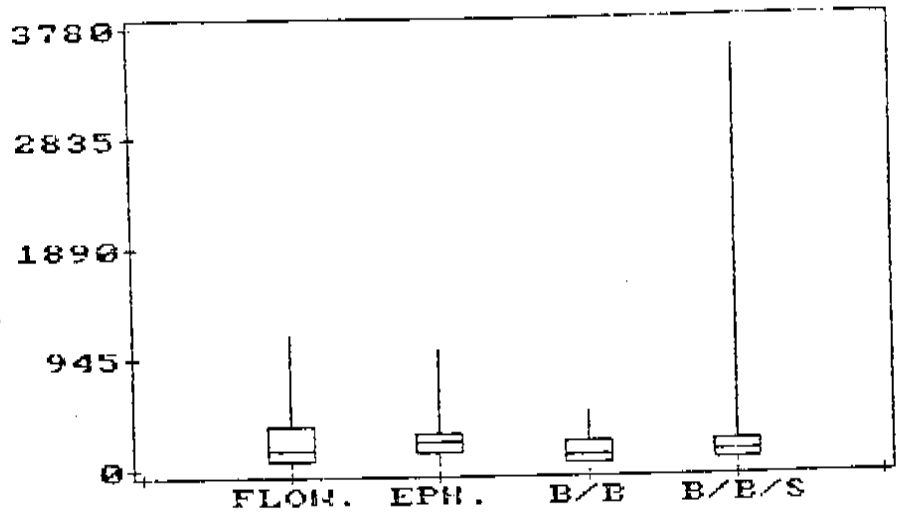


TABLE 58

NON-PARAMETRIC RANGE STATISTICS FOR WATER DISTANCE DATA

Data Set	Min	25th-ile	Median	75th-ile	Max	Range	75th-ile-Max Ra.
Total Data	24	108	192	288	3600	3576	3312
p1802	48	120	192	840	840	792	0
1802-1849	24	120	168	288	1152	1128	864
1849-1868	24	96	180	264	960	936	696
1868-1893	24	96	240	300	3600	3576	3300
Agricultural	24	120	192	312	3600	3576	3288
Non-agri-cultural	24	48	120	240	480	456	240
Flowing stream	24	72	156	336	1152	1128	816
Ephemeral stream	24	144	240	312	1008	984	696
Bay/basin	48	48	120	240	480	432	240
Bay/basin/ stream	24	72	144	240	3600	3576	3360

It should also be noted here that the distance measures used for this analysis were derived particularly for fresh water rather than navigable water. Thus, the proximity to water noted above is related more to potable water than to access to water transportation. The relatively large number of sites associated with ephemeral streams and bay/basins, neither of which are navigable (see Table 54), supports this contention.

Surface water distance data were also analyzed for sites of different functions. The values in Table 58 and the box plot in Figure 47 show that the values are relatively similar for the different functional site types. However, the agricultural sites show the largest range of values.

Varied types of surface water settings were also analyzed for surface water distance and the results shown in Table 58 and Figure 48 reveal that the values are relatively constant. However, the median value for ephemeral streams is larger than those for the other surface water settings. On the other hand, the bay/basin/stream settings show the largest range of distance values.

In sum, surface water settings show important relationships to historic site locations for all types of sites during all time periods. Half of the sites are within approximately 200 meters of a freshwater source and 75% are within 300 meters. During the post-Civil War period, more agricultural sites are located at increasingly large distances from fresh water settings. Also, lower order streams and springs are used more commonly during the post-Civil War time period.

Access to Transportation Networks. One of the important site location factors noted by Lemon (1972:69) is access to markets. Main (1973) has categorized the New Castle County area as a commercial farm community which sold a high proportion of its agricultural produce. Consequently, access to transportation networks was quite important for the maintenance of a successful farm economy. For the study area, there were three main transportation networks available at different time periods: water transportation, the road network, and the railroad system.

Water transportation was the most important transportation method for most of the historic period in the Delmarva and Chesapeake (Earle 1975; Middleton 1953) region because until well into the 19th century the road networks were very poorly developed (Gray 1961:311). Access to water transportation was measured in two ways. The straightline distance from site locations to the nearest navigable water was measured along with the distance to local historically documented landing sites. Landings were chosen for measurement based on an examination of Beer's Atlas. For the Appoquinimink area, distances to Thomas Landing, Stave Landing, Taylor's Bridge, and Blackbird Landing were calculated. Distances to Blackbird Landing, Short's Landing, Fleming's Landing, Eagle Nest Landing, and Brick Store Landing were measured for sites in the Blackbird area. No landing measurements were taken for the sites in the St. Georges area due to the limited number of sites and the proximity of major transshipment points such as Port Penn, St. Georges, and Delaware City.

Although the road networks of the study area were very poorly developed, they were still important transportation corridors throughout the 18th and 19th centuries (Main 1973; Gray 1961). Road networks were so important that in some cases entire farmsteads in Delaware (Coleman et al. 1984; Heite 1984) and New Jersey (Manning 1984) were reorganized and reoriented in response to shifts in road placement. Access to road networks was measured in two ways. First, straightline distance to the closest major road of the 18th and 19th century was measured. The roads used for these measurements were the major trans-peninsular connectors including the major north-south route (Route 13) and various east-west connectors. The roads used for measurements were consistent with those used in the development of predictive zones for the original Route 13 planning study (Custer et al. 1984: Attachments VI and VII). In all cases the roads utilized for measurement were extant at the time the sites were occupied.

As part of the analysis of road networks, distance to major crossroads and transhipment points was also measured. Crossroads used for measurements in the St. Georges area included Port Penn, St. Georges, and Delaware City. For the Appoquinimink area, distances to Port Penn, Odessa, and Smyrna Landing were measured. Smyrna Landing was also the major crossroad measured in the Blackbird area.

Access to rail transportation for post-1850 sites was measured by recording the distance to the nearest railroad depot for structures post-dating 1850, which was the date of the construction of the railroad through the study area (Hayman 1979; Custer et al. 1984:15). Railroad depots were chosen for measurement based on Beer's Atlas. Railroad depots used for analysis in the St. Georges area included Mount Pleasant and St. Georges Station. The major depots studied in the Appoquinimink area were Middletown, Townsend, and Blackbird. In the Blackbird area, the major depots studied were Blackbird, Sassafras (Green Springs), and Clayton.

In all cases where there were multiple measures of transportation network access, such as landings, crossroads, and railroad depots, the minimum distance for each historic site was recorded. Thus, for each site there were both measurements to specific landings, crossroads, and railroad depots and measurements of the minimum distance to each of these major transportation nodes. All of the measures were checked for normal distributions using the Q-Q test and Table 59 shows the results. Most of the distributions are normal and the three which are not normal are still close to normal. Therefore, parametric statistical tests could be utilized.

Table 60 shows the descriptive statistics for minimum navigable water distances for the total data set, varied time periods, and varied functional site types. The large values for the standard deviations and kurtosis and the relatively low skewness values indicate distributions that are centered, yet fairly dispersed. Varied combinations of means were tested for significant differences and the resulting test statistics are noted in Table 61. None of the differences are significant; however, there is a tendency for sites to be located at increasingly greater distances from navigable water through time. This tendency is probably related to the increased use of roads and railroads for transportation through the 19th century (Hayman 1979). It is interesting to note, however, that the shift to alternate transportation networks was a gradual process such that when the varied time periods are compared on a serial basis there are no significant differences. The cumulative difference is significant, nonetheless. There are no apparent differences among the site types.

A related measure is minimum distance to the major landing sites and the descriptive statistics are noted in Table 62 for varied data sets. The distributions are all negatively skewed toward the smaller values and the standard deviations are relatively small compared to the other distance distributions. Table 63 shows the test statistics for difference-of-mean tests among the sites of different functions and time periods. No significant differences are noted. The distances to landings can be compared with distances to navigable water and the results are noted in Table 64. In all cases, the distances to navigable water are smaller indicating that the direct distance to major landings is probably not an important consideration in historic site

TABLE 59

Q-Q STATISTICS FOR TRANSPORTATION ACCESS MEASURES

Variable	Data Set	Q-Q	Probability
Navigable Water Distance	Total Data	.9751*	.05 < p < .10
	p1802	.8171	p > .10
	1802-1849	.9668*	.05 < p < .10
	1849-1868	.9767*	.05 < p < .10
	1868-1893	.9937*	p < .01
	Agricultural	.9676*	.05 < p < .10
	Non-agricultural	.9550*	.05 < p < .10
Road Distance	Total Data	.9751*	.05 < p < .10
	p1802	.9166*	.05 < p < .10
	1802-1849	.9710*	.05 < p < .10
	1849-1868	.9758*	.05 < p < .10
	1868-1893	.9446*	.05 < p < .10
	Agricultural	.9713*	.05 < p < .10
	Non-agricultural	.9739*	.01 < p < .05
Minimum Cross-road Distance	Total Data	.9610*	.05 < p < .10
	p1802	.9292*	.01 < p < .05
	1802-1849	.9649*	.05 < p < .10
	1849-1868	.9621*	.05 < p < .10
	1868-1893	.9365*	.05 < p < .10
	Agricultural	.9646*	.05 < p < .10
	Non-agricultural	.9470*	.05 < p < .10
Minimum Rail-road Distance	Total Data	.8833	p > .10
	1849-1868	.9820*	.01 < p < .05
	1868-1893	.9466*	.01 < p < .05
	Agricultural	.8726	p > .10
	Non-agricultural	.9040*	.05 < p < .10
Minimum Landing Distance	Total Data	.9820*	p < .01
	p1802	.9670*	p < .01
	1802-1849	.9775*	.05 < p < .10
	1849-1868	.9812*	p < .01
	1868-1893	.9640*	.01 < p < .05
	Agricultural	.9826*	.05 < p < .10
	Non-agricultural	.9750*	.05 < p < .10

* - normal distribution

TABLE 60

DESCRIPTIVE STATISTICS NAVIGABLE WATER DISTANCE

Data Set	N	Mean	Std. Dev.	Skew.	Kurtosis
Total	176	1394.59	1024.32	.58	2.57
p1802	9	690.67	952.98	1.95	5.57
1802-1849	67	1274.15	933.62	.88	3.28
1849-1868	76	1477.58	1098.28	.42	2.32
1868-1893	24	1732.00	924.75	.21	2.64
Agricultural	128	1426.50	1029.17	.76	2.79
Non-agricultural	48	1309.50	1017.11	.06	1.71

TABLE 61

DIFFERENCE-OF-MEAN TEST STATISTICS - NAVIGABLE WATER DISTANCE

Data Combination	Test Statistic	Probability
p1802 - 1802-1849	1.73	p>.10
1802-1849 - 1849-1868	1.20	p>.10
1849-1868 - 1868-1893	1.21	p>.10
Agricultural - Non-agricultural	.68	p>.10

* - significant difference

TABLE 62

DESCRIPTIVE STATISTICS - MINIMUM LANDING DISTANCE

Data Set	N	Mean	Std. Dev.	Skew.	Kurtosis
Total	176	3678.82	1974.06	-.28	2.49
p1802	9	5053.00	2274.78	-.60	2.63
1802-1849	67	3373.52	2097.16	-.17	2.11
1849-1868	76	3789.14	1862.79	-.31	2.74
1868-1893	24	3666.42	1692.30	-.69	2.83
Agricultural	128	3502.61	1975.85	-.23	2.39
Non-agricultural	48	4148.73	1910.65	-.41	2.84

TABLE 63

DIFFERENCE-OF-MEAN TEST STATISTICS - MINIMUM LANDING DISTANCE

Data Combination	Test Statistic	Probability
p1802 - 1802-1849	.83	p>.10
1802-1849 - 1849-1868	1.39	p>.10
1849-1868 - 1868-1893	1.40	p>.10
Agricultural - Non-agricultural	.56	p>.10

TABLE 64

DIFFERENCE-OF-MEAN TEST STATISTICS - MINIMUM LANDING DISTANCE AND NAVIGABLE WATER DISTANCE

Data Combination	Minimum Landing Distance mean(std.dev.)	Navigable Water Distance mean(std.dev.)	Test Statistics	Probability
Total Data	3678.82(1974.06)	1394.59(1024.32)	13.63	p < .001
p1802	5053.00(2274.78)	690.67(952.98)	5.31	p < .01
1849	3372.52(2097.16)	1274.15(933.62)	7.49	p < .01
1868	3789.14(1862.79)	1477.58(1098.28)	9.32	p < .001
1893	3666.42(1692.30)	1732.00(924.75)	4.91	p < .01
Agricultural	3502.61(1975.85)	1426.50(1029.17)	10.54	p < .001
Non-agicul-tural	4148.73(1910.65)	1309.50(1017.11)	10.63	p < .001
			9.08	p < .001

selection. Distance to roads and site-specific distances to navigable water are more important and meaningful.

Table 65 shows the descriptive statistics for road distance measures and the skewness and kurtosis figures show quite varied distributions. Table 66 shows the difference-of-mean statistics for varied combinations of data and no significant differences are noted. There are no consistent trends through time. Therefore, the mean value for the total data set (1.06 km) can be viewed as a good approximation of the common distance of historic sites from major road transportation routes.

A related measure is the minimum distance to the major crossroads of the area. Table 67 shows the descriptive statistics and the varied skewness and kurtosis coefficients indicate a series of distributions of different shapes and

TABLE 65

DESCRIPTIVE STATISTICS - ROAD DISTANCE

Data Set	N	Mean	Std. Dev.	Skew.	Kurtosis
Total	176	1056.95	761.26	.26	2.21
p1802	9	1248.00	944.88	-.38	1.65
1802-1849	67	975.76	751.45	.42	2.33
1849-1868	76	1151.37	757.07	.01	1.88
1868-1893	24	913.00	724.45	1.06	4.91
Agricultural	128	1038.56	791.09	.39	2.25
Non-agricultural	48	1106.00	680.66	-.21	2.03

TABLE 66

DIFFERENCE-OF-MEAN TEST STATISTICS - ROAD DISTANCE

Data Combination	Test Statistic	Probability
p1802 - 1802-1849	.93	p>.10
1802-1849 - 1849-1868	.37	p>.10
1849-1868 - 1868-1893	1.24	p>.10
Agricultural - Non-agricultural	1.15	p>.10

TABLE 67

DESCRIPTIVE STATISTICS - MINIMUM CROSSROAD DISTANCE

Data Set	N	Mean	Std. Dev.	Skew.	Kurtosis
Total	176	6503.98	3709.71	.01	1.55
p1802	9	5068.33	3716.23	.88	2.48
1802-1849	67	6279.24	3542.98	.05	.58
1849-1868	76	6496.14	3643.16	.01	1.55
1868-1893	24	7694.54	4262.96	-.50	1.69
Agricultural	128	6302.59	3657.62	.07	1.59
Non-agricultural	48	7041.00	3832.32	-.15	1.49

compositions. Table 68 shows the difference-of-mean statistics for varied data combinations and one significant difference is noted for the ca. 1868 time period. The significant difference is an increase in crossroads distance for the 1868-1893 time period and this increase is part of a trend of increasing distance which is seen through all time periods. This trend may indicate that the preferred locations closest to crossroads, which were also market and social interaction centers, were settled first. Later people coming to the area had to choose less desirable locations farther from the crossroads, especially during the post-1868 time period. Trends in choices of less than

TABLE 68

DIFFERENCE-OF-MEAN TEST STATISTICS - MINIMUM CROSSROAD DISTANCE

Data Combination	Test Statistic	Probability
p1802 - 1802-1849	.52	p>.10
1802-1849 - 1849-1868	1.39	p>.10
1849-1868 - 1868-1893	2.09	p>.10
Agricultural - Non-agricultural	1.25	p>.10

optimal soils settings also showed similar trends for the post-Civil War time period.

The final distance measure to be considered was distance to railroad depots. Table 69 shows the descriptive statistics and the skewness coefficients show a preponderance of larger values. Table 70 shows the difference-of-mean statistics and the only significant difference noted is between agricultural and non-agricultural sites with the agricultural sites being located significantly closer to railroad depots than non-agricultural sites. Proximity to railroad depots was probably especially important for late-19th century farmsteads given the importance of marketing agricultural products of all types.

TABLE 69

DESCRIPTIVE STATISTICS - MINIMUM RAILROAD DISTANCE

Data Set	N	Mean	Std. Dev.	Skew.	Kurtosis
Total	100	2021.67	2582.25	1.00	2.69
1849-1868	76	3639.26	2399.36	.17	2.06
1868-1893	24	3304.42	2842.65	.52	1.88
Agricultural	68	1846.75	2489.93	1.18	3.23
Non-agricultural	32	2488.12	2787.44	.58	1.81

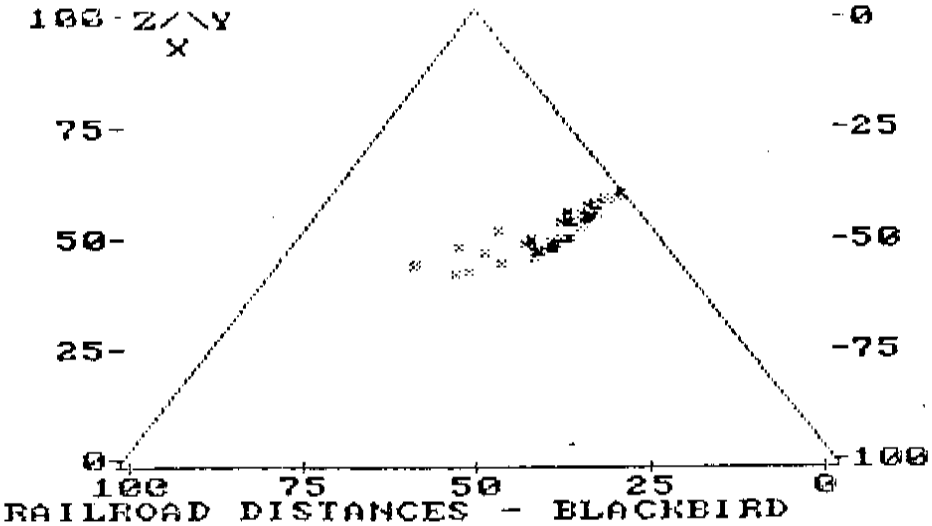
TABLE 70

DIFFERENCE-OF-MEAN TEST STATISTICS - MINIMUM RAILROAD DEPOT DISTANCE

Data Combination	Test Statistic	Probability
1849-1868 - 1868-1893	.30	p>.10
Agricultural- Non-agricultural	1.97	p>.10

* - significant difference

FIGURE 49
Railroad Distances – Blackbird Area



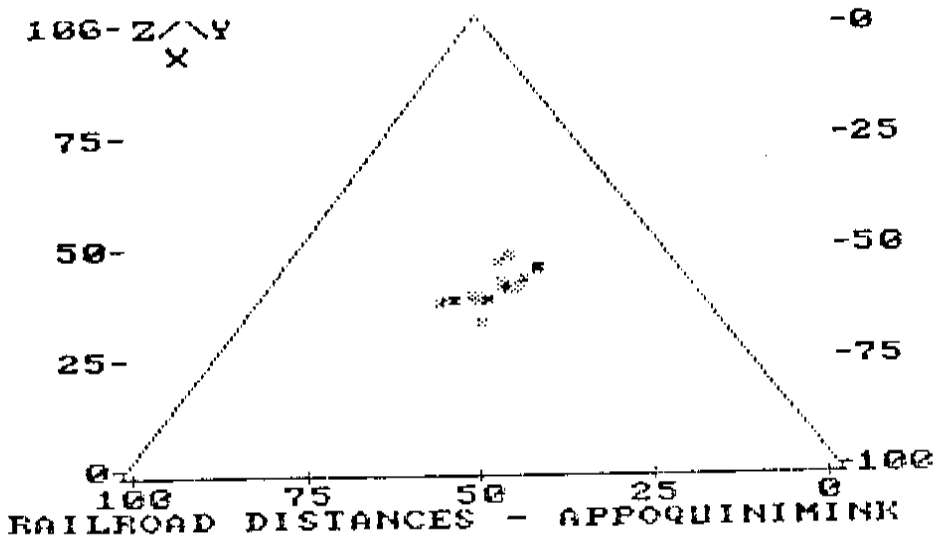
X–Blackbird Y–Sassafras Z–Clayton

In addition to considering the minimum distance data noted above, a series of analyses of distance to specific railroad depots, crossroads, and landings were undertaken for those areas where multiple measurements were available. The analyses consisted of development of three-way scatter plots of the distance measurements to see which of the railroad depots, crossroads, and landings had the largest number of minimum distances. In other words, the analysis sought to identify the railroad depots, crossroads, and landings around which the greatest number of sites clustered. Although proximity to a certain transportation node does not necessarily mean that that particular node was most commonly used, proximity can be used as a rough measure of the relative importance of the various nodes.

Figure 49 shows the scatter plot for railroad depots in the Blackbird area. Most of the sites are closest to Blackbird Station and are relatively evenly spaced between Sassafras and Clayton. Figure 50 shows the scatter plot for railroad distances in the Appoquinimink area. In this case the historic sites are pretty much equidistant from the major railroad depots. It would be interesting to see if there are any differences in the frequency of railroad depot use in the Blackbird area given the fact that Blackbird has more closer sites. Furthermore, it would be interesting to see if there are differences in railroad depot use between the Blackbird and Appoquinimink areas given the differing relationships among historic sites and railroad depots between the two areas.

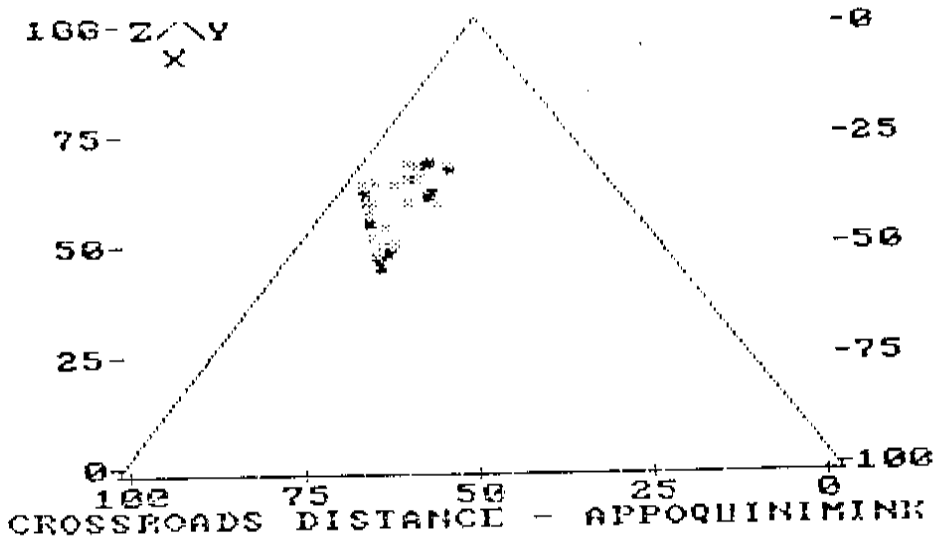
The Appoquinimink area was the only area with sufficient data on proximity to several crossroads and Figure 51 shows the three-way scatter plot of these data. The majority of the historic sites are closest to Odessa as would be expected.

FIGURE 50
Railroad Distances – Appoquinimink Area



X–Middletown Y–Townsend Z–Blackbird

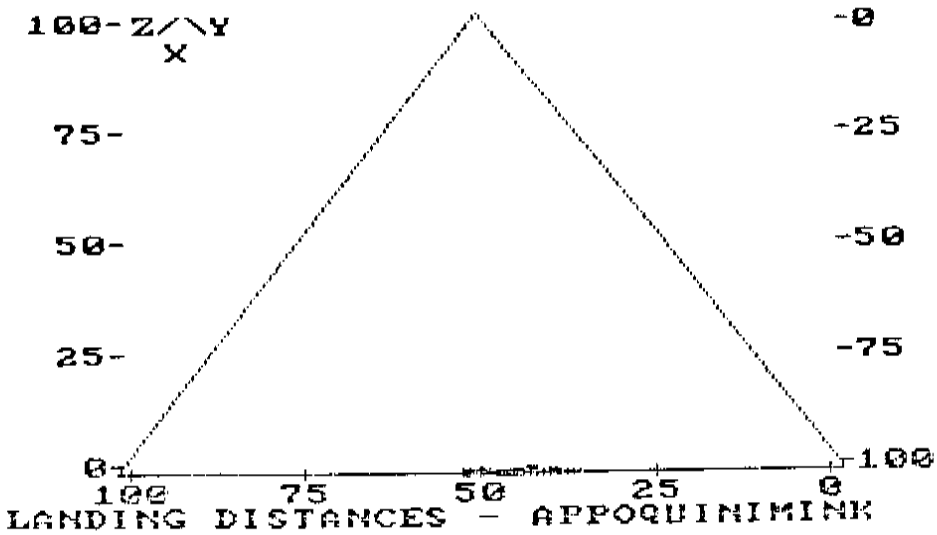
FIGURE 51
Crossroads Distances – Appoquinimink Area



X–Port Penn Y–Odessa Z–Smyrna Landing

FIGURE 52

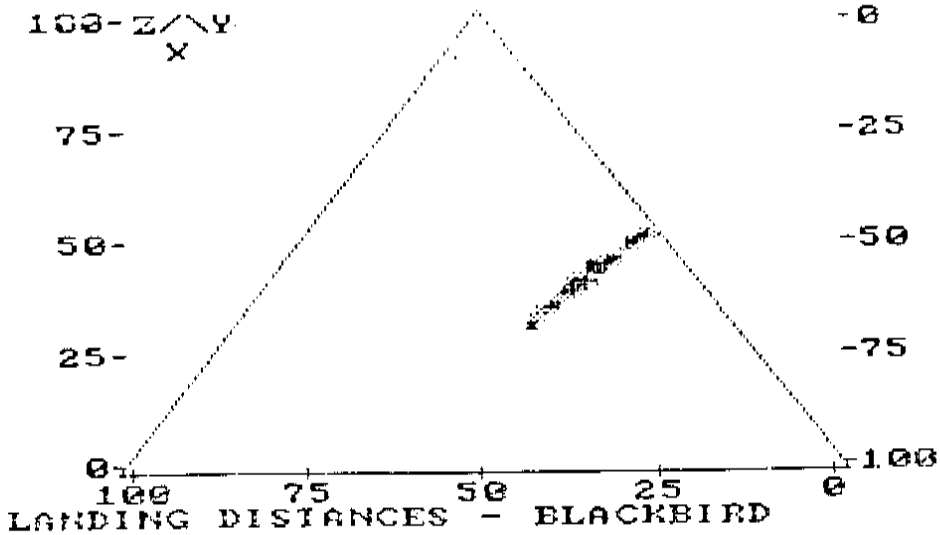
Landing Distances – Appoquinimink Area



X–Thomas Y–Stave Z–Blackbird

FIGURE 53

Landing Distances – Blackbird Area



X–Blackbird Y–Fleming Z–Brick Store

Distances to landings were plotted for the Appoquinimink area and the Blackbird areas and these plots are shown in Figures 52 and 53. In the Appoquinimink area (Figure 52), by far all of the sites are closest to Blackbird Landing and are equidistant from Thomas and Stave Landings. In the Blackbird area (Figure 53), most of the sites are closest to Fleming's Landing and equidistant from Blackbird and Brick Store Landings. In both of these cases, it would be interesting to see if the most proximate landings are the landings used most frequently. It should also be noted that this quick analysis of distance distributions suggests that a gravity model of differential distances to transportation nodes may be appropriate for mapping out economic and social interaction patterns (Coleman et al. 1984). However, such an analysis is beyond the scope of this report.

A final analysis undertaken using the distance data and the agricultural soil productivity data was a factor analysis to see how the variables overlapped. Table 71 shows the zero-one cluster-centroid transformation matrices for a two-factor and three-factor analysis. The two-factor analysis separated out minimum crossroads distance and all other measures were clustered in a similar factor. In the three factor-analysis, minimum

TABLE 71

ZERO-ONE CLUSTER-CENTROID TRANSFORMATION MATRIX - DISTANCE MEASURES

	F1	F2	F1	F2	F3
WDIS	1	0	0	0	1
NWDIS	1	0	1	0	0
RDIS	1	0	1	0	0
MINCD	0	1	0	1	0
MINRR	1	0	1	0	0
MINLAND	1	0	1	0	0
AGRICULTURAL SOILS	1	0	0	0	1

crossroads distance remained a separate factor and water distance and agricultural soils were grouped into a factor of their own. The remaining factor consisted of navigable water distance, road distance, minimum railroad distance and minimum landing distance. These factors may be interpreted as follows:

Factor I - Subsistence Factor

Water Distance
Agricultural Productivity Factor

Factor II - Market Factor

Minimum Crossroads Distance

Factor III - Transportation Factor

Navigable Water Distance
Road Distance
Minimum Road Distance
Minimum Landing Distance

Discussion of Historic Site Location Analysis. The data analyzed above can be used to generate a series of descriptions of typical historic site locations for different site types and time periods. These descriptions are listed in Table 72 and only the most useful variables are listed. These typical settings can be used as guides to likely locations of historic sites (eg. - Lafferty et al. 1981) and will be used to develop refined historic site sensitivity areas in the management section of this report.

TABLE 72

TYPICAL HISTORIC SITE LOCATIONS

Site Type	Water Dis.(km)	Percent Class I Soil(%)	Min. Cross Road Dis. (km)	Nav. Water Dis.(km)	Road Dis. (km)	R.R Distance (km)
General	1.9	66	6.5	1.4	1.1	N/A
p1802	1.9	64	5.1	.7	1.2	N/A
1802-1849	1.7	70	6.3	1.3	1.0	N/A
1849-1868	1.8	64	6.5	1.5	1.2	3.6
1868-1893	2.4	67	7.7	1.7	.9	3.3
Agricul-tural	1.9	70	6.3	1.4	1.0	1.8
Non-agricul-tural	1.2	49	7.0	1.3	1.1	2.5

It should be noted that the results of the site location analysis are consistent with trends noted in general histories of the area. The importance of marketing of agricultural produce throughout the 19th century is underscored by the fact that farmsteads are generally within approximately 1 kilometer of a road or within 1.5 kilometers of navigable water. The importance of productive soils is underscored by their high percentage within 100 acre site catchments. These two factors, plus surface water, seem to be the major determinants of historic site locations in the areas studied. It would be interesting to use

these variables in a multivariate analysis of the site locations, such as a logistical regression, and see how much of the variation in site locations they account for.

An interesting fact pointed out by the site location analysis is that it was during the period immediately after the Civil War that there is a significant shift in settlement patterns within the areas studied. During the post-Civil War period farmsteads do not contain as high percentages of Class I agricultural soils, nor do they have as easy access to transportation networks. A simple explanation for this phenomenon is the fact that the best locations were already taken and the study area was beginning to fill up. A similar phenomenon seems to have taken place earlier in the more northern parts of the Delmarva Peninsula (Karinen 1958; Coleman et al. 1984:41-43). It would be interesting to see if the quality of life varied between sites which appear to be in more optimal settings and those sites which are in the less desirable settings. Such a comparison could be part of Phase II and III archaeological research at sites impacted by the proposed highway.

In many ways, this preliminary analysis of historic site locations opens many more questions for further research and has several applications. For one thing, it would be interesting to carry out identical analyses with a larger data base. Because the data used here are a non-random sample of a limited geographical area, the conclusions about site locations presented here may not be applicable to a larger area. The existing listing of known historic sites available for the entire Route 13 corridor (Custer et al. 1984: Attachments II and III) would be a more representative data base for analysis. These locational data may also be used within a geographic information system to generate more sophisticated predictive models. It may also be possible to apply LANDSAT satellite data to these predictive models.

NEAREST-NEIGHBOR ANALYSIS

A final analysis of historic site locations that was undertaken used nearest-neighbor analysis. Nearest-neighbor analysis was originally developed in biology to describe the degree to which items of interest are spatially clustered or dispersed (Clark and Evans 1954). The mean distance to the nearest-neighbor is measured from empirical data and compared to the expected distance given a random Poisson distribution of a certain density (Parsons 1974:241-246). The two values are compared as a ratio with the observed value divided by the expected random value. The ratio will vary between 0 and 2.1491 with 0 indicating a completely clustered distribution (all individuals at one location), 1 indicating a random distribution, and 2.1491 indicating an even hexagonally-spaced distribution. The value 1 acts as a dividing point with values greater than 1 indicating a trend toward regular spacing and values less than 1 indicating spatial aggregation. The ratio can be viewed as a

measure of the degree of spatial autocorrelation of the data points (Cliff and Ord 1973). In other words, the nearest-neighbor statistic tells you how much the location of one site is dependent on the location of other sites. The most useful applications in archaeology have been those which used the nearest-neighbor statistic to look for the presence and absence of site clustering, or to look for changes in the degree of site clustering through time (eg. - Earle 1976). However, in these analyses one of the biggest problems is controlling for the contemporaneity of sites (see Tolstoy 1981:3-4 for a discussion of this problem with respect to Earle's 1976 study).

The historic site data from the Appoquinimink and Blackbird areas are especially suitable for nearest-neighbor analysis because both of these study areas are large in extent and include many potential data points. Furthermore, the relatively precise dating of historic sites minimizes the problem of assuring relative contemporaneity of the sites used in the analysis. For each of the areas, the empirical minimum distances to contemporaneous nearest-neighbor sites were calculated from the sites' Universal Transverse Mercator coordinates. Time periods utilized to organize the chronological variation were the same as those used for the other historic site analyses. One problem that does arise when applying nearest-neighbor analyses to the Appoquinimink and Blackbird areas is termed the "boundary effect" imposed by the shape of the study area (McNutt 1981). Generally, the boundary effect is an artificial inflation of the nearest-neighbor empirical measures which occurs when the boundaries of the study area cut off some sites from their nearest-neighbors which lie outside the study area boundaries. However, McNutt (1981) and Pinder, Shimada, and Gregory (1979) offer correction factors to account for this difficulty.

Table 73 shows a series of nearest-neighbor statistics for the Appoquinimink and Blackbird areas during different time periods. There is an insufficient number of pre-1802 sites in the Blackbird area for analysis and no statistics were calculated. Uncorrected values, and corrected values of the nearest-neighbor statistic are all noted. The values from the McNutt corrections were utilized here for interpretation because they fell within the middle of the range of values produced by the alternative calculation methods. Standard error statistics were calculated using the formula provided by Pinder et al. (1979:437). The values are low for all cases except for the pre-1802 sites of the Appoquinimink area. Consequently, the pre-1802 data are somewhat suspect.

Pinder et al. (1979:439) provide a series of charts which show how to interpret the R-statistics given variations in sample size and standard errors of the statistics. The final column of Table 73 shows the interpretations of the study area statistics. In the Appoquinimink area, the sites show random distributions prior to 1849. However, between 1849 and 1868 the distributions tend to become clustered and they retain this characteristic throughout the remainder of the 19th century.

TABLE 23: NEAREST - NEIGHBOR STATISTICS

Area	Time Period	n	D.O.(km)	D.Pan.1	P1	D.Pan.2	P2	D.Pan.3	P3	σ'Pan.	Distrib. Type
Appoquinimink	pre-1802	7	1.21	1.28	.94	2.07	.58	1.59	.76	.25	random
	pre-1849	30	.58	.61	.95	.98	.59	.67	.87	.05	random
	pre-1868	59	.33	.43	.77	.53	.62	.46	.72	.03	cluster
	pre-1893	65	.30	.42	.71	.50	.60	.43	.70	.03	cluster
Blackbird	pre-1802	2	4.38	---	---	---	---	---	---	---	---
	pre-1849	37	.52	.42	1.24	.45	1.15	.46	1.13	.04	random
	pre-1868	79	.34	.29	1.17	.34	1.00	.32	1.06	.02	random
	pre-1893	95	.30	.27	1.11	.31	.97	.28	1.07	.01	random

D.O. - Observed Distance D.Pan. - Random Distance P - D.O./D.Ran

1 = uncorrected
2 = Pinder et al. 1979 correction
3 = McNutt correction

Figure 54 shows the varied site distribution through time for the Appoquinimink area. The post-1850 clusters that appear are located near Middletown, the Boyd's Corner/Drawyer's Church area, and the Mathews Corner/Hangman's Branch area. It should be noted that these clusters should be interpreted as lower-order clusterings of historic settlement because the areas of greatest site clustering, the towns of Middletown and Odessa, were not included in the analysis. Thus, the measures of clustering are really measuring the clustering of rural sites outside the limits of the emerging town centers. The largest of the clusters identified is to the west of Middletown and is no doubt associated with the juxtaposition of the major transpeninsular road (US 301) and the railroad. The association of a secondary cluster with the primary cluster center of Middletown suggests that Middletown was growing rather rapidly after the introduction of the railroad. This is hardly a big suprise. However, it is interesting to note the absence of any secondary clusters associated with Odessa. Clearly, Middletown was eclipsing Odessa as a center of new settlement after the middle of the 19th century.

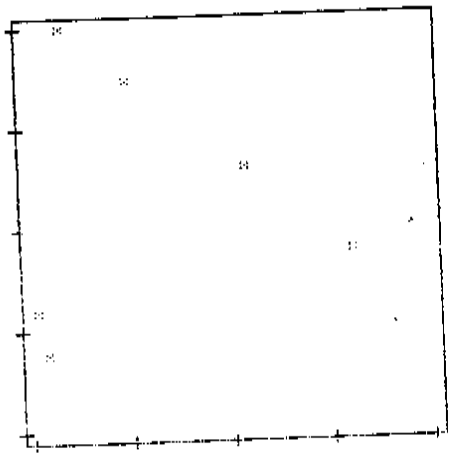
It can further be noted that when site clustering did occur in the areas away from Middletown, such as the clusters identified at the Boyd's Corner/Drawyer's Church and Mathews Corner/Hangman's Branch areas, the clusters were not associated with Odessa, which had been a major transhipment point during earlier time periods and which was an established community that could provide major services. Rather, the clusters are in the vicinity of secondary crossroads which appear to have acted as secondary service centers. Thus, population growth and economic development in the middle and late 19th century favored some existing population centers and fostered the development of others which were somewhat distant from the previous service centers. Further documentary research on the role of these emerging secondary service centers and emerging transportation networks (Cleland 1985) would be profitable and archaeological research at sites may show the emergence of different types of purchase and consumption habits in light of these developments.

In the Blackbird area, the sites retain a random distribution through time. It is important here to stress what the randomness of the distributions means. It does <u>not</u> mean that there is no patterning to the placement of sites. The previous analyses have shown that indeed there are patterns for the locations of historic sites. What randomness in the nearest-neighbor statistic does indicate is that the historic sites do not cluster, nor are they patterned in their placement, with respect to one another, i.e., their spatial autocorrelation is low. Figure 55 shows the site distributions for the Blackbird area through time.

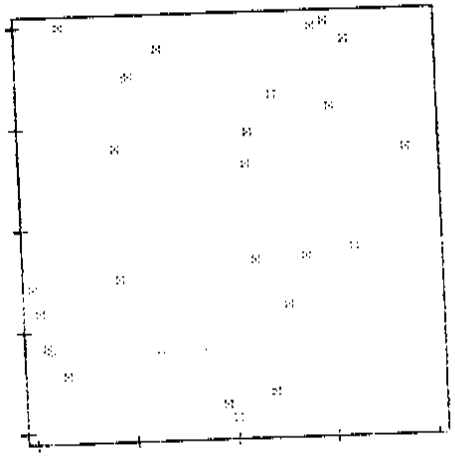
The absence of clustering in the Blackbird area, and its presence in the Appoquinimink area suggests that the patterns of economic development were different between the two areas. It is possible that the growth of secondary service centers and site

FIGURE 54

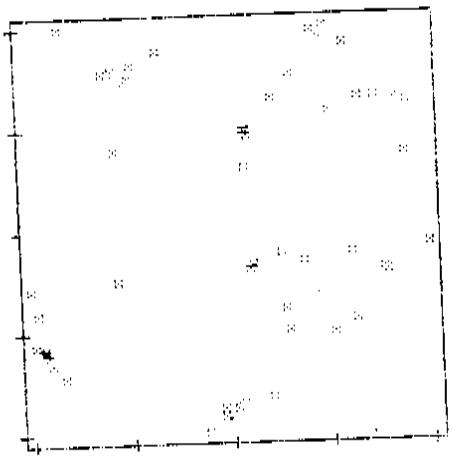
Appoquinimink Area Historic Site Distributions



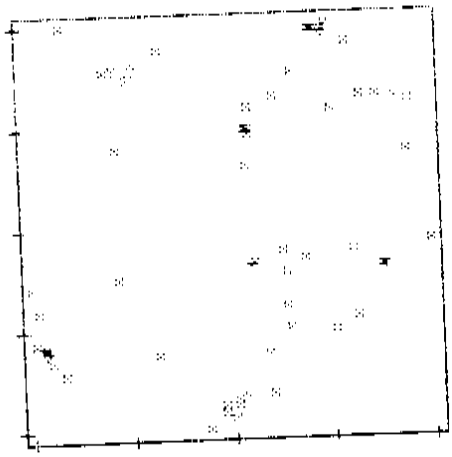
PRE-1802



PRE-1849



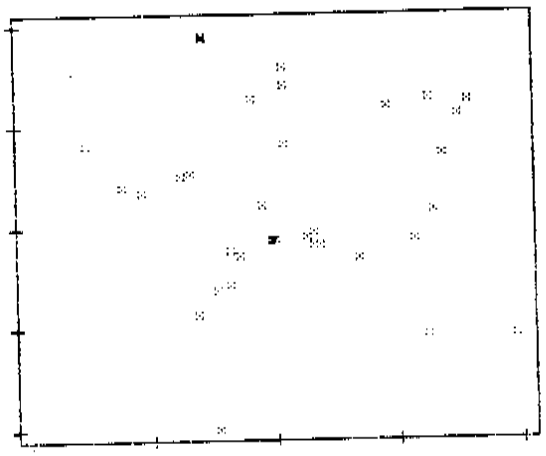
PRE-1868



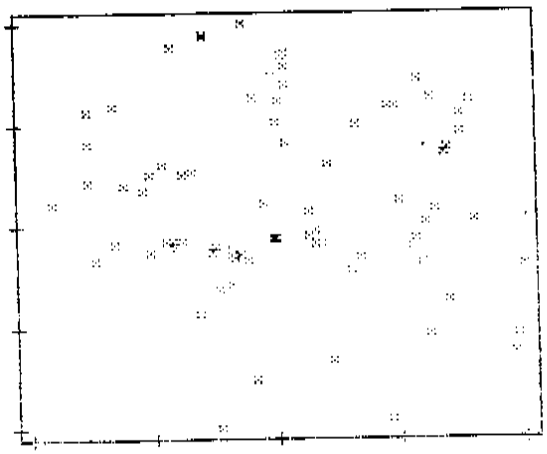
PRE-1893

FIGURE 55

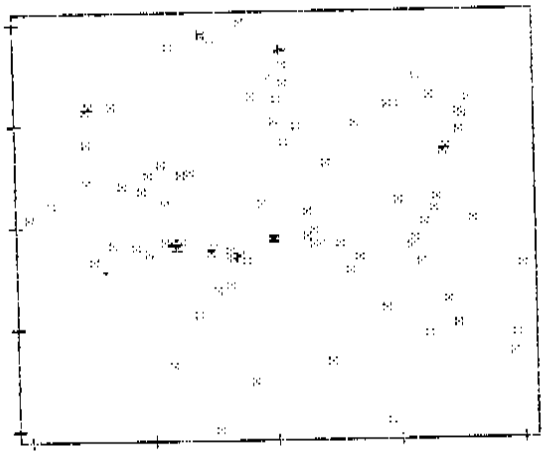
Blackbird Area Historic Site Distributions



PRE-1849



PRE-1868



PRE-1893

clusters is conditioned by the presence of primary clusters. Such relationships have been demonstrated for more modern data in the geographical literature (Abler, Adams, and Gould 1971: Chapter 9). These different growth patterns provide yet another interesting avenue for future research and another problem framework within which future historic archaeological research in the Route 13 corridor can focus.

MANAGEMENT CONSIDERATIONS

The site location data and analyses which have been presented can be used to develop a series of recommendations for the management of archaeological cultural resources within the "problem areas" of the New Castle county portion of the proposed Route 13 corridor. The main types of recommendations to be presented here are maps of sites of various significance for each of the problem areas.

ASSESSMENTS OF SITE SIGNIFICANCE

The first cultural resource planning study of the Route 13 corridor (Custer et al. 1984:113-129) developed a basic interpretive framework for the assessment of prehistoric and historic archaeological site significance. All sites noted on the maps included with the first report received a preliminary significance assessment based on the data available at that time. The present report mainly provides refined assessments for sites within the problem areas. The refined assessments are based on the more extensive site-specific data gathered during the field survey. For the most part, the original report's framework for determining site significance was utilized. However, in a few instances this framework was altered in light of new information and these alterations are discussed below.

For prehistoric and historic sites discovered during field survey of the study areas, all unplowed sites were considered to be of high significance because the survey data showed that the uplowed fringes of cultivated fields along major drainages and unplowed, isolated well-drained knolls within poorly-drained woodlands contained undisturbed and intact sites which could yield important data. Site 7NC-H-20, which was subjected to intensive testing during this survey, is a good example of this type of significant site which is eligible for listing on the National Register of Historic Places. It is also important to note that in many cases the sites which were found during sub-surface testing of wooded, unplowed areas are quite different from those identified from surface survey of plowed fields. For example, in the Appoquinimink area a series of small Woodland II sites (7NC-G-59, 60, 62, 63, 64) were discovered in the unplowed woodlands which fringed the south side of Drawyer's Creek north of Odessa. These were the only Woodland II sites discovered in the Appoquinimink area and their study will provide important data, in fact the only data available, on late prehistoric adaptations for the area.

Any plowed sites with Archaic or late Paleo-Indian components were also considered to be of high significance and certainly eligible for listing on the National register of Historic Places. These sites are all considered significant because they are rare and will provide important information on a poorly known period of Delaware's prehistory, (see earlier discussion in prehistoric site location analysis and Custer 1983a). It should be noted that plowed Archaic and late Paleo-Indian sites are included because even when plowed these sites can yield significant information. However, if a site was plowed and had been subjected to extensive erosion, it was not considered to be of high significance.

All plowed base camp sites from all time periods were also considered to be of high significance with a high probability of being eligible for listing on the National Register of Historic Places. Macro-band base camps, micro-band base camps, and generalized base camps are included here and are sources of data on a wide range of prehistoric activities. As was the case with Archaic sites, plowed sites are included in this significance category as long as they are not also disturbed by natural erosion.

All of the sites in the high significance category would require at least Phase II testing to determine their eligibility for listing on the National Register. In some cases, mainly the plowed sites in the high significance category, Phase II testing may be sufficient to mitigate any adverse effects on the site. However, all the unplowed sites would most likely require Phase III data recovery.

A second category of sites of medium significance was also recognized and consisted of all plowed historic sites and any non-procurement plowed prehistoric sites associated with bay/basin features. These sites all would probably require at least Phase II testing to determine National Register eligibility. However, they would probably only require Phase III data recovery if subsurface features were encountered. The historic sites would be the most likely sites to contain sub-surface features in this category.

Two additional categories of sites encountered during the field survey were discovered and were also recognized. The first was a category of low significance which included sites which would not require Phase II determination-of-eligibility testing. All plowed, disturbed, and eroded sites fall into this category along with plowed procurement sites. The final class of sites noted is comprised of sites of unknown significance. For the most part, plowed sites for which no function can be determined comprise this category. Appendix VII lists the various sites by significance categories and study areas.

Assessments of historic site significance built from the basic assessments presented in the original report (Custer et al.

1984: Appendices II and III), but also included data from the field checks of the historic structures and potential archaeological sites taken from the various atlases. An index of archaeological potential was developed for each historic site listed in Tables 9 - 11 and this index was based on the following data:

1. **Preservation:** Sites containing well preserved structural, faunal, floral, or skeletal remains are more significant.

2. **Multi-Function** (Number and type of outbuildings): Sites exhibiting a range of well-defined activity/functional loci are more significant.

3. **Size and Density** (Number and type of archaeological features): Larger sites and those containing dense deposits of material culture are more significant.

4. **Duration of Occupation:** Sites exhibiting descrete temporal loci whether in the context of long-term or short-term occupations are more significant.

The archaeological significance ratings and historical significance ratings, which were taken from the work of the BAHP and the first Route 13 planning study (Custer et al. 1984:27), were combined to produce a four level system of ranking total cultural resource potential for the historic sites. The sites of the highest significance had high historic significance and high archaeological potential and the lower ranks had lesser composite rankings. Appendix VII lists the varied sites by area and total cultural resource potential categories. The historic significance and archaeological potential rankings are also noted in Appendix VIII.

CULTURAL RESOURCE PLANNING MAPS

The various significance categories of sites listed in Appendices VII and VIII were plotted on a series of large scale maps, which are included as attachments to this report.

Attachment I consists of maps of all known prehistoric sites of various significance levels for each study area. Where no site-specific data are available, the probability zones from the first report (Custer et al. 1984: Attachment V) were plotted for the study areas. For the Blackbird area, the probability zones were adjusted in accordance with the new findings of this report.

Attachment II consists of maps of all known historic sites of various significance levels for each study area. Again, where no site-specific data are available, a series of predictive zones were plotted. These historic predictive zones were plotted on

the basis of the predictive zones noted in the original report (Custer et al. 1984: Attachments VI and VII) and the descriptions of typical site settings noted in Table 72.

Attachment III provides composite site significance maps for the study areas and these maps can be used as guides to the Route 13 corridor planning within the study areas. These maps represent the best current data on archaeological cultural resource sensitivity for the St. Georges, Appoquinimink, and Blackbird study areas.

FUTURE MANAGEMENT AND RESEARCH ISSUES

This final part of the report will consider some specific management and research issues which go beyond the scope of the general management considerations considered up to this point. An important management issue to consider is the individual assessment of the uniqueness of sites in relation to their significance. Table 74 shows the frequencies of prehistoric sites of various types within the study area, the entire Delmarva Archaeological Data System (DADS), the entire state of Delaware, the High Coastal Plain, the Low Coastal Plain, and the general Coastal Plain. Tables 75-78 show the frequencies of historic sites of various types within the study area and the total corridor. These tables can be used to determine the uniqueness of particular classes of sites for future management decisions and determintations-of-eligibility.

Guide to Attachment Maps

These attachment maps record the prehistoric (Attachment 1) and historic (Attachment II) sites by the significance categories noted in the management section of the report and listed in Appendices VII - VIII. The management zones noted in the maps on Attachment III are defined below:

Zone I - High prehistoric sigificance and/or high and medium - high historic significance

Zone II - Medium prehistoric significance and/or medium - low historic significance

Zone III - Low prehistoric significance and low historic significance

ATTACHMENT I

Prehistoric Sites by Significance Categories
for the
St. Georges Study Area

Site location information may be obtained by
written request to: Delaware Department of Transportation
Division of Highways - Location Studies
P.O. Box 778
Dover, DE 19903

302-736-4644

ATTACHMENT I

Prehistoric Sites by Significance Categories
for the
Apppquinimink Study Area

ATTACHMENT I

Prehistoric Sites by Significance Categories
for the
Blackbird Study Area

ATTACHMENT II

Historic Sites by Significance Categories
for the
St. Georges Study Area

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ATTACHMENT II

Historic Sites by Significance Categories
for the
Apppquinimink Study Area

ATTACHMENT II

Historic Sites by Significance for the Blackbird Study Area

ATTACHMENT III

Management Zones for Prehistoric and Historic Sites in the St. Georges Study Area

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ATTACHMENT III

Management Zones for Prehistoric and Historic Sites in the Appoquinimink Study Area

ATTACHMENT III

Management Zones for the Prehistoric and Historic Sites in the Blackbird Study Area

TABLE 74

PREHISTORIC SITE FREQUENCIES

Site Type	DADS	DE	High C.P.	Low C.P.	Tot. C.P.
Paleo-Indian	96	63	3	72	75
Procurement	5	4	0	3	3
Macroband	9	9	1	7	8
Microband	0	0	0	0	0
Gen. B.C.	8	8	2	6	8
Archaic	281	55	12	58	70
Procurement	3	2	0	1	1
Macroband	9	8	1	4	5
Microband	0	0	0	0	0
Gen. B.C.	13	13	4	9	13
Woodland I	504	245	29	332	613
Procurement	7	5	2	2	4
Macroband	20	19	1	16	17
Microband	1	1	0	1	1
Gen. B.C.	49	48	11	34	45
Woodland II	446	205	45	292	373
Procurement	8	6	3	1	4
Macroband	22	20	1	15	16
Microband	2	2	2	0	2
Gen. B.C.	42	42	8	31	39

TABLE 75

HISTORIC SITE FREQUENCIES - PRE-1802

Site Function	Survey	Potential Arch. Sites	BAHP Survey	Total Corr.
AGCX	4	1	31	32
GMCX	2	6	1	7
BRID	1	0	0	0
CHUR	1	2	4	6
MANUFY	1	0	1	1
LANOP	0	1	0	1
AGMCX	0	1	4	5
MMCX	0	1	0	1
SMCX	0	2	0	2
DWCX	0	0	4	4
EST	0	0	13	13
PLANT	0	0	2	2
STO	0	0	1	1
TAV	0	0	1	1

TABLE 76

HISTORIC SITE FREQUENCIES - 1802-1849

Site Function	Survey	Potential Arch. Sites	BAHP Survey	Total Corr.
AGCX	49	106	110	216
AGTEN	10	37	11	48
INDTEN	2	2	0	2
GMCX	1	5	1	6
DWCX	1	8	12	20
SCH	2	9	1	10
RRSTA	1	1	0	1
HOT	0	0	1	1
STRUC	1	2	0	2
CHUR	1	4	2	6
LANOP	1	2	2	4
AGBLDG	1	0	0	0
PEACH	1	0	3	3
BRID	0	1	0	1
WKSH	0	1	0	1
COMM	0	3	0	3
EST	0	1	7	8
MMCX	0	1	0	1
RR	0	2	0	2
SMCX	0	3	0	3
STO	0	5	4	9
MANUFY	0	0	1	1
ALMHSE	0	0	1	1
PO	0	0	1	1
SCOSTA	0	0	1	1

TABLE 77

HISTORIC SITE FREQUENCIES - 1849-1868

Site Function	Survey	Potential Arch. Sites	BAHP Survey	Total Corr.
AGCX	23	263	168	431
AGTEM	29	286	40	326
IDTEN	4	17	1	18
DWCX	8	60	14	74
SCH	1	21	2	23
RRSTA	1	0	2	2
STRUC	1	15	1	16
WKSH	1	3	0	3
MANUFY	1	5	1	6
TENANT	2	3	1	4
PEACH	1	0	8	8
GMCX	0	2	2	4
BRID	0	1	0	1
CHUR	0	9	4	13
LANOP	0	1	0	1
AGMCX	0	2	1	3
ALMHSE	0	1	1	2
BSSH	0	5	0	5
CCBLDG	0	3	0	3
CEM	0	1	0	1
EST	0	7	5	12
HOT	0	3	0	3
PHYS	0	1	0	1
PO	0	2	0	2
RR	0	1	3	4
SMCX	0	1	0	1
SOMCX	0	2	0	2
STO	0	13	3	16
WARE	0	7	0	7
AGBLDG	0	0	1	1
PLANT	0	0	1	1
SLAVQ	0	0	1	1

TABLE 78

HISTORIC SITE FREQUENCIES - 1868-1893

Site Function	Survey	Potential Arch. Sites	BAHP Survey	Total Corr.
AGCX	11	24	43	67
AGTEN	5	33	1	34
BRID	1	0	0	0
DWCX	8	21	47	68
HOT	1	1	0	1
STRUC	5	15	2	17
INDTEN	0	2	0	2
RRSTA	0	2	1	3
TENANT	0	4	0	4
CEM	0	1	2	3
EST	0	2	1	3
RR	0	2	1	3
RT	0	1	0	1
STO	0	1	1	2
SCH	0	0	5	5
CHUR	0	0	4	4
MANUFY	0	0	1	1
WARE	0	0	1	1

Another management issue to consider includes research issues which can be addressed during future archaeological research in the Route 13 corridor. A number of research issues pertaining to prehistoric sites can be investigated. One of the most important research problems to consider is the improvement of the predictive models for prehistoric sites in the Blackbird area. As was discussed earlier, the medium and high probability zones can be combined into a single high probability zone and this combined zone was used in the preparation of Attachment I. However, there is still a problem with discrimination of bay/basin features. Although the combination of zones can be used for planning purposes, the discrimination problem means that non-proportional sampling of rights-of-way should not be attempted until the model is upgraded. As was noted earlier one possible way to upgrade the model would be to undertake a new logistical regression analyis of the Blackbird using data from the LANDSAT 4 thematic mapper with supplemental low altitude aerial photos.

Other research issues for prehistoric sites can be noted and these deal primarily with site distribution questions and their effects on site-specific research. For example, an interesting point to consider is the apparent absence of Paleo-Indian sites in the study areas. As was noted earlier, bay/basin features have been noted as foci of Paleo-Indian sites. However, Paleo-Indian sites were not found associated with bay/basin features, or any other topographic features for that matter, in our survey. Several potential explanations of this absence were noted earlier and these in part related to the age and developmental history of

the bay/basin features. Consequently, an important part of future research in the Route 13 corridor will be geomorphological analysis of these bay/basin features. Radiocarbon dates from organic-rich sediments will be required and samples should be taken from bay/basin sites which show varied time periods of utilization to see if the age of the bay/basins affect the ways in which humans used them. Within this research context, both wet (unplowed) and dry (plowed) features will have to be studied. Also in relation to the question of Paleo-Indian utilization of bay/basin features, it will be important to identify those bay/basin features which are associated with secondary cobble lithic sources. As was noted earlier, these bay/basin sites would be more likely to be associated with Paleo-Indian sites.

With regard to the Archaic Period, an important question for further research relates to site size. Within the study area, and the Delmarva Coastal Plain in general, Archaic sites generally tend to be small. The only large sites are located near large interior swamp settings. Careful excavation and survey techniques should be developed so that accurate estimates of Archaic site size and settlement intensity can be developed. Archaic sites may indeed all be small, but this impression may be a result of biased and incomplete samples.

An interesting question relating to further research concerning the Woodland I Period is the timing of Woodland I settlement. No Woodland I ceramics were recovered from any of the sites studied. Taken at face value, this absence could indicate that all Woodland I settlement pre-dates 1200 B.C. However, there may be a preservation bias. Nonetheless, the absence of Woodland I ceramics from all the study area sites is a puzzling problem which will require further study.

With regards to the Woodland II Period, analysis of site size is an interesting issue for future research. All of the Woodland II sites found in the study area seem to be smaller than the earlier Woodland I sites. Future research could seek to ascertain if there really is a population reduction moving into Woodland II times and could also seek to explain such a population reduction.

Field survey data could also be used to address a series of general methodological problems. First, the complete surveys of the Appoquinimink areas, and portions of the Blackbird area, provide a firm basis for undertaking sampling simulation studies. The data from such simulation studies would provide an interesting contrast to other simulations from the Middle Atlantic area which focused on high elevation, high relief settings (Custer 1979; 1984). The site data from this study could also be used as part of a new test of the logistical regression model's predictions. In a new test a target area could be restratified on the basis of three sets of variables: projected probability zones, environmental zones, and social model predictions (Custer et al.1984:92-100).

With regard to historic archaeological research, the large size of the Route 13 Relief Route planning corridor allows for the development and testing of a number of research questions framed within the economic and settlement pattern paradigms current in historical geography and archaeology. The theoretical framework for research would be partly based on several assumptions developed from previous archaeological research in Delaware and the surrounding region. Based upon the known post-1802 site locations and the predictive model developed in the initial planning volume for pre-1802 sites, a series of high and medium probability zones for the location of pre- and post-1802 sites was developed in the original planning study (Custer et al. 1984: Attachments VI - VII). The projected presence of certain site types was based upon the regional historical context and economic and settlement pattern relationships summarized in earlier studies. The expectations of the assemblages to be recovered from the individual site types was developed from previous excavations in Delaware and through consultation with the available historical archaeological literature. The following research questions and topics will be integrated into a general research design that will allow both interdisciplinary research and the coordination of all different phases of the eventual mitigation program.

The present historic archaeological data base existing prior to any mitigation program consists of a small number of urban and rural sites in Delaware. The urban environment of Wilmington has been intensively explored by Thomas (1980), Klein and Garrow (1984), and Cunningham et.al. (1984). The excavation of several rural sites in northern Delaware under contract with the Department of Transportation has provided a small data base for comparisons with site types in southern Delaware. The mitigation programs of these northern Delaware sites included questions on topics like settlement patterns, agricultural development, transportation networks, and other aspects of the region (Coleman et al. 1983, 1984).

Most of the Route 13 corridor has been, and continues to be, an important agricultural area. The roots of that livelihood provides a focus for inquiry. For example, little is known about the lower class of non-landed tenant farmers. Few of their dwellings survive and the historical record makes little reference to the role played by this group in the rural society. Most known agricultural tenant dwellings are of less substantial construction and appear to be situated near the roadsides of each farmstead, while the landowner's more imposing dwelling is located back from the road. How this is related to the agricultural community and the general social structure has not yet been explained.

As has been stated above numerous times, there has been a general shift through time from a subsistence to market agriculture. However, farm-specific and inter-farm preferences for marketable versus subsistence foodstuffs are poorly known. From primary documents like agricultural censuses, orphans court

records, and deeds, some indication of regional agricultural preferences could be obtained and the overall pattern of agricultural land use could be better understood. The location analysis generated here could also be an important part of this research.

Related to both agriculture and settlement pattern is the question of farmstead design. How were the agricultural complexes laid out, what was the arrangement and function of outbuildings, where were the yard areas and how was each used, and, in a more general sense, where were the early farmsteads placed within each land parcel? The relative importance of transportation, soils, markets, and other factors should be studied further on a more site-specific basis to see how they influenced farmstead design and placement through time. It has also been shown that the "long-lot" system of land use was prevalent in the early historic period in Tidewater Maryland, and Virginia and it is postulated that it was also used in the project area. However, this remains to be demonstrated and a detailed study of early land records and plat maps would be required.

Transportation has always been an important consideration in the marketability of Delaware agricultural produce, and through time, various types of transportation have served that need. At the same time, the emphasis on each type has shifted and with it have come subtle changes in town development and size, rural settlement pattern, population density, and opportunities for light manufacturing and foodstuff processing. The general improvement of the transportation system also allowed for the appearance of some manufacturing in a number of towns in an otherwise highly agrarian economy. Pursuits like carriage-making, tanning, and peach processing were introduced. Very little of this activity is present today, most of it having presumably declined with changing market conditions. This aspect of the local economy has never been documented and future archaeological research could seek to reconstruct these activities.

The earliest forms of travel in the Route 13 corridor were probably by boat and on foot, as the few early roads were frequently unsuitable for cart travel. The heads of stream navigation became transhipment centers and thus foci of settlement. During the 19th century, the establishment of adequate roads and then railroads altered the commercial pattern and emphasized the junctions of these later modes of travel. Hamlets grew up around road/railroad intersections and the importance of places like Blackbird Landing, Smyrna Landing, and Odessa was eclipsed by Blackbird Station, Clayton, and Middletown. Research within the proposed Rt. 13 Corridor should try to reveal the mechanisms of this change and document its ramifications for village life, commercial patterns, and population change. Not to be overlooked is the impact of the construction of the present Rt. 13 on the lifeways of the people of the Upper Delmarva Peninsula. This road, which essentially

replaced an older Philadelphia to Lewes Post Road, drastically altered the traffic pattern on the Delmarva when it was opened in the early 1920s.

One of the features of the early road network was taverns or inns placed at intervals of approximately a day's ride along the major thoroughfares. If the establishment could be situated at a crossroads, so much the better. Research into the Buck Tavern, at Summit Bridge, Delaware (Wilkins and Quick, 1976) suggested that rural inns and taverns in Delaware were often ephemeral businesses which were licensed, but otherwise loosely defined, were often contained in farmhouses or dwellings only slightly modified for the purpose, and as a group are presently poorly documented. The analysis of such an establishment may present thorny problems for it is currently unknown how many inns and taverns have existed within the Rt. 13 Corridor. So far only three such structures have been identified so far in the survey: one 18th century structure in Kenton Hundred and two 19th century examples in St. Georges Hundred.

Another aspect of the historic settlement pattern is the element of church building placement and the demographics of the supporting congregations. Churches were especially important gathering places for a variety of social events during the seventeenth and eighteenth centuries when they were often one of the first structures erected in the community. Furthermore, ministers were frequently the most literate individuals in the community and thus assumed leadership roles. Church records are valuable sources of demographic information, for they were often the only repository of personal records in newly settled areas which lacked strong local governments with record keeping facilities. These sorts of records should be examined for information on congregation size, areal extent, and the kinds of activities, both secular and ecclesiastical, conducted at the church site.

The black enclave south of Townsend, Delaware, known locally as "New Discovery", presents an opportunity to study a late 19th and 20th century rural ethnic community and its associated social structure. Areas of inquiry should include land tenure, land size and use for each landowner, land transferral practices, subsistence and cash crop growing practices, house type and preference and construction practices, and group identity and cohesion through time.

In sum, by evaluating the site-specific data available from the sites discovered during this study within broader research questions, the significance of prehistoric and historic archaeological sites can be evaluated. Furthermore, analyses of these data can yield valuable insights on human behavior in the Delmarva region through time.

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APPENDIX I

PROJECT PROPOSAL AND RESEARCH DESIGN

This proposal describes additional Phase I archaeological work to be carried out in conjunction with alignment selection for the proposed Route 13 highway project. Previous work accomplished under the existing agreement included preparation of maps of areas that were likely to contain large numbers of significant cultural resources (prehistoric archaeological sites, historic archaeological sites, and standing structures). These areas are located primarily along the major drainages which must be traversed by the highway and along the major transportation routes. Of the varied resources identified and predicted, the prehistoric sites are the most difficult for which to specify exact boundaries. Therefore, in consultation with the Delaware Department of Transportation staff, it was decided that additional information on exact site location boundaries (particularly for prehistoric archaeological sites, but also for historic sites) within the areas of greatest cultural resource potential would be useful in planning potential highway alignments.

The reasearch proposed here would seek to identify cultural resources within the highest sensitivity zones and determine their precise boundaries. Also, areas with no resources, would be delimited and recommended for possible construction. In this manner impact on cultural resources within the areas of their densest occurrence would be minimized.

Areas chosen for further study were locations within the project area where high sensitivity zones spanned most of the proposed highway corridor. Mapped areas with high potential for prehistoric sites were noted and also played an important role in determining areas for further study because these cultural resources tend to be the largest and hardest to define spatially without fieldwork. Each of the areas proposed for further work is listed below in their order of priority from highest to lowest.

1) **Drawyer's Creek-Appoquinimink River Area** - Five separate non-contiguous sub-areas within this area are noted in Figure 1 as potential locations for further fieldwork. This area spans the entire allignment east of Noxontown Pond and it will be important to find an area of low site density to minimize impact on cultural resources. The north and south sides of the Appoquinimink will require the lowest amount of fieldwork because the number of known sites is high and because an earlier study of a sewer line right-of-way between Middletown and Odessa delimited site boundaries within the corridor on the north bank of the Appoquinimink. On the other hand, the Drawyer Creek drainage has many high probability zones and very little fieldwork to date.

2) **Blackbird Area** - This portion of the proposed alignment includes many high probability areas for prehistoric sites and has very little fieldwork accomplished to date. Only three known sites are found within the area. The zone noted for research is

quite large and spans the entire corridor. Fieldwork would be focused on site location survey of areas adjacent to the numerous bay/basin features that are present (Figure 2).

3) **Leipsic River Area** - Headlands adjacent to the Leipsic River are included in this area which spans most of the proposed highway corridor (Figure 3). Only two known sites are recorded for this section of the project area and fieldwork will be extensive.

4) **Spring Creek Area** - Located at the southern terminus of the proposed western allignment, this area has been extensively studied as a part of planning for an earlier proposed Dover-ByPass (Figure 4). Fieldwork will be minimal here.

5) **Little River/Pipe Elm Branch Area** - This area is located close to the southern terminus of the proposed eastern alignment and includes four known prehistoric sites (Figure 5). Because the area is rather large, fieldwork will include extensive pedestrian survey.

6) **Hughes Crossing Area** - This area spans the entire corridor along its western alignment north of Dover (Figure 6) and has only two known sites within it.

7) **Derby Pond Area** - This small area spans the entire corridor near Dover and includes five known sites (Figure 7). Therefore, required fieldwork will be minimal.

8) **Chesnut Grove Area** - Another relatively small area, this proposed focus of research includes three known sites and should not require much fieldwork (Figure 8).

9) **Wyoming Lake Area** - Like many of the preceding areas, this area is relatively small, spans the project corridor of the western alignment near Dover, and will require minimal fieldwork because there are several known sites in the area (Figure 9).

10) **Muddy and Dyke Branches Area** - Two sub-areas (Figure 10) are included and this project area spans the eastern alignment north of Dover. Only two sites are known for the area and extensive fieldwork will be required.

11) **Dragon Creek Area** - Located in the extreme northern portion of the proposed project area, this area contains only one site and will require extensive fieldwork.

12) **Smyrna Area** - One of the larger study areas, it lies on the east side of the Smyrna town limits and includes the confluence of Duck and Mill Creeks and their tributaries. Land use is almost completely agricultural and only two sites are known; thus, extensive pedrestrian survey will be required.

The research proposed for the area noted above will include:

1) Field checking of previously noted sites to verify their existence and determine their exact boundaries using controlled surface collections and sub-surface testing. Extensive soil augering will be carried out to determine the possibilities for buried landscapes and associated archaeological remains. This research will include both known prehistoric sites within the state inventory and standing structures and historic archaeological sites noted by the report on the earlier Phase I work within the corridor.

2) Areas with no known sites will be surveyed at a location/identification level to determine the presence of sites. Any sites located during this phase will have their boundaries and their integrity determined using the methods noted above.

It should be noted that the work proposed here is not a substitution for determinations of site eligibility for the National Register of Historic Places, although it will provide much useful data for later determinations of eligibility. Because one goal of the study is to provide a series of recommendations of potential construction areas that will have minimal impact on cultural resources, there will be more emphasis placed on determining areas where sites are not found.

In large areas to be studied such as Areas 1 and 2, some selected sampling might take place. However, complete location and identification surveys within the specified areas will be attempted. Although the areas are large in many cases, this complete coverage should not be too difficult to obtain because several areas already have existing site data and surveys carried out within them.

The expected results of the project would include a standard report detailing the investigations within each area. A standard archaeological site report would be completed for all sites investigated and maps of site boundaries would be prepared. Also, site forms would be filled out for all new sites discovered in the surveys. All artifacts would be washed and marked for accessioning in accordance with the procedures of the Island Field Museum.

A series of maps detailing the recommended construction areas with minimal cultural resource impact will also be prepared using map scales to be determined by DelDOT.

Finally, it should be noted that the research proposed here can be viewed as a test of the prehistoric predictive model used in the initial Phase I research. The final report will include and assessment of the model's accuracy and precision in light of the test results.

APPENDIX II

TECHNICAL DATA FOR BLACKBIRD AREA SAMPLING DESIGN

A stratified random sampling program was developed for the sub-surface testing program in the Blackbird study area due to its large size and the large extent of wooded areas within it. A 5% sampling fraction was chosen due to time and money restrictions.

The first step in the development of the sampling design was to determine the variables to use for stratification of the study area. The two main variables usually utilized are surface water setting and soil types. In previous studies these variables were seen to account for much of the variability in site locations (Custer and Galasso 1983; Wells 1981). It was not possible to use soil data for the Blackbird area because the dense tree cover and the large extent of poorly drained soils caused much of the area to be mapped as a limited range of soil series in the USDA soil survey. Consequently, surface water settings were used as the only variable for stratification of the study area.

Table 79 shows the ten varied surface water settings recognized in the study area. The entire wooded portion of the study area was divided into sample units of variable size and each sample unit was categorized into one of the ten surface water types. Table 80 provides a summary of the area included within each surface water type. A 5% sample was then drawn from each of surface water types I - IX. Table 81 shows the final areas chosen for study and the actual percentage sampled within each strata for the total study area and for the sample. Because the size of the initial sample units was not equal, the size of the actual sampling fraction varies for each stratum. However, in all but two cases, the fraction is at least 5%, and it is larger than 4% in all cases. The mean sampling fraction is 12% with a standard deviation of 2.53%. The last column of Table C shows the percentage representation of each stratum within the sample. Comparison of these values with the values of the final column of Table B using the chi-square test shows no significant difference (chi-square=2.27, degrees-of-freedom=8, $.975<p<.99$). Therefore, the sampled area is a proportional representation of the varieties of surface water settings within the total Blackbird study area.

Table 79: Surface Water Types

Type	Description
I	No surface water
II	Simple (single) bay/basin association
III	Complex (multiple) bay/basin association
IV	Major stream (Blackbird)
V	Minor stream
VI	Major/minor confluence
VII	Minor/minor confluence
VIII	Springhead
IX	Bay/basin-stream association
X	Poorly drained and untestable

Table 80: Extent of Surface Water Types

Surface Water Type	Total Area (ha)	Percent of Total Area
I	207.95	13
II	33.79	2
III	494.12	31
IV	7.91	1
V	269.07	17
VI	66.54	4
VII	144.87	9
VIII	64.35	4
IX	101.00	6
X	192.42	13
TOTAL	1582.02	100

Table 81: Sampled Areas - Blackbird Area

Surface Water Type	Sampled Area	% w/in Stratum	% w/in Sample
I	15.73	8	15
II	4.68	14	4
III	21.30	4	20
IV	.98	12	1
V	12.05	4	11
VI	11.83	18	11
VII	7.55	5	7
VIII	20.66	32	19
IX	13.11	13	12
TOTAL	107.89	7	100

APPENDIX III

DESCRIPTION OF PREHISTORIC SITE ATTRIBUTES RECORDED IN GENERAL SURVEY

Listed below is a description of the attributes recorded for all sites encountered in the general site survey. The defining characteristics of the cultural periods and complexes are taken from Custer (1984).

Site Number - trinomial archaeological site number assigned by the BAHP

CRS Number - New Castle County cultural resources survey number assigned by the BAHP

USGS Quad - name of the USGS 7.5' quadrangle map on which the site is located

UTM North, UTM East - the universal transverse mercator coordinates of the site

Geomorphological Setting - description of the topographic feature associated with the site

Primary and Secondary Soil Series - USDA soil series associated with the site

Drainage - major drainage associated with the site

Surface Water Setting - description of the surface water closest to the site - the main distinction is between flowing streams and closed bay/basin features

Confluence - presence/absence of a stream confluence

Water Distance - distance in meters to the closest surface water

Slope - slope of the ground surface in degrees as taken from the USDA soils maps

Aspect - exposure direction of the ground surface at the site location

Elevation - elevation above sea level in meters

Paleo-Indian - presence/absence of Paleo-Indian period components as defined by the presence of fluted and early notched points (Palmer, Kirk, Amos)

Archaic - presence/absence of Archaic period components as defined by the presence of bifurcate points

Woodland I - presence/absence of Woodland I period components as defined by the presence of non-Minguannan ceramics and a variety of stemmed, notched, and broad blade projectile points

Woodland II - presence/absence of Woodland II period components as defined by the presence of Minguannan, Townsend, or Killens ceramics and triangular projectile points

Clyde Farm (CF) - presence/absence of Clyde Farm complex components as defined by the presence of broad blade, stemmed, and notched points, steatite bowls, and experimental ceramics

Wolfe Neck (WN) - presence/absence of Wolfe Neck complex components as defined by the presence of stemmed and notched points and Wolfe Neck ceramics

Carey (CA) - presence/absence of Carey complex components as definedby thepresence of Mockley ceramicsand stemmed points

Webb (WB) - presence/absence of Webb complex components as defined by the presence of Hell Island ceramics, stemmed points, and Jacks Reef points

Delmarva Adena (DA) - presence/absence of Delmarva Adena complex components as defined by the presence of Coulbourn, Wilgus, or Nassawango ceramics, and Delmarva Adena exotic artifacts

Delaware Park (DP) - presence/absence of Delaware Park complex components as defined by the presence of Hell Island ceramics and stemmed points

Minguannan (MG) - presence/absence of Minguannan complex components as defined by the presence of Minguannan ceramics and triangular points

Slaughter Creek - presence/absence of Slaughter Creek complex components as defined by the presence of Townsend ceramics and triangular points

Historic - presence/absence of any historic artifacts

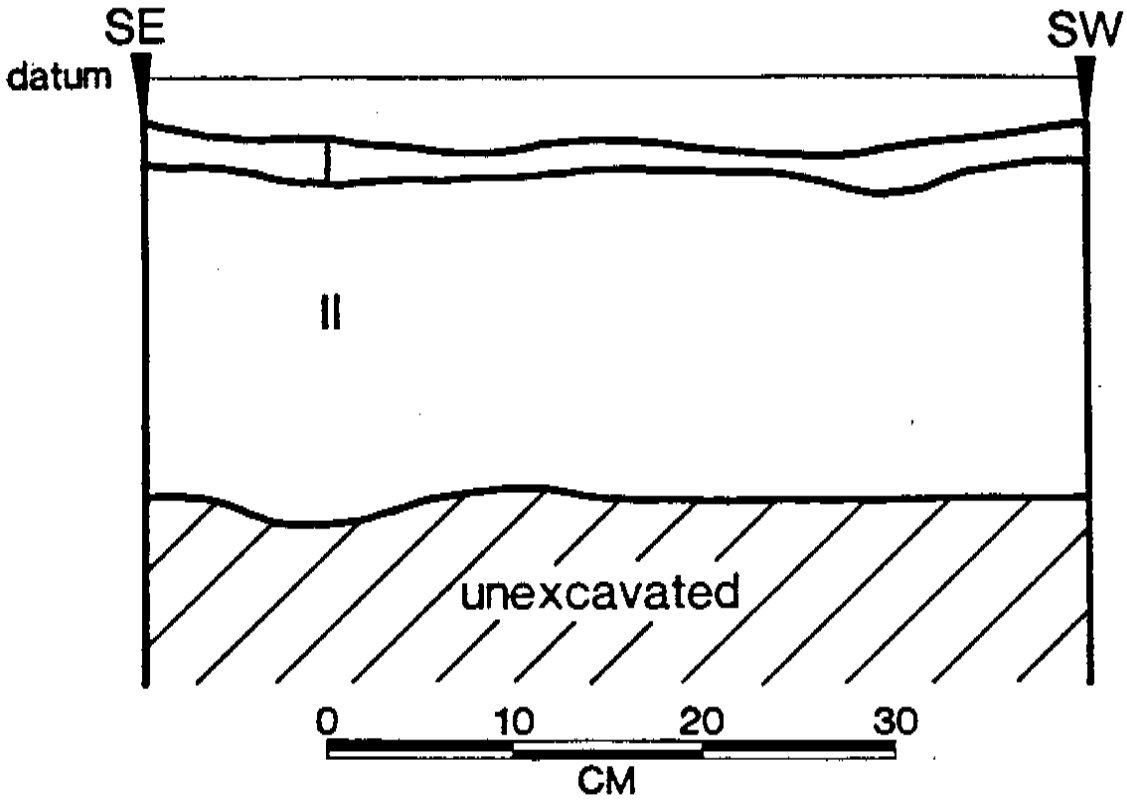
In addition to these attributes the presence/absence of the following artifact classes was also noted: bifaces, scrapers, flake tools, cores, flakes, ground stone tools, fire-cracked rock, and ceramics.

APPENDIX IV

REPRESENTATIVE SOIL PROFILES FROM SUBSURFACE TESTING

7NC-H-12 Blackbird Study Area

area 2, subarea 1, test unit 8

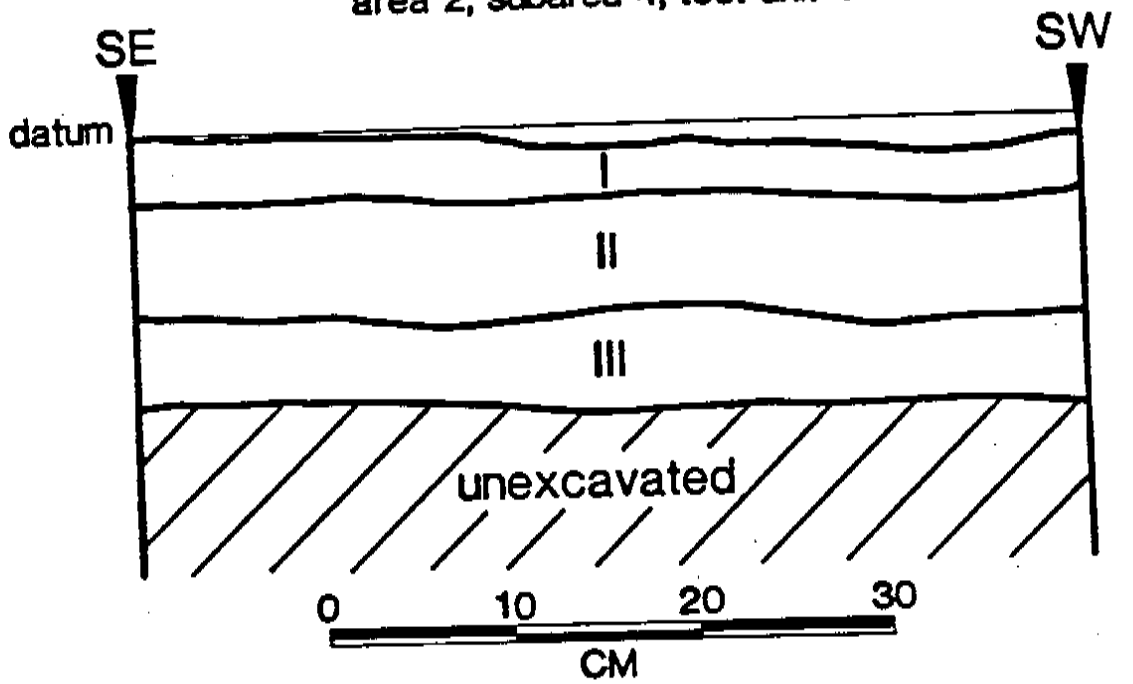


I-A horizon: gray silty loam; sterile

II-B horizon: light yellow silty loam; cultural
1 jasper stemmed biface

7NC-H-20 Blackbird Study Area

area 2, subarea 4, test unit 1



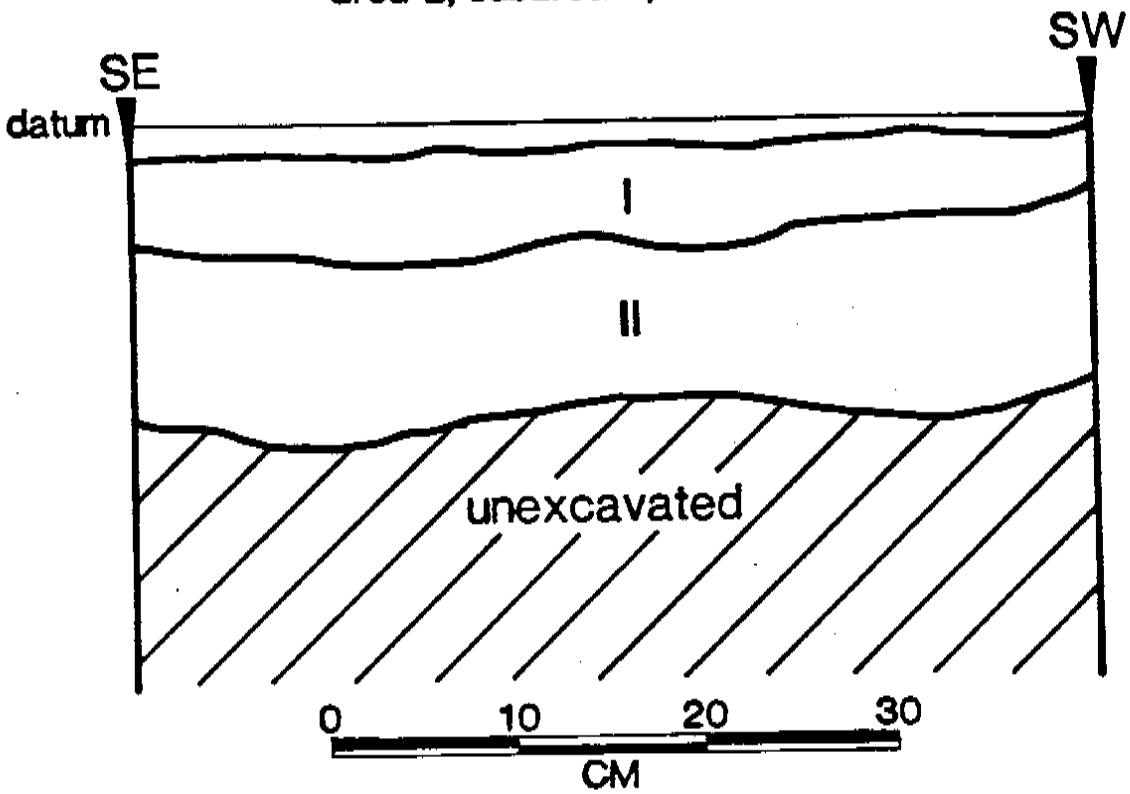
I-A horizon: gray-brown humus, root material; sterile

II-B_1 horizon: yellow-brown sandy loam; cultural flakes, FCR

III-B_2 horizon: orange-brown clayey loam; cultural 1 flake

7NC-J-23 Blackbird Study Area

area 2, subarea 2, test unit 2

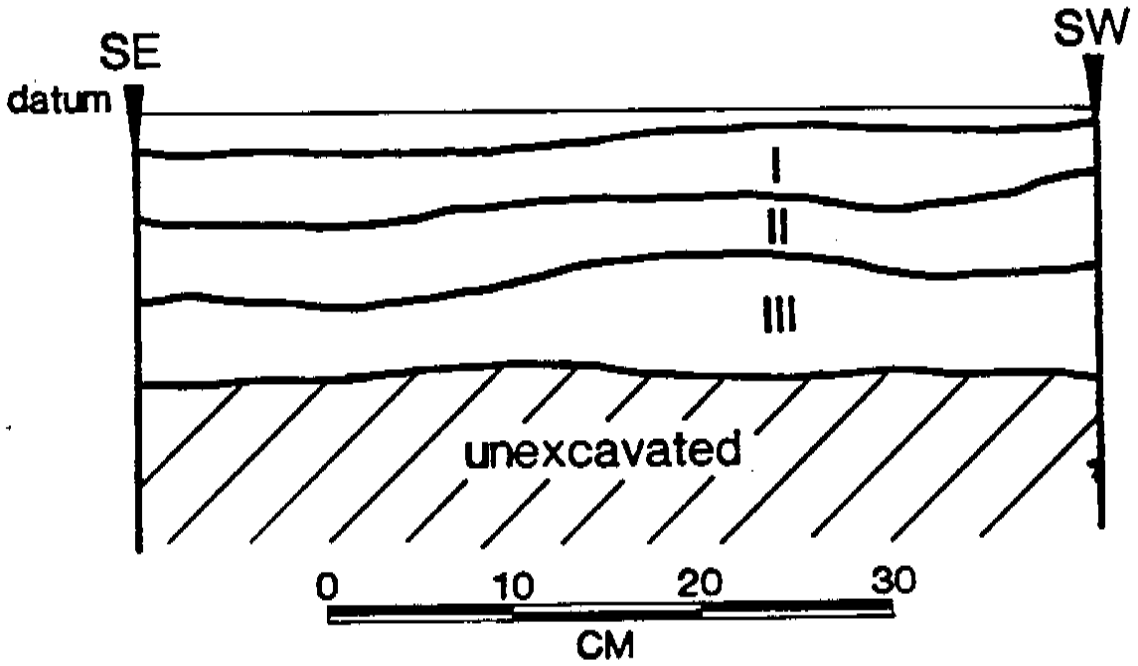


I-A horizon: gray-brown sandy loam; cultural glass and lithic debitage

II-B horizon: yellowish-tan sandy silt; sterile

7NC-H-33 Blackbird Study Area

area 2, subarea 6, test unit 3



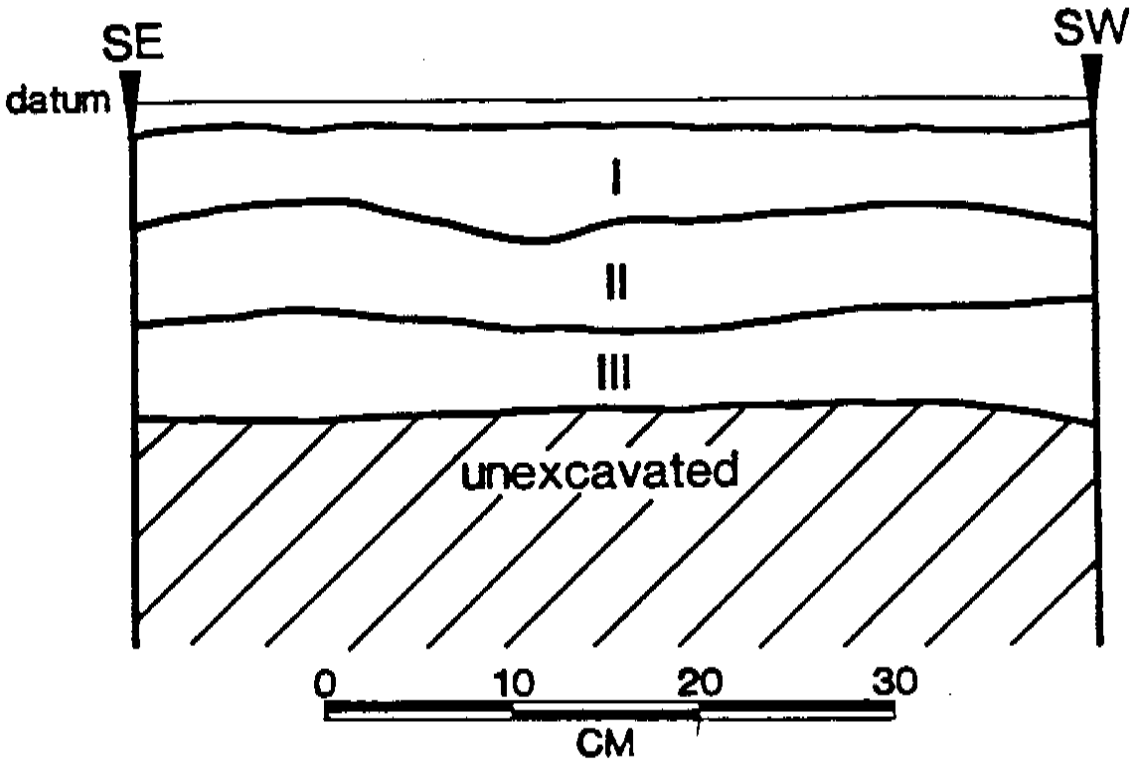
I-A horizon: dark gray-brown sandy loam; cultural 2 flakes, FCR, glass and coal

II-B_1 horizon: yellow-brown sandy loam with pebbles and cobbles; cultural 2 flakes, FCR, glass

III-B_2 horizon: orange-brown clayey loam with pebbles and cobbles; sterile

7NC-J-40 Blackbird Study Area

area 2, subarea 3, test unit 3



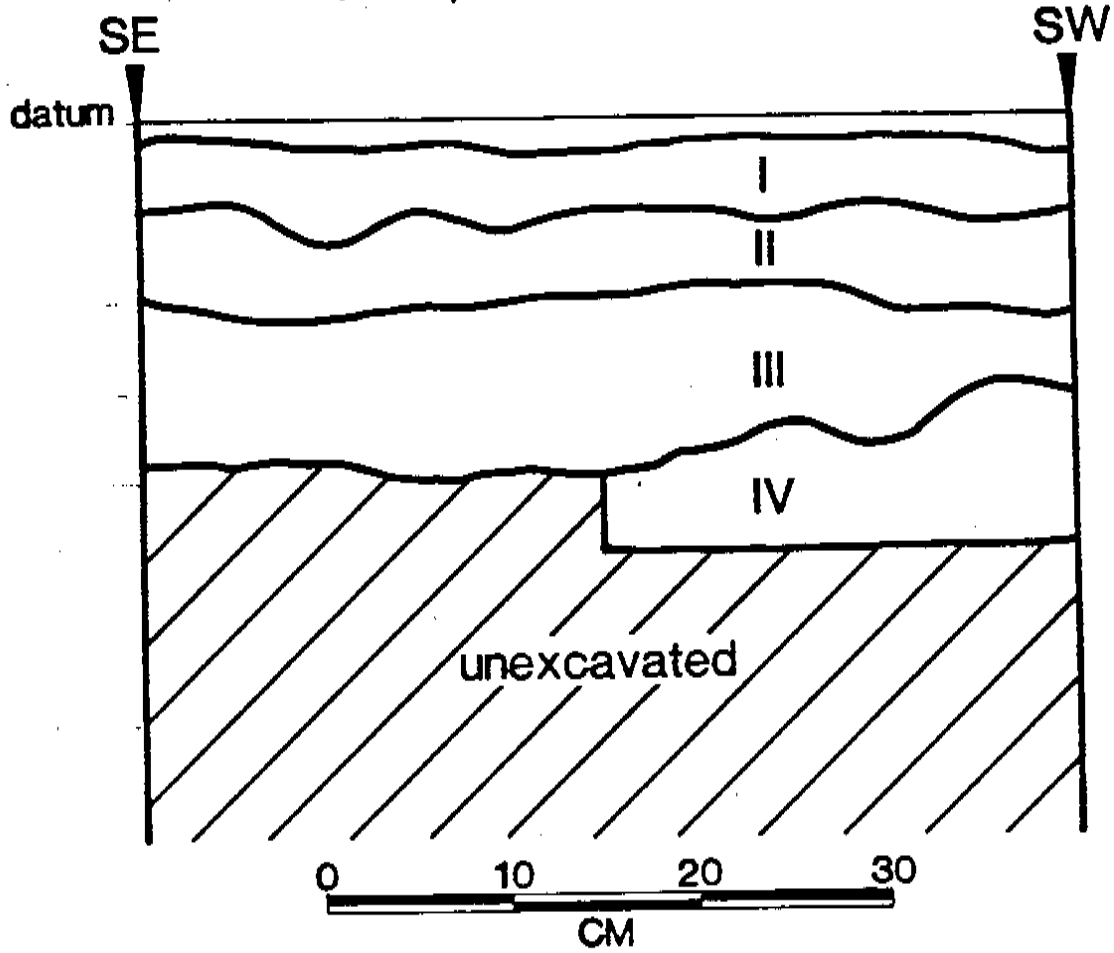
I-A horizon: gray-brown sandy loam with root material; cultural 3 flakes

II-B_1 horizon: yellow-brown silty loam; cultural 1 chert scraper, 2 chert flakes

III-B_2 horizon: orange clayey silt; sterile

7NC-G-59 Appoquinimink Study Area

area 1, subarea 11, test unit 1



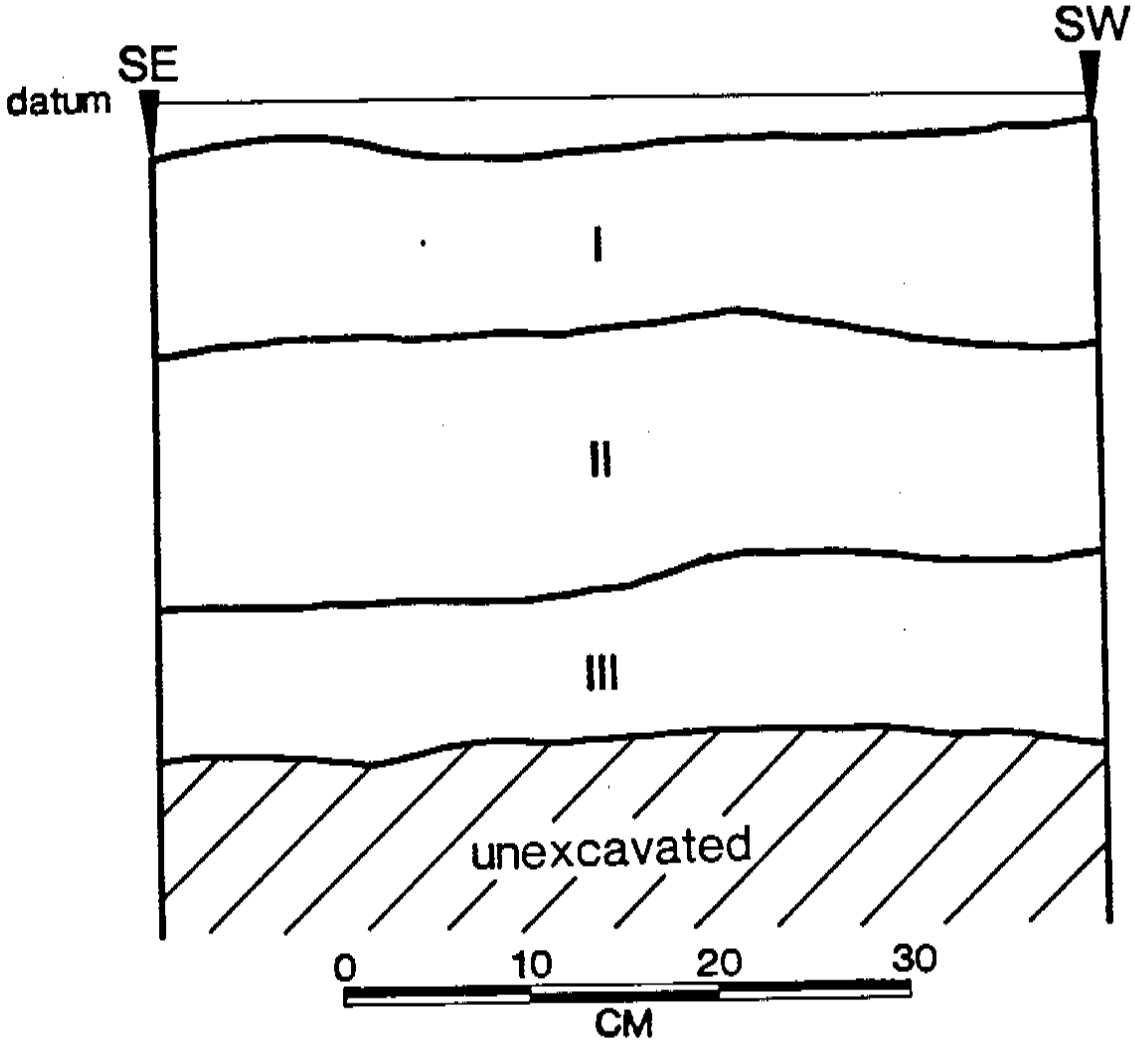
I & II-A horizon: gray-brown sandy loam with pebbles; cultural
Minguannan sherd, flakes, FCR

III-B_1 horizon: yellow-brown coarse sandy loam with pebbles;
cultural
1 chert biface fragment, flakes, FCR

IV-B_2 horizon: orange-brown clayey loam; sterile

7NC-H-83 Blackbird Study Area

area 2, subarea 8, test unit 1



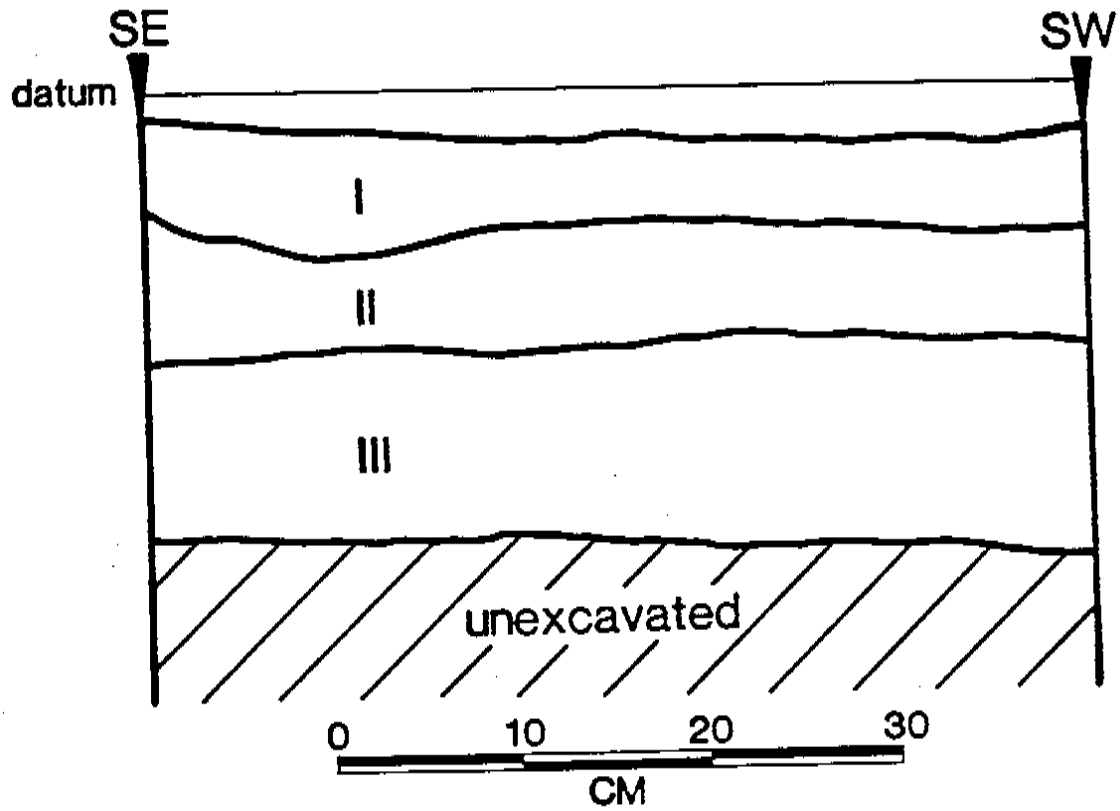
I-A horizon: plowzone; dark brown sandy loam with root material; cultural coal

II-B_1 horizon: yellow-brown sandy loam; cultural 2 jasper flakes

III-B_2 horizon: reddish brown clayey sand with FeO staining; cultural 1 quartzite flake

7NC-J-113 Blackbird Study Area

area 2, subarea 14, test unit 2



I-A horizon: humus, gray-brown silty loam; cultural flakes, FCR, barbed wire

II-B_1 horizon: yellow-brown silty loam; cultural flakes, FCR

III-B_2 horizon: orange-brown clay loam grading into mottled yellow-orange clay; cultural flakes in upper part

APPENDIX V

SUMMARY OF SUBSURFACE TESTING RESULTS

subarea	unit #	site	original setting type	corrected setting type	specific geophysical setting	historically plowed	artifacts recovered						
							ceramics	bifaces	flakes	scrapers util. fls. fl. tools	f.c.r.	other	historic/ temporal
1-11	1	7NC-G-59	—	—	Headland Adjacent to Stream	NO	1 Ming.	1	14		4		
1-11	2	7NC-G-60	—	—	"	NO	20 Ming.		40		YES		
1-11	3	7NC-G-61	—	—	"	NO			YES				
1-11	4	7NC-G-62	—	—	"	NO	YES Ming.		YES		YES	Preh. Pipe. Frag.	
1-11	5	7NC-G-63	—	—	"	NO	YES Ming.	1	YES				
1-11	6	7NC-G-64	—	—	"	NO	1 Ming.		33	1	2		
1-11	7	7NC-G-65	—	—	"	NO			Yes				
1-11	8	7NC-G-66	—	—	"	NO			60				
1-11	9	7NC-G-67	—	—	"	YES			6	3			

KEY:
Preh. Pipe. Frag. --- Prehistoric Pipestem Fragment
Ming. --- Minguannan
Hum. --- Humus
Cer. --- Ceramic

subarea	unit #	site	original setting type	corrected setting type	specific geophysical setting	historically plowed	artifacts recovered						
							ceramics	bifaces	flakes	scrapers util. fls. fl. tools	f.c.r.	other	historic/ temporal
2-1	1	—	I	III	On rise in b/b cluster	Y	NONE						
2-1	2	—	I	IX	Rise adjacent to stream	N	NONE						
2-1	3	—	I	IX	Rise adjacent to b/b	N	NONE						
2-1	4	7NC-H-11	I	IX	On rise north of b/b	N			1				
2-1	5	—	I	IX	Rise east of b/b	Y	NONE						
2-1	6	—	I	IX	Rise east of b/b	N	NONE						
2-1	7	—	III	III	Rise northwest of b/b	N	NONE						
2-1	8	7NC-H-12	III	III	Rise northeast of b/b	N		1					
2-1	9	—	III	III	Rise between 2 b/b's	N	NONE						
2-1	10	—	III	III	Rise west of 3 b/b's	N	NONE						

subarea	unit #	site	original setting type	corrected setting type	specific geophysical setting	historically plowed	artifacts recovered						
							ceramics	bifaces	flakes	scrapers util. fls. fl. tools	f.c.r.	other	historic/ temporal
2-1	11	—	III	III	Between 2 b/b's	N	NONE						
2-1	12	7NC-H-13	III	III	Low flat rise adjacent to 2 b/b's	N		1					
2-1	13	—	III	III	Rise northeast of b/b	N	NONE						
2-2	1	7NC-J-22	V	VII	West side of ephemeral stream	Y			6				
2-2	2	7NC-J-23	V	VII	Bluff confluence of 2 ephemeral streams	N							Bottle glass date unknown in humus
2-2	3	7NC-J-24	V	VII	Bluff confluence of 2ephemeral streams	Y			5				19th cent. whiteware redware coal in PZ
2-2	4	—	V	VII	Bluff confluence of 2 ephemeral streams	?	NONE						
2-2	5	7NC-J-25	V	VII	Headland adjacent to stream	Y			2				19thcent. ceramics, coal, nail frag in PZ
2-2	6	7NC-J-26	V	VII	Rise some distance from ephemeral stream	Y							19th cent. glass, ceramic, brick in PZ
2-2	7	7NC-J-27	I	VII	Rise south of pair of b/b's	Y			Y				

subarea	unit #	site	original setting type	corrected setting type	specific geophysical setting	historically plowed	artifacts recovered						
							ceramics	bifaces	flakes	scrapers util. fls. fl. tools	f.c.r.	other	historic/ temporal
2-6	3	7NC-H-33	VII	VII	On the bluff at confluence	N			4		Y		Clear glass & coal in humus & subsoil
2-6	4	7NC-H-33	VII	VII	On the bluff at confluence	N			1				
2-7	1	7NC-H-70	VII	VII	On rise at confluence	N			2		1		.38 cal. slugs, charcoal in humus
2-7	2	7NC-H-71	VII	VII	Low rise at confluence	Y			8				19th cent. whiteware in PZ
2-8	1	7NC-H-83	VIII	IX	Rise southeast of a b/b	Y			3				
2-8	2	7NC-H-84	VIII	IX	Rise east of a b/b	Y			3				
2-8	3	7NC-H-85	VIII	IX	Rise east of a b/b	Y		1	2				Coal and brick in PZ
2-8	4	7NC-H-86	VIII	IX	Rise on north side of active stream	Y			6				Early 19th cent. cer. glass, much nail & brick in PZ
2-8	5	7NC-H-87	VIII	IX	Rise on north side of active stream	N			33		1		
2-8	6	—	VIII	IX	Rise on north side of active stream	N	NONE						

subarea	unit #	site	original setting type	corrected setting type	specific geophysical setting	historically plowed	artifacts recovered						
							ceramics	bifaces	flakes	scrapers util. fls. fl. tools	f.c.r.	other	historic/ temporal
2-2	8	———	I	III	Wooded flat near 2 b/b's	N	NONE						
2-2	9	———	I	III	Wooded flat near 2 b/b's	N	NONE						
2-3	1	7NC-J-38	VI	VI	Headland adjacent to ephemeral stream	N							Embossed clear glass late 19th cent in hum.
2-3	2	7NC-J-39	VI	VI	Headland at confluence major/minor	Y			5		2		Much 19th cent. ceramic, nail brick in PZ
2-3	3	7NC-J-40	VI	VI	Headland at confluence major/minor	N			5	1			
2-3	4	7NC-J-41	VI	VI	Headland at confluence minor/minor ephem. streams	N			5		1		19th cent whiteware, coal in humus
2-4	1	7NC-H-20	IX	IX	Rise in center of cluster of b/b's	N			12		2		
2-4	2	7NC-H-21	IX	IX	Small ridge between b/b & active stream	N	1 Ming.		8				
2-6	1	7NC-H-34	V	V	Rise on north side of stream	Y		1	3				19th cent whiteware & glass in PZ
2-6	2	7NC-H-33	VII	VII	Bluff at confluence	N			35		4		

subarea	unit #	site	original setting type	corrected setting type	specific geophysical setting	historically plowed	artifacts recovered						
							ceramics	bifaces	flakes	scrapers util. fls. fl. tools	f.c.r.	other	historic/ temporal
2-8	7	—	VIII	IX	Rise between pair of b/b's and an active stream	N	NONE						
2-14	1	—	V	V	Berm of a bluff on east side of an active stream	N	NONE						
2-14	2	7NC-J-13	V	V	Berm of a bluff on east side of an active stream	N			36		3		19th cent barbed wire frag. in PZ & subsoil

APPENDIX VI

RESULTS OF ANALYSIS OF POLLEN AND SOIL SAMPLES FROM BAY/BASIN FEATURES

POLLEN ANALYSES FROM BROWN UNIVERSITY

Initial Pollen Scan Results
Basin A and Basin B

Report on pollen analysis of the samples sent by Jay Custer (10 samples from Delaware and 1 from Pennsylvania).

1. Pollen extraction procedure (Paige Newby)
   a. constant volume (2.5 cc) samples taken
   b. 4 tablets of Lycopodium tracers added to each sample (12,000 grains each= 48,000 tracers per sample)
   c. HCl (10%) used to remove carbonates
   d. HF (48%) used to remove silicates (used both "overnight stand" and 30 minute hot HF treatments)
   e. Acetylation procedure employed to remove cellulose
   f. KOH (5%) used to remove organic materials
   g. for the Delaware samples a second HF was necessary to remove remaining silicates
   h. for the Pennsylvania sample more than 30 water washes were required to remove organic residues following KOH
   i. samples washed with TBA to remove water and residues mounted in silicone oil (1000 cs.)

2. Pollen slide scanning (Bob Thompson)
   a. sample residues mounted on microslides and coverslip placed on top
   b. non-overlapping traverses made (at 40X) until at least 20 Lycopodium tracers counted
   c. talleys made of identifiable and unidentifiable pollen.
   d. results presented in tabular form (see attached sheet)

3. Plant macrofossil analysis (Paige Newby and Bob Thompson)
   a. sediment samples disaggregated with Trisodium Phosphate
   b. organic remains in samples "floated" to segregate them from inorganic fraction of samples
   c. organic residues split into different size ranges with nested soil sieves
   d. organic remains dried and examined under 10X magnification

4. Results and Assessment (Bob Thompson)

With the exception of a few rootlets which may be contaminants, no plant macrofossils were recovered from these samples. The sample from Pennsylvania was also devoid of pollen.

The surface samples from the Delaware localities contained abundant pollen, as did the samples from 161 cm below the surface and lower (see table 1). Pine pollen grains were in the majority in the lowermost sample, suggesting that this horizon represents a time in which vegetation was very different from that of today. While it would not be possible to construct a complete Holocene diagram from the samples submitted, it seems that if a site could be found nearby with more permanent and/or deeper water, it should be possible to get a long continuous sequence. Alternatively, the lower materials could be analyzed to provide information on the vegetation and climate of the period of their deposition.

Table 1. The pollen content of the subsurface samples from Delaware. The pollen concentration is in grains/cc.

Horizon	Depth (cm)	Pollen concentration	Percent unidentifiable pollen	Percent *Pinus* pollen
2	38	33,000	76	0
3	56	0	-	-
4	70	0	-	-
4	92	0	-	-
4	112	2,900	33	67
4	141	0	-	-
4	161	11,500	38	38
4	176	11,300	11	89

Initial Field Record from Coring from Basin B

Pollen Laboratory - Brown University

Core Report

Walter's Puddle (Basin B)
Townsend, Delaware 39 24'N 75 41'30"
Dates: 6/4 - Rain: Moderate to Downpour
6/5 Warm and Sunny

Crew: R. Thompson, B. Scharf, R.Webb, P. Newby

Coring Site: 27m diameter basin (of unknown origin); coring done in approx. center. Water depth approx. 1m.

Coring Summary: 4.04m of Holocene and late-glacial (?) sediment. Two cores (A and B) were taken. In both cases clay content in sediment made the process difficult. Core A was abandoned due to extrusion difficulties and rain. An additional surface sample was taken-23.5cm recovery.

Core logs:

Core A: 0 - 90 cm (45cm recovered)

90 - 151 cm (59 cm recovered)

Core B:

Section 1 0 - 40 cm (30cm recovered)
Sandy silt. Visible leaf mold; possible macros.

Section 2 40 - 1.40 (97cm recovered)
Clayey silt. Clean extrusion in the field.

Section 3 1.40 - 233.5 (93.5cm drive, 78cm recovery)
Silty clay. Some exterior discoloration.

Section 4 233.5 - 3.06 (73cm drive, 66cm recovery)
Fine sand/silty clay. Charcoal flecks in lower 10cm of section.

Section 5 3.06 - 3.84 (78cm drive, 79cm recovery)
Silt,sand,clay lenses. Laminae (?) in lower 20 - 25cm of section. Some mottled discoloration also visible.

Section 6 3.84 - 4.04 (20cm drive and recovery)
Clayey silt. Very "blue" appearance in field. Rejection at 20 cm.

Paige Newby

June 25. 1985

Preliminary Report on Pollen and Sediments, Basin B

Preliminary Report: Walter's Puddle, Delaware

Field Operations

At the request of Jay F. Custer, sediment cores for palynological analyses were collected in June, 1985 at a bay/basin feature near Townsend, Delaware as part of the archaeological survey of the Route 13 Corridor in northern Delaware. Previous work done at Brown University indicated the presence of pollen in samples processed from sediments excavated from two selected basins in this area.

Two cores were taken from Basin B (Walter's Puddle); an oval basin approximately 27 meters in diameter. This basin was selected for study at the suggestion of the archaeologists because it contains a permanent pond (85cm water depth at date of coring) and is in proximity to archaeological sites.

The cores were taken with a Livingstone piston corer (2" internal diameter). The individual one-meter-length segments were extruded and wrapped in layers of plastic and aluminum foil, and then placed in aluminum "flashing" and secured with tape. Labels indicating top, bottom and depth were placed in each segment (see Core Report for detailed core information). In addition, botanical samples were taken of the modern vegetation surrounding the pond.

Laboratory Processing

In the laboratory, the core segments were re-measured and photographed. The textures and Munsell colors were described from each sedimentary unit and the cores were examined for evidence of disconformities (see enclosed sediment description and photographs of the lower portion (52 - 79cm) of Section 5). Composite 1 cc samples were taken for pollen and weight loss on

ignition analyses at selected intervals in the core based upon the observed sediment stratigraphy (Table 1).

The processing of the samples for pollen analysis followed the usual procedures for the removal of unwanted organic materials (KOH), carbonates (HCl), and silicates (HF) (Faegri and Iversen, 1975). The samples also were screened to remove large "sand" grains, and treated with sodium pyrophosphate to remove clay size particles (Bates, Coxon and Gibbard, 1978). A series of slides were made at different stages during the processing to monitor the progress of the samples. A known quantity of *Lycopodium* spores (an exotic type) was added to each sample during processing to allow calculation of pollen concentration.

A weight loss technique (Dean, 1974) was used to obtain information on the organic carbon content of the sediments. This technique involves the weighing of the residual material after burning the sample at 550 degrees C, and comparing this weight to the original dry weight of the sample. The percentage of the sample weight lost after ignition is an estimate of the relative organic carbon content of the sample.

Preliminary Results

The preliminary results of the pollen and weight loss analyses are presented in Figure 1. With the exception of intervals in Section 5, the sediment stratigraphy from the core does not indicate any changes with depth. The core is predominantly sand, silt and clay with gradational textural and color boundaries. The sediment grades from a loose, flocculent consistency from 0 - 13cm to a slightly hard, plastic consistency to the bottom of the core. The only abrupt sedimentary changes are in Section 5 (306cm - 384cm) which contains an incoherent, poorly sorted sand lens between 337 - 346cm, a 4cm mottled sandy clay interval from 350cm to 354cm (photograph 1), and rhythmites from 358cm to 374cm (photograph 2). The rhythmites (approx. 1mm wide) have

irregular textures and are defined by different colors. There are also a few small, fine sand lenses in this section.

Gradual changes in texture, color and composition do not suggest any dramatic changes in the depositional regime, although the rhythmites in Section 5 may reflect some short term fluctuations. However, the darker color of the sediments from the surface to 65cm correspond to more organic content in the upper than in the lower portions of the core, probably the result of leaf litter, terrestrial organics and detrital material from in and around the basin. Weight loss analyses indicate a similar change in organic composition with a reduction in % organic carbon from 23.3% to 6.16% between 58.5cm - 6.16cm. Fungal hyphae, perhaps associated with a sub-aereal environment, were observed in the lower sediments, suggesting dry intervals for at least a portion of the basin's history. Terrestrial pollen concentration calculations indicate a substantial decrease from the top (greater than 2 million grains/cc at 58.5cm0) to the bottom (less than 10 thousand grains/cc at 69.5cm) of the core. The quality of the preservation of the pollen follows the same pattern: less than 20% of the grains counted in each of samples 1 - 3 (0 - 69.5cm) were "indeterminates" compared to greater than 50% "indeterminates" in sample 10 (339.5cm). All of this information suggests that the sediments below approx. 65cm may have undergone oxidation during intermittent (seasonal?) dry periods at the basin.

Preliminary pollen counts indicate a negative correlation between *Pinus* and *Quercus*. At 20.5cm, the organic horizon is predominantly *Quercus* species (51%) with *Pinus*, *Liquidambar*, *Carya* and other trees shrubs, herbs and aquatics. Between 58.5cm and 69.5cm, *Pinus* rises steeply to 60%, *Quercus* decreases to 3% and all other types are either degraded or entirely absent. The presence of *Typha* and *Cephalanthus* in the upper and not the lower portion of the core may be the result of differential preservation or the lack of water required for these species.

Discussion

Two hypotheses are proposed from the analyses thus far. The change from *Pinus* to *Quercus* dominance in the pollen spectra may correlate with an early Holocene transition observed at other sites in the Middle Atlantic region (Watts, 1979). This would place the early Holocene horizon at Walter's Puddle between 58.5cm and 69.5cm, with the lower sediments being of either early Holocene or late Pleistocene. The second hypothesis is that the *Pinus* to *Quercus* transition reflects the differential destruction of pollen below 60cm from oxidation and/or other diagenic processes. The stratigraphy from Szabo Pond, N.J. has a similar phenomenon: pollen spectra from the upper section of organic mud were dominated by *Quercus* (70%) while the lower sediments were oxidized and contained poorly preserved pollen (Watts, 1979). This transition post dates 11,950 yrs. BP (Watts, 1979). In any case, it appears that the data from Walter's Puddle provide information on the water levels of this basin and/or changes in the terrestrial vegetation in this area. Additional pollen samples and analyses will increase the resolution of the diagram with more details on aquatics and other taxa and on the transition from *Pinus* to *Quercus* dominance. The presence of *Ambrosia* in the Oswego River, N.J. and Helmetta, N.J. profiles are suggested as related to pre-European forest clearance (Watts, 1979). Closer examination of the upper sediments and the disturbance types profile from Walter's Puddle may provide similar disturbance evidence and/or the historic *Ambrosia* rise. Finally, the radiocarbon dating of the sediment should provide absolute dates necessary to develop a chronostratigraphy for the core and permit comparisons with other Holocene pollen diagrams.

References Cited

Bates, C.D., P. Coxon and P.L. Gibbard (1978). A new method for the preparation of clay-rich clay-rich sediment samples for palynological investigation. *New Phytologist* 81, 459-463.

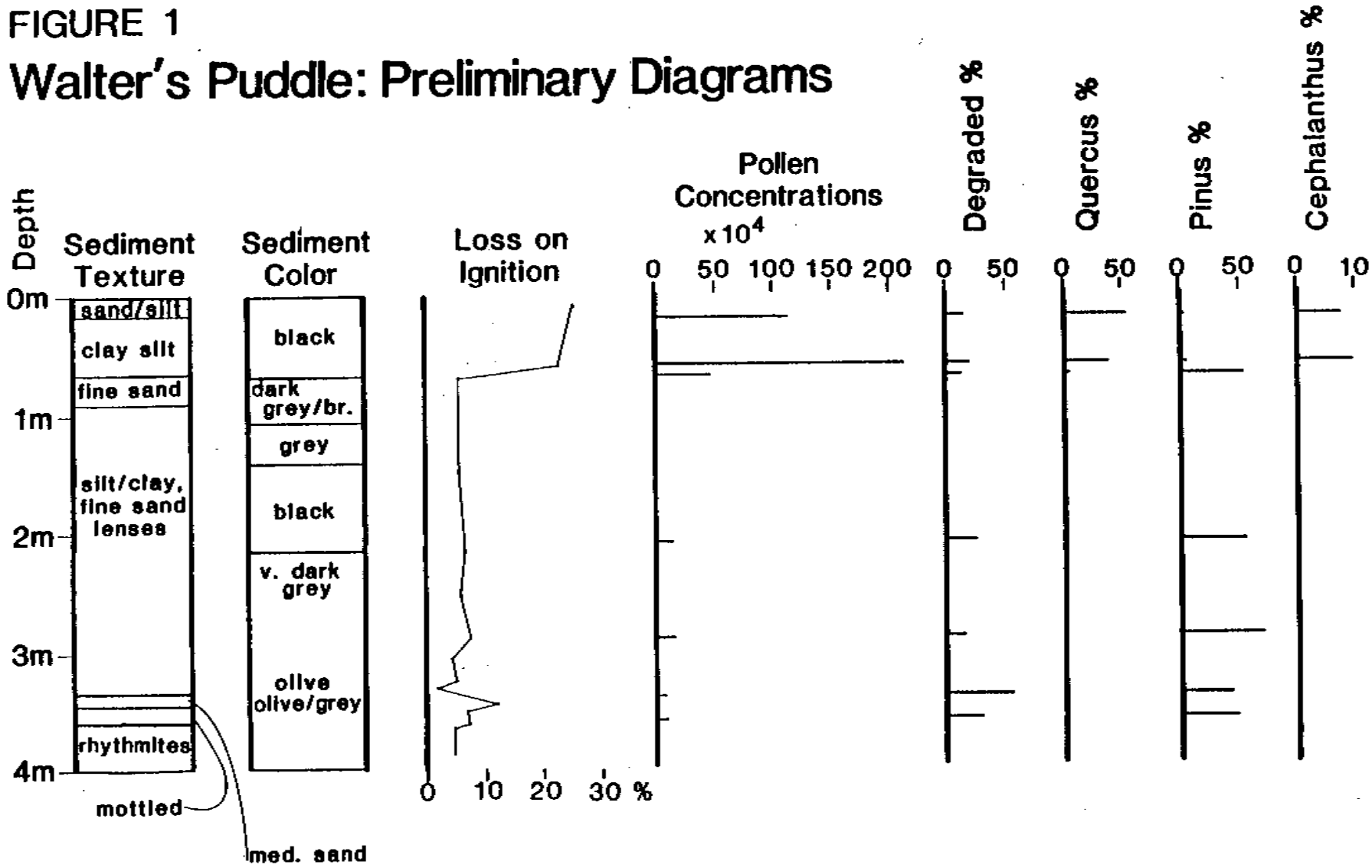
Dean, W.E.,Jr. (1974). Determination of carbonate and organic matter in calcareous sediments and sedimentary rocks by loss on ignition: comparison with other methods. *Journal of Sedimentary Petrology* 44, 242-248.

Faegri, K. and J. Iversen (1975). *Textbook of Pollen Analysis* Hafner Press, New York.

Watts, W.A. (1979). Late Quaternary vegetation of central Appalachia and the New Jersey coastal plain. *Ecological Monographs* 49(4), 427-469.

FIGURE 1

Walter's Puddle: Preliminary Diagrams



Pollen Laboratory -- Brown University
Table 1 -- Sampling Description
Walter's Puddle (Basin B) -- Core B
Townsend, Delaware 39 24'N 75 41'30"W

Sample Number	Section of core	Location of Sample: cm below top of Section	Depth Below Sediment Water Interface	Type of Samples	Processing Status*
#1	1	20-21 cm	20.5 cm	pollen & LOI	A
#2	2	18-19 cm	58.5 cm	pollen & LOI	A
#3	2	29-30 cm	69.5 cm	pollen & LOI	A
#4	3	10-11 cm	150.5 cm	pollen & LOI	B
#5	3	72-73 cm	212.5 cm	pollen & LOI	A
#6	4	20-21 cm	254.0 cm	pollen & LOI	B
#7	4	56-57 cm	290.0 cm	pollen & LOI	A
#8	5	10-11 cm	316.5 cm	pollen & LOI	B
#9	5	26-27 cm	332.5 cm	pollen & LOI	B
#10	5	33-34 cm	339.5 cm	pollen & LOI	A
#11	5	41-42 cm	347.5 cm	pollen & LOI	B
#12	5	45-46 cm	351.5 cm	pollen & LOI	B
#13	5	51-52 cm	357.5 cm	pollen & LOI	A
#14	5	60-61 cm	366.5 cm	pollen & LOI	B
#15	5	71-72 cm	377.5 cm	pollen & LOI	C
#16	5	10-11 cm	394.5 cm	pollen & LOI	C

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* A -- LOI (*Loss on Ignition*) analysis completed. Pollen sample processed and preliminary counts available.
B-- LOI analysis completed. Pollen sample processed but not counted.
C -- LOI analysis completed. Pollen sample taken but not processed.

Pollen Laboratory – Brown University
Sediment Description

Walter's Puddle (Basin B)
Townsend, Delaware 39 24'N 75 41'30"W

Core B
Section 1 – 0-40 cm (30 cm recovered)

00.0-13.0 cm* ***0.00-13.0 cm***	7.5 YR 2/0 Black (moist Munsell color of core rind). Sandy silt, loose and friable. Contains possible macrofossils and leaf mold. The boundary at 13 cm coincides with a break in the sediment core. Exterior (core rind) has leaf fragments adhering to it.
13.0-30.0 cm ***13.0-30.0 cm***	10 YR 2/1 Dark black-brown (moist Munsell color of core rind). Slightly clayey silt. Ranges from loose and friable to plastic.

Section 2 – 40-140 cm (97 cm recovered).

0.00-13.0 cm ***40.0-53.0 cm***	10 YR 2/1 Black (moist Munsell color of core rind). Slightly clayey silt, slightly sticky, non-plastic. 7-9 cm small fracture.
13.0-23.0 cm ***53.0-63.0 cm***	5 Y 2.5/2 Black (Munsell color of moist core rind). Clayey silt, slightly sticky, non-plastic.
23.0-50.0 cm ***63.0-90.0 cm***	12.5 Y 3/2 Very dark greyish brown (moist Munsell). Silty fine sand.
50.0-66.0 cm ***20.0-106.0 cm***	2.5 Y 3/2 Very dark greyish brown (moist Munsell). Clayey silt, plastic.
66.0-97.0 cm ***106.0-137.0 cm***	5 YR 3/1 Very dark grey (Munsell of moist core rind) Silty clay, very plastic.

---

* Depth below the top of the section.
** Depth below sediment-water interface.

Section 3 -- 140-233.5 cm (recovery 78 cm)

00.0-78.0 cm
140.0-218.0 cm 5 Y 2.5/2 Black (moist core rind Munsell color).
Grades from silty clay (at the top) to slightly silty clay (near 54 cm) plastic, slightly sticky. Extrusion breaks at 54 and 65 cm. Discoloration (darkening) of the exterior of the sediment core, probably due to oxidation.

Section 4 -- 233.5-306 cm (66 cm recovery).

0.00-66.0 cm
233.5-299.5 cm 5 Y 3/1 very dark grey to 5 Y 3/2 dark olive grey.
Color grades from very dark grey (top i.e. 0 cm) to dark olive grey (at the bottom). Very fine sandy or possibly silty clay -- very plastic. Possible charcoal flecks in the last 10 cm (56-66 cm) of the sediment core. Extrusion breaks at 37 and 51 cm.

Section 5 -- 306-384 cm (79 cm recovery).

00.0-10.0 cm
306.0-316.0 cm 5 Y 3/2 Dark olive grey.
Silt. Extrusion break at 5 cm.

10.0-15.0 cm
316.0-321.0 cm 5 Y 3/2 Dark olive grey silty sand.

15.0-17.0 cm
321.0-323.0 cm 5 Y 3/2 Dark olive grey silt

17.0-21.0 cm
323.0-327.0 cm 5 Y 3/2 Dark olive grey.
Silty sand. Break in the sediment at 21 cm.

21.0-25.0 cm
327.0-331.0 cm 5 Y 3/2 Dark olive grey silt.

25.0-27.0 cm
331.0-333.0 cm 5 Y 3/2 Dark olive grey.
Silty sand.

27.0-31.0 cm
333.0-337.0 cm 5 Y 3/2 Dark olive grey.
Silt. Break in the sediment at 30 cm.

31.0-40.0 cm
337.0-346.0 cm 5 Y 3/1 Very dark grey medium.
Sand. Break in the sediment at 37 cm.

40.0-42.0 cm
346.0-348.0 cm 5 Y 4.2 Olive grey silt.

42.0-44.0 cm
348.0-350.0 cm 5 Y 5/3 Olive clay (mottled with some black flecks)

44.0-50.0 cm
350.0-356.0 cm 5 Y 5/3 Olive sandy clay.
Extrusion break at 49 cm.

50.0-53.5 cm
356.0-359.5 cm 5 Y 4/2 Olive grey silty clay.
At 52 cm, rhythmites begin. Rhythmites, which extend from 52 cm to 68 cm, are an average of 1 mm wide of irregularly alternating lighter/darker colors and irregularly alternating lithographies.

53.5-54.5 cm
359.5-360.5 cm 5 Y 4/2 Olive grey sandy lens.

54.5-58.0 cm
360.5-364.0 cm 5 Y 4/2 Olive grey.
Clayey silt with a small amount of sand.

58.0-60.0 cm
364.0-366.0 cm 5 Y 4/2 Olive grey fine sand.
Extrusion break at 59 cm.

60.0-75.0 cm
366.0-381.0 cm 5 Y 4/2 Olive grey clayey silt.
Extrusion break at 70 cm. At 68 cm the rhythmites end.

75.0-79.0 cm
381.0-385.0 cm 5 Y 4/3 Olive with mottles sandy clay.

Section 6 – 384-404 cm (20 cm recovery)

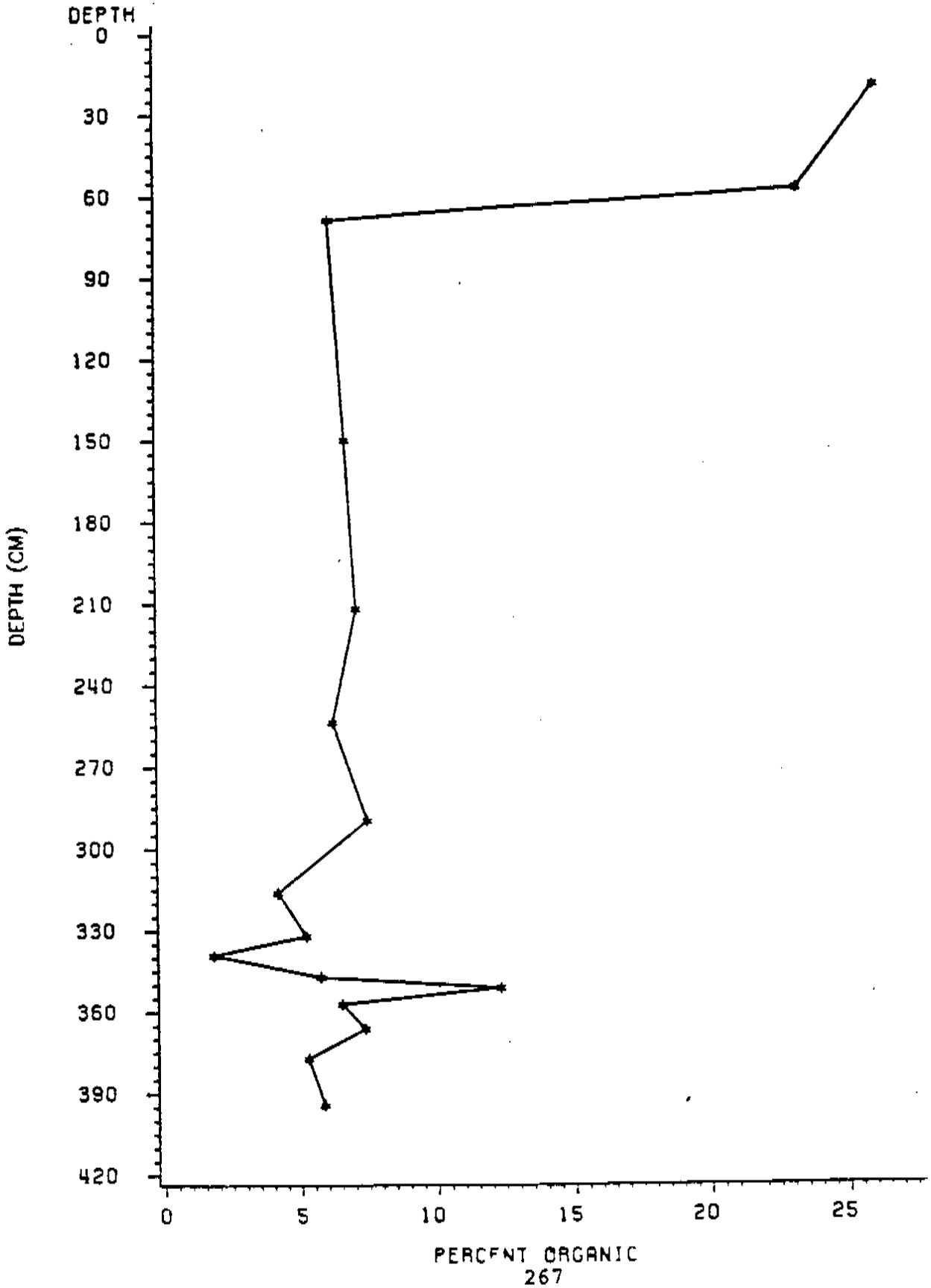
0.00-10.0 cm
384.0-394.0 cm 5 B 5/1 (bluish grey) to 5 B 4/1 (Dark bluish grey) interior (unoxidized) sediment. Core rind 5 Y 5/3 Olive clayey silt.

10.0-11.0 cm
394.0-395.0 cm 2.5 Y 3/0 Very Dark Grey clayey silt, plastic.

11.0-20.0 cm
395.0-404.0 cm 5 Y 5/2 Olive grey silt.

LOSS ON IGNITION

WALTERS PUDDLE



WALTERS PUDDLE: LOSS ON IGNITION, DRY WEIGHT, AND WET WEIGHT DATA

Sample Number	Depth Below Sed-Water Interface (cm)	Wet Weight (gm)	Dry Weight (gm)	Ignited Weight (gm)	Percent Water Content	Percent Organic Matter
1	20.5	.	0.4472	0.3301	.	26.19
2	58.5	.	0.5777	0.4431	.	23.30
3	69.5	.	0.4544	0.4264	.	6.16
4	150.5	.	0.9721	0.9067	.	6.73
5	212.5	.	1.0539	0.9792	.	7.09
6	254.0	.	0.6841	0.6415	.	6.23
7	290.0	.	0.9459	0.8751	.	7.48
8	316.5	.	0.9817	0.9409	.	4.16
9	332.5	.	1.1858	1.1240	.	5.21
10	339.5	.	1.5346	1.5068	.	1.81
11	347.5	.	1.6897	1.5929	.	5.73
12	351.5	.	1.2022	1.0542	.	12.31
13	357.5	.	1.0639	0.9947	.	6.50
14	366.5	.	1.1070	1.0256	.	7.35
15	377.5	.	1.1560	1.0952	.	5.26
16	394.5	.	1.2091	1.1385	.	5.84

Interim Pollen Identifications
Basin B

BROWN UNIVERSITY Providence, Rhode Island • 02912-1846

DEPARTMENT OF GEOLOGICAL SCIENCES
401-863-3128

October 21, 1985

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University of Delaware
Department of Anthropology
Newark, Delaware 19716

Dear Jay:

Enclosed is an up-date of our pollen work at Walter's Puddle. We were able to improve on the differentiation of conifer grains and found a fair number of spruce (Picea) grains from 60 cm down. We seem to have Pleistocene material below 60 cm and Holocene material above it. An hiatus may exist somewhere between 60 and 90 cm. We have submitted material for C-14 dates at 50 cm and at 100 cm. Those dates will help us tie down our interpretations. Please regard all interpretations with caution. The counts are preliminary and indicate much potential for further work. Paige Newby has done a neat job in completing this work. I can see a publication emerging from this work.

Yours sincerely,

Tom

Thompson Webb III

TW/map
enclosures

Pollen Laboratory -- Brown University
Sampling Description -- Walter's Puddle, Delaware

Sample Number	Section of core	Location of Sample: cm below top of Section	Depth Below Sediment Water Interface	Type of Samples	Processing Status*
#2	poly.	10-11cm	10-11cm	pollen	D
#1	1	20-21 cm	20.5 cm	pollen & LOI	A
#3	1	29-30cm	29-30cm	pollen	D
#4	2	1-2cm	41-42cm	pollen	D
#2	2	18-19 cm	58.5 cm	pollen & LOI	A
#5	2	23-24cm	63-64cm	pollen	D
#3	2	29-30 cm	69.5 cm	pollen & LOI	A
#6	2	82-83cm	122-123cm	pollen	D
#4	3	10-11 cm	150.5 cm	pollen & LOI	A
#5	3	72-73 cm	212.5 cm	pollen & LOI	A
#6	4	20-21 cm	254.0 cm	pollen & LOI	A
#7	4	56-57 cm	290.0 cm	pollen & LOI	A
#8	5	10-11 cm	316.5 cm	pollen & LOI	B
#9	5	26-27 cm	332.5 cm	pollen & LOI	A
#10	5	33-34 cm	339.5 cm	pollen & LOI	A
#11	5	41-42 cm	347.5 cm	pollen & LOI	B
#12	5	45-46 cm	351.5 cm	pollen & LOI	B
#13	5	51-52 cm	357.5 cm	pollen & LOI	A
#14	5	60-61 cm	366.5 cm	pollen & LOI	B
#15	5	71-72 cm	377.5 cm	pollen & LOI	A
#16	5	10-11 cm	394.5 cm	pollen & LOI	C

*A -- LOI (Loss on Ignition) analysis completed. Pollen sample processed and counts available.
B-- LOI analysis completed. Pollen sample processed but not counted.
C -- LOI analysis completed. Pollen sample taken but not processed.
D -- Pollen sample processed and preliminary counts available.

Preliminary Pollen Zones

Zone	Zone Name	Depth
WP-1	*Quercus* *Cephalanthus*	0 - 60 cm
WP-2	*Pinus-Picea* *Cyperaceae* *Betula*	60 - 300 cm
WP-3	*Pinus-Quercus* *Cyperaceae*	300 - 400 cm

Notes on Interpretation

Walter's Puddle - 1

The lowest zone (WP-1) may represent a time before the last full glacial period at 18,000 BP.

Walter's Puddle - 2

The middle zone (WP-2) may represent glacial to late-glacial times about 15,000 to 12,000 yrs. BP.

Walter's Puddle - 3

The upper zone (WP-3) represents deposition during the Holocene, perhaps only the late Holocene. No clear *Ambrosia* rise is evident at 10 cm. We have not analyzed any sediments above 10 cm from Core B. In the preliminary diagram the 0 - 2 cm pollen spectra is from a Walter's Puddle Basin B sample processed during the initial phase of the project.

A hiatus may exist between zones WP-2 and WP-3 and may be marked in the sediments by the section of fine sands from 63 to 90 cm. Sediments at 50 to 60 cm and 90 to 137 cm have been submitted for radiocarbon dating.

Preliminary Pollen Zones

Zone	Zone Name	Depth
WP-1	*Quercus* *Cephalanthus*	0 - 60 cm
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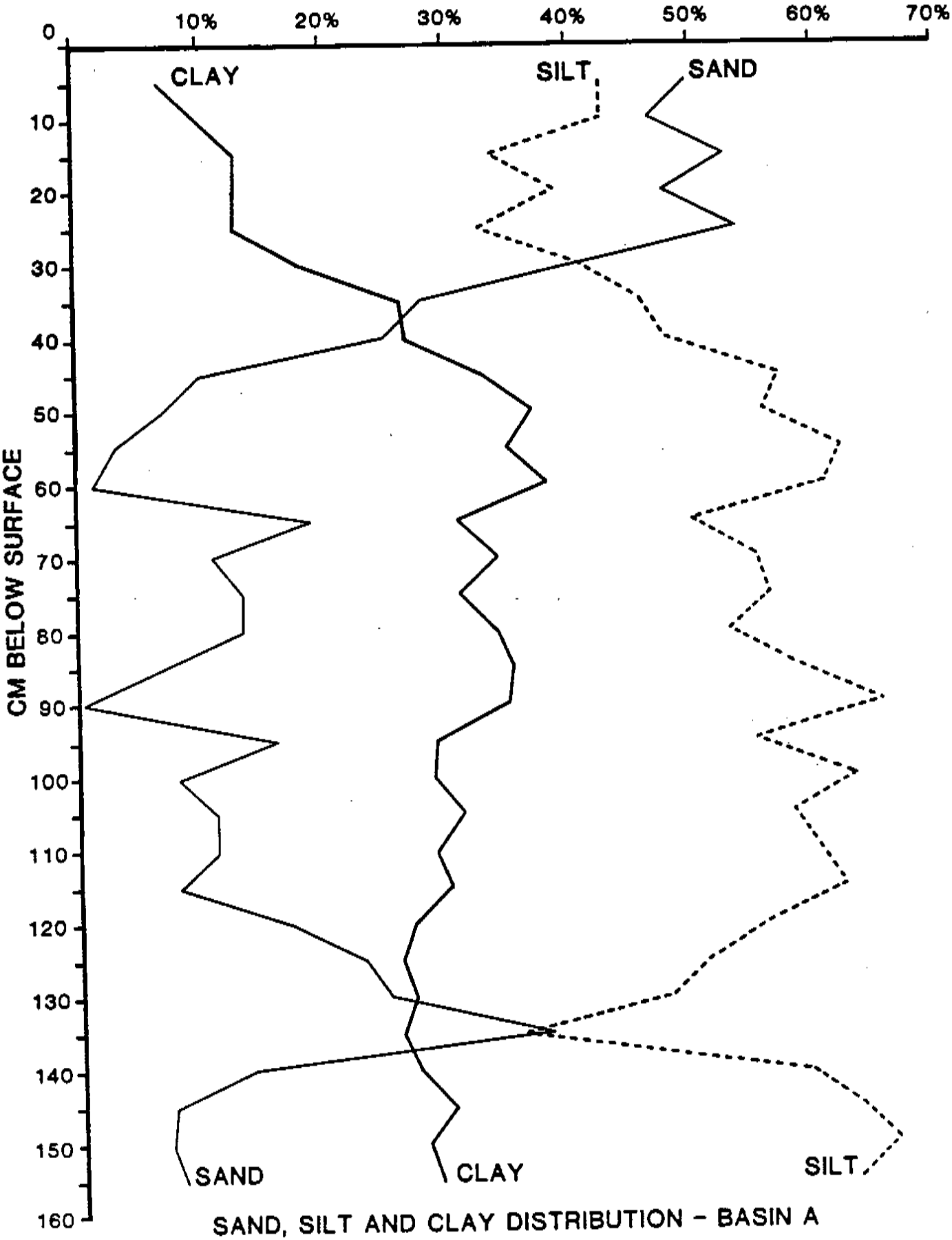
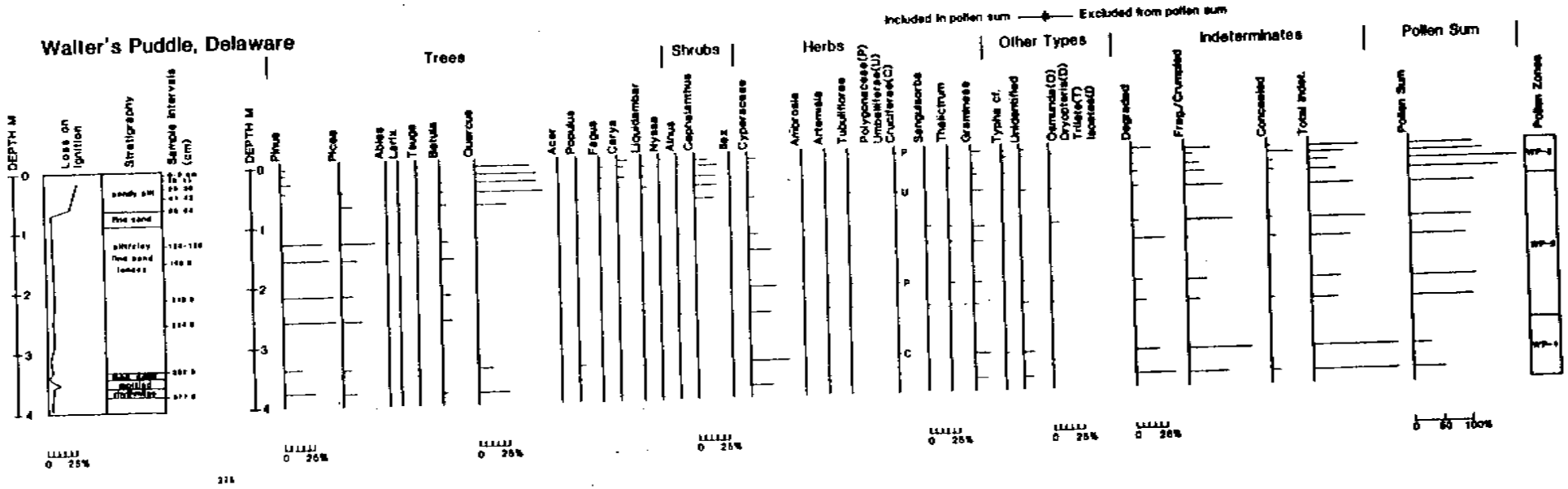
Basin A - Soil Column Analysis Results

DEPTH	CLAY	SILT	SAND	pH	Ph	K	Ca	Mg
0-5	7	43	50	5.2	6	12	24	25
5-10	10	43	47	5.1	3	11	20	18
10-15	13	34	53	5.1	2	14	21	18
15-20	13	39	48	5.1	1	13	18	12
20-25	13	33	54	5.0	1	11	15	20
25-30	18	41	41	4.9	1	13	19	71
30-35	26	46	28	4.9	1	17	27	141
35-40	27	48	25	4.9	1	21	26	150
40-45	33	57	10	4.8	1	27	29	150
45-50	37	56	7	4.8	1	32	31	150
50-55	35	62	3	4.8	1	37	34	160
55-60	38	61	1	4.8	1	40	37	150
60-65	31	50	19	4.9	2	40	35	150
65-70	34	55	11	5.0	5	43	35	150
70-75	31	56	13	5.2	6	46	41	150
75-80	34	53	13	5.2	6	49	42	150
80-85	35	58	7	5.3	3	53	42	150
85-90	35	65	0	5.5	2	55	43	150
90-95	29	55	16	5.4	3	48	40	150
95-100	29	63	8	5.4	4	47	37	150
100-105	31	58	11	5.8	2	42	36	150
105-110	29	60	11	5.9	2	38	36	150
110-115	30	62	8	6.0	2	39	39	150
115-120	27	56	17	6.2	3	38	40	150
120-125	26	51	23	6.3	6	30	36	150
125-130	27	48	25	6.2	5	31	36	150
130-135	26	36	38	6.3	4	30	35	150
135-140	27	59	14	6.1	3	30	35	150
140-145	30	63	7	6.2	3	33	38	150
145-150	28	66	7	6.1	3	30	36	150
150-155	29	63	8	6.2	5	31	36	150



SAND, SILT AND CLAY DISTRIBUTION - BASIN A


Walter's Puddle, Delaware
Included in pollen sum
Excluded from pollen sum
Trees
Shrubs
Herbs
Other Types
Indeterminates
Pollen Sum
DEPTH M
Loss on Ignition
Stratigraphy
Sample Intervals (cm)
Pinus
Picea
Abies
Larix
Tsuga
Betula
Quercus
Acer
Populus
Fagus
Carya
Liquidambar
Nyssa
Alnus
Cephalanthus
Ilex
Cyperaceae
Ambrosia
Artemisia
Tubuliflorae
Polygonaceae(P)
Umbelliferae(U)
Cruciferae(C)
Sanguisorba
Thalictrum
Gramineae
Typha cf.
Unidentified
Osmunda(O)
Dryopteris(D)
Triletes(T)
Isoetes(I)
Degraded
Frag./Crumpled
Concealed
Total indet.
Pollen Sum
Pollen Zones
0 25%
0 50 100%

APPENDIX VII

LISTINGS OF FIELD SURVEY SITES BY STUDY AREA AND SIGNIFICANCE CLASS

SITES OF HIGH SIGNIFICANCE - APPOQUINIMINK AREA

SITE NUMBER	SITE TYPE	ARCHAIC	WOOD LAND I	WOOD LAND II	SURFACE WATER
7NC-F-50	BASE CAMP		Y		STREAM
7NC-F-52	MACRO BC		Y		STREAM
7NC-G-13					STREAM
7NC-G-50	MACRO BC				STREAM
7NC-G-59	MACRO BC			Y	STREAM
7NC-G-60	MACRO BC			Y	STREAM
7NC-G-61					STREAM
7NC-G-62	MACRO BC			Y	STREAM
7NC-G-64	MACRO BC			Y	STREAM
7NC-G-65	PROCUREMENT				STREAM
7NC-G-66	PROCUREMENT				STREAM
7NC-F-59	MACRO BC				STREAM
7NC-F-28	MACRO BC				STREAM
7NC-F-60	MACRO BC		Y		STREAM
7NC-G-68	MICRO BC				BAY/BASIN
7NC-G-73	MACRO BC		Y		STREAM
7NC-G-11	MACRO BC		Y		STREAM
7NC-G-88	MACRO BC				STREAM

SITES OF MEDIUM SIGNIFICANCE - APPOQUINIMINK AREA

SITE NUMBER	SITE TYPE	ARCHAIC	WOOD LAND I	WOOD LAND II	SURFACE WATER
7NC-G-74	HISTORIC				STREAM

SITES OF LOW SIGNIFICANCE - APPOQUINIMINK AREA

SITE NUMBER	SITE TYPE	ARCHAIC	WOOD LAND I	WOOD LAND II	SURFACE WATER
7NC-F-3					STREAM
7NC-F-44	PROCUREMENT				STREAM
7NC-F-45	PROCUREMENT				STREAM
7NC-F-46	PROCUREMENT				STREAM
7NC-F-47	PROCUREMENT				STREAM
7NC-G-39	PROCUREMENT				STREAM
7NC-G-40	PROCUREMENT				STREAM
7NC-G-41	PROCUREMENT				STREAM
7NC-G-42	MICRO BC				STREAM
7NC-G-43	PROCUREMENT				STREAM
7NC-G-44	PROCUREMENT				STREAM
7NC-G-45	PROCUREMENT				STREAM
7NC-F-48	PROCUREMENT				STREAM
7NC-F-49	PROCUREMENT				STREAM
7NC-F-53	PROCUREMENT				STREAM
7NC-F-21					STREAM
7NC-F-54	PROCUREMENT				STREAM
7NC-F-55	PROCUREMENT				STREAM
7NC-F-56	PROCUREMENT				STREAM
7NC-G-15	MACRO BC		Y		STREAM
7NC-G-51	PROCUREMENT		Y		STREAM
7NC-G-52	PROCUREMENT				STREAM
7NC-G-53	PROCUREMENT				STREAM
7NC-G-54	PROCUREMENT				STREAM
7NC-G-55	PROCUREMENT				STREAM
7NC-G-56	MICRO BC	Y			STREAM
7NC-G-57	PROCUREMENT				STREAM
7NC-G-58	PROCUREMENT				STREAM
7NC-G-67	PROCUREMENT				STREAM
7NC-F-57	PROCUREMENT				STREAM
7NC-F-58	PROCUREMENT				STREAM
7NC-G-69	PROCUREMENT				BAY/BASIN
7NC-G-70	PROCUREMENT				STREAM
7NC-G-71	PROCUREMENT				STREAM
7NC-G-72	PROCUREMENT				STREAM
7NC-G-75	PROCUREMENT		Y		STREAM
7NC-G-76	PROCUREMENT		Y		STREAM
7NC-G-77	PROCUREMENT				STREAM
7NC-G-78	PROCUREMENT				STREAM
7NC-G-79	PROCUREMENT			Y	STREAM
7NC-G-80	PROCUREMENT				STREAM
7NC-G-81	PROCUREMENT			Y	STREAM
7NC-G-82	PROCUREMENT			Y	STREAM
7NC-G-83	PROCUREMENT				STREAM
7NC-G-84	PROCUREMENT				STREAM
7NC-G-85	PROCUREMENT				STREAM
7NC-G-86	PROCUREMENT				STREAM
7NC-G-90			Y		STREAM

SITES OF UNKNOWN SIGNIFICANCE - APPOQUINIMINK AREA

SITE NUMBER	SITE TYPE	ARCHAIC	WOOD LAND I	WOOD LAND II	SURFACE WATER
7NC-F-51					STREAM
7NC-G-46					STREAM
7NC-G-47					STREAM
7NC-G-48					STREAM
7NC-G-49					STREAM
7NC-G-26			Y		STREAM
7NC-G-28					STREAM
7NC-G-87					STREAM
7NC-G-89					STREAM
7NC-G-91					STREAM
7NC-G-92					STREAM

SITES OF HIGH SIGNIFICANCE - BLACKBIRD AREA

SITE NUMBER	SITE TYPE	ARCHAIC	WOOD LAND I	WOOD LAND II	SURFACE WATER
7NC-H-11					BAY/BASIN
7NC-H-12			Y		BAY/BASIN
7NC-H-13					BAY/BASIN
7NC-J-31	MACRO BC		Y		BAY/BASIN/STR
7NC-J-32	MACRO BC		Y	Y	STREAM
7NC-J-35	MICRO BC				BAY/BASIN/STR
7NC-J-38					STREAM
7NC-J-40					STREAM
7NC-J-41					STREAM
7NC-H-14	MICRO BC		Y		BAY/BASIN
7NC-H-15	MICRO BC		Y		BAY/BASIN/STR
7NC-H-18	MICRO BC		Y		SPRINGHEAD
7NC-H-20	MICRO BC				BAY/BASIN
7NC-H-21	MACRO BC			Y	BAY/BASIN/STR
7NC-J-47	MICRO BC		Y	Y	BAY/BASIN
7NC-J-50	BASE CAMP				BAY/BASIN
7NC-J-51	BASE CAMP				BAY/BASIN
7NC-J-54	MICRO BC		Y	Y	BAY/BASIN
7NC-J-65	MICRO BC		Y		STREAM
7NC-H-22	MICRO BC		Y		STREAM
7NC-H-33	BASE CAMP		Y		STREAM
7NC-H-39	MACRO BC	Y	Y		BAY/BASIN
7NC-H-56	MICRO BC				STREAM
7NC-H-76	BASE CAMP		Y		BAY/BASIN/STR
7NC-H-78	MACRO BC		Y		STREAM
7NC-H-87					STREAM
7NC-J-81	BASE CAMP	Y			BAY/BASIN/STR
7NC-J-95	MICRO BC		Y		BAY/BASIN/STR
7NC-J-99		Y			BAY/BASIN
7NC-J-102	MICRO BC				BAY/BASIN/STR
7NC-J-103	MACRO BC		Y		BAY/BASIN/STR
7NC-J-105	MACRO BC		Y		BAY/BASIN
7NC-J-107	BASE CAMP		Y		BAY/BASIN/STR
7NC-J-110	MACRO BC		Y		BAY/BASIN
7NC-J-113					STREAM

SITES OF MEDIUM SIGNIFICANCE - BLACKBIRD AREA

SITE NUMBER	SITE TYPE	ARCHAIC	WOOD LAND I	WOOD LAND II	SURFACE WATER
7NC-J-23	HISTORIC				STREAM
7NC-J-26	HISTORIC				STREAM
7NC-J-49					BAY/BASIN
7NC-H-51			Y		BAY/BASIN/STR
7NC-H-61					BAY/BASIN
7NC-H-68					BAY/BASIN/STR
7NC-H-69					BAY/BASIN/STR
7NC-H-88	HISTORIC				STREAM
7NC-H-89	HISTORIC				BAY/BASIN/STR
7NC-H-75	HISTORIC				BAY/BASIN
7NC-H-81			Y		BAY/BASIN/STR
7NC-H-82					BAY/BASIN
7NC-H-83					BAY/BASIN
7NC-H-84					BAY/BASIN
7NC-H-85					BAY/BASIN
7NC-H-86					BAY/BASIN/STR
7NC-J-98					BAY/BASIN

SITES OF LOW SIGNIFICANCE - BLACKBIRD AREA

SITE NUMBER	SITE TYPE	ARCHAIC	WOOD LAND I	WOOD LAND II	SURFACE WATER
7NC-J-17	PROCUREMENT				BAY/BASIN
7NC-J-18	PROCUREMENT				BAY/BASIN
7NC-J-19	PROCUREMENT				BAY/BASIN
7NC-J-20	PROCUREMENT				BAY/BASIN/STR
7NC-J-21	PROCUREMENT				BAY/BASIN/STR
7NC-J-27	PROCUREMENT				BAY/BASIN
7NC-J-33	BASE CAMP		Y		STREAM
7NC-J-34	PROCUREMENT				STREAM
7NC-J-36	PROCUREMENT				BAY/BASIN/STR
7NC-J-37	PROCUREMENT				STREAM
7NC-H-16	PROCUREMENT				BAY/BASIN/STR
7NC-H-17	PROCUREMENT				BAY/BASIN/STR
7NC-H-19	PROCUREMENT				BAY/BASIN/STR
7NC-J-42	PROCUREMENT				STREAM
7NC-J-43	PROCUREMENT				STREAM
7NC-J-44	MACRO BC				STREAM
7NC-J-45	PROCUREMENT				STREAM
7NC-J-48	PROCUREMENT				STREAM
7NC-J-52	PROCUREMENT				BAY/BASIN
7NC-J-53	PROCUREMENT				BAY/BASIN
7NC-J-55	PROCUREMENT				BAY/BASIN
7NC-J-56	PROCUREMENT				BAY/BASIN
7NC-J-57	PROCUREMENT				BAY/BASIN
7NC-J-58	PROCUREMENT				BAY/BASIN
7NC-J-59	PROCUREMENT				BAY/BASIN
7NC-J-60	PROCUREMENT				BAY/BASIN
7NC-J-61	PROCUREMENT		Y		BAY/BASIN
7NC-J-62	PROCUREMENT				BAY/BASIN
7NC-J-64	PROCUREMENT				STREAM
7NC-J-66	PROCUREMENT				STREAM
7NC-J-67	PROCUREMENT				STREAM
7NC-J-68	PROCUREMENT		Y		STREAM
7NC-H-23	PROCUREMENT				BAY/BASIN
7NC-H-24	PROCUREMENT		Y		STREAMS
7NC-H-25	PROCUREMENT				BAY/BASIN
7NC-H-26	PROCUREMENT				BAY/BASIN
7NC-H-27	PROCUREMENT				BAY/BASIN
7NC-H-28	PROCUREMENT				BAY/BASIN
7NC-H-29	PROCUREMENT		Y		BAY/BASIN
7NC-H-30	PROCUREMENT				BAY/BASIN/STR
7NC-H-31	PROCUREMENT		Y		BAY/BASIN
7NC-H-32	MICRO BC		Y		BAY/BASIN
7NC-H-34	PROCUREMENT				STREAM
7NC-H-35	PROCUREMENT				BAY/BASIN
7NC-H-36	PROCUREMENT				BAY/BASIN
7NC-H-37	PROCUREMENT				BAY/BASIN
7NC-H-38	PROCUREMENT				BAY/BASIN
7NC-H-40	PROCUREMENT		Y		BAY/BASIN
7NC-H-41	PROCUREMENT				STREAM

SITES OF LOW SIGNIFICANCE - BLACKBIRD AREA

SITE NUMBER	SITE TYPE	ARCHAIC	WOOD LAND I	WOOD LAND II	SURFACE WATER
7NC-H-42	PROCUREMENT				STREAM
7NC-H-43	PROCUREMENT				STREAM
7NC-H-44	PROCUREMENT				STREAM
7NC-H-45	PROCUREMENT				STREAM
7NC-H-46	PROCUREMENT				STREAM
7NC-H-47	MICRO BC		Y		STREAM
7NC-H-48	PROCUREMENT				BAY/BASIN
7NC-H-49	PROCUREMENT				BAY/BASIN
7NC-H-50	PROCUREMENT				BAY/BASIN/STR
7NC-H-52	PROCUREMENT				BAY/BASIN
7NC-H-53	PROCUREMENT				STREAM
7NC-H-54	PROCUREMENT		Y		STREAM
7NC-H-55	PROCUREMENT				BAY/BASIN
7NC-H-57	PROCUREMENT		Y		BAY/BASIN
7NC-H-58	PROCUREMENT				BAY/BASIN/STR
7NC-H-59	PROCUREMENT				SPRINGHEAD
7NC-H-60		Y			STREAM
7NC-H-62	PROCUREMENT				BAY/BASIN
7NC-H-63	PROCUREMENT		Y		BAY/BASIN
7NC-H-64	PROCUREMENT		Y		STREAM
7NC-H-65	PROCUREMENT				BAY/BASIN
7NC-H-66	MICRO BC				STREAMS
7NC-H-67	BASE CAMP				STREAM
7NC-H-8					STREAM
7NC-H-70					STREAM
7NC-H-72	PROCUREMENT				BAY/BASIN
7NC-H-73	PROCUREMENT				BAY/BASIN
7NC-H-74	PROCUREMENT				BAY/BASIN
7NC-H-79	PROCUREMENT		Y		BAY/BASIN/STR
7NC-H-80	PROCUREMENT				BAY/BASIN/STR
7NC-J-69	PROCUREMENT			Y	SPRINGHEAD
7NC-J-70	PROCUREMENT				BAY/BASIN
7NC-J-71	PROCUREMENT		Y	Y	BAY/BASIN
7NC-J-72	PROCUREMENT				STREAM
7NC-J-73	PROCUREMENT		Y		BAY/BASIN
7NC-J-74	PROCUREMENT				BAY/BASIN
7NC-J-75	PROCUREMENT				STREAM
7NC-J-76	PROCUREMENT				BAY/BASIN
7NC-J-77	PROCUREMENT				BAY/BASIN/STR
7NC-J-78	PROCUREMENT				BAY/BASIN
7NC-J-79	PROCUREMENT				BAY/BASIN
7NC-J-80	PROCUREMENT				BAY/BASIN
7NC-J-82	PROCUREMENT				BAY/BASIN
7NC-J-83	PROCUREMENT				BAY/BASIN
7NC-J-84	PROCUREMENT		Y		BAY/BASIN
7NC-J-85	PROCUREMENT		Y		BAY/BASIN
7NC-J-86	PROCUREMENT	Y			BAY/BASIN
7NC-J-87	PROCUREMENT				BAY/BASIN
7NC-J-88	PROCUREMENT				BAY/BASIN

SITES OF LOW SIGNIFICANCE - BLACKBIRD AREA

SITE NUMBER	SITE TYPE	ARCHAIC	WOOD LAND I	WOOD LAND II	SURFACE WATER
7NC-J-89	PROCUREMENT				BAY/BASIN
7NC-J-90	PROCUREMENT		Y		BAY/BASIN
7NC-J-91	PROCUREMENT		Y		BAY/BASIN
7NC-J-92	PROCUREMENT				BAY/BASIN/STR
7NC-J-93	PROCUREMENT				BAY/BASIN/STR
7NC-J-94	PROCUREMENT				BAY/BASIN/STR
7NC-J-96	PROCUREMENT				BAY/BASIN
7NC-J-97	BASE CAMP				BAY/BASIN
7NC-J-100	PROCUREMENT				BAY/BASIN
7NC-J-101	PROCUREMENT				BAY/BASIN/STR
7NC-J-104	PROCUREMENT				BAY/BASIN/STR
7NC-J-106	PROCUREMENT				BAY/BASIN
7NC-J-108	PROCUREMENT				BAY/BASIN/STR
7NC-J-109	PROCUREMENT				BAY/BASIN/STR
7NC-J-111	PROCUREMENT				STREAM
7NC-J-112	PROCUREMENT		Y		STREAM
7NC-J-114	PROCUREMENT				BAY/BASIN
7NC-J-115	PROCUREMENT				STREAM
7NC-J-116	PROCUREMENT				STREAM
7NC-J-117	MACRO BC	Y			STREAM

SITES OF UNKNOWN SIGNIFICANCE - BLACKBIRD AREA

SITE NUMBER	SITE TYPE	ARCHAIC	WOOD LAND I	WOOD LAND II	SURFACE WATER
7NC-J-22					STREAM
7NC-J-24					STREAM
7NC-J-25					STREAM
7NC-J-28					STREAM
7NC-J-29					STREAM
7NC-J-30					STREAM
7NC-J-39					STREAM
7NC-J-46					STREAM
7NC-H-71					STREAM
7NC-H-77					STREAM

SITES OF LOW SIGNIFICANCE - ST. GEORGES AREA

SITE NUMBER	SITE TYPE	ARCHAIC	WOOD LAND I	WOOD LAND II	SURFACE WATER
7NC-G-93					STREAM
7NC-G-94	MICRO BC		Y		STREAM
7NC-G-95	PROCUREMENT				STREAM
7NC-G-96	PROCUREMENT				STREAM
7NC-G-97	PROCUREMENT				STREAM
7NC-G-20	MACRO BC		Y		STREAM
7NC-G-98	PROCUREMENT		Y		STREAM
7NC-G-99	PROCUREMENT			Y	STREAM

APPENDIX VIII

LISTINGS OF HISTORIC SITES BY STUDY AREA AND SIGNIFICANCE CLASS

HISTORIC SITES OF HIGH SIGNIFICANCE
APPOQUINIMINK AREA

SITE NUMBER	DATE	FUNCTION	HISTORIC. SIGNIF.	ARCHEO. POTENT.
N3961	P1802	AGCX	H	H
164	1849-1868	INDTEN	H	H
165	1849-1868	INDTEN	H	H
N5141	A1849	DWCX	H	H
179	P1849	AGCX		H
184	1849-1868	DWCX	H	H
N432	1850	PEACH	H	H
N5158	P1849	AGCX	H	H
N5159	P1849	AGCX	H	H
N5178	P1849	AGCX	H	H
N5179	P1849	AGCX	H	H
N154	1770	CHUR	H	H
215	P1849	AGCX	H	H
216	P1849	AGCX	H	H
231	1849-1868	INDTEN	H	H
232	1849-1868	STRUC	H	H
N5902	P1849	AGBLDG	H	H
N3965	1820-1850	AGCX	H	H
256	P1849	AGTEN	H	H
N417	C1767	MANUFY	H	H
N214	1773	AGCX	H	H
N119	P1849	AGCX	H	H
N5873	P1849	AGCX	H	H

HISTORIC SITES OF MEDIUM-HIGH SIGNIFICANCE
APPOQUINIMINK AREA

SITE NUMBER	DATE	FUNCTION	HISTORIC. SIGNIF.	ARCHEO. POTENT.
160	1849-1868	INDTEN	H	M
161	P1802	GMCX	H	M
162	P1849	AGCX	H	M
N1309	1681	BRID	H	M
183	P1849	AGCX	H	M
N5160	1849-1868	AGCX	H	M
191	1849-1868	TENANT	H	M
N5177	P1849	AGCX	H	M
N3909	1671	AGCX	H	M
N110	1846	PEACH	H	H
229	P1802	GMCX	H	M
871	1849-1868	AGCX	H	M
N5899	1803	AGCX	H	M
N5898	P1849	AGCX	H	M
N5903	1826	AGCX	H	M
264	1849-1868	AGTEN	H	M

HISTORIC SITES OF MEDIUM-LOW SIGNIFICANCE
APPOQUINIMINK AREA

SITE NUMBER	DATE	FUNCTION	HISTORIC. SIGNIF.	ARCHEO. POTENT.
163	P1849	AGCX	H	L
N1502	P1849	AGCX	H	L
915	1849-1868	AGTEN	H	L
916	1849-1868	AGTEN	H	L
917	1849-1868	AGTEN	H	L
918	1849-1868	AGTEN	H	L
920	1868-1893	DWCX	M	M
190	1849-1868	TENANT	H	L
230	P1849	INDTEN	H	M
255	1849-1868	MANUFY	H	L
N5872	1849-1868	AGCX	H	M
N5922	1849-1868	AGTEN	H	L

HISTORIC SITES OF LOW SIGNIFICANCE
APPOQUINIMINK AREA

SITE NUMBER	DATE	FUNCTION	HISTORIC. SIGNIF.	ARCHEO. POTENT.
926	1868-1893	AGTEN	M	L
927	1868-1893	AGTEN	M	L
914	1868-1893	AGTEN	M	L
251	P1849	AGTEN	H	L
253	1849-1868	AGTEN	H	L
855	1849-1868	AGCX	H	L
867	1849-1868	AGTEN	H	L
868	1849-1868	AGTEN	H	L
869	1849-1868	AGCX	H	L
254	1849-1868	AGTEN	H	L
257	1849-1868	AGTEN	H	L
259	1849-1868	SCH	M	L
266	P1849	AGTEN	H	L
262	1849-1868	AGTEN	H	L
263	1849-1868	AGTEN	H	L
863	1868-1893	STRUC	M	L
870	1868-1893	STRUC	M	L

HISTORIC SITES OF HIGH SIGNIFICANCE
BLACKBIRD AREA

SITE NUMBER	DATE	FUNCTION	HISTORIC. SIGNIF.	ARCHEO. POTENT.
N5919	P1849	AGCX	H	H
284	P1849	AGCX	H	H
879	1849-1868	DWCX	H	H
882	1849-1868	AGCX	H	H
886	1849-1868	AGCX	H	H
N423	1847	CHUR	H	H
N5857	P1849	AGCX	H	H
281	1849-1868	AGCX	H	H
357	1849-1868	DWCX	H	H
N3918	P1849	LANOP	H	H
N3919	P1849	AGCX	H	H
N3921	1849-1868	AGTEN	H	H
N5879	1849-1868	AGTEN	H	H
N5887	P1849	AGCX	H	H
891	1868-1893	DWCX	M	H
N5855	P1849	AGCX	H	H
N5846	P1849	AGCX	H	H
N5888	1868-1893	AGCX	H	H
833	1868-1893	AGCX	M	H
N5851	P1868	RRSTA	H	H
N5854	P1849	AGCX	H	H
N131	1849-1868	AGCX	H	H
294	P1849	GMCX	H	H
295	P1849	SMCX	H	H
347	P1849	AGCX	H	H
794	1849-1868	DWCX	H	H
N6270	P1849	AGCX	H	H
328	1849-1868	AGCX	H	H
332	P1849	AGCX	H	H
N5938	P1849	AGCX	H	H
326	P1849	SCH	H	H
345	P1849	AGCX	H	H
327	1849-1868	AGCX	H	H
797	1868-1893	AGCX	H	H
319	P1849	AGCX	H	H
330	1849-1868	AGCX	H	H
842	1849-1868	AGTEN	H	H

HISTORIC SITES OF MEDIUM-HIGH SIGNIFICANCE
BLACKBIRD AREA

SITE NUMBER	DATE	FUNCTION	HISTORIC. SIGNIF.	ARCHEO. POTENT.
N5858	C1940	AGCX	M	M
N3920	C1690	AGCX	H	M
841	1849-1868	DWCX	H	M
N5878	P1849	AGCX	H	M
286	P1849	AGCX	H	M
287	1849-1868	AGTEN	H	M
N5856	P1849	AGTEN	H	M
888	1849-1868	AGCX	H	M
1156	1868-1893	AGTEN	H	M
290	1849-1868	AGCX	H	M
838	1849-1868	DWCX	H	M
N5847	1880	DWCX	M	M
N5849	LATE 19TH C.	HOTRRR	M	M
N5853		DWCX	U	M
293	1849-1868	AGCX	H	M
350	1849-1868	AGCX	H	M
796	1868-1893	STRUC	M	M
1155	1869	AGCX	H	M
320	P1849	AGCX	H	H
790	1868-1893	AGCX	H	M
N6271	P1849	AGCX	H	M
325	1849-1868	AGTEN	H	M
344	1849-1868	AGTEN	H	M
792	1868-1893	AGCX	M	H

HISTORIC SITES OF MEDIUM-LOW SIGNIFICANCE
BLACKBIRD AREA

SITE NUMBER	DATE	FUNCTION	HISTORIC. SIGNIF.	ARCHEO. POTENT.
843	1868-1893	DWCX	H	M
844	1868-1893	DWCX	H	M
N5896		STRUC	H	U
N5852	1868-1893	DWCX	M	M
839	1849-1868	AGCXC	H	M
N6274	P1849	AGCX	H	M
342	P1849	AGCX	H	M
351	1849-1868	AGCX	H	M
311	P1849	AGTEN	H	L
314	1849-1868	AGCX	H	L
321	1849-1868	AGTEN	H	M

HISTORIC SITES OF LOW SIGNIFICANCE
BLACKBIRD AREA

SITE NUMBER	DATE	FUNCTION	HISTORIC. SIGNIF.	ARCHEO. POTENT.
872	1868-1893	AGCX	H	H
880	1868-1893	STRUC	M	M
283	1849-1868	DWCX	H	L
285	P1849	AGTEN	H	L
282	P1849	AGCX	H	L
288	1849-1868	WKSH	H	L
892	1849-1868	AGCX	H	L
N5848	1849-1868	RRSTA	H	L
388	P1849	STRUC	U	L
889	1868-1893	AGTEN	M	M
890	1849-1868	AGTEN	H	M
N5850	P1868	DWCX	H	L
387	P1849	INDTEN	H	M
312	1849-1868	AGTEN	H	M
313	1849-1868	AGTEN	H	M
324	P1849	AGCX	H	M
346	P1849	AGCX	H	L
348	1849-1868	AGCX	H	L
349	1849-1868	AGCX	H	L
355	1849-1868	AGCX	H	L
800	1868-1893	AGCX	H	M
323	1849-1868	AGTEN	H	L
341	P1849	AGCX	H	L
353	1849-1868	AGTEN	H	L
873	1868-1893	AGCX	M	L
322	1849-1868	AGTEN	H	L
329	P1849	AGCX	H	L

HISTORIC SITES OF HIGH SIGNIFICANCE
ST. GEORGES AREA

SITE NUMBER	DATE	FUNCTION	HISTORIC. SIGNIF.	ARCHEO. POTENT.
26	P1849	AGCX	H	H
27	1849-1868	AGTEN	H	H

HISTORIC SITES OF MEDIUM-HIGH SIGNIFICANCE
ST. GEORGES AREA

SITE NUMBER	DATE	FUNCTION	HISTORIC. SIGNIF.	ARCHEO. POTENT.
31	P1849	SCH	M	H
32	P1849	AGCX	H	M
33	P1868	AGTEN	H	M
N5044	A1893	AGCX	M	H

HISTORIC SITES OF MEDIUM-LOW SIGNIFICANCE
ST. GEORGES AREA

SITE NUMBER	DATE	FUNCTION	HISTORIC. SIGNIF.	ARCHEO. POTENT.
34	P1849	AGTEN	H	L
35	P1849	AGTEN	H	L
36	P1849	AGTEN	H	L

HISTORIC SITES OF LOW SIGNIFICANCE
ST. GEORGES AREA

SITE NUMBER	DATE	FUNCTION	HISTORIC. SIGNIF.	ARCHEO. POTENT.
29	P1849	AGCX	H	L
30	1849-1868	AGCX	H	L
28	P1849	AGCX	H	L
1027	1868-1893	DWCX	M	L
N4291	1920	BRID	L	L
21	P1849	AGCX	N	L
22	1849-1868	AGTEN	H	L
25	1849-1868	AGTEN	H	L

APPENDIX IX

DATA BASE FILE STRUCTURES

This Appendix lists the various computer data base files which were developed for the completion of this project. All of the data bases were compiled using the dBASE III system from Ashton-Tate, Inc. The floppy computer disks with these files will be maintained as a permanent record of the data bases at the Island Field Museum. The listings below provide description of the data base content and structure.

RT13N - This data base provides information on all archaeological sites found during the field survey of the project areas.

Structure for database : A:RT13N.dbf
Number of data records : 266
Date of last update : 02/27/85

Field	Field name	Type	Width	Dec
1	SITENUMBER	Character	10	
2	NUMBER	Numeric	3	
3	CRSNUMBER	Character	5	
4	FIGNUMBER	Numeric	2	
5	AREANUMBER	Numeric	3	
6	LOCNUMBER	Character	3	
7	CONDITION	Numeric	1	
8	POINTBIF	Character	1	
9	FLAKETOOL	Character	1	
10	CERAMICS	Character	1	
11	PCR	Character	1	
12	SCRAPERS	Character	1	
13	FLAKES	Character	1	
14	GROUND	Character	1	
15	CORE	Character	1	
16	PALEO	Character	1	
17	ARCHAIC	Character	1	
18	WOODLANDI	Character	1	
19	WOODLANDII	Character	1	
20	CLYDE	Character	1	
21	BARKERS	Character	1	
22	WOLFNECK	Character	1	
23	CAREY	Character	1	
24	WEBB	Character	1	
25	ADENA	Character	1	
26	DELPARK	Character	1	
27	SLAUGHTER	Character	1	
28	MINGUANNAN	Character	1	
29	HISTORIC	Character	1	
30	POINT1	Character	15	
31	POINT2	Character	15	
32	POINT3	Character	15	
33	[illegible]	Character	15	
34	[illegible]	Character	15	
35	[illegible]	Character	15	
36	[illegible]	Character	15	
37	[illegible]	Numeric	4	2

38	ACOUNT	Numeric	3	
39	AREA	Numeric	8	
40	INDEX	Numeric	4	2
41	UTMNORTH	Numeric	7	
42	UTMEAST	Numeric	6	
43	GEOMORPH	Character	15	
44	SOIL1	Character	10	
45	SOIL2	Character	10	
46	SECDRAIN	Character	25	
47	SURFWATER	Character	15	
48	CONFLUENCE	Character	1	
49	WATERDIS	Numeric	4	
50	SLOPE	Numeric	2	
51	ASPECT	Character	3	
52	ELEVATION	Numeric	3	
53	INDEX2	Numeric	5	2
54	PROBZONE	Character	1	
55	SIGNIF	Numeric	1	
** Total **			282	

HIST13N - This data base contains all data on historic sites which were field checked during the survey. These sites were checked based on the presence of standing structures from the BAHP files of from their location on historic atlases.

Structure for database : A:HIST13N.dbf
Number of data records : 184
Date of last update : 02/25/85

Field	Field name	Type	Width	Dec
1	AREA	Character	2	
2	SUBAREA	Character	2	
3	USGSQUAD	Character	15	
4	HUNDRED	Character	25	
5	SITENUMBER	Character	8	
6	DATE	Character	12	
7	FUNCTION1	Character	6	
8	FUNCTION2	Character	6	
9	FUNCTION3	Character	6	
10	FUNCTION4	Character	6	
11	HISSIG	Character	2	
12	HSIG1	Character	2	
13	HSIG2	Character	2	
14	HSIG3	Character	2	
15	HSIG4	Character	2	
16	HSIG5	Character	2	
17	HSIG6	Character	2	
18	HSIG7	Character	2	
19	HSIG8	Character	2	
20	HSIG9	Character	2	
21	HSIG10	Character	2	
22	HSIG11	Character	2	
23	HSIG12	Character	2	
24	DISTURB1	Character	12	
25	DISTURB2	Character	12	

26	DISTURB3	Character	12
27	OUTBLDGNUM	Numeric	2
28	OUBLDG1	Character	30
29	OUTBLDG2	Character	30
30	OUTBLDG3	Character	30
31	OUTBLDG4	Character	30
32	OUTBLDG5	Character	30
33	OUTBLDG6	Character	30
34	OUTBLDG7	Character	30
35	OUTBLDG8	Character	30
36	OUTBLDG9	Character	30
37	OUTBLDG10	Character	30
38	FEATURENUM	Numeric	2
39	FEA1	Character	12
40	FEA2	Character	12
41	FEA3	Character	12
42	FEA4	Character	12
43	FEA5	Character	12
44	ARCHPOTENT	Character	2
45	ARCHPOT1	Character	2
46	ARCHPOT2	Character	2
47	ARCHPOT3	Character	2
48	ARCHPOT4	Character	2
49	ARCHPOT5	Character	2
50	TOTCRPOT	Numeric	1
51	AGECODE	Numeric	1
** Total **			529

SDATE13N - This data base contains data on Delaware High Coastal Plain soil series and their wildlife and vegetation capabilities.

Structure for database : A:SDATA13N.dbf
Number of data records : 133
Date of last update : 02/27/85

Field	Field name	Type	Width	Dec
1	SERIES	Character	6	
2	GRSC	Numeric	1	
3	GRSL	Numeric	1	
4	WHUP	Numeric	1	
5	HWWP	Numeric	1	
6	CWP	Numeric	1	
7	WFCP	Numeric	1	
8	OWF	Numeric	1	
9	WDWF	Numeric	1	
10	WLWF	Numeric	1	
** Total **			16	

HSOIL13N - This data base contains information on soilssettings of historic sites in the study area.

Structure for database : A:HSOIL13N.dbf
Number of data records : 146
Date of last update : 01/18/85

Field	Field name	Type	Width	Dec
1	SITENUMBER	Character	8	
2	DATE	Character	12	
3	FUNCTION1	Character	6	
4	WOOD	Numeric	6	2
5	CROPS	Numeric	6	2
6	GRAZE	Numeric	6	2
7	HUNT	Numeric	6	2
8	FUNCTION	Numeric	2	
9	AGE	Numeric	2	
** Total **			55	

STRUC13 - This data base contains information on all standing structures in the Route 13 Corridor.

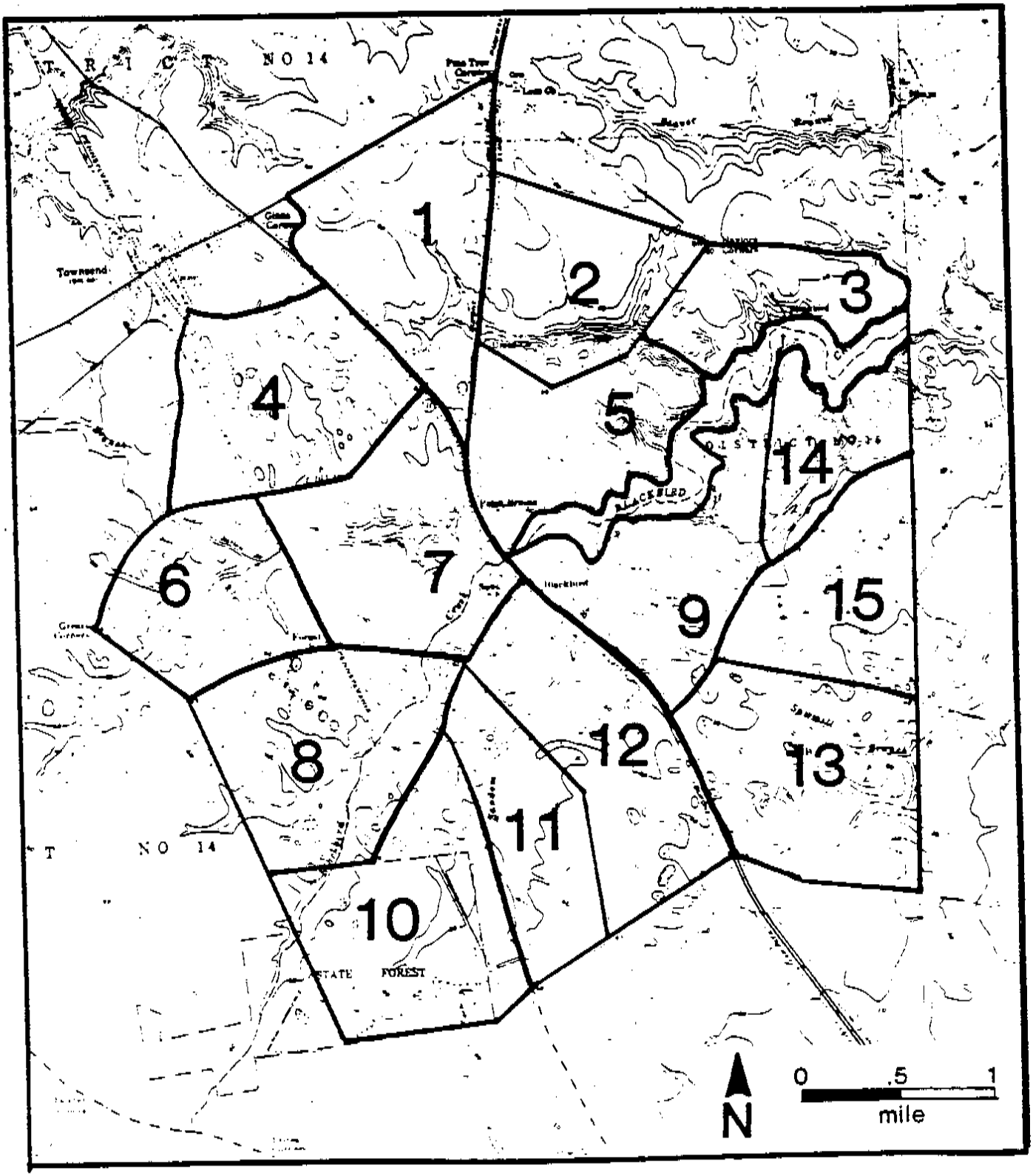
Structure for database : A:STRUC13.dbf
Number of data records : 748
Date of last update : 02/25/85

Field	Field name	Type	Width	Dec
1	CRSNUM	Character	6	
2	HUNDRED	Character	25	
3	USGSQUAD	Character	15	
4	NATREGLIST	Character	2	
5	STRUCDATE	Character	12	
6	CONDITION	Character	3	
7	MATERIAL	Character	10	
8	FUNCTION1	Character	6	
9	FUNCTION2	Character	6	
10	FUNCTION3	Character	6	
11	FUNCTION4	Character	6	
12	NATREGELIG	Character	2	
13	ARCHPOTENT	Character	2	
14	SIGNIF	Character	2	
15	SIG1	Character	2	
16	SIG2	Character	2	
17	SIG3	Character	2	
18	SIG4	Character	2	
19	SIG5	Character	2	
20	SIG6	Character	2	
21	SIG7	Character	2	
22	SIG8	Character	2	
23	SIG9	Character	2	
24	SIG10	Character	2	
25	SIG11	Character	2	
26	ARCHDATE	Character	12	
27	AGECODE	Numeric	1	
** Total **			139	

HARCH13 - This data base contains information on all potential historic sites noted in atlases for the Route 13 Corridor.

Structure for database : A:HARCH13.dbf
Number of data records : 1052
Date of last update : 02/25/85

Field	Field name	Type	Width	Dec
1	SITENUMBER	Character	5	
2	HUNDRED	Character	25	
3	USGSQUAD	Character	15	
4	DATE	Character	12	
5	FUNCTION1	Character	6	
6	FUNCTION2	Character	6	
7	FUNCTION3	Character	6	
8	FUNCTION4	Character	6	
9	SITEPOTENT	Character	2	
10	SIGNIF	Character	2	
11	SIG1	Character	2	
12	SIG2	Character	2	
13	SIG3	Character	2	
14	SIG4	Character	2	
15	SIG5	Character	2	
16	SIG6	Character	2	
17	SIG7	Character	2	
18	SIG8	Character	2	
19	SIG9	Character	2	
20	SIG10	Character	2	
21	SIG11	Character	2	
22	AGECODE	Numeric	1	
** Total **			109	

FIGURE 35

Standing Structure Data from BAHP Files – Blackbird Area