Appendix B

Geomorphological Report

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GEOARCHAEOLOGICAL INTERPRETATIONS

OF SITE 7K-C-73

WEST DOVER CONNECTOR PROJECT

PHASE I AND II INVESTIGATIONS

DOVER, DELAWARE

Submitted to
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Introduction and Methods

This report discusses pedological and geomorphological interpretations of the soils and landscapes at Site 7K-C-73 southwest of Dover, Delaware. The investigation was intended to develop a paleogeographic interpretation of the site to assess the framework of soil and landscape conditions with which prehistoric inhabitants of the site would have been familiar. Such assessments are based on considerations of landscape type, relative deposit ages, degrees of disturbance, and environmental conditions relating to human utilization of a landscape.

Field investigation of the site area was made on May 5, 2013. Efforts entailed pedestrian traversal of the project area landscapes together with examinations of soils exposed in archaeological test units. Detailed descriptions were compiled for two soil profiles considered representative of the site's major soil types in accordance with standard techniques and nomenclature for the field description of soil. These descriptions are given at the end of the report.

Geologic Setting

The central Delaware location of the site is within the Coastal Plain Physiographic Province that comprises all but the most northern portion of the state. Geographically, the site lies within the mid-drainage zone of the lower Coastal Plain region in which landscapes generally lie at elevations of less than about 12 m and occupy the middle stretches of eastward flowing stream systems draining toward Delaware Bay. Geologic materials in the region consist of variously textured unconsolidated sediments derived both from marine and fluvial sedimentation. In the study area marine deposits are restricted to fairly deep depths, and the surficial deposits in which the soils and landscapes are formed are considered to be of fluvial and terrestrial origin. These surficial deposits are identified mainly as the Columbia Formation of Pleistocene age, which is extensive throughout much of the Delaware Coastal Plain and consists largely of stratified sand and gravel.

Columbia deposits were laid down by an ancient system of rivers whose flow and discharge patterns were influenced by the climatic variations of the Pleistocene glacial cycles. Based on the coarseness of the Columbia deposits that indicate strong flow velocities with high sediment transport competence, there has been some speculation that most Columbia materials were amassed during and near the ends of glacial advances, with little or no deposition occurring during the more stable interstadial periods. Some of the sands and gravels in northern Delaware may even have been directly transported by glacial meltwater, but such an intimate glacial linkage is not likely for Columbia deposits in the central and southern portions of the state. Most Columbia sediments probably date well into the Pleistocene, and even though early Holocene deposits, particularly those of

fluvial origin, are not normally distinguished from the much more prevalent Columbia sediments, ages for most of the Columbia materials are well in excess of 30,000 years.

Although the bulk of the Columbia sediments are likely to be of mid-Pleistocene age, few if any of the existing land surfaces formed in these deposits would be of similar antiquity. Rather, most of the region's landscapes and surfaces should be viewed as considerably younger, with origins largely attributable to processes acting well after the emplacement of the Columbia sediments. Erosional actions, directed by such forces as climate, vegetational changes, alterations in stream base levels in response to varying sea levels, and perhaps even tectonic movements of land masses, have acted on the Columbia through multiple subsequent periods of the Pleistocene as well as the Holocene. Gross erosional processes together with stream valley alluviation and near-surface soil reworking by a host of pedoturbational agents have combined to generally limit the ages for most of the region's landscapes to a late Pleistocene through Holocene time frame.

Soils and Geomorphology

Occupations of the site are contained on nearly level to gently sloping upland positions that define the northern edge of a broad interfluve between Isaac Branch some 2 km to the south and Puncheon Run immediately to the north. The location is peripheral to a more pronounced slope that declines northward toward the wetland floodplain within which the poorly defined drainage of Puncheon Run courses. Most of the slope intervening between the occupation area and the wetland is both sufficiently well drained and of modest enough slope that it too would have been suitable for occupation. It is therefore of some interest that although close proximity to Puncheon Run was obviously a desirable attribute of the site, occupations appear to have been exclusively limited to the more level terrain above the slope inflection.

As would be expected for a relatively small upland position, soils throughout the site are similar. Developed in coarse-textured, mostly sandy Coastal Plain deposits, most of the site soils are nonetheless strongly developed with readily discernible subsoil argillic (Bt) horizons. The principal natural difference between soils is some variation in sand content and the thickness of upper subsoil (E and BE) horizons overlying argillic horizons. Other differences reflect varying historic disturbances related to tillage and the shifting location of the farm lane running around the field perimeter. As is typical in tilled or formerly tilled settings some soil deflation has occurred on the higher slope positions, with an attending slight amount of over-thickening of surface horizons lower on the slope. Soils within the former location of the farm lane tend to be truncated and variably mixed.

The profile of Test Unit 2 is representative of most of the site. Although located within the present edge of the woodland, like those over the predominant open field portion of the site, it has a well expressed plow zone, thus giving a clear indication that the woodland has encroached into a former field area. The soil is well drained and other

than the surficial mixing produced by plowing, it is otherwise fully intact. Beneath the surface plow zone are upper subsoil horizons (E and BE) that are typical of advanced soil profile development but which are often lacking in actively or formerly cultivated settings (Figure 1). On terrain more sloping than that of the site, lengthy histories of agricultural soil deflation generally lead to enough downward migration of plow zones to eventually intercept and, through incorporation, destroy upper subsoil horizons. Hence, the persistence of these horizons at the location of Test Unit 2 as well as over most of the site where soils have been largely unaltered by other forms of historical disturbance is an indication of minimal tillage-induced soil loss.

Figure 1. Light colored, upper subsoil horizons between the surface plow zone and the well developed argillic horizon at the depth of 47 cm indicate little soil loss has occurred at the location of TU 2.

Mature development is characteristic of most of the regional upland soils, and thereby evinces a prolonged period of largely stable soil weathering extending to at least the early Holocene and typically well into the Pleistocene. Such antiquity tends to place a near-surface restriction on most cultural deposits since essentially the same land surface would have been available for occupation throughout the region's cultural history. Accordingly, in the absence of subsurface features the great majority of cultural materials should be concentrated mainly in the plow zone as well as underlying biomantle horizons into which artifacts can be introduced by natural pedoturbational mechanisms. This upper biomantle zone includes both the E and BE horizons; however, there is normally a distinct tendency for artifact concentrations to rapidly tail off with depth through the BE horizon. The tops of underlying argillic (Bt) horizons usually mark the bases of the biomantle, and any artifacts present below this level are normally limited to a few very

small flakes that may have migrated via the channels of roots or insects. Depths of excavation in all of the test units available for examination at the time of this investigation extended below the tops of argillic horizons, and hence were sufficient to retrieve any cultural materials present.

Even within such a comparatively small site area some minor amount of soil variation is present. As represented by the profile of Test Unit 7, a portion of the site is contained within a local concavity toward which run off from slightly higher positions is directed. Historically, this has resulted in a slight over-thickening of the plow zone (28 cm vs. 20 cm for TU 2) as slope wash from higher parts of the field was transported to this saddle-like landscape position. It also appears likely that natural additions of slope wash also occurred during the Holocene. Relative to other soils of the site the soil here has a more sandy composition, but more importantly it also has a much thicker sequence of upper subsoil horizons atop the lower subsoil argillic horizon (Figure 2). At 80 cm vs. depths of less than 50 cm for the remainder of the site, the thicker combination of E and BE horizons in Test Unit 7 could well be reflective of gradual deposition over the course of millennia. Some amount of this deposition is possibly attributable to eolian action, but a few small pebbles throughout this profile as well as others of the site argue against appreciable eolian influences.

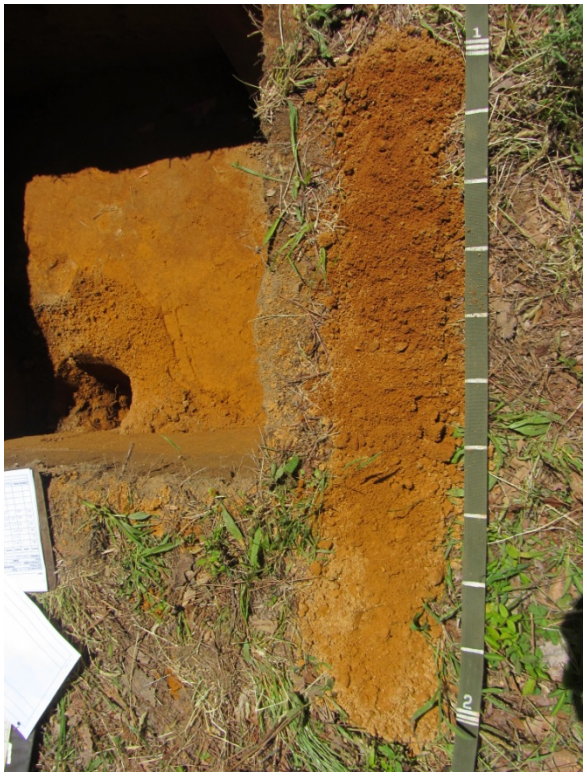

Figure 2. The argillic subsoil horizon in TU 7 is between the depths of 80 and 140 cm. Thick overlying upper subsoil horizons (not shown) are likely formed partly in local slope wash deposits.

Whatever the principal mechanism for sediment contributions to the local concavity, archaeological interpretations for the Test Unit 7 is profile are not especially different from those occupying other parts of the site. The local depositional regime does offer the prospect of cultural stratification of artifacts independent of biomantle processes, but these upper horizons above the argillic horizon could nonetheless have still been susceptible to biomantle mixing. In any event, as with the rest of the examined test units, the depth of excavation in this test unit was sufficient to intercept the entire potential cultural zone.

Summary

Site 7K-C-73 is distributed along the edge of a broad gently sloping Coastal Plain upland peripheral to where the landscape declines somewhat more sharply toward the wetland floodplain of Puncheon Run. The well drained soils of the site are formed in relatively coarse-textured sediments dominated by sand but also containing small amounts of pebbles. Despite this coarse composition subsoil development is advanced and has achieved argillic horizon formation compatible with a probable Pleistocene age typical for most of the regional uplands. Because of this antiquity most cultural materials should be confined to levels relatively near the surface, but over most of the site some could also be present as deep as a half meter or so due to introduction by biomantle processes above more stable argillic horizon levels. Part of the site also spans a small localized concavity where some slope wash additions probably occurred during the Holocene. This allows for the possibility of deeper, potentially stratified cultural materials to depths of as much as 80 cm. Again, however, the underlying argillic horizon should correspond to the level of cultural sterility.

Soil Profile Descriptions

Test Unit 2

Horizon	Depth (cm)	Properties
Ap	0-20	Dark yellowish brown (10YR 3/4) sandy loam; weak, medium platy structure; very friable consistence; abrupt, smooth boundary
E	20-33	Dark yellowish brown (10YR 4/4) sandy loam; weak, medium platy structure; friable consistence; clear, smooth boundary
BE	33-47	Brown (7.5YR 4/4) sandy loam; weak, medium subangular blocky structure; friable consistence; clear, smooth boundary
Bt	47-65	Strong brown (7.5YR 4/6) heavy sandy loam; weak to moderate, medium subangular blocky structure; nearly continuous clay films; ~5% pebbles, mostly near top; friable consistence; clear, smooth boundary
BC1	65-80	Strong brown (7.5YR 4/6) light sandy loam; weak, medium subangular blocky structure; very friable consistence; clear, smooth boundary
BC2	80-115+	Strong brown (7.5YR 4/6) loamy sand; weak, coarse subangular blocky structure; very friable consistence

Other comments: Upland backslope position; 4% slope; well drained; woodland edge; few pebbles throughout; described 5/2/13

Test Unit 7

Horizon	Depth (cm)	Properties
Ap	0-28	Dark brown (10YR 3/3) light sandy loam; structureless, massive; very friable consistence; abrupt, smooth boundary
E	28-68	Dark yellowish brown (10YR 4/4) to brown (7.5YR 4/4) loamy sand; weak, medium platy structure; very friable consistence; clear, smooth boundary
BE	68-80	Brown (7.5YR 4/4) to dark yellowish brown (10YR 4/4) light sandy loam; weak, medium subangular blocky structure; very friable consistence; gradual, smooth boundary
Bt	80-140	Strong brown (7.5YR 4/6) light sandy loam; weak, medium subangular blocky structure; patchy clay films; very friable consistence; gradual, smooth boundary
BC1	140-160	Strong brown (7.5YR 5/6) light fine sandy loam; very friable consistence; clear, smooth boundary
BC2	160-205+	Yellowish brown (10YR 5/6) to strong brown (7.5YR 5/6) loamy fine sand; very friable consistence

Other comments: Upland footslope position, local concavity; 3% slope; well drained; field edge; small pebbles throughout; augered below 100 cm; described 5/2/13