

"WETLANDS AND WATERS OF THE U.S." IDENTIFICATION AND DELINEATION REPORT SR 1/Little Heaven Grade Separated Intersection



Murderkill Hundred, Kent County, Delaware

► Prepared for:



Delaware Department of Transportation
P.O. Box 778
Dover, Delaware 19903

and



Century Engineering, Inc.
4134 North Dupont Highway
Dover, Delaware 19901

► Prepared by:



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Suite 200
Conshohocken, Pennsylvania 19428

Revised December 2008

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ABSTRACT

This document presents the results of a wetland investigation required for the improvements to SR 1 as part of the Delaware Department of Transportation's (DelDOT) SR 1 Corridor Capacity Preservation Program in Kent County, Delaware. Current land classification within the project area includes residential and commercial properties and agricultural land.

The SR 1, Little Heaven Grade Separated Intersection Project study area is located in Kent County, Delaware, at the intersection of U.S. 113A/Clapham Road and SR 1. The project study area extends from the existing intersection of SR 1 and Clapham Road approximately 2,700.0 feet to the north along SR 1, 12,000.0 feet to the south along SR 1 south of the existing Barratts Chapel Road, 3,300.0 feet to the northwest along Clapham Road, 2,700.0 feet to the east along Mulberrie Point Road, and 400.0 feet east along Skeeter Neck Road. In addition, the project study area extends east 2,200.0 feet along Bowers Beach Road. The width of the project study area varies (Figure 1).

Field investigations completed in October, November, and December 2003 and June 2004 originally identified six wetlands (Wetlands 1 through 6) within the project study area. Wetlands 4 and 5 are classified as palustrine emergent (PEM) communities. Wetlands 1, 2, 3, and 6 are classified as palustrine forested (PFO) communities. Wetlands 1, 2, and 3 are located on the east side of SR 1. Wetlands 4, 5, and 6 are located in the area between SR 1 and Clapham Road. None of the wetlands are tidally influenced. Subsequent to the 2003/2004 delineation, a United States Army Corp of Engineers (USACE) Jurisdictional Determination field view was held on November 23, 2004. It was determined at this field view that Wetlands 2 and 4 did not meet all three wetland criteria and were not considered wetlands; therefore, they are not discussed in this report. The project study area was expanded in 2007/2008, and a portion of the project now overlaps the Barratts Chapel Road Improvements Project (Project # 28-045-01). The additional areas were reviewed for wetlands and waterways in January 2008. No new wetlands were identified, although 8 additional waterways were identified and WUS 2 was extended. This extension of WUS 2 is located on the west side of SR 1 within Wetland 6. On July 31, 2008 an additional USACE Jurisdictional Field View was held to review the resources in the extended project area. One previously identified wetland, Wetland 5, was determined to not meet the three wetland criteria. In addition, one previously identified waterway, WUS1, three drainage ditches located along Barratts Chapel Road, and a portion of WUS 3 were found by the USACE representative to be non-jurisdictional.

Photographs of the wetland areas are included in Appendix A. Observations of the wetland parameters are documented on Routine On-Site Data Forms; copies are attached as Appendix B. Appendix C contains a summary of the individual soil series that are found in the project study area. The wetland study limits, data collection points, wetland boundaries, and photograph locations and directions are indicated on Plan Sheets in Appendix D. Survey coordinates for the wetlands and waterways are contained in Appendix E.

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I. INTRODUCTION

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A. Project Location and Description

The proposed SR 1, Little Heaven Grade Separated Intersection project is located in Kent County, Delaware, at the intersection of U.S. 113A/Clapham Road and SR 1. The project study area extends from the existing intersection of SR 1 and Clapham Road approximately 2,700.0 feet to the north along SR 1, 12,000.0 feet to the south along SR 1 south of the existing Barratts Chapel Road, 3,300.0 feet to the northwest along Clapham Road, 2,700.0 feet to the east along Mulberrie Point Road, and 400.0 feet east along Skeeter Neck Road. In addition, the project study area extends east 2,200.0 feet along Bowers Beach Road. The width of the project study area varies (Figure 1).

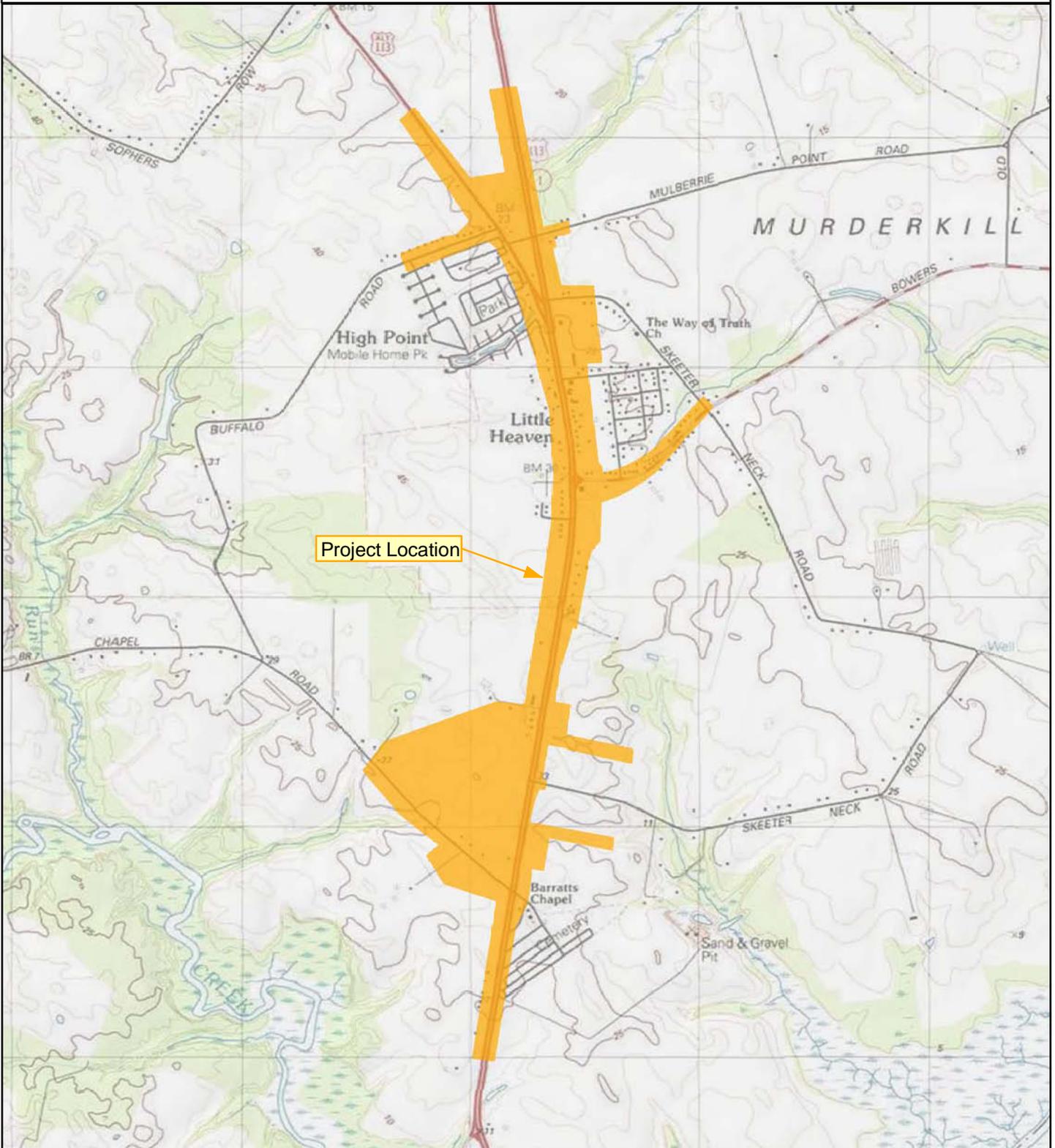
The following report presents the results of a wetland investigation completed for the proposed roadway improvements project, which will consist of the following primary design elements: a new service road located approximately 250.0 feet to the east of the existing SR 1 roadway corridor; new southbound and northbound SR1 travel lanes constructed approximately 100.0 feet to the east of the existing southbound lanes; and elevation of the proposed SR1 roadway over the existing Bowers Beach Road/SR1 intersection. Other aspects of the project design include improvements to the intersection of Mulberrie Point Road and SR 1, and the existing intersection of SR 1 and Clapham Road. This project is part of DeIDOT's SR 1 Corridor Capacity Preservation Program. The project study area for the project encompasses a large enough area to address several project alternatives.

B. Description of the Project Study Area

The project study area predominantly consists of mixed residential and commercial land uses, isolated portions of agricultural fields, and wetlands. The project study area drains into Spring Creek and the Murderkill River, which are located in two watersheds, the St. Jones watershed in the northern portion of the study area and the Murderkill River watershed in the southern portion of the study area. These two watersheds drain into the Delaware Bay.

Figure 1 Site Vicinity Map

SR I/Little Heaven Grade Separated Intersection
Murderkill Hundred, Kent County, Delaware



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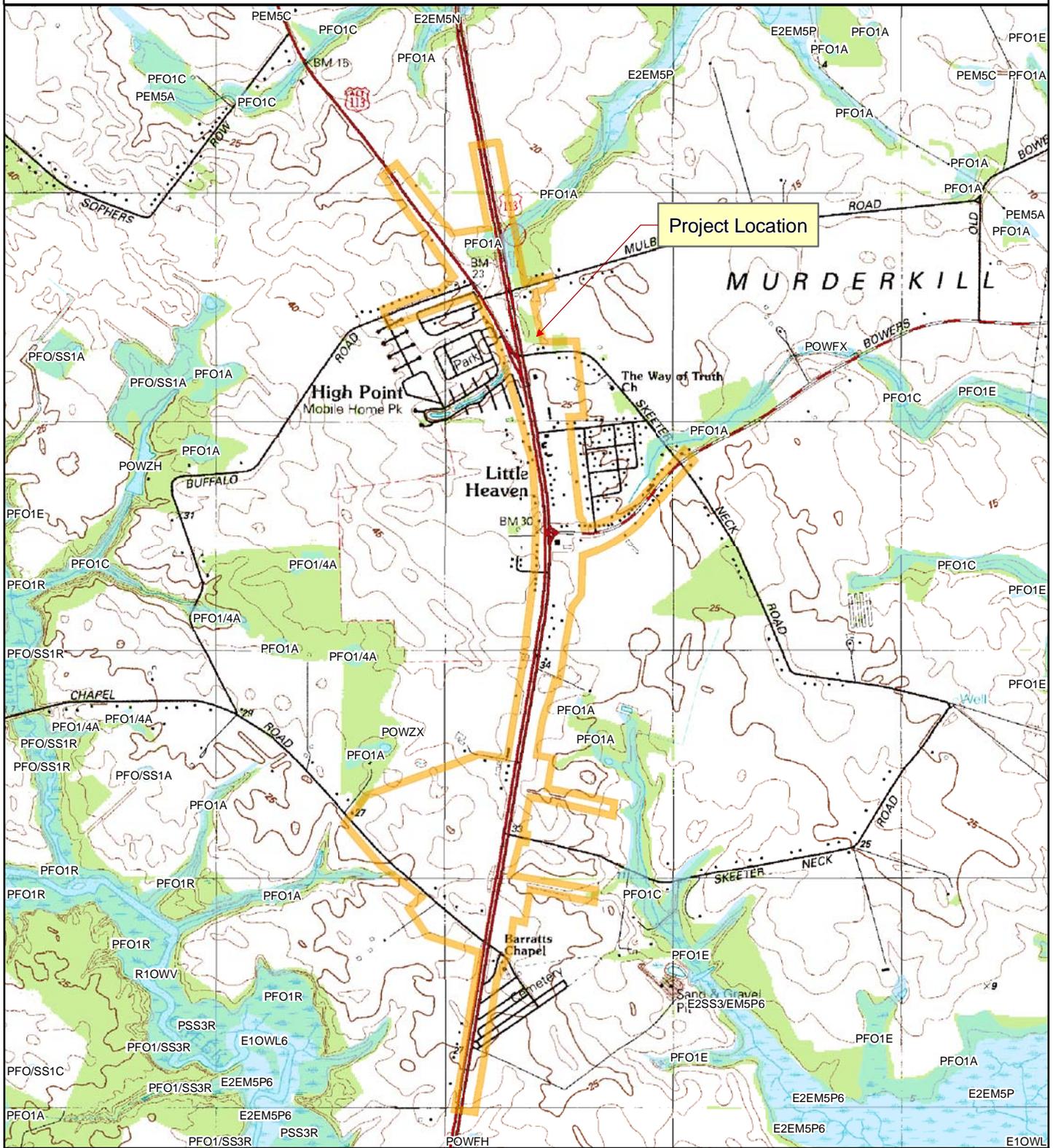


 Project Location

The Delaware Surface Water Quality Standards (August 11, 1999) designates the Mid Murderkill River as an Industrial Water Supply, Secondary Contact Recreation, and an Agricultural Water Supply. The Spring Creek Branch of the Murderkill River is designated as a Secondary Contact Recreation and an Industrial Water Supply.

The Delaware Department of Natural Resource and Environmental Control's (DNREC) System Wide Monitoring Program (SWMP) wetland mapping (Frederica, Delaware) identified three wetland areas within the project study area (Figure 2). Locations of these mapped wetlands and their corresponding labels within this report include two PFO areas located along SR 1 north of Mulberrie Point Road. One of these wetlands is located on the west side of SR 1 (Wetland 6) with a pipe connecting the water flow to a PFO wetland (Wetland 3) on the east side of SR 1.

Figure 2 DNREC Wetland Map SR I/Little Heaven Grade Separated Intersection Murderkill Hundred, Kent County, Delaware



Map Document: (X:\Projects\SR_I_CCP\PP73\1\Maping\Fig3\DNREC\Wetlands.mxd) 9/23/2008 -- 11:40:18 AM



- Study Area Boundary
- Wetlands

II. APPROACH TO THE INVESTIGATION

II. APPROACH TO THE INVESTIGATION

This report was prepared to satisfy the requirements of the United States Army Corps of Engineers (USACE), which has jurisdictional authority over the “Wetlands and Waters of the U.S.” under the purview of Section 404 of the Clean Water Act. The report also satisfies requirements of Delaware’s Title 7, Chapter 66, “Wetlands Act,” and Chapter 72, “Subaqueous Lands,” administered by DNREC.

As a consequence of the recent U.S. Supreme Court decisions in *Rapanos v. U.S.* and *Carabell v. U.S.*, the USACE, in cooperation with the Environmental Protection Agency (EPA), developed the *Practices for Documenting Jurisdiction under Section 404 of the Clean Water Act (CWA) and Section 9 and 10 of the Rivers and Harbors Act (RHA) of 1899* (RGL 07-01 USACE 2007). This guidance requires the application of new standards, as well as a revised Jurisdictional Determination (JD) form, to document the agencies assertion or declination of CWA jurisdiction. The guidance states that the agencies will assert jurisdiction over the following categories of water bodies: traditional navigable waterways (TNWs); all wetlands adjacent to TNWs; non-navigable tributaries to TNWs that are relatively permanent waters (RPWs) with year-round flow or continuous flow at least seasonally; and wetlands directly abutting such tributaries. In addition, the agencies will assert jurisdiction over every water body that is not an RPW if that water body is determined to have a significant nexus to a TNW.

The following classes of water bodies are subject to CWA jurisdiction only if significant nexus is demonstrated: non-navigable tributaries that do not typically flow year-round or do not have continuous flow at least seasonally; wetlands abutting to such tributaries; and wetlands adjacent but not directly abutting such tributaries. A significant nexus exists if the tributary, in combination with all of its adjacent and abutting wetlands, has more than speculative or more than insubstantial effect on the chemical, physical, and/or biological integrity of a TNW. All waterways within the project area were evaluated in accordance with RGL-07-01.

An initial desk review involved the examination of existing literature and mapping including the U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle (Frederica, DE; Figure 1),

the *Soil Survey of Kent County, Delaware* (USDA 1971; Figure 3), and the Delaware SWMP mapping (Figure 2). These sources were reviewed to determine potential wetland areas as well as previously identified wetlands within the project study area.

The wetland investigation was conducted in accordance with the procedures outlined in the *U.S. Army Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987). Field data was collected on October 29, November 3 and 17, and December 17, 2003, and June 9, 2004. Additional studies were conducted in September 2007 to evaluate the waterways in the project study area for compliance with RGL 07-01 and again in January 2008 to evaluate the expanded project study area for additional wetlands and waterways.

USACE regulations require that the following three criteria be met in order for an area to be classified as a wetland: the dominance of hydrophytic vegetation, the presence of hydric soils, and the evidence of wetland hydrology (Environmental Laboratory 1987). The Routine On-Site Determination Plant Community Assessment Procedure was followed. This approach requires the identification of representative plant community types in the area of study and the characterization of vegetation, soils, and hydrology for each plant community type. Wetland boundaries are delineated after identifying wetland and non-wetland plant communities and after observing the three mandatory criteria for soils, vegetation, and hydrology. Observations were made as necessary to ensure adequate coverage and characterization of the project area. Observations were recorded on field data sheets at representative points located in both upland and wetland areas (Appendix B). The entire project area was evaluated, with special attention given to topographically low areas, areas adjacent to streams, hydric soils, and areas with poorly drained soils.

After wetland boundaries were flagged and numbered, representative points were surveyed in the field by Century Engineering, Inc., using conventional survey methods.

A. Soils

Soils located within the project study area were identified using the USDA-NRCS SSURGO Database for Kent County, Delaware (USDA 2006). Soils were evaluated in the field for the

presence or absence of hydric characteristics. Typical characteristics of these soils are summarized in Table 1.

Table 1. Soil Descriptions.

Series	Symbol	Texture and Slope	Brief Soil Description
Downer	DoC	Sandy loam five to ten percent	very deep, moderate or moderately rapidly drained sandy upland soils
Fallsington*	FaA	Sandy loam zero to two percent	poorly drained sandy upland soils
	FgA	Loam zero to two percent	
Ingleside	IeA	Loamy sand zero to two percent	very deep, and well drained sandy loam
	IeB	Loamy sand two to five percent	
Greenwich Urban Land Complex	GuB	zero to five percent	well drained
Hammonton*	HnA	Sandy loam zero to two percent	very deep, and well drained
Hammonton-Fallsington-Mullica Complex*	HoA	Zero to two percent slopes	very deep, and moderately well drained/ Fallsington poorly drained sandy upland soils
Hurlock*	HvA	Sandy loam zero to two percent	poorly drained
Lenape*	Lk	Mucky peat zero to one percent	very poorly drained soils, frequently flooded, tidal
Rosedale	RoB	Rosedale loamy sand two to five percent	well drained
Runclint*	RuA	Loamy sand zero to two percent	excessively drained sand
	RuB	Loamy sand two to five percent	
Sassafras*	SSD	Soils ten to fifteen percent	well drained sandy loam, with moderate or moderately slow permeability
Unicorn	UIA	Loam zero to two percent	very deep, well drained, moderately permeable soils
Woodstown*	WdA	Sandy loam zero to two percent	very deep moderately well drained sandy marine and old alluvial sediments

* Indicates soils with major hydric components

According to the list of *National Hydric Soils* (USDA-NRCS 2007), the following soils within the project study area are considered hydric: Fallsington (FaA, Fga), Hammonton (HnA), Hammonton-Fallsington-Mullica Complex (KgB), Hurlock (HvA), Lenape (Lk), Runclint (RuA, RuB), and Sassafras (SSD) and Woodstown (WdA, WoA).

Soil test pits were excavated in the project study area to determine if hydric soil characteristics were present. The soil test pit locations are represented as UPLAND-(number) in the uplands and as WETLAND-(number) in the wetlands. The soil test pits were dug to a minimum depth of 18.0

inches. The colors of the soil matrix and mottles were described using the *Munsell Soil Color Charts* (Macbeth Division of Kollmorgen Instruments Corporation 1992). Data sheets describing the soil within the project area can be found in Appendix B.

B. Vegetation

Representative observation points were selected within each wetland community, and field data sheets were completed for each of these sample points. Visual estimates of species abundance were made at each sample point, and the dominant species were determined and recorded by genus and species on the field data sheets contained in Appendix B. Dominant species were determined separately for each vegetative stratum (herbs, sapling/shrub, trees, and vines).

Species indicator status was determined according to the *National List of Plant Species That Occur in Wetlands: Region 1, Northeast* (Sabine 1993). Hydrophytic vegetation is defined as a plant community with 50 percent or greater of the dominant plant species ranked as obligate wetland (OBL), facultative wetland (FACW), or facultative (FAC or FAC+). Non-hydrophytic vegetation is defined as a plant community with 50 percent or greater of the dominant plant species ranked as facultative (FAC-), facultative upland (FACU), or upland (UPL). If a plant is not included on the national list, it is assumed to be upland (UPL). Species of uncertain indicator values are ranked as either no agreement (NA) or as no indicator assigned (NI). Positive (+) or negative (-) modifiers indicate a greater or lesser occurrence in either wetland or upland conditions from the major ranking classification.

C. Hydrology

Hydrology was determined in the field on October 29, November 3 and 17, and December 17, 2003, and June 9, 2004, and reviewed in September 2007 and January 2008 based on properties such as soil saturation, inundation, oxidized root zones, manganese concretions, drainage patterns, and proximity to a waterway. Hydrologic indicators are based on the *U.S. Army Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987).

D. Functional Assessment

A function and value assessment was conducted for each wetland in the project study area using the modified New England Corps Descriptive Approach (CDA)(USACE 1995). Neither this nor any other method of function and value assessment has been endorsed or recommended by the Philadelphia District Corps of Engineers as necessary to the Corps permit application process or appropriate for use on this project site. This method was developed by the USACE, New England District; it includes a qualitative description of the physical characteristics of the wetland, identifies the functions and values exhibited, and provides the basis for conclusions using a “best professional judgment” approach. The CDA method is two-fold in that it first determines whether particular functions and values are present. It then determines what functions and values are primary and why. A function or value can be primary if it is an important physical component of a wetland ecosystem and/or if it is considered of special value or significance to society from a local, regional, and/or national perspective.

Wetland functions are self-sustaining properties of an ecosystem that exist in the absence of society. Values are benefits that are derived from either one or more functions and the physical characteristics associated with a wetland based on societal value. The CDA considers eight functions and five values for each of the wetlands assessed (Table 2). The completed function-value evaluation forms and a list of considerations are provided in Appendix E.

Table 2. Wetlands and Waterways Functions and Values.

Functions	Description
Ground Water Recharge/Discharge	Considers the potential for a wetland to serve as a groundwater recharge and/or discharge area. Recharge relates to the potential for the wetland to contribute water to an aquifer. Discharge relates to the potential for the wetland to serve as an area where groundwater can be discharged to the surface.
Floodflow Alteration	Considers the effectiveness of the wetland in reducing flood damage by attenuation of floodwaters for prolonged periods following precipitation events.
Fish and Shellfish Habitat	Considers the effectiveness of seasonal or permanent waterbodies associated with the wetland for fish and shellfish habitat.
Sediment/Toxicant/Pathogen Retention	Considers the effectiveness of the wetland as a trap for sediments, toxicants, or pathogens to reduce degradation of water quality.

Functions	Description
Nutrient Removal/Retention/Transformation	Considers the effectiveness of the wetland to prevent adverse effects of excess nutrients entering aquifers or surface waters such as ponds, lakes, streams, rivers, or estuaries.
Production Export	Considers the effectiveness of the wetland to produce food or usable products for human or other living organisms.
Sediment/Streambank Stabilization	Considers the effectiveness of the wetland to stabilize stream banks and shorelines against erosion.
Wildlife Habitat	Considers the effectiveness of the wetland to provide habitat for various types and populations of animals typically associated with wetlands and the wetland edge.
Values	Description
Recreation	Considers the effectiveness of the wetland and associated watercourses to provide recreational opportunities such as canoeing, boating, fishing, hunting, and other active or passive recreational activities.
Educational/Scientific Value	Considers the effectiveness of the wetland as a site for an “outdoor classroom” or as a location for scientific study or research.
Uniqueness/Heritage	Considers the effectiveness of the wetland or its associated waterbodies to produce certain special values. Special values may include such things as archaeological sites, unusual aesthetics quality, historical events, or unique plants, or animals.
Visual Quality/Aesthetics	Considers the visual and aesthetic qualities of the wetland.
Threatened or Endangered Species Habitat	Considers the effectiveness of the wetland or associated bodies of water to support Threatened or Endangered species.

III. INVESTIGATION RESULTS

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Field delineation, completed on October 29, November 3 and 17, December 17, 2003, and June 9, 2004, indicated that six wetland areas exist within the project study area, although two of these areas were determined not to meet the definition of wetlands and were removed from the plan after the November 2004 USACE Jurisdictional field view. Additional surveys were conducted in September 2007 to re-evaluate the waterways within the project study area for compliance with the new waterways guidance and in January 2008 to review the expanded project study area for additional wetlands and waterways. No new wetlands were identified, although 8 additional waterways were identified, and WUS 2 was extended. This extension of WUS 2 is located on the west side of SR 1 within Wetland 6. On July 31, 2008 a USACE Jurisdictional Field View was held to review the resources in the extended project area. One previously identified wetland, Wetland 5, was determined to not meet the three wetland criteria. In addition, one previously identified waterway, WUS 1, three drainage ditches located along Barratts Chapel Road, and a portion of WUS 3 were found by the USACE representative to be non-jurisdictional. This is discussed in more detail in Section III.A.

The additional surveys for the expanded project study area conducted in January 2008 identified three additional waterways along Barratts Chapel Road (WUS 6, 7 and 8), 4 waterways associated with the extended portion of WUS 2 (WUS 9, 10, 11 and 12), and a waterway located adjacent to the Skeeter Neck Road/Bowers Beach Intersections (WUS 13). Combined with the previous survey results, there were 11 waterways identified in the project area. Seven, of these would be considered relatively permanent waterways (RPW), waterways that have relatively permanent waters at least three months of the year. All of the waterways were reviewed in the field by USACE on July 31, 2008 and the seven RPW waterways were considered jurisdictional. WUS 1, a previously identified waterway and the three non-RPW waterways were identified as non-jurisdictional by the USACE representative and were removed from the mapping and discussion (Table 4). A portion of WUS 3 is also no longer considered jurisdictional and has been removed from the mapping. All of the waterways within the project study area are associated with Spring Creek and, ultimately, the Delaware Bay, a traditional navigable

waterway (TNW). None of the wetlands or watercourses in the project area are tidally influenced.

As a result of the original field investigation, three PFO wetlands and one PEM wetland were delineated within the project study area. Subsequent to the July 31, 2008 USACE Field View, Wetland 5 was determined to no longer meet the three wetland criteria and was removed from the mapping and the discussion (Table 5). Wetlands 1 and 3 are located on the east side of SR 1, and Wetland 6 is located in the area between SR 1 and Clapham Road. Wetland vegetation and characteristics that are typical of the delineated wetlands in the project study area are depicted in the photographs in Appendix A. The wetlands are depicted on the Plan Sheets (Appendix D).

DNREC's SWMP wetland mapping (Frederica, Delaware) identified two wetland areas within the project study area and three wetland areas near the project study area boundary. Two PFO areas are located along SR 1 north of Mulberrie Point Road. Of these, one wetland is located on the west side of SR 1 (Wetland 6) with a pipe connecting the water flow to a PFO wetland on the east side of SR 1 (Wetland 3). A PFO wetland is located on the east side of SR 1, north of Bowers Beach Road and two PFO wetlands are located north of the southern section of Skeeter Neck Road. Spring Creek and its adjacent wetlands are located southwest of the project study area; the Murderkill River and its adjacent wetlands are located west of the project study area.

The largest wetland system identified on DNREC's mapping is Trunk Ditch, located immediately north of the project study area boundary. Trunk Ditch drains to the Murderkill River, a second large system identified by the DNREC mapping, located immediately south of the project study area boundary.

In the following sections, the wetland communities identified during the field investigation are described separately from the upland communities. For each plant community identified, a description of the following information is given: vegetative composition, soil series as indicated by the soil survey, soil characteristics as determined in the field, and general indications of the presence or absence of wetland hydrology. Detailed field data sheets of the observation points are found in Appendix B, and the locations of the data collection points are shown on the Plan

Sheets in Appendix D. Areas within the study area and not covered by a Plan Sheet do not contain any aquatic resources. The Project Vegetation List shows a sampling of the dominant vegetation identified within the project study area, as well as the wetland indicator status for these species (Table 3).

Table 3. Dominant Vegetation within the Project Area.

Scientific Name	Common Name	Indicator Status
<i>Acer rubrum</i>	red maple	FAC
<i>Celastrus orbiculatus</i>	Chinese bittersweet	UPL
<i>Clethra alnifolia</i>	summersweet	FAC+
<i>Diospyros virginiana</i>	persimmon	FAC-
<i>Glycine sp.</i>	soybean	UPL
<i>Ilex opaca</i>	American holly	FACU+
<i>Lindera benzoin</i>	spicebush	FACW-
<i>Liriodendron tulipifera</i>	tulip poplar	FACU
<i>Lonicera japonica</i>	Japanese honeysuckle	FAC-
<i>Matteuccia struthiopteris</i>	ostrich fern	FACW
<i>Nyssa sylvatica</i>	black gum	FAC
<i>Onoclea sensibilis</i>	sensitive fern	FACW
<i>Osmunda regalis</i>	royal fern	OBL
<i>Phytolacca Americana</i>	pokeweed	FACU+
<i>Quercus alba</i>	white oak	FACU-
<i>Quercus bicolor</i>	swamp white oak	FACW+
<i>Quercus falcata</i>	northern red oak	FACU-
<i>Smilax rotundifolia</i>	greenbriar	FAC
<i>Vaccinium corybosum</i>	highbush blueberry	FACW-
<i>Viburnum dentatum</i>	arrowwood viburnum	FAC

A. Watercourses/Open-Water Wetlands

There are seven “Waters of the U.S.” (WUS) located within the project study area: WUS 2, 3, 9, 10, 11, 12 and 13 (Table 4). WUS4 and 5 were removed from the report after the November 2004 Jurisdictional Determination field view and WUS 1, 6, 7 and 8 were removed after the July 31, 2008 Jurisdictional Determination Field View. It was determined that they did not meet the criteria of a jurisdictional waterway. All seven of the jurisdictional waterways identified in the project area are considered RPWs with waters that are present for at least three months of the year. Table 4 provides a summary of all jurisdictional waterways located within the project study area.

Table 4. Waterway Summary Table.

Waterway ID	Classification	Linear Feet within Project	Extends Beyond Project
WUS2	RPW	460.00	N
WUS3	RPW	1597.00	Y

Waterway ID	Classification	Linear Feet within Project	Extends Beyond Project
WUS9	RPW	76.00	Y
WUS10	RPW	35.00	N
WUS11	RPW	33.00	N
WUS12	RPW	49.00	N
WUS13	RPW	89.00	Y
Total Linear Feet of Waterway within		2,339.00	

WUS2 is located on the west side of Clapham Road within Wetland 6 and flows under SR1 via pipe to connect to WUS3 within Wetland 3. WUS3 is a large system that connects a stream adjacent to Wetland 1, on the east side of SR 1 to Wetland 3. At Wetland 1, it becomes an open stream and extends northward into a pipe and flows via pipe under Mulberrie Point Road to Wetland 3, where it reappears as a stream. WUS9, 10 11 and 12 are all tributaries of the section of WUS2 located within Wetland 6. WUS13 is located at the eastern end of the project area, just north of the Skeeter Neck Road and Bowers Beach Road intersection, Except for WUS13, all of the major watercourses located within the project study area are associated with a large wetland system on the east side of SR 1.

Hydrologic conditions for WUS2, WUS3, WUS9, WUS 10, WUS 11, WUS 12 and WUS 13 indicate that there is continuous surface flow for at least three months of the year. Therefore, in accordance with the RGL 07-01 procedure for evaluating hydrologic conditions, they would be classified as RPW.

B. Wetland Areas

Table 5 summarizes the wetlands within the project area boundary.

Table 5. Wetlands Summary Table.

Wetland ID	Classification	Acres within Project Study Area (Ac)	Extends Beyond Project Study Area Limits? (Y/N)
Wetland 1	PFO	0.03	N
Wetland 3	PFO	5.51	Y
Wetland 6	PFO	1.50	N
Total Acre of Wetlands within Project Study Limits		7.04	

1. Wetland 1 (Data Point WETLAND 1). Wetland 1 is classified as a PFO community (Cowardin et al. 1979). This wetland is located along the eastern edge of SR 1 between Mulberrie Point Road and Skeeter Neck Road (Appendix A, Photograph 1; Appendix D, Plan Sheet C). Wetland 1 is 12,054.9 square feet (0.03 acre) in size. Wetland 1 is contained within the project study area boundaries. Functions and values for Wetland 1 are groundwater recharge, sediment/toxicant retention, nutrient removal, and wildlife habitat (USACE 1995).

The plant community is comprised primarily of *Nyssa sylvatica* (black gum, FAC). Supportive plant species consist of *Lindera benzoin* (spicebush, FACW-), *Osmunda regalis* (royal fern, OBL), *Viburnum dentatum* (arrowwood viburnum, FAC), and *Acer rubrum* (red maple, FAC). As indicated on the Wetland 1 field data sheet (WETLAND 1, Appendix B), the soil is hydric sand. Hydrologic indicators included saturation to the surface, drainage patterns in the wetland, and local soil survey data. The soil between 0.0 to 6.0 inches consists of organic matter. The matrix color within 6.0 to 12.0 inches of the soil surface was black (2.5Y 2.5/1) sand. The soil matrix color within 12.0 to 18.0 inches of the soil surface was gray (2.5Y 5/1) sand.

2. Wetland 3 (Data Point WETLAND 3). Wetland 3 is classified as a PFO community (Cowardin et al. 1979). This wetland is located in a heavily wooded area along the eastern edge of SR 1, north of Mulberrie Point Road (Appendix A, Photographs 2-3; Appendix D, Plan Sheets B-1 and B-2). Wetland 3 is 5.51 acres in size within the project study area boundaries. The wetland extends beyond the project study area boundary to the northeast. In addition, Wetland 3 is connected via pipe under SR 1 and Mulberrie Point Road to Wetland 1 and Wetland 6. Functions and values for Wetland 3 are groundwater recharge/discharge, sediment/toxicant retention, nutrient removal, wildlife habitat, recreation, uniqueness, and visual quality/aesthetics (USACE 1995).

The plant community is comprised primarily of *Matteuccia struthiopteris* (ostrich fern, FACW) and *Ilex opaca* (American holly, FACU+). Supportive plant species consist of *Clethra alnifolia* (summersweet, FAC+), *Onoclea sensibilis* (sensitive fern, FACW), *Smilax rotundifolia* (greenbriar, FAC), *Quercus alba* (white oak, FACU-), and *Diospyros virginiana* (persimmon, FAC-). Hydrologic indicators consist of soil saturation to the surface, drainage patterns in the

wetland, water-stained leaves, and local soil survey data. As indicated on the Wetland 3 field data sheet (WETLAND 3, Appendix B), the soil is hydric sand. The soil between 0.0 to 2.0 inches is a brown organic sand layer (7.5YR 4/2). The matrix color within 2.0 to 12.0 inches of the soil surface is very dark gray (7.5YR 3/1) sand. The soil matrix color within 12.0 to 18.0 inches of the soil surface is gray (7.5YR 5/1) sand.

4. Wetland 6 (Data Point WETLAND 6). Wetland 6 is classified as a PFO community (Cowardin et al. 1979). This wetland is located in a wooded area along the northern edge of the project study area between Clapham Road and SR 1 (Appendix A, Photograph 4; Appendix D, Plan Sheet A). Wetland 6 is 1.50 acres in size and is located entirely within the project study area boundaries. Wetland 6 is hydrologically connected via a pipe under SR 1 to Wetland 3. Functions and values are groundwater recharge, sediment/toxicant retention, nutrient removal, and wildlife habitat (USACE 1995).

The plant community is comprised primarily of red maple (FAC) and sensitive fern (FACW). Supportive plant species consist of *Smilax rotundifolia* (greenbriar, FAC), *Lonicera japonica* (Japanese honeysuckle, FAC-), and arrowwood (FAC). Hydrologic indicators consist of saturated soils to the surface, drainage patterns in the wetland, and oxidized root channels in the upper 12.0 inches. As indicated on the Wetland 6 field data sheet (WETLAND 6, Appendix B), the soil is hydric sand and clay loam. The soil from 0.0 to 10.0 inches is a dark gray (10YR 4/1) sand with many bright yellow-brown (10YR 5/6) and dark gray (10YR 2/1) faint mottles. The soil matrix from 10.0 to 18.0 inches of the soil surface is a dark gray (10YR 3/1) clay loam with yellow brown (10YR 4/6) and few, distinct mottles.

C. Upland Areas

1. Agricultural field/roadside field. Within the project boundaries, the upland areas are located within agricultural fields, roadside areas, or woodlands. A typical upland data point in an agricultural field or roadside area is UPLAND 6. Dominant plant species consist of *Glycine* sp. (soybean, UPL). Supportive plant species consist of Japanese honeysuckle, *Phytolacca Americana* (pokeweed, FACU+), and *Celastrus orbiculata* (Oriental bittersweet, UPL). There

are no hydrologic indicators. From the surface to 18.0 inches, the soil is yellowish brown (10YR 5/6) sand.

A typical forested upland data point is UPLAND 1. Dominant plant species consist of black gum (FAC). Supportive plant species consist of American holly (FACU+), red maple (FAC), and Japanese honeysuckle (FAC-). There are no hydrologic indicators. From the surface to 8.0 inches, the soil is a dark brown (10YR 3/3) sandy loam. The matrix color within 8.0 to 10.0 inches of the soil surface is brown (10YR 5/3) sand. The matrix color within 10.0 to 15.0 inches of the soil surface is very dark grayish brown (10YR 3/2) sand. Auger refusal occurred at 15.0 inches.

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APPENDIX A:
PHOTOGRAPHS



Photograph 1: Wetland 1, view looking southeast. Flag 19 is in the foreground. Note the *Phragmites australis* (common reed, FACW) and *Salix nigra* (black willow, FACW+) in the center of the photograph (October 2003).



Photograph 2: Wetland 3, view looking west past flag 21. Note bog area prior to stream corridor (October 2003).



Photograph 3: Wetland 3, view looking south along SR 1. Note flag 5a and the inlet pipe in the foreground and the treatment plant in the background (October 2003).



Photograph 4: Wetland 6, view looking east toward SR 1 from Clapham Road. Note flag 32 in the forested wetland in the background (December 2003).

APPENDIX B:
DATA SHEETS

A.D. Marble & Company Data Form - Routine Wetland Determination

Wetland ID: WETLAND 1 Project Site: SR-1/Little Heaven Interchange County/State: Kent County, DE

Prepared By: DAD, SLM Survey Date: 10/29/2003 Nearest Delineation Flag: WL2-16

Remarks: Recent rain, sunny 55 degrees

Vegetation Determination

Dominant Plant (Indicator)	Stratum:	Dominant Vegetation
Lindera benzoin (FACW-)	S	<input type="checkbox"/>
Nyssa sylvatica (FAC)	T	<input checked="" type="checkbox"/>
Osmunda regalis (OBL)	H	<input type="checkbox"/>
Viburnum dentatum (FAC)	S	<input type="checkbox"/>
Acer rubrum (FAC)	T	<input type="checkbox"/>

This site is dominated by Hydrophytic Vegetation Remarks:

Hydrology

Recorded Data

- Stream, Lake or Tide Guage
- Aerial Photographs
- Digital Photo

No Recorded Data Available

Water Hydrology Indicators:

Primary Indicators:

- Inundated
- Saturated in Upper 12 inches
- Water Marks
- Drift Lines
- Sediment Deposits
- Drainage Patterns in Wetlands

Secondary Indicators:

- Oxidized Root Channels in Upper 12 in.
- Water Stained Leaves
- Local Soil Survey Data
- FAC Neutral Test

Other:

Field Observations:

Depth to Surface Water: (inches)
 Depth Free Water in Pit: (inches)
 Depth to Saturated Soil: 0 (inches)

This site has Wetland Hydrology Remarks: Saturated to surface.

Soils

Soil Map Unit Name Mv

Drainage Class: Poorly drained

Field Observations Confirm Map Type:

Depth (in.):	Horizon:	Matrix Hue:	Matrix Value:	Matrix Chroma:	Mottle Hue:	Mottle Value:	Mottle Chroma:	Mottle Quantity/Contrast:	Texture:
0-6	O								Organic matter
6-12	A	2.5 Y	2.5	1					Sand
12-18	B	2.5 Y	5	1					Sand

This site has Hydric Soils Remarks:

WETLAND DETERMINATION

Is this sampling point in a wetland? Yes No

A.D. Marble & Company Data Form - Routine Wetland Determination

Wetland ID: WETLAND 3 Project Site: SR-1/Little Heaven Interchange County/State: Kent County, DE

Prepared By: DAD, SLM Survey Date: 11/7/2003 Nearest Delineation Flag: WL5-9

Remarks:

Vegetation Determination

Dominant Plant (Indicator)	Stratum:	Dominant Vegetation
Matleuccia struthiopteris (FACW)	H	<input checked="" type="checkbox"/>
Ilex opaca (FACU+)	T	<input checked="" type="checkbox"/>
Clethra alnifolia (FAC+)	S	<input type="checkbox"/>
Onoclea sensibilis (FACW)	H	<input type="checkbox"/>
Smilax rotundifolia (FAC)	S	<input type="checkbox"/>
Quercus alba (FACU-)	T	<input type="checkbox"/>
Diospyros virginiana (FAC-)	T	<input type="checkbox"/>

This site is dominated by Hydrophytic Vegetation Remarks:

Hydrology

Recorded Data

- Stream, Lake or Tide Guage
- Aerial Photographs
- Digital Photo
- No Recorded Data Available

Water Hydrology Indicators:

Primary Indicators:

- Inundated
- Saturated in Upper 12 inches
- Water Marks
- Drift Lines
- Sediment Deposits
- Drainage Patterns in Wetlands

Field Observations:

Depth to Surface Water: (inches)
 Depth Free Water in Pit: (inches)
 Depth to Saturated Soil: 0 (inches)

Secondary Indicators:

- Oxidized Root Channels in Upper 12 in.
- Water Stained Leaves
- Local Soil Survey Data
- FAC Neutral Test

Other:

This site has Wetland Hydrology Remarks: Saturated throughout profile.

Soils

Soil Map Unit Name Mv

Drainage Class: Poorly drained

Field Observations Confirm Map Type:

Depth (in.):	Horizon:	Matrix Hue:	Matrix Value:	Matrix Chroma:	Mottle Hue:	Mottle Value:	Mottle Chroma:	Mottle Quantity/Contrast:	Texture:
0-2	O	7.5 YR	4	2					Sand, org. matter
2-12	A	7.5 YR	3	1					Sand
12-18	B	7.5 YR	5	1					Sand

This site has Hydric Soils Remarks:

WETLAND DETERMINATION Is this sampling point in a wetland? Yes No

A.D. Marble & Company Data Form - Routine Wetland Determination

Wetland ID: WETLAND 6 Project Site: SR-1/Little Heaven interchange County/State: Kent County, DE

Prepared By: DAD, SLM Survey Date: 12/17/2003 Nearest Delineation Flag: W/L9-5

Remarks: Overcast, drizzle 50 degrees

Vegetation Determination

Dominant Plant (Indicator)	Stratum:	Dominant Vegetation
Smilax rotundifolia (FAC)	S	<input type="checkbox"/>
Lonicera japonica (FAC-)	WV	<input type="checkbox"/>
Onoclea sensibilis (FACW)	H	<input checked="" type="checkbox"/>
Acer rubrum (FAC)	T	<input checked="" type="checkbox"/>
Viburnum dentatum (FAC)	S	<input type="checkbox"/>

This site is dominated by Hydrophytic Vegetation Remarks: PEM area adjacent to this wetland. Typha latifolia dominant.

Hydrology

- Recorded Data
- Stream, Lake or Tide Guage
 - Aerial Photographs
 - Digital Photo
 - No Recorded Data Available
- Water Hydrology Indicators:
- Primary Indicators:
- Inundated
 - Saturated in Upper 12 inches
 - Water Marks
 - Drift Lines
 - Sediment Deposits
 - Drainage Patterns in Wetlands

Field Observations:

Depth to Surface Water: 2 (inches)

Depth Free Water in Pit: (inches)

Depth to Saturated Soil: 0 (inches)

Secondary Indicators:

- Oxidized Root Channels in Upper 12 in.
- Water Stained Leaves
- Local Soil Survey Data
- FAC Neutra' Test

Other:

This site has Wetland Hydrology Remarks: Areas of standing water, undefined channels, ORZ

Soils

Soil Map Unit Name Mv Drainage Class: Poorly drained Field Observations Confirm Map Type:

Depth (in.):	Horizon:	Matrix Hue:	Matrix Value:	Matrix Chroma:	Mottle Hue:	Mottle Value:	Mottle Chroma:	Mottle Quantity/Contrast:	Texture:
0-10	A	10 YR	4	1	10 YR	5	6	Many, Faint	Sand
0-10					10 YR	2	1	Many, Faint	Clay Loam
10-18	B	10 YR	3	1	10 YR	4	6	Few, Distinct	Clay Loam

Hydric Soil Indicators:

Oxidized Root Zones Concretions High Organic Content Sulfidic Odor Gleying

This site has Hydric Soils Remarks: ORZ

WETLAND DETERMINATION Is this sampling point in a wetland? Yes No

A.D. Marble & Company Data Form - Routine Wetland Determination

Wetland ID: UPLAND 1 Project Site: SR-1/Little Heaven Interchange County/State: Kent County, DE

Prepared By: DAD, SLM Survey Date: 10/29/2003 Nearest Delineation Flag: WL2-16

Remarks: Recent rain, sunny 55 degrees

Vegetation Determination

Dominant Plant (Indicator)	Stratum:	Dominant Vegetation
Ilex opaca (FACU+)	T	<input type="checkbox"/>
Nyssa sylvatica (FAC)	T	<input checked="" type="checkbox"/>
Acer rubrum (FAC)	T	<input type="checkbox"/>
Lonicera japonica (FAC-)	WV	<input type="checkbox"/>

This site is dominated by Hydrophytic Vegetation

Remarks:

Hydrology

Recorded Data

- Stream, Lake or Tide Gauge
- Aerial Photographs
- Digital Photo

No Recorded Data Available

Water Hydrology Indicators:

Primary Indicators:

- Inundated
- Saturated in Upper 12 inches
- Water Marks
- Drift Lines
- Sediment Deposits
- Drainage Patterns in Wetlands

Secondary Indicators:

- Oxidized Root Channels in Upper 12 in.
- Water Stained Leaves
- Local Soil Survey Data
- FAC Neutral Test

Field Observations:

Depth to Surface Water: (inches)

Depth Free Water in Pit: (inches)

Depth to Saturated Soil: (inches)

Other:

This site has Wetland Hydrology

Remarks:

Soils

Soil Map Unit Name SaB

Drainage Class: Well drained

Field Observations Confirm Map Type:

Depth (in.):	Horizon:	Matrix Hue:	Matrix Value:	Matrix Chroma:	Mottle Hue:	Mottle Value:	Mottle Chroma:	Mottle Quantity/Contrast:	Texture:
0-8	A1	10 YR	3	3					Sandy Loam
8-10	A2	10 YR	5	3					Sand
10-15	B	10 YR	3	2					Sand
15+	B2								Auger refusal

This site has Hydric Soils

Remarks:

WETLAND DETERMINATION

Is this sampling point in a wetland? Yes No

A.D. Marble & Company Data Form - Routine Wetland Determination

Wetland ID: UPLAND 3 Project Site: SR-1/Little Heaven Interchange County/State: Kent County, DE

Prepared By: DAD, SLM Survey Date: 11/7/2003 Nearest Delineation Flag: WL5-9

Remarks:

Vegetation Determination

Dominant Plant (Indicator)	Stratum:	Dominant Vegetation
Clethra alnifolia (FAC+)	S	<input checked="" type="checkbox"/>
Quercus falcata (FACU-)	T	<input checked="" type="checkbox"/>
Quercus bicolor (FACW+)	T	<input type="checkbox"/>
Liriodendron tulipifera (FACU)	T	<input type="checkbox"/>
Vaccinium corymbosum (FACW-)	S	<input type="checkbox"/>
Carya sp.	T	<input type="checkbox"/>

This site is dominated by Hydrophytic Vegetation Remarks:

Hydrology

- Recorded Data
- Stream, Lake or Tide Gauge
 - Aerial Photographs
 - Digital Photo
- No Recorded Data Available

Water Hydrology Indicators:

Primary Indicators:

- Inundated
- Saturated in Upper 12 inches
- Water Marks
- Drift Lines
- Sediment Deposits
- Drainage Patterns in Wetlands

Secondary Indicators:

- Oxidized Root Channels in Upper 12 in.
- Water Stained Leaves
- Local Soil Survey Data
- FAC Neutral Test

Field Observations:

Depth to Surface Water: (inches)

Depth Free Water in Pit: (inches)

Depth to Saturated Soil: (inches)

Other:

This site has Wetland Hydrology Remarks:

Soils

Soil Map Unit Name RuB Drainage Class: Excessively drained Field Observations Confirm Map Type:

Depth (in.):	Horizon:	Matrix Hue:	Matrix Value:	Matrix Chroma:	Mottle Hue:	Mottle Value:	Mottle Chroma:	Mottle Quantity/Contrast:	Texture:
0-3	A	7.5 YR	3	3					Sand
3-18	B	10 YR	5	6					Sand

This site has Hydric Soils Remarks:

WETLAND DETERMINATION

Is this sampling point in a wetland? Yes No

A.D. Marble & Company Data Form - Routine Wetland Determination

Wetland ID: UPLAND 6 Project Site: SR-1/Little Heaven Interchange County/State: Kent County, DE

Prepared By: DAD, SLM Survey Date: 12/17/2003 Nearest Delineation Flag: WL9-5

Remarks: overcast, drizzle, 50 degrees

Vegetation Determination

Dominant Plant (Indicator)	Stratum:	Dominant Vegetation
Glycine sp.	H	<input checked="" type="checkbox"/>
Lonicera Japonica (FAC-)	WV	<input type="checkbox"/>
Phytolacca americana (FACU+)	S	<input type="checkbox"/>
Celastrus orbiculata (UPL*)	WV	<input type="checkbox"/>

This site is dominated by Hydrophytic Vegetation Remarks:

Hydrology

- Recorded Data
 - Stream, Lake or Tide Guage
 - Aerial Photographs
 - Digital Photo
- No Recorded Data Available

Water Hydrology Indicators:

- Primary Indicators:*
- Inundated Drift Lines
 - Saturated in Upper 12 inches Sediment Deposits
 - Water Marks Drainage Patterns in Wetlands

Field Observations:

Depth to Surface Water: (inches)
 Depth Free Water in Pit: (inches)
 Depth to Saturated Soil: (inches)

Secondary Indicators:

- Oxidized Root Channels in Upper 12 in.
- Water Stained Leaves
- Local Soil Survey Data
- FAC Neutral Test

Other:

This site has Wetland Hydrology Remarks: Moist throughout profile.

Soils

Soil Map Unit Name SaC3 Drainage Class: Well drained Field Observations Confirm: Map Type:

Depth (in.):	Horizon:	Matrix Hue:	Matrix Value:	Matrix Chroma:	Mottle Hue:	Mottle Value:	Mottle Chroma:	Mottle Quantity/Contrast:	Texture:
0-18	AB	10 YR	5	6					Sand

This site has Hydric Soils Remarks:

WETLAND DETERMINATION Is this sampling point in a wetland? Yes No

APPENDIX C:
SOIL DESCRIPTIONS

Downer Series:

The Downer series are generally very deep, moderate or moderately rapidly drained sandy upland soils. The permeability is moderate or moderately rapid, the parent material is fluviomarine deposits. Most areas are used for growing field crops, vegetables, flowers, and some tree fruits. Native vegetation includes white oak, red oak, scarlet oak, black oak, Virginia pine, pitch pine, hickory, sassafras, dogwood, greenbriar, and American Holly. Loblolly Pine occurs in the southern part of Downer soils distribution.

A representative profile of Downer loamy sand:

Ap--0 to 10 inches; dark grayish brown (10YR 4/2) loamy sand, brown (10YR 5/3) dry; weak fine granular structure; very friable; strongly acid; abrupt smooth boundary. (0 to 11 inches thick)

BA--10 to 18 inches; yellowish brown (10YR 5/6) loamy sand; single grain; loose; few extremely weakly cemented masses of oxidized iron in lower part; very strongly acid; gradual smooth boundary. (0 to 12 inches thick)

Bt--18 to 30 inches; yellowish brown (10YR 5/6) sandy loam; weak fine and medium subangular blocky structure; very friable; common distinct clay bridging of sand grains; very strongly acid; gradual smooth boundary. (10 to 24 inches thick)

C--30 to 80 inches; yellowish brown (10YR 5/6) loamy sand; single grain; loose; very strongly acid.

Fallsington Series:

The Fallsington series are generally poorly drained sandy upland soils. Adequately drained areas are used for growing general crops and truck crops including corn, soybeans, and small grains. Some areas are in pasture. Wooded areas are white oak, water oak, willow oak, swamp or red maple, sweet gum, holly, greenbriar, and pond pine. Loblolly pine occupies some formerly cultivated areas.

A representative profile of Fallsington sandy loam:

Ap--0 to 10 inches; dark gray (10YR 4/1) sandy loam; moderate coarse granular structure; friable; nonsticky, nonplastic; many fine roots; 2 percent, by volume gravel; moderately acid; abrupt smooth boundary. (0 to 12 inches thick)

Btg1--10 to 20 inches; gray (10YR 6/1) sandy clay loam; weak very coarse prismatic structure parting to moderate subangular blocky; friable; slightly sticky, slightly plastic; common fine roots; common distinct clay films on faces of peds and in pores; common medium prominent yellowish brown (10YR 5/6) soft iron masses; extremely acid; clear smooth boundary.

Btg2--20 to 32 inches; gray (10YR 6/1) sandy clay loam; weak very coarse prismatic structure parting to moderate medium subangular blocky; friable; moderately sticky, slightly plastic; common fine roots along ped faces; common prominent clay films on faces of peds; common coarse prominent yellowish brown (10YR 5/6) soft iron masses; extremely acid; clear wavy boundary. (Combine thickness of the Btg horizon is 15 to 30 inches.)

BCtg--32 to 40 inches; gray (2.5Y 6/1) sandy loam; weak very coarse subangular blocky structure; very friable; nonsticky, nonplastic; very few faint clay films on faces of peds; common medium distinct yellowish brown (10YR 5/6) soft masses of iron accumulation and gray (10YR 5/1) iron depletions; very strongly acid; clear wavy boundary. (0 to 10 inches thick)

BCg--40 to 46 inches; gray (2.5Y 5/1) loamy sand; weak moderate subangular blocky structure; firm; slightly sticky, slightly plastic; few fine distinct yellowish brown (10YR 5/6) iron masses; very strongly acid; clear wavy boundary.

Cg--46 to 65 inches; light gray (10YR 7/2) sand; single grained; loose; nonsticky, nonplastic; very strongly acid.

Ingleside Series

The Ingleside Series is a very deep, and well drained sandy loam. The surface runoff is slow, and the parent material is stratified loamy alluvial and marine sediments. Wooded areas have an overstory of white oak, black oak, and scarlet oak. Some areas have Virginia pine and loblolly pine mixed with the oaks. Common understory species are sassafras, dogwood, greenbriar, American holly, and lowbush blueberry.

A representative profile of Ingleside Series:

Ap--0 to 10 inches; dark brown (10YR 4/3) sandy loam; moderate fine granular structure; very friable; slightly sticky, slightly plastic; common very fine and few fine and medium roots; common very fine tubular pores; slightly acid; abrupt smooth boundary. (7 to 12 inches thick)

E--10 to 15 inches; brown (10YR 5/3) sandy loam; weak medium subangular blocky structure; very friable; slightly sticky, slightly plastic; common fine and very fine roots; many very fine, common fine, and few medium tubular pores; slightly acid; abrupt smooth boundary. (0 to 8 inches thick)

Bt1--15 to 24 inches; dark yellowish brown (10YR 4/6) sandy loam; moderate medium subangular blocky structure; friable; slightly sticky, slightly plastic; common very fine and fine roots; common very fine and fine tubular pores; common distinct clay films on faces of peds and clay bridging between sand grains; slightly acid; clear wavy boundary.

Bt2--24 to 33 inches; strong brown (7.5YR 4/6) sandy loam; moderate medium subangular blocky structure; friable; slightly sticky, slightly plastic; few very fine roots; common very fine and fine tubular pores; common prominent clay films on faces of peds and clay bridging between sand grains; slightly acid; clear wavy boundary. (Combined thickness of the Bt horizon is 10 to 30 inches.)

BC--33 to 43 inches; yellowish brown (10YR 5/6) sandy loam; weak medium subangular blocky structure; very friable; slightly sticky, slightly plastic; few very fine roots; common very fine and fine irregular pores; clay bridging between sand grains; slightly acid; gradual wavy boundary. (2 to 15 inches thick)

C1--43 to 48 inches; yellowish brown (10YR 5/8) loamy sand; single grain; loose; few very fine and fine irregular pores; moderately acid; clear wavy boundary.

C2--48 to 56 inches; light yellowish brown (10YR 6/4) loamy fine sand; single grain; loose, common medium distinct light brownish gray (10YR 6/2) iron depletions; common medium prominent strong brown (7.5YR 5/8) iron accumulations; moderately acid; clear smooth boundary.

C3--56 to 72 inches; pale brown (10YR 6/3) silt loam; massive; friable; slightly sticky, slightly plastic; common medium faint gray (10YR 6/1) iron depletions; common fine prominent strong brown (7.5YR 5/8) iron accumulations; moderately acid.

Greenwich-Urbau land complex

The Greenwich series consists of silty colian deposits over fluvio-marine deposits. This component is found on flats and uplands. This soil does not meet hydric criteria.

Hammonton Series

The Hammonton Series is very deep, and moderately well drained. Cleared areas are used for production of fruit, vegetables, row crops, and nursery stock. Native vegetation is a mixed hardwood forest containing scattered pitch pine, shortleaf pine, loblolly pine and Virginia pine.

A representative profile of Hammonton Series:

Ap--0 to 20 cm (0 to 8 inches); very dark grayish brown (2.5Y 3/2) loamy sand, dark grayish brown (2.5Y 4/2) dry; weak medium granular structure; very friable; nonsticky, nonplastic; many fine roots; very strongly acid; abrupt smooth boundary. (5 to 30 cm thick)

E--20 to 46 cm (8 to 18 inches); yellowish brown (10YR 5/4) loamy sand; weak fine granular structure; very friable; nonsticky, nonplastic; many fine roots; very strongly acid; gradual wavy boundary. (0 to 30 cm thick)

Bt--46 to 91 cm (18 to 36 inches); yellowish brown (10YR 5/6) sandy loam; weak fine subangular blocky structure; friable; slightly sticky, nonplastic; common fine roots; few faint clay films on faces of peds or lining pebble niches; clay bridging common in upper part decreasing with depth; common medium prominent light gray (5Y 7/2) irregularly shaped iron depletions with clear boundaries in the matrix and common medium distinct brownish yellow (10YR 6/8) irregularly shaped masses of oxidized iron with diffuse boundaries throughout; 3 percent, by volume rounded quartzite pebbles; very strongly acid; gradual wavy boundary. (25 to 61 cm thick)

C--91 to 203 (36 to 80 inches); brownish yellow (10YR 6/6) sand; single grain; loose; nonsticky, nonplastic; few fine roots; few medium prominent light gray (5Y 7/2) irregularly shaped iron depletions with clear boundaries in the matrix and few medium faint brownish yellow (10YR 6/8) irregularly shaped masses of oxidized iron with diffuse boundaries throughout; 5 percent, by volume rounded quartzite pebbles; very strongly acid.

Hammonton-Fallsington-Mullica complex

The Hammonton Series consists of loamy fluviomarine sediments. This component is found on uplands and flats. This soil does not meet hydric criteria.

The Fallsington series consists of loamy fluviomarine sediments. This component is found on flats and uplands. The soil meets hydric criteria.

The Mullica series consists of sandy and loamy fluviomarine sediments. This component is found on uplands and flats. This soil meets hydric criteria.

Hurlock Series:

The Hurlock series are generally poorly drained. Permeability in the most restrictive layer is moderately low. The parent material consists of loamy fluviomarine sediments. Wooded areas have an overstory of sweetgum, red oak, white oak, willow oak, loblolly pine, and red maple. Common understory species are greenbriar, American holly, highbush blueberry, and sweetbay. Most areas are wooded. Some areas are cleared and used for growing corn, small grain and soybeans.

This soil meets hydric criteria

A representative profile of the Hurlock Series:

Oc--0 to 3 inches; moderately decomposed to slightly decomposed leaves, needles, and twigs; abrupt smooth boundary. (0 to 4 inches thick)

A--3 to 6 inches; black (10YR 2/1) sandy loam; weak fine granular structure; very friable; slightly sticky, slightly plastic; many very fine, fine, and medium roots; common very fine and fine irregular pores; very strongly acid; abrupt smooth boundary. (2 to 8 inches thick)

Eg--6 to 13 inches; gray (10YR 6/1) sandy loam; weak fine subangular blocky structure; very friable; slightly sticky, slightly plastic; many fine and very fine, and few coarse and medium roots; many very fine, and common fine tubular pores; strongly acid; gradual smooth boundary. (0 to 10 inches thick)

Btg--13 to 25 inches; gray (10YR 6/1) sandy loam; moderate medium subangular blocky structure; friable; slightly sticky, slightly plastic; common very fine and fine, and few medium roots; many very fine and common fine tubular pores; common faint and distinct clay films on faces of peds and clay bridging between sand grains; common medium prominent strong brown (7.5YR 5/8) irregularly shaped soft iron accumulations; very strongly acid; gradual wavy boundary. (10 to 28 inches thick)

BCg--25 to 28 inches; light brownish gray (10YR 6/2) loamy sand; weak medium subangular blocky structure; very friable; slightly sticky; common very fine, and few medium and fine roots; many very fine irregular pores; faint clay bridging between sand grains; common medium prominent strong brown (7.5YR 5/8) irregularly shaped soft iron accumulations; very strongly acid; clear smooth boundary. (0 to 6 inches thick)

Cg1--28 to 41 inches; light brownish gray (10YR 6/2) sand; single grain; loose; few very fine and fine roots; few medium prominent strong brown (7.5YR 5/8) soft iron accumulations; very strongly acid; clear wavy boundary.

Lenape Series

The Lenape series consists of deep, very poorly drained soils that formed in organic deposits overlying high n-value loamy estuarine or marine deposits. They formed in closed depressions, floodplains, and freshwater tidally flooded swamps of the mid-Atlantic Coastal Plain. Permeability is moderately slow. Lenape soils are used mainly for wetland wildlife habitat. Native vegetation includes red maple, water oak, bald cypress, sweetgum, Atlantic white cedar, sweetbay, American holly, greenbriar, sedges, ferns, and mosses.

A representative profile of Lenape Series:

Oe1--0 to 4 inches; dark brown (7.5YR 3/2) mucky peat, hemic soil material; 60 percent fibers, 30 percent rubbed; 10 percent blackened leaves and twigs; few fine and medium roots; 45 percent organic material; very strongly acid; clear wavy boundary.

Oe2--4 to 8 inches; very dark grayish brown (10YR 3/2) mucky peat, hemic soil material; 45 percent fibers, 18 percent rubbed; few fine and medium roots; 50 percent organic material; extremely acid; clear smooth boundary.

Oa--8 to 26 inches, very dark brown (10YR 2/2) muck, sapric soil material; 20 percent fibers, 5 percent rubbed; few fine roots; 70 percent organic material; extremely acid; gradual wavy boundary.

Cg1--26 to 34 inches; very dark gray (10YR 3/1) loam; massive; friable, slightly sticky, slightly plastic; n-value greater than 1.0, material flows easily between fingers when squeezed; 5 percent organic soil material; very strongly acid; clear smooth boundary.

Cg2--34 to 60 inches; dark greenish gray (5GY 4/1) silty clay loam; massive; firm, slightly sticky, plastic; n- value greater than 1.0, material flows easily between fingers when squeezed; strongly acid.

2Cg3--60 to 72 inches; gray (10YR 6/1) and light gray (10YR 7/1) sand; single grain; loose; very strongly acid.

Rosedale Loamy Sand 2 to 5 Percent Slopes

The Rosedale series are generally well drained soils found on flats and uplands. The permeability is moderately high. The parent material consists of sandy eolian deposits over fluvial sediments. Major use for the land is cultivation. Where cultivated corn, soybeans, sorghum, small grains were grown. Wooded areas included white oak, scarlet oak, loblolly pine, sassafras, dogwood and American holly.

A representative profile of Rosedale loamy sand:

A--0 to 5 cm (0 to 2 inches); dark brown (10YR 3/3) loamy sand; weak medium granular structure; very friable; many very fine and fine, common medium, and few coarse roots; extremely acid; clear wavy boundary. (2.5 to 10 cm thick)

AE--5 to 23 cm (2 to 9 inches); dark yellowish brown (10YR 4/4) loamy sand; weak coarse and very coarse granular structure; very friable; common fine and medium, and few very fine roots; very strongly acid; clear smooth boundary. (15 to 20 cm thick).

E1--23 to 46 cm (9 to 18 inches); light yellowish brown (2.5Y 6/3) loamy sand; weak fine and medium subangular blocky; very friable; few very fine, fine and medium roots; few very fine vesicular pores; very strongly acid; gradual wavy boundary.

E2--46 to 64 cm (18 to 25 inches); light yellowish brown (2.5Y 6/4) loamy sand; weak fine and medium subangular blocky; very friable; few very fine and fine roots; few very fine vesicular pores; very strongly acid; clear wavy boundary. (combined thickness of the E horizon is 30 to 50 cm).

BE--64 to 71 cm (25 to 28 inches); brownish yellow (10YR 6/6) loamy sand; weak fine subangular blocky structure; very friable; few very fine and fine roots; few very fine vesicular pores; very strongly acid; clear wavy boundary. (0 to 10 cm thick).

Runclint Series

Runclint Series is excessively drained sand. The major uses are woodland and cropland, the native vegetation is Virginia Pine, black oak, white oak, hickory, post oak and scarlet oak.

A representative profile of Runclint Series:

Oi--0 to 5 cm (0 to 2 inches); slightly decomposed loblolly pine needles and twigs; abrupt smooth boundary. (0 to 5 cm)

Ap--5 to 28cm (2 to 11 inches); dark brown (10YR 3/3) sand; massive; very friable; common fine and medium roots; many very fine, and few fine irregular pores; very strongly acid; abrupt wavy boundary. (15 to 28 cm thick)

E--28 to 61 cm (11 to 24 inches); yellowish brown (10YR 5/6) sand; massive; very friable; few medium and coarse roots; many very fine irregular pores; strongly acid; clear wavy boundary. (28 to 43 cm thick)

B/E--61 to 107 cm (24 to 42 inches); yellowish red (5YR 5/8) (B) and light yellowish brown (10YR 6/4) (E) sand; common medium distinct brownish yellow (10YR 6/6) mottles; massive; very friable; few fine, medium and coarse roots; few fine and medium irregular pores; common medium rounded dark yellowish brown (10YR 3/4) soft accumulations of iron and manganese; very strongly acid; clear wavy boundary. (28 to 58 cm thick)

E--107 to 124 cm (42 to 49 inches); variegated colors of light yellowish brown (10YR 6/4) and light gray (10YR 7/2) sand; massive; very friable; common medium rounded reddish brown (5YR 4/4) soft accumulations of iron and manganese; very strongly acid; clear irregular boundary. (13 to 23 cm thick)

E & Bt--124 to 155 cm (49 to 61 inches); light yellowish brown (10YR 6/4) sand (E); single grain; loose; few yellowish brown (10YR 5/6) loamy sand lamellae 1 to 3 mm thick (Bt); weak thin platy structure; very friable; common faint continuous clay bridging between sand grains in lamellae; individual lamellae are discontinuous in length within the pedon; common medium rounded dark reddish brown (2.5YR 3/4) soft accumulations of iron and manganese; 5 percent pebbles; very strongly acid; clear irregular boundary. (15 to 30 cm thick)

C--155 to 188 cm (61 to 74 inches); pale brown (10YR 6/3) loamy coarse sand; massive; friable; common medium distinct light gray (10YR 7/1) irregular iron depletions throughout; 5 percent pebbles; very strongly acid.

Sassafras Series

Sassafras series is well drained sandy loam, with moderate or moderately slow permeability. Sassafras series is mainly used for general crops, truck crops, pastures, fruits, woodland, and wide variety of nonfarm uses. Native vegetation is mixed upland hardwoods, with some shortleaf and Virginia pine.

A representative profile of Sassafras Series:

Ap--0 to 9 inches; brown (10YR 5/3) sandy loam; weak very fine subangular blocky structure; very friable; slightly sticky, slightly plastic; few roots; strongly acid, abrupt smooth boundary. (0 to 12 inches thick)

BA--9 to 21 inches; yellowish brown (10YR 5/4) loam; moderate very fine to medium subangular blocky structure; friable; slightly sticky, slightly plastic; few roots; strongly acid; clear smooth boundary. (0 to 12 inches thick)

Bt1--21 to 32 inches; brown (7.5YR 5/4) sandy clay loam; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; few clay films on faces of peds; very few roots; very strongly acid; clear smooth boundary.

Bt2--32 to 40 inches; strong brown (7.5YR 5/6) sandy loam; weak thick platy structure parting to weak fine subangular blocky structure; friable; slightly sticky, slightly plastic; few clay films on faces of peds; very few roots; very strongly acid; abrupt smooth boundary. (Combined thickness of the Bt horizon is 10 to 20 inches.)

C1--40 to 52 inches; strong brown (7.5YR 5/6) gravelly sandy loam; massive; friable; slightly sticky, nonplastic; very strongly acid; 3 percent small light yellowish brown (10YR 6/4) pockets of clay; clear smooth boundary.

C2--52 to 70 inches; brownish yellow (10YR 6/8) loamy sand; single grain; loose; nonsticky, nonplastic; 5 percent, by volume fine yellowish brown (7.5YR 5/8) gravel; extremely acid.

Unicorn Series:

The Unicorn Series consists of very deep, well drained, moderately permeable soils on level to strongly sloping Coastal Plain uplands. They formed in loamy sediments high in silt, overlying stratified fluvial Coastal Plain sediments. Most areas of Unicorn soils are cleared and used for growing corn, soybeans, wheat, and barley. Some areas are irrigated. Areas of second growth forest contain white oak, black gum, pignut hickory, American beech, red maple, black oak, Virginia pine, tulip poplar, and sweetgum in the canopy; and lowbush blueberry, huckleberry, sassafras, dogwood, black cherry, American holly, cedar, oblong-leaf serviceberry, and deerberry in the understory.

A representative profile of Unicorn Series:

Ap--0 to 11 inches; brown (10YR 4/3) loam; weak coarse granular structure; very friable, slightly sticky and slightly plastic; common very fine and fine roots throughout; few very fine and fine tubular pores; 2 percent subrounded gravel; neutral; abrupt irregular boundary. (7 to 14 inches thick)

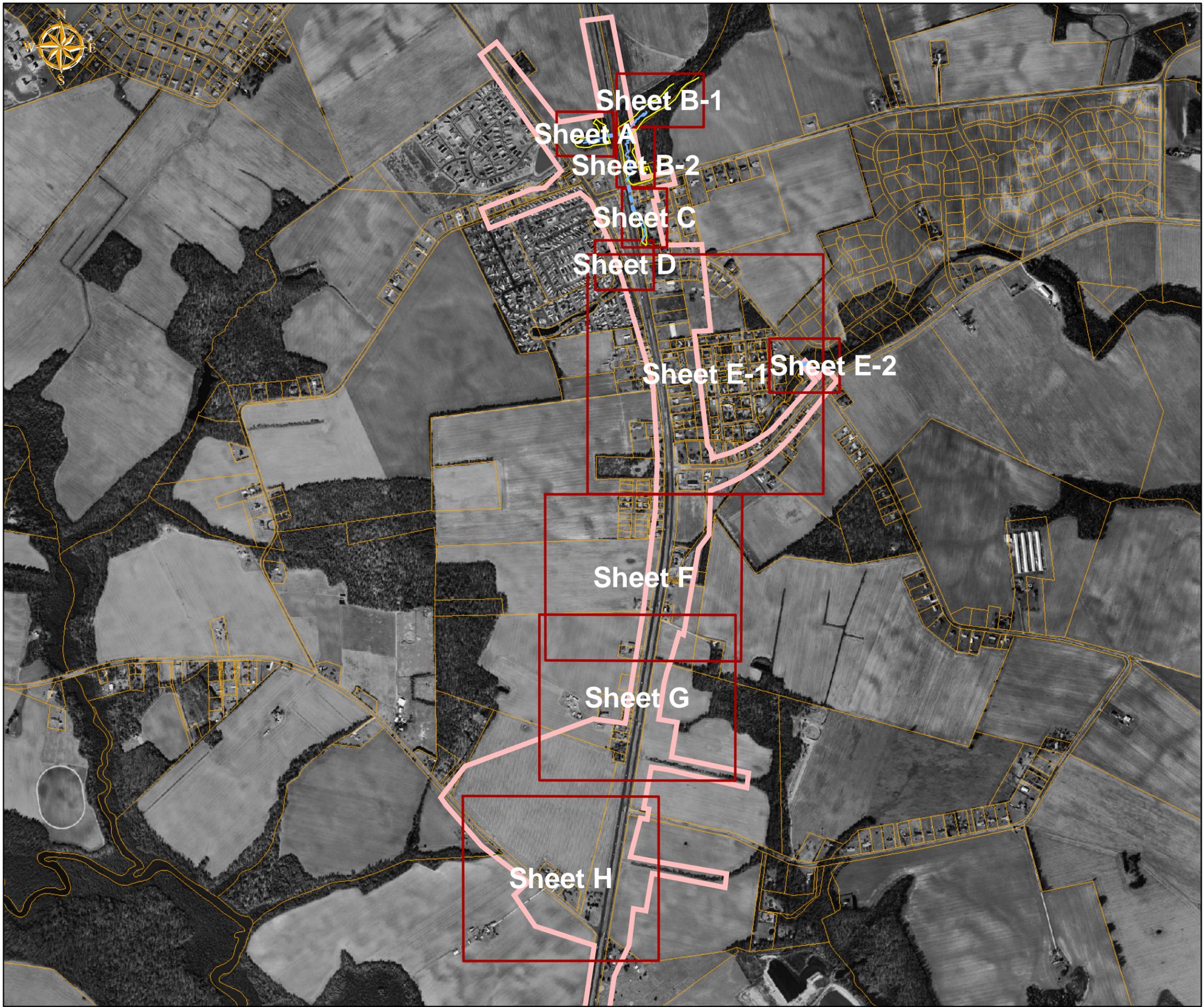
Bt/E--11 to 18 inches; dark yellowish brown (10YR 4/6) loam (Bt); yellowish brown (10YR 5/4) loam (E); moderate medium subangular blocky structure; friable, slightly sticky and slightly plastic; common very fine and fine roots throughout; few very fine and fine tubular pores and few medium tubular pores; common faint patchy yellowish brown (10YR 5/4) clay films on faces of peds; 3 percent subrounded mixed gravel; neutral; clear smooth boundary. (0 to 7 inches thick)

Bt1--18 to 24 inches; dark yellowish brown (10YR 4/6) loam; moderate medium subangular blocky structure; friable, slightly sticky and slightly plastic; few very fine and fine roots throughout; common very fine and fine tubular pores and few medium tubular pores; common faint dark yellowish brown (10YR 4/6) clay films on faces of peds and in pores; 4 percent subrounded mixed gravel; neutral; abrupt wavy boundary. (5 to 12 inches thick)

2Bt2--24 to 35 inches; strong brown (7.5YR 4/6) sandy loam; weak coarse subangular blocky structure; friable, slightly sticky and nonplastic; few fine and medium roots between peds; few very fine and fine tubular pores; common faint brown (7.5YR 4/4) clay films on faces of peds; 6 percent subangular mixed gravel; slightly acid; clear wavy boundary. (0 to 15 inches thick)

2C1--35 to 51 inches; 70 percent strong brown (7.5YR 5/8) and 30 percent brown (7.5YR 4/4) loamy sand; common yellowish brown (10YR 5/4 and 5/6), and black (10YR 2/1) lamina; single grain; very friable; strongly acid; abrupt broken boundary.

APPENDIX D:
PLAN SHEETS



**SR 1/Little Heaven
Grade Separated Intersection
Kent County, Delaware**

-  Wetland Boundary
-  "Waters of the U.S." / OHW
-  "Waters of the U.S." Contained in Pipe
-  Plan Sheet Index
-  Study Area Boundary
-  Open Water
-  Tax Parcel

Sources:
 1999 Aerial Photography
 Century Engineering
 Kent County, Delaware
 A.D. Marble Site Investigation

Project Plan Index
 Revised Per USACE on 07/31/08



December 2008



SR 1/Little Heaven Grade Separated Intersection Kent County, Delaware



-  Photograph Location
-  Sampling Point
-  Wetland Flag Point
-  DelDot Survey Monument
-  Wetland Boundary
-  "Waters of the U.S." / OHW
-  "Waters of the U.S." Contained in Pipe
-  Study Area Boundary
-  Open Water
-  Tax Parcel

Sources:
 1999 Aerial Photography
 Century Engineering
 Kent County, Delaware
 A.D. Marble Site Investigation

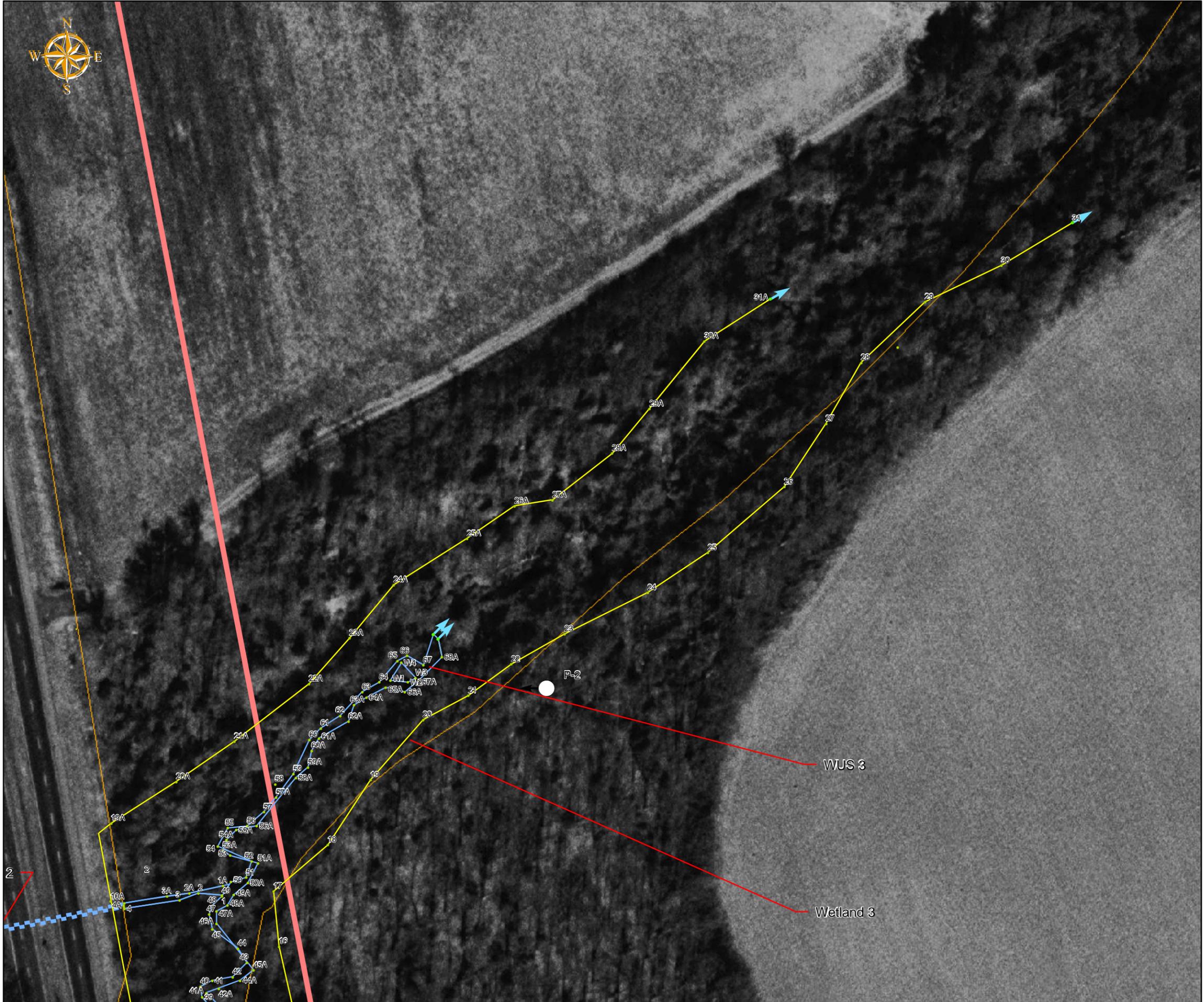
Project Plan Sheet A
 Revised Per USACE on 07/31/08

1 inch = 60 feet

December 2008



**SR 1/Little Heaven
Grade Separated Intersection
Kent County, Delaware**



- Photograph Location
- Sampling Point
- Wetland Flag Point
- DelDot Survey Monument
- Wetland Boundary
- "Waters of the U.S." / OHW
- "Waters of the U.S." Contained in Pipe
- Study Area Boundary
- Open Water
- Tax Parcel

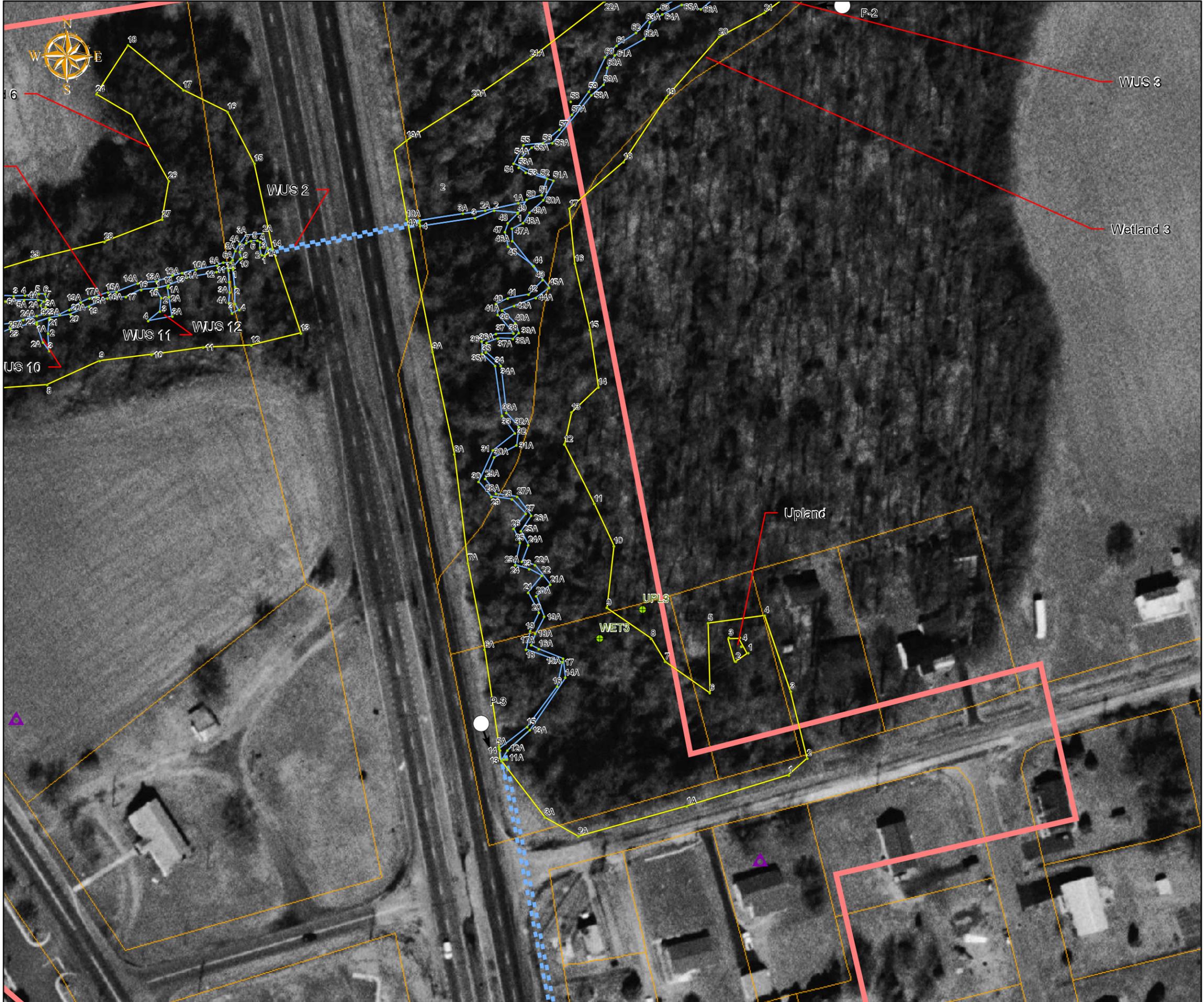
Sources:
1999 Aerial Photography
Century Engineering
Kent County, Delaware
A.D. Marble Site Investigation

Project Plan Sheet B-1
Revised Per USACE on 07/31/08

1 inch = 100 feet

December 2008

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**SR 1/Little Heaven
Grade Separated Intersection
Kent County, Delaware**

-  Photograph Location
-  Sampling Point
-  Wetland Flag Point
-  DelDot Survey Monument
-  Wetland Boundary
-  "Waters of the U.S." / OHW
-  "Waters of the U.S." Contained in Pipe
-  Study Area Boundary
-  Open Water
-  Tax Parcel

Sources:
 1999 Aerial Photography
 Century Engineering
 Kent County, Delaware
 A.D. Marble Site Investigation

Project Plan Sheet B-2
 Revised Per USACE on 07/31/08

1 inch = 100 feet

December 2008

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**SR 1/Little Heaven
Grade Separated Intersection
Kent County, Delaware**

-  Photograph Location
-  Sampling Point
-  Wetland Flag Point
-  DelDot Survey Monument
-  Wetland Boundary
-  "Waters of the U.S." / OHW
-  "Waters of the U.S." Contained in Pipe
-  Study Area Boundary
-  Open Water
-  Tax Parcel

Sources:
 1999 Aerial Photography
 Century Engineering
 Kent County, Delaware
 A.D. Marble Site Investigation

Project Plan Sheet C
 Revised Per USACE on 07/31/08

1 inch = 70 feet

December 2008



**SR 1/Little Heaven
Grade Separated Intersection
Kent County, Delaware**

-  Photograph Location
-  Sampling Point
-  Wetland Flag Point
-  DelDot Survey Monument
-  Wetland Boundary
-  "Waters of the U.S." / OHW
-  "Waters of the U.S." Contained in Pipe
-  Study Area Boundary
-  Open Water
-  Tax Parcel

Sources:
 1999 Aerial Photography
 Century Engineering
 Kent County, Delaware
 A.D. Marble Site Investigation

Project Plan Sheet D
 Revised Per USACE on 07/31/08

1 inch = 70 feet

December 2008



**SR 1/Little Heaven
Grade Separated Intersection
Kent County, Delaware**

-  Photograph Location
-  Sampling Point
-  Wetland Flag Point
-  DelDot Survey Monument
-  Wetland Boundary
-  "Waters of the U.S." / OHW
-  "Waters of the U.S." Contained in Pipe
-  Study Area Boundary
-  Open Water
-  Tax Parcel

Sources:
 1999 Aerial Photography
 Century Engineering
 Kent County, Delaware
 A.D. Marble Site Investigation

Project Plan Sheet E-1
 Revised Per USACE on 07/31/08

1 inch = 300 feet

December 2008

Map Document: X:\Projects\SR1_CCRP\0731\Maping\0731\ProjectPlanSheetE-1.mxd
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**SR 1/Little Heaven
Grade Separated Intersection
Kent County, Delaware**

-  Photograph Location
-  Sampling Point
-  Wetland Flag Point
-  DelDot Survey Monument
-  Wetland Boundary
-  "Waters of the U.S." / OHW
-  "Waters of the U.S." Contained in Pipe
-  Study Area Boundary
-  Open Water
-  Tax Parcel

Sources:
 1999 Aerial Photography
 Century Engineering
 Kent County, Delaware
 A.D. Marble Site Investigation

Project Plan Sheet E-2
 Revised Per USACE on 07/31/08

1 inch = 60 feet

December 2008



SR 1/Little Heaven Grade Separated Intersection Kent County, Delaware

- Photograph Location
- Sampling Point
- Wetland Flag Point
- DelDot Survey Monument
- Wetland Boundary
- "Waters of the U.S." / OHW
- "Waters of the U.S." Contained in Pipe
- Study Area Boundary
- Open Water
- Tax Parcel

Sources:
 1999 Aerial Photography
 Century Engineering
 Kent County, Delaware
 A.D. Marble Site Investigation

Project Plan Sheet F
 Revised Per USACE on 07/31/08

1 inch = 200 feet

December 2008



SR 1/Little Heaven Grade Separated Intersection Kent County, Delaware

-  Photograph Location
-  Sampling Point
-  Wetland Flag Point
-  DelDot Survey Monument
-  Wetland Boundary
-  "Waters of the U.S." / OHW
-  "Waters of the U.S." Contained in Pipe
-  Study Area Boundary
-  Open Water
-  Tax Parcel

Sources:
 1999 Aerial Photography
 Century Engineering
 Kent County, Delaware
 A.D. Marble Site Investigation

Project Plan Sheet G

Revised Per USACE on 07/31/08

1 inch = 200 feet

December 2008



**SR 1/Little Heaven
Grade Separated Intersection
Kent County, Delaware**

-  Photograph Location
-  Sampling Point
-  Wetland Flag Point
-  DelDot Survey Monument
-  Wetland Boundary
-  "Waters of the U.S." / OHW
-  "Waters of the U.S." Contained in Pipe
-  Study Area Boundary
-  Open Water
-  Tax Parcel

Sources:
 1999 Aerial Photography
 Century Engineering
 Kent County, Delaware
 A.D. Marble Site Investigation

Project Plan Sheet H
 Revised Per USACE on 07/31/08

1 inch = 200 feet

December 2008

APPENDIX E:
WETLANDS AND WATERWAYS
NORTHINGS AND EASTINGS
SURVEY COORDINATES

DeIDOT SR 1, Little Heaven Interchange Survey Coordinates

Wetland and Waterways Flag	Northing	Easting	Elevation
Wetland 1			
WL2-1	382582.1716	644253.5655	9.6030
WL2-2	382572.1764	644273.1883	11.6745
WL2-3	382535.8612	644321.8466	12.4216
WL2-4	382507.1809	644334.7220	11.3683
WL2-5	382464.2228	644355.4105	11.0494
WL2-6	382429.7734	644367.0735	10.8481
WL2-7	382382.9659	644388.0025	12.1836
WL2-8	382325.1557	644397.8287	12.6505
WL2-9	382270.3291	644399.6784	11.9295
WL2-10	382229.9463	644390.6865	13.0510
WL2-11	382203.4176	644402.8917	13.7561
WL2-12	382162.9291	644389.4575	13.8874
WL2-13	382217.2374	644331.1203	13.1774
WL2-14	382270.7612	644351.8341	12.6558
WL2-15	382345.7484	644346.8996	11.2550
WL2-16	382404.5462	644332.2596	11.6505
WL2-17	382439.5209	644316.6926	12.0043
WL2-18	382494.5924	644292.3789	11.0818
WL2-19	382536.5448	644261.3374	10.4102
WL2-20	382577.0988	644245.9635	9.7620
Wetland 3			
WL5-1	382984.5608	644451.9819	10.2760
WL5-1A	382952.3735	644345.5530	9.8855
WL5-2	383001.9453	644471.4313	11.0411
WL5-2A	382921.0363	644232.2247	10.0858
WL5-3	383071.5677	644454.1948	11.7897
WL5-3A	382940.7124	644197.3743	9.8336
WL5-4	383150.8951	644426.8610	12.5726
WL5-4A	383001.5054	644150.1790	10.0657
WL5-5	383142.9584	644367.8791	12.0369
WL5-5A	383013.9566	644149.4293	9.7881
WL5-6	383070.0151	644369.6819	10.4936
WL5-6A	383115.0962	644134.4011	9.8272
WL5-7	383102.5440	644323.0766	10.3681
WL5-7A	383205.5744	644116.9068	9.5431
WL5-8	383126.7776	644308.3517	10.8436
WL5-8A	383318.4681	644102.6790	8.3426
WL5-9	383158.7405	644262.0092	10.9751
WL5-9A	383425.6932	644079.9843	8.0381
WL5-10	383223.0965	644269.5286	10.7826
WL5-10A	383563.6515	644052.6279	9.6209
WL5-11	383267.1814	644248.7354	11.1233
WL5-12	383328.9851	644217.8078	10.2881
WL5-13	383362.3238	644225.2599	9.4521
WL5-14	383388.4184	644253.1430	8.8014
WL5-15	383448.1140	644244.3730	8.9742
WL5-16	383517.1763	644228.5755	9.0792
WL5-17	383574.4596	644222.9317	8.3966

DeIDOT SR 1, Little Heaven Interchange Survey Coordinates

WL5-18	383622.8849	644279.5680	8.7626
WL5-19	383690.2607	644324.2302	8.7631
WL5-19A	383645.5567	644053.2375	8.3402
WL5-20	383753.1075	644379.4280	8.4644
WL5-20A	383688.5422	644121.2047	9.1151
WL5-21	383778.0925	644426.3744	9.2037
WL5-21A	383730.5614	644182.0317	8.8282
WL5-22	383811.0146	644471.5765	8.2750
WL5-22A	383790.4558	644260.1434	8.0193
WL5-23	383842.3740	644527.0689	8.0244
WL5-23A	383838.1658	644302.4327	7.8880
WL5-24	383885.2701	644614.0493	8.9652
WL5-24A	383893.4454	644348.6990	8.0509
WL5-25	383926.9580	644676.7421	9.4800
WL5-25A	383941.6375	644425.1807	8.6691
WL5-26	383995.6691	644756.9879	9.6909
WL5-26A	383975.6056	644474.8435	8.8040
WL5-27	384061.4078	644800.3798	8.4161
WL5-27A	383981.9536	644514.5621	8.3571
WL5-28	384124.8235	644837.1242	6.5599
WL5-28A	384030.3943	644577.0248	8.0505
WL5-29	384188.2463	644903.9814	7.3730
WL5-29A	384077.0228	644615.8357	8.4647
WL5-30	384225.9817	644983.5709	7.3231
WL5-30A	384147.0423	644673.2918	7.8609
WL5-31	384270.5432	645057.8519	7.4225
WL5-31A	384190.9784	644742.1049	7.6238
Wetland 6			
WL9-1	383421.4830	643321.7705	16.1417
WL9-2	383436.0814	643391.3851	14.9935
WL9-3	383395.6765	643471.1239	14.3864
WL9-4	383404.8189	643482.4886	14.2483
WL9-5	383410.4237	643510.4513	12.7383
WL9-6	383386.9113	643620.0640	10.8788
WL9-8	383396.6106	643543.6006	12.5844
WL9-8	383390.7821	643676.8169	9.9909
WL9-9	383416.0207	643731.8470	8.7623
WL9-10	383422.1906	643786.1743	10.0621
WL9-11	383429.9689	643839.7602	9.8021
WL9-12	383432.3093	643890.2609	10.5841
WL9-13	383444.7888	643942.1936	10.5191
WL9-14	383532.2710	643912.6861	9.6448
WL9-15	383621.3381	643893.5675	9.6023
WL9-16	383675.3065	643865.6434	10.4819
WL9-17	383697.9838	643819.4523	10.3115
WL9-18	383744.6409	643761.7378	11.3536
WL9-19	383849.8427	643594.6004	13.2213
WL9-20	383941.2728	643525.8645	13.9700
WL9-21	383931.9961	643423.5530	13.8246
WL9-22	383852.6996	643452.6916	14.0944
WL9-23	383782.4969	643580.2132	13.4442

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WL9-24	383693.6914	643728.4250	11.2242
WL9-25	383671.8269	643765.3438	10.0766
WL9-26	383603.2760	643804.1349	9.6681
WL9-27	383563.2973	643797.3107	8.7708
WL9-28	383540.0726	643737.0603	9.7389
WL9-29	383521.2741	643660.1428	10.8784
WL9-30	383502.8825	643599.7343	11.2039
WL9-31	383516.5812	643543.3995	13.2112
WL9-32	383483.0970	643456.3220	14.1412
WL9-33	383446.8081	643341.6312	15.3979
WL9-34	383424.6610	643319.1853	16.3335
WUS 2			
WUS 2/East Side			
WUS6-1	383570.3499	644168.7512	7.0146
WUS6-1A	383580.1612	644169.8909	6.7088
WUS6-2	383572.4210	644144.1625	6.2545
WUS6-2A	383572.4479	644135.1251	6.0940
WUS6-3	383565.0296	644124.3872	6.2947
WUS6-3A	383569.3614	644111.7160	5.6721
WUS6-4	383556.2915	644067.1266	6.6965
WUS6-4A	383562.2451	644067.0784	6.4335
WUS 2/West Side			
WUS3A-1A	383533.2319	643907.2294	6.9228
WUS3A-2A	383548.5617	643902.5298	7.365
WUA3A-3A	383547.0395	643885.2404	7.0001
WUA3A-4A	383537.6531	643878.1273	6.2754
WUA3A-5A	383530.2889	643873.3874	6.5874
WUA3A-6A	383520.8663	643870.8237	7.1042
WUA3A-7A	383518.0744	643868.3307	6.4354
WUA3A-1	383525.3759	643904.1003	7.0387
WUA3A-2	383526.0618	643901.0572	7.8686
WUA3A-3	383533.7679	643899.2975	7.7505
WUA3A-4	383539.5207	643899.4011	7.0506
WUS3A-5	383541.3006	643896.5106	6.9825
WUA3A-6	383540.5385	643889.6366	7.1448
WUS3A-7	383538.6578	643884.8078	7.0166
WUS 3			
WUS5-1	382220.4769	644337.7825	10.2421
WUS5-1A	382214.4439	644346.6445	14.0812
WUS5-2	382242.5224	644346.3194	10.9604
WUS5-2A	382241.5328	644358.2857	11.2280
WUS5-3A	382263.1084	644363.6057	10.4122
WUS5-3A	382271.1696	644355.2608	9.8815
WUS5-4	382296.5557	644380.8986	10.4438
WUS5-4A	382292.0181	644387.7851	10.8048
WUS5-5	382311.2651	644379.0971	10.0713
WUS5-5A	382319.4226	644389.5218	9.7993
WUS5-6	382335.4593	644368.7446	9.6607
WUS5-6A	382380.3320	644375.2003	9.7740

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WUS5-7	382364.9575	644367.1726	9.9766
WUS5-7A	382413.8681	644369.6396	9.7392
WUS5-8	382384.3522	644339.6737	10.2036
WUS5-8A	382435.8034	644357.2379	8.7213
WUS5-9	382425.5355	644330.2238	9.8409
WUS5-9A	382523.6047	644304.3207	8.7706
WUS5-11A	383000.7658	644157.6912	9.6887
WUS5-12A	383010.6252	644158.5748	9.1336
WUS5-13	382999.7311	644151.9015	10.1264
WUS5-13A	383031.6002	644181.7893	6.9660
WUS5-14	383012.3768	644149.7903	9.8288
WUS5-14A	383085.7936	644218.9712	6.5669
WUS5-14A	383102.2795	644215.6327	6.4176
WUS5-15	383034.8063	644178.8993	6.1016
WUS5-15A	383106.0149	644216.6350	5.3707
WUS5-16	383077.0312	644210.2742	6.8693
WUS5-16A	383116.0708	644191.0357	7.7097
WUS5-17	383102.2721	644215.6514	6.4194
WUS5-17A	383119.7922	644183.0968	7.1756
WUS5-18	383115.6386	644177.8545	6.8583
WUS5-18A	383132.0696	644187.5638	6.5039
WUS5-19	383134.4609	644181.9222	5.7695
WUS5-19A	383149.5342	644196.8403	6.6963
WUS5-20	383153.7686	644191.2317	7.1317
WUS5-20A	383171.0282	644188.5301	7.8455
WUS5-21	383174.8963	644179.9232	7.5318
WUS5-21A	383182.7731	644203.3240	7.6898
WUS5-22	383192.3341	644194.0547	6.5894
WUS5-22A	383203.1680	644187.1187	5.8408
WUS5-23	383199.3498	644181.1764	6.8499
WUS5-23A	383206.8890	644173.3647	7.5922
WUS5-24	383203.6082	644166.3229	7.3370
WUS5-24A	383224.3790	644180.2996	6.2889
WUS5-25	383226.4602	644171.4269	7.1667
WUS5-25A	383239.0427	644172.4593	6.4380
WUS5-26	383241.0921	644164.8660	7.0060
WUS5-26A	383254.9371	644183.2389	5.8750
WUS5-27	383256.7475	644177.5178	6.4309
WUS5-27A	383274.7248	644168.4710	6.0630
WUS5-28	383272.0122	644163.1523	6.6832
WUS5-28A	383277.6155	644146.6110	6.2265
WUS5-29	383274.8050	644141.3350	6.0180
WUS5-29A	383292.8572	644135.0808	6.2049
WUS5-30	383290.2058	644128.1651	6.1159
WUS5-30A	383315.6504	644144.5669	6.8561
WUS5-31	383322.4275	644142.7659	7.3531
WUS5-31A	383328.0234	644167.8617	5.2487
WUS5-32	383340.7056	644165.9185	6.8762
WUS5-32A	383347.1287	644170.2138	5.2612
WUS5-33	383358.6688	644152.6176	5.5526
WUS5-33A	383362.0294	644157.2211	6.2259
WUS5-34	383410.7182	644145.2871	6.0018

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WUS5-34A	383410.7772	644151.3897	6.0256
WUS5-35	383423.3660	644131.7239	5.4440
WUS5-35A	383424.8876	644135.9418	5.3536
WUS5-36	383436.1614	644131.5260	5.5184
WUS5-36A	383435.0470	644136.4100	6.4978
WUS5-37	383444.3948	644146.2713	5.3448
WUS5-37A	383439.5152	644148.4670	6.2207
WUS5-38	383444.6702	644164.8319	6.6405
WUS5-38A	383439.0557	644164.1801	6.0785
WUS5-39	383463.9427	644148.1493	6.0639
WUS5-39A	383445.2520	644170.1391	5.4013
WUS5-40	383475.1454	644146.5604	6.1856
WUS5-40A	383454.8843	644166.4970	5.2132
WUS5-41	383481.2970	644158.6950	6.0298
WUS5-41A	383468.6992	644152.7869	5.9649
WUS5-42A	383473.3862	644165.5964	5.9911
WUS5-42	383485.3211	644180.3638	5.4331
WUS5-43	383500.1086	644195.0519	5.9923
WUS5-44	383515.0095	644185.7615	6.3794
WUS5-44A	383481.7423	644188.1335	5.5545
WUS5-45	383534.9316	644158.9882	6.9397
WUS5-45A	383492.3613	644202.0104	6.0704
WUS5-46A	383541.0684	644163.3865	5.4773
WUS5-47	383550.3732	644155.5596	6.7778
WUS5-47A	383553.5983	644163.2736	5.4134
WUS5-48	383559.4220	644158.8424	6.9532
WUS5-48A	383559.7321	644174.7230	5.5592
WUS5-49	383569.5068	644168.9385	6.9773
WUS5-49A	383570.6540	644181.5288	6.9134
WUS5-50	383584.0263	644178.3811	6.5648
WUS5-50A	383583.2264	644195.9678	5.5990
WUS5-51	383588.6273	644193.9881	4.9064
WUS5-51A	383603.5965	644206.6259	5.3114
WUS5-52	383605.7734	644199.9661	5.2068
WUS5-53	383611.8425	644177.4838	5.3606
WUS5-53A	383617.2492	644170.2125	5.6503
WUS5-54	383621.2601	644164.6846	4.5772
WUS5-54A	383627.9856	644173.6275	5.7209
WUS5-55	383640.4128	644175.0682	5.5021
WUS5-55A	383638.3420	644183.9312	5.6732
WUS5-56	383642.4957	644195.3788	5.4107
WUS5-56A	383642.8085	644205.3815	4.4687
WUS5-57	383656.9759	644212.7702	5.8621
WUS5-57A	383672.3268	644225.8212	5.5180
WUS5-58	383685.9564	644224.5039	5.3159
WUS5-58A	383692.6090	644246.2972	5.3079
WUS5-59	383696.6102	644243.5485	5.2105
WUS5-59A	383703.6800	644258.9048	5.2500
WUS5-60	383732.2049	644260.3868	4.8774
WUS5-60A	383720.8649	644262.7093	5.3096
WUS5-61	383744.2168	644272.1678	5.2832
WUS5-61A	383733.8319	644270.3710	5.5845

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WUS5-62	383757.5456	644292.6941	5.0351
WUS5-62A	383751.2982	644301.4196	4.8915
WUS5-63	383781.9646	644315.5348	4.6787
WUS5-63A	383768.3895	644307.0810	5.1457
WUS5-64	383792.0004	644333.5053	4.9288
WUS5-64A	383776.5078	644320.2187	4.9049
WUS5-65	383814.5400	644352.4911	4.9765
WUS5-65A	383786.8921	644340.3999	5.0126
WUS5-66	383819.6703	644362.5638	4.9605
WUS5-66A	383782.0641	644360.3917	5.7471
WUS5-67	383809.9213	644379.6471	4.9003
WUS5-67A	383794.9515	644375.6955	4.8091
WUS5-68	383841.9492	644389.8850	4.8390
WUS5-68A	383818.4185	644398.9368	5.0935
WUS5-69A	383837.4579	644394.9970	4.2790
WUS5-W1	383793.9831	644345.0416	5.6355
WUS5-W2	383792.2105	644363.4524	5.0649
WUS5-W3	383796.3769	644371.6578	4.9580
WUS5-W4	383812.4268	644356.7624	5.9400
WUS 9			
WUS09-01	374530.0114	642466.4756	19.2929
WUS09-01A	374527.7419	642467.9209	19.3494
WUS09-02	374534.1532	642498.9248	19.6074
WUS09-02A	374532.2807	642506.2797	19.9614
WUS09-03	374538.474	642541.0161	19.8411
WUS09-03A	374536.3368	642544.759	19.954
WUS09-04	374535.1635	642566.2486	19.9492
WUS09-04A	374533.4024	642561.0377	19.8496
WUS09-05	374533.8449	642581.2819	20.1547
WUS09-05A	374531.0401	642580.2845	20.0276
WUS09-06	374542.1821	642590.6281	20.7714
WUS09-06A	374540.0363	642592.6092	20.1984
WUS 10			
WUS10-01	374705.3711	642410.071	22.4545
WUS10-01A	374704.5993	642409.0989	22.5518
WUS10-02	374702.4189	642413.8884	22.292
WUS10-02A	374701.5835	642412.9046	22.5286
WUS10-03	374671.0822	642446.2085	22.0094
WUS10-03A	374670.6321	642445.7115	22.8572
WUS10-04	374641.8098	642477.5437	21.4642
WUS10-04A	374640.7915	642476.5368	21.4312
WUS10-05	374600.8437	642523.1323	21.3586
WUS10-05A	374599.8817	642521.8704	21.372
WUS10-06	374555.6138	642573.3557	21.6303
WUS10-06A	374554.3111	642572.0124	21.7521
WUS10-7	374541.6924	642589.1076	20.6939
WUS10-7A	374540.7506	642587.9876	20.8284
WUS10-8	374538.4559	642592.9976	20.5468
WUS10-8A	374536.5272	642591.8712	20.8739

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WUS10-9	374534.4673	642598.2001	21.2048
WUS10-9A	374533.1166	642597.2609	21.3222
WUS 11			
WUS11-01	374598.856	642581.4859	21.7695
WUS11-01A	374597.4515	642580.4586	21.7814
WUS11-02	374579.8832	642603.4519	21.3958
WUS11-02A	374578.6848	642602.302	21.4658
WUS11-03	374569.5665	642615.8464	21.4348
WUS11-03A	374567.1964	642614.086	20.8872
WUS11-04	374567.3826	642617.1947	21.026
WUS11-04A	374565.5733	642615.7894	20.8559
WUS11-05	374564.839	642621.0312	21.7109
WUS11-05A	374563.1836	642620.0476	21.8283
WUS 12			
WUS12-1	383510.8708	643871.0697	7.1913
WUS12-2	383493.1999	643873.1306	8.0146
WUS12-3	383475.0882	643873.0975	7.7106
WUS12-4	383468.9708	643877.3078	7.6317
WUS12-1A	383509.9248	643866.469	6.7503
WUS12-2A	383498.3259	643867.2741	7.4791
WUS12-3A	383487.545	643867.737	7.594
WUS12-4A	383476.6804	643866.7567	8.0169
WUS12-4A	383465.4223	643870.2433	7.7241
WUS 13			
WUS13-4A	380670.5659	646367.3147	18.0299
WUS13-5A	380667.4573	646343.0162	15.9964
WUS13-6A	380659.6933	646321.6046	15.934
WUS13-4	380664.1837	646368.7875	16.4635
WUS13-5	380660.4655	646346.1795	16.2409
WUS13-6	380655.7413	646325.6502	16.5154
WUS13-1A	380687.2185	646424.6878	16.332
WUS13-2A	380683.4883	646436.1294	15.5722
WUS13-3A	380692.4733	646463.7271	16.1597
WUS13-1	380670.8847	646426.2982	16.3851
WUS13-2	380676.2732	646440.8449	17.1218
WUS13-3	380684.3975	646458.428	17.9752
Upland Data Points			
UPL5-1	383111.9519	644409.7007	11.9458
UPL5-2	383102.9944	644396.8505	11.9887
UPL5-3	383127.4227	644389.6600	12.0549
UPL5-4	383127.8155	644401.1569	13.0085
Monuments			
DeIDOT-1	385914.3299	643531.4715	16.8565
DeIDOT-2	384036.3107	643895.7503	15.1873
DeIDOT-3	383534.4330	643229.8907	19.6993
DeIDOT-4	382720.2758	643805.0879	17.2213
DeIDOT-5	381583.4236	644286.3588	23.0783

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DeIDOT-6	380853.6241	644566.5712	26.1943
DeIDOT-7	379590.5105	644682.8783	25.287
DeIDOT-8	379362.3395	644946.8664	28.0223
DeIDOT-9	379458.2948	645680.7999	26.8323
DeIDOT-10	379871.8657	646154.7947	22.6223
DeIDOT-11	380403.2372	646566.1022	23.1723
DeIDOT-12	381018.6129	646122.8330	19.8623
DeIDOT-13	381943.1543	645290.8173	23.3223
DeIDOT-14	382045.1107	644855.9344	19.8823
DeIDOT-15	382984.1747	644600.2159	13.1923
DeIDOT-16	382913.1224	644176.0509	11.3623
DeIDOT-17	378115.8344	644552.8740	31.477
DeIDOT-18	377017.2987	644508.1338	34.997
DeIDOT-19	375305.2808	644082.7679	32.187
DeIDOT-20	374192.7608	644024.4095	30.237



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