

**SOIL INVESTIGATIVE REPORT FOR COMMUNITY,  
LARGE ON-SITE WASTEWATER TREATMENT AND  
DISPOSAL FOR SITING RAPID INFILTRATION BASINS  
AND  
SITE SELECTION AND EVALUATION REPORT FOR  
SPRAY IRRIGATION**

FOR THE

**LANDS OF WANDENDALE FARMS, INC.**

**SUSSEX COUNTY, DELAWARE**

**Tax Map 2-34-7.00 Parcels 127.00 and 130.00  
and Tax Map 2-34-11.00 Parcels 48.00 and 50.00**

July 23, 2009

*Prepared for:*

Mr. Bruce Patrick  
Tidewater Environmental Services, Inc.  
1100 South Little Creek Road  
Dover, DE 19901

**COPY**

*Prepared by:*

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**SOIL INVESTIGATIVE REPORT BY  
TERRA FIRMA CONSULTING, INC.  
APPROVAL PAGE**

The Soil Investigative Report (SIR) submitted for review is approved when the following is completed in full and signed by the approving authority. This Approval Page does not absolve the engineer, client, or any other interested party from the responsibility of reading the accompanying Site Investigation Report in its entirety prior to using any of the information contained herein. Alteration of the soils within the proposed treatment and disposal area by any means, **may negate** this approval or modify the type of system that can be permitted. The LOWTDS area is currently an open field. An approved SIR must accompany any permit application. Further, approval of the SIR does not imply all other regulatory requirements have been met (such as PGIA approval, groundwater mounding analysis, consideration of pollution control strategies, etc.). This is not a construction permit.

**Project Name:** Lands of Wandendale Farms, Inc.

**Tax Map #'s:** 2-34-7.00-127.00 and 130.00  
2-34-11.00-48.00 and 50.00

**Project Location:** East and West off State Route 24 (John J. Williams Highway); East and West of Camp Arrowhead Road (CR 279); north of CR 277 (Robinsonville Road and/or Angola Road); in Sussex County, Delaware

**Property Owner's Name & Address:**

Wandendale Farms, Inc.  
821 Savannah Road  
Lewes, DE 19958

**Wastewater Utility Name & Address:**

Tidewater Environmental Services, Inc.  
1100 South Little Creek Road  
Dover, DE 19901

**Proposed Soil Absorption System:** Rapid Infiltration Basins (2)

**Permeability Rate Assigned:** 2.5 MPI/ 24 In/Hr RIB Area A; 80 MPI/ 0.75 In/Hr RIB Area B; See Section 3.1.3 of Accompanying Soil Investigative Report

**Existing Permitted Wastewater Flow:** 934,000 gallons per day (as currently proposed)

**Number of Dwelling Units:** Regional Wastewater Facility only; No proposed dwelling units

**Design Considerations and Comments:** See Section 3.2.2 of Accompanying Report

This report has been prepared by or under the supervision of: \_\_\_\_\_, License # 2403

Lisa S. Wood

**TERRA FIRMA CONSULTING, INC., P.O. Box 938 \* Ocean View, DE 19970**

**Disclaimer:** Approval of this Site Investigation Report indicates only that the site investigation, **based on information presented to us**, was conducted in compliance with these regulations. It is not an indication of the correctness or quality of the evaluation nor does it guarantee the evaluation is free of omissions.

For Office Use Only

Field Checked: 3/12/08, 3/17/08, 3/25/08

Expiration Date \_\_\_\_\_

Date \_\_\_\_\_

\_\_\_\_\_  
DNREC Reviewing Soil Scientist

Departmental Review Comments/Suggestions:

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## TABLE OF CONTENTS

Introduction .....	2
1.0 SITE DESCRIPTION .....	4
1.1 General Location .....	4
1.2 Topographic Map .....	4
1.3 Existing Soil Survey Mapping.....	5
1.4 Generalized Site Investigation Observations .....	6
1.5 Project Description and Flow Projections .....	7
2.0 GENERAL SOIL CHARACTERISTICS.....	7
2.1 Community, Large On-Site Wastewater Treatment and Disposal System Area Selection .....	7
3.0 DETAILED SOILS INVESTIGATION.....	8
3.1 Soil Identification and Discussion .....	8
3.1.1 Soil Units Defined .....	9
3.1.2 Soil Particle Size Analysis.....	10
3.1.3 Soil Permeability Considerations .....	11
3.2 Disposal System Recommendations and Summary .....	12
3.2.1 Regulatory Summary .....	12
3.2.2 Design Considerations and Comments .....	12
4.0 HYDROLOGY/OBSERVATION WELL/PIEZOMETER MONITORING .....	14
5.0 USE LIMITATIONS.....	15

## Introduction

Mr. Bruce Patrick of Tidewater Environmental Services, Inc. (TESI) retained Terra Firma Consulting, Inc. (TFCI) of Ocean View, Delaware to conduct the necessary on site soils investigations to complete a Soil Investigative Report for Community, Large On-Site Wastewater Treatment and Disposal for siting Rapid Infiltration Basins and a Site Selection and Evaluation Report for Spray Irrigation (LOWTDS) on the lands identified as Sussex County Tax Map Number 2-34-7.00 Parcels 127.00 and 130.00 and Tax Map Number 2-34-11.00 Parcels 48.00 and 50.00. These investigations were conducted in accordance with Delaware Department of Natural Resources and Environmental Control Regulations Governing the Design, Installation, and Operation of On-Site Wastewater Treatment and Disposal Systems as well as the Guidance Regulations Governing the Land Treatment of Wastes. Part 1 of this report consists of the Soil Investigative Report conducted in accordance with Section 5.12000 of the aforementioned regulations for siting and design of the RIBS while Part 2 consists of the Site Selection and Evaluation Report prepared in accordance with Table 201-2 of the aforementioned Guidelines for spray irrigation.

The project is currently known as the *Wandendale Regional Wastewater Treatment and Disposal Facility*. As currently proposed the system would utilize two (2) Rapid Infiltration Basins totaling approximately 19.72 acres and approximately 150.91 acres for Spray Irrigation situated as shown on the attached Preliminary Site Plan (Sheets 1-4) prepared by Cabe Associates, Inc. (CABE), the consulting engineers on the project. All surveying services were coordinated through CABE and were performed by Charles Murphy and Associates, Inc. According to CABE, this project meets the on-site wastewater treatment and disposal system performance standards for both nitrogen and phosphorus in the recently promulgated Regulations Governing the Pollution Control Strategy for the Indian River, Indian River Bay, Rehoboth Bay and Little Assawoman Bay Watersheds. The detailed hydrogeologic investigation is being prepared by Mr. Thomas Dwyer. Eastern Geosciences, Inc. (EGI). The GIA report and supporting documentation will be provided under separate cover.

All pertinent information is provided in the enclosed appendices, including: Appendix A— Reproductions of Zoning Information, General Location Map, Sussex County Tax Map, USGS 7.5 Minute Topographic Map – Fairmount Quadrangle, U.S. Department of Agriculture, NRCS Soil Survey Geographic (SSURGO) – DE005; National Wetlands Inventory Map – Fairmount Quadrangle, and USGS Hydrologic Atlas Map (HA-109); Appendix B— Particle Size Analysis, Soil Boring Analysis, Minimum RIB Invert Elevations, and Logged Soil Profile Descriptions; Appendix C—Infiltration Test Data; Appendix D—Observation Well/Piezometer Data; and Appendix E—Site Photographs. The packet in the rear of the report contains all site plans referenced in this report.

# **PART 1**

## **SOIL INVESTIGATIVE REPORT FOR COMMUNITY, LARGE ON-SITE WASTEWATER TREATMENT AND DISPOSAL FOR SITING RAPID INFILTRATION BASINS**

FOR THE

**LANDS OF WANDENDALE FARMS, INC.**

**SUSSEX COUNTY, DELAWARE**

**Tax Map 2-34-7.00 Parcels 127.00 and 130.00  
and Tax Map 2-34-11.00 Parcels 48.00 and 50.00**

## **1.0 SITE DESCRIPTION**

### **1.1 General Location**

A General Location Map and a reproduction of the Sussex County Tax Map for 2-34-7.00 Parcels 127.00 and 130.00 and Tax Map 2-34-11.00 Parcels 48.00 and 50.00 are included in Appendix A for review. The evaluated area includes four separate tax map parcels. Tax Map 2-34-11.00 Parcel 48.00 is located on the west side of State Route 24 (John J. Williams Highway); the eastern boundary is contiguous to County Road 277 (Robinsonville Road) and includes 48.53± acres. Tax Map 2-34-11.00 Parcel 50.00 is located east of State Route 24 (John J. Williams Highway), north of County Road 277 (Angola Road) and south and contiguous to County Road 289 (Jolyns Way) and includes 147.74± acres. Tax Map 2-34-7.00 Parcel 127.00 is located north and contiguous to County Road 289 (Jolyns Way), and west and contiguous to County Road 279 (Camp Arrowhead Road) and includes 29.17± acres. Tax Map 2-34-7.00 Parcel 130.00 is located east and contiguous to County Road 279 (Camp Arrowhead Road), and is bordered on the northeastern boundary by Love Creek, and includes 94.77± acres. Parcel 48.00 is bordered by some scattered residences, farmland and woods. Parcels 50.00 and 127.00 are bordered mostly by farmland and woods, and a few scattered residences. Parcel 130.00 is bordered on the north by a residential development, on the south by a golf course (Marsh Island GC); and Love Creek borders the east northeast. Most of the residential lots adjacent to the evaluated areas have been improved by single family dwellings. See the attached tax map reproduction and zoning certificate for property information, property owners' names, and tax map verification (Appendix A).

### **1.2 Topographic Map**

A reproduction of the USGS Fairmount Quadrangle Topographic Map is included in Appendix A. The elevations are based on mean sea level and the contour intervals depicted range from 5 to 35 feet. Love Creek and its associated tributary as well as Sarah Run may be at or near sea level. Ground surface elevations were provided at each of the staked locations within the 75 foot grids established by Charles Murphy and Associates, Inc. The elevations reported within the proposed RIB areas ranged from 28.40 feet to 34.25 feet.

The vast majority of the project site consists of agricultural lands currently in production. Proposed RIB Area A is situated almost entirely within the agricultural portion of Tax map 2-34-11.00 Parcel 50.00. Two small portions of the evaluated area are situated within wooded lands. Proposed RIB Area B is situated entirely within the wooded portion of Tax Map 2-34-7.00 Parcel 127.00. Approximately 54.16 acres of the total 150.91 acres (roughly 36%) proposed for spray irrigation is situated within wooded portions of the site.

There are three blue-line (perennial) streams depicted within the evaluated area: Sarah Run which runs along the southern boundary of Tax Map 2-34-11.00 Parcel 48.00 and encroaches slightly onto Tax Map 2-34-11.00 Parcel 50.00, and Love Creek which runs along the northeastern boundary of Tax Map 2-34-7.00 Parcel 130.00, and an un-named tributary of Love Creek which reaches Tax Map 2-34-7.00 Parcel 127.00.

### **1.3 Existing Soil Survey Mapping**

Soil mapping of the project site is adapted from the most recent Sussex County Legend as published by NRCS Soil Survey Geographic (SSURGO) – DE005. A reproduction of the sheet is attached in Appendix A. From the soil survey mapping, ten (10) soil mapping units are shown within the vicinity of the evaluated area:

- 1) Downer sandy loam, 0 to 2 percent slopes (DoA); well drained
- 2) Greenwich loam, 0 to 2 percent slopes (GrA); well drained
- 3) Downer sandy loam, 2 to 5 percent slopes (DoB); well drained
- 4) Broadkill mucky peat, very frequently flooded, tidal (Br), very poorly drained
- 5) Downer loamy sand, 5 to 10 percent slopes (DnC), well drained
- 6) Longmarsh and Indiantown soils, frequently flooded (LO), very poorly drained
- 7) Downer sandy loam, 5 to 10 percent slopes (DoC), well drained
- 8) Fallsington loam, 0 to 2 percent slopes (FgA), poorly drained
- 9) Fort Mott loamy sand, 2 to 5 percent slopes (FmB), well drained
- 10) Evesboro loamy sand, 5 to 15 percent slopes (EvD), excessively drained

The project site is primarily mapped as Downer sandy loam, 0 to 2 and 2 to 5 percent slopes and Greenwich loam, 0 to 2 percent slopes. Both of these soil series are deep, well drained soils with only slight limitations for on-site wastewater disposal. These soils are coarse loamy and are classified as Typic Hapludults. The proposed RIB area A is mapped entirely within the DoA mapping unit. The proposed RIB area B is mapped within the DoB and EvD mapping units.

This investigation revealed soils similar to those mapped and consisted of the following Soil Series:

- 1) Ingleside loamy sand, 0 to 2 percent slopes (IgA)
- 2) Sassafras sandy loam, 0 to 2 percent slopes (SaA)
- 3) Downer loamy sand, 0 to 2 percent slopes (DnA)
- 4) Hambrook sandy loam, 0 to 2 percent slopes (HbA)
- 5) Fort Mott loamy sand, 0 to 2 percent slopes (FmA)
- 6) Greenwich loam, 0 to 2 percent slopes (GrA)
- 7) Hambrook sandy loam, 2 to 5 percent slopes (HbB)
- 8) Galestown loamy sand, 0 to 5 percent slopes (GaB)
- 9) Greenwich loam, 2 to 5 percent slopes (GrB)
- 10) Unicorn loam, 0 to 2 percent slopes (UIA)
- 11) Henlopen loamy sand, 2 to 5 percent slopes (HpB)

#### **1.4 Generalized Site Investigation Observations**

A wetland delineation/ determination was beyond the scope of this investigation. However, a review of the National Wetlands Inventory Map revealed there are four wetland polygons identified near or along the project boundaries: PF01A on Parcel 48.00; PF01E on parcel 50.00; PF01C on Parcel 127.00 and PF01E on Parcel 130.00. These wetland polygons are not located near or within areas proposed for wastewater disposal.

According to the USGS Hydrologic Atlas HA-109 (Appendix A), the project site is mapped as AM 2/24 – nonplastic to slightly plastic sandy and silty soil derived from fluvial deposits of

Pleistocene age associated with AM24 soil. The marshy land associated with Love Creek is mapped as MTM – Marine tidal marsh deposits and the Love Creek tributary border is mapped as AR/Z – Flood-plain deposits associated with swamp deposits. Based on the groundwater contour intervals shown on the hydrologic atlas, regional groundwater flow can be interpreted in the area of the project site to flow generally from the northwest to the southeast toward Love Creek. The nearest observation well, located north/north west of the study area on the Hydrologic Atlas Map, indicates groundwater elevations ranged between six (6) and thirteen (13) feet above mean sea level. A second well located south/southeast of the evaluated area indicates groundwater elevations ranged between four (4) and ten (10) feet above mean sea level. With ground surface elevations within the proposed RIB areas of 28 to 35 feet MSL, groundwater averages approximately 24 feet beneath the soil surface. A network of observation/ monitoring wells and piezometers were installed by EGI. Data will be discussed later in this report.

### **1.5 Project Description and Flow Projections**

As proposed by the client and the design engineer based on the hydrogeologic work conducted by EGI, the loading rate for the RIBS is projected to be 3 gallons per day per square foot loaded over 50% of the RIB Areas A and B which corresponds to 934,000 gallons per day. It is anticipated that because of the present economy, the RIB Areas will be able to handle sufficient flow that will serve Tidewater for many years. Therefore, the client intends to proceed with the permitting of the RIBS as primary and spare and have the spray irrigation for spare area as well.

## **2.0 GENERAL SOIL CHARACTERISTICS**

### **2.1 Community, Large On-Site Wastewater Treatment and Disposal System Area Selection**

An initial soils reconnaissance investigation was conducted by Atlantic Resource Management, Inc. in December 2006. Initial investigations included Tax Map 2-34-7.00 Parcel 130.00 and Tax Map 2-34-11.00 Parcels 48.00 and 50.00. Tax Map 2-34-7.00 Parcel 127.00 was subsequently added to proposed project area and was evaluated for soil suitability. An interpretive soils map

was prepared which identified areas of suitability for both RIBS and spray irrigation. This plan is included in the packet of plans located in the rear of this report and is entitled Preliminary Soils Reconnaissance. After reviewing the interpretive soils map and consulting with the property owner, two areas were identified as potential RIB areas. These areas were further studied by EGI with results and recommendations reported in a document entitled Preliminary Hydrogeologic Evaluation for Subsurface Wastewater Discharge Capacity at the Russell Marsh Property. Upon completion of this preliminary evaluation, proposed RIB Areas A and B were selected for the detailed soils and hydrogeologic analyses.

Further soil investigations were conducted in March through June 2008. A seventy five (75) foot grid was staked in the field by Charles Murphy Associates, Inc. The numbering scheme on the stakes was carried through this investigation. In addition, ground surface elevations at each of the staked locations were provided. A total of one hundred seven (107) soil borings were conducted with a 3.25 inch diameter hand auger and recorded. In addition, forty (40) test pits were excavated and described. In total, there were 147 grid points characterized. In RIB Area "A" twelve (12) double ring infiltrometer tests were conducted at grid point locations: TP 739, TP 745, TP 758, TP 774, TP 777, TP 788, TP 790, TP 794, TP 807, TP 825, TP 834 and TP 843. In RIB Area "B" eight (8) double ring infiltrometer tests were conducted at grid point locations: TP 704, TP 706, TP 710, TP 719, TP 720, TP 723, TP 728 and TP 732.

Mr. Jack Hayes, Jr., DNREC, was on site March 12, 2008 and March 17, 2008 to examine test pits and confirm the interpretations for siting the Community, Large On-Site Wastewater Treatment and Disposal System based on observed soil characteristics. Mr. Jack Hayes, Jr. DNREC, and Mr. Scott Strohmer, DNREC, were on site March 25, 2008. Additional test pits were excavated for Scott's review. It was agreed that both RIB areas met the current criteria for RIBS. However, RIB Area B is less desirable due to surficial soil conditions than Area A.

### **3.0 DETAILED SOILS INVESTIGATION**

#### **3.1 Soil Identification and Discussion**

### **3.1.1 Soil Units Defined**

For the soil boring descriptions and analysis, point specific soil series were adapted from the existing State Soil Legend adapted from the recent Soil Survey Update. A soil series name implies a host of soil properties, which are commonly published in soil survey reports. The soils identified rarely have all of the properties consistent with the soil series identified. The intent of this investigation is to identify mapping units as they relate to the suitability for on-site wastewater treatment and disposal systems via RIBS only. The use of soils data for any other use is prohibited without the written permission of TFCI. While the sampling and mapping intensity is greater than that common to published soil surveys, the locations of specific map unit boundaries, if shown, are estimated.

The following soil series were identified at specific grid points within the evaluated areas noted as RIB Areas A and B. The soil mapping units were identified as follows:

- 1) Ingleside loamy sand, 0 to 2 percent slopes (IgA)
- 2) Sassafras sandy loam, 0 to 2 percent slopes (SaA)
- 3) Downer loamy sand, 0 to 2 percent slopes (DnA)
- 4) Hambrook sandy loam, 0 to 2 percent slopes (HbA)
- 5) Fort Mott loamy sand, 0 to 2 percent slopes (FmA)
- 6) Greenwich loam, 0 to 2 percent slopes (GrA)
- 7) Hambrook sandy loam, 2 to 5 percent slopes (HbB)
- 8) Galestown loamy sand, 0 to 5 percent slopes (GaB)
- 9) Greenwich loam, 2 to 5 percent slopes (GrB)
- 10) Unicorn loam, 0 to 2 percent slopes (UIA)
- 11) Henlopen loamy sand, 2 to 5 percent slopes (HpB)

Within the proposed RIB Area A, one hundred fourteen (114) grid points were evaluated. Of those, ninety five (95) were classified to the subgroup taxa as Typic Hapludults. Corresponding soil series included the Sassafras sandy loam (60 grid points), Downer loamy sand (24 grid points), Greenwich loam (8 grid points), and Hambrook sandy loam (3 grid points). These soils

were all deep and well drained with 92 grid points greater than 72 inches to redoximorphic indicators of the seasonal high water table/ seasonal saturation. The Hambrook soils had interpreted depths to the seasonal high water table/ seasonal saturation at depths greater than 40 inches. Based on wet season monitoring across the area in a network of observation/ monitoring wells and piezometers, the features observed were likely stripped sands rather than redoximorphic features. Fifteen (15) of the grid points were classified as Arenic Hapludults, Fort Mott series. These soils are also deep and well drained with greater than 72 inches to redoximorphic indicators of the seasonal high water table/ seasonal saturation. Four (4) grid point locations were classified as Lamellic or Psammentic Hapludults. These soils would correlate to the Henlopen and Galestown series in the recent soil survey update. No redoximorphic features were observed within 72 inches of the soil surface.

Within the proposed RIB Area B all thirty three (33) grid points were classified as Typic Hapludults. Corresponding soil series included Greenwich loam (19 grid points), Sassafras sandy loam (2 grid points), Hambrook sandy loam (4 grid points), Unicorn loam (7 grid points), and Ingleside sandy loam (1 grid point). The Greenwich and Sassafras series are deep, well drained soils with no redoximorphic features within 72 inches of the soil surface. The Hambrook, Unicorn, and Ingleside series are deep, somewhat well drained soils with 40 inches or greater to redoximorphic features.

Pertinent soils data are presented for each grid point on the Soil Boring Analysis Spreadsheet (See Appendix B). In addition, all logged profile descriptions are included in Appendix B.

### **3.1.2 Soil Particle Size Analysis**

In order to validate the soil textural classes determined in the field by “hand” texturing, sixteen (16) soil samples were collected and submitted to A&L Eastern Laboratories in Richmond, Virginia. Textural analysis was determined on the samples by the hydrometer method. Results of these analyses are included in Appendix B. In general, the laboratory results validated the field textures. Only in three (3) instances were the field textures over-estimated slightly (TP 704, 720, and 825). Most importantly, the argillic horizons were confirmed to be sandy clay loam and loam

as estimated in the field. Additionally, a sand fractionation conducted on the sample at TP 706 confirmed that the sand fraction was dominated by fine sand (0.25-0.1mm). This was typical of the subsoil/ substratum found in several locations throughout RIB Area B. These finer textures result in reduced permeability rates and possible short term seasonal saturation. While the wet season monitoring indicates deeper groundwater levels, excavation beneath the finer textured materials is likely not possible due to the apparent seasonal saturation.

### **3.1.3 Soil Permeability Considerations**

Permeability estimates for system design, by DNREC policy, are based on the least permeable horizon in the upper 60 inches of the soil profile. Estimates of soil permeability may be determined by field evaluation of soil texture in conjunction with percolation/ permeability rates as provided in DNREC Regulations. A representative number of soil permeability tests are required for the Site Investigation in accordance with current Regulations. See the Infiltration Test Data in **Appendix C**.

In RIB Area "A" twelve (12) double ring infiltrometer tests were conducted at grid point locations: TP 739, TP 745, TP 758, TP 774, TP 777, TP 788, TP 790, TP 794, TP 807, TP 825, TP 834 and TP 843. In RIB Area "B" eight (8) double ring infiltrometer tests were conducted at grid point locations: TP 704, TP 706, TP 710, TP 719, TP 720, TP 723, TP 728 and TP 732.

Because of the excessive depths to groundwater based on well monitoring, excavation of the RIBs to beneath the argillic materials was proposed in proposed RIB Area 1. Excavation would allow for the RIB inverts to interface with the coarser textured materials beneath the argillic horizon. Jack Hayes, DNREC, agreed in concept. As a result, infiltration tests were conducted within the least permeable material encountered within three feet beneath the proposed depth of excavation/ sand-lining. Depths of testing ranged from 25 to 56 inches beneath the existing ground surface. Infiltration rates ranged from 1.5 to 20 minutes per inch. Infiltration rates beneath the proposed depth of excavation ranged from 1.5 to 3.48 minutes per inch. The arithmetical average is 2.47 minutes per inch. A design rate of 2.5 minutes per inch or 24 inches per hour is recommended for design.

In the proposed Area B the infiltration rates were far more variable. The rates ranged from 2.75 minutes per inch to 320 minutes per inch. The slower rates were encountered within the sandy clay loam to loam argillic horizons. Poor structure and/ or firm and dense consistence were also noted in portions of the subsoil horizons. The slower rates were not found within a specific location of the evaluated area. Unless otherwise approved by the Department, the RIBS in Area B cannot be excavated beneath the argillic horizons. Therefore, it is recommended that a design rate of 80 minutes per inch or 0.75 inches per hour be utilized in this area.

### **3.2 Disposal System Recommendations and Summary**

#### **3.2.1 Regulatory Summary**

Delaware Department of Natural Resources and Environmental Control's (DNREC) policy is that redoximorphic features, commonly referred to as drainage mottles, of chroma two (2) or less and/ or chroma 8 define a limiting zone for on-site wastewater siting and design purposes. The limiting zone is a depth beneath the surface at which extended periods of saturation occur either by the regional water table or internal drainage restrictions. High chroma redoximorphic concentrations (drainage mottles) are often observed higher in the profile than the low chroma or gray mottles. For this investigation, low and high chroma redoximorphic features were utilized for design purposes. In some cases, the limiting zone was assigned where faint, 3 chroma and/ or high chroma redoximorphic features were identified. For all large systems, wet season monitoring via piezometers/ observation wells is required. Wet season monitoring provides empirical data to support/ refute the interpretations made from soil morphological indicators. Extensive well monitoring was conducted across the project site.

#### **3.2.2 Design Considerations and Comments**

Based on these findings to date, the two specific study areas (Area A and Area B) contain approximately 15.42 and 4.3 acres, respectively capable of supporting RIBs. Area A is the best location for the initial RIBs as the seasonal saturation and hydraulically limiting layers are generally deeper than 6 feet from the soil surface. A design infiltration rate of 2.5 minutes per inch (24 inches per hour) is recommended. Area B, while suitable for RIBs, will not be able to

handle the wastewater loading as Area A. Infiltration rates were considerably slower than found in Area A. A design infiltration rate of 80 minutes per inch or 0.75 inches per hour is recommended based on the variability observed with respect to the infiltration test results.

Basins constructed in Area A should be excavated to a minimum elevation as shown on the site plan entitled Soil Investigative Report for Rapid Infiltration Basins-Area A-Detail Plan. This excavation is necessary to ensure the invert of the basin is beneath the subsoils (sandy clay loam and/ or loam materials) which are more easily subject to compaction, smearing, disruption of the vertical macropore network, and crusting due to precipitation. Minimum invert elevations range from 25 feet to 30 feet across the 15± acres. The basins in Area B should be based on a depth of seasonal saturation of 41 inches based upon morphological observations. A deeper limiting zone may be assigned after completion of the hydrogeological report and a thorough analysis of the water groundwater monitoring.

Final site grading should divert stormwater flow rapidly away from the basin areas. Specifications for final grading should extend outside of the disposal areas and should be an integral part of the overall wastewater system design. Allowing stormwater to pond adjacent to basins or placing unlined ponds in the general area of the basins effectively increases the loading rate and increases the risk of hydraulic mounding. Excess spoil generated by basin excavation may be utilized to raise the existing grade around the basins in such a way so as to shed precipitation rapidly away from the basin areas reducing infiltration in the vicinity of the basins.

Incorporation of the “spare area” into the initial basin construction is not recommended. Basin underperformance will not be as evident in a basin area that is twice as large and may result in delayed recognition of problems.

Berm width should be adequate for machinery access for maintenance, monitoring, and remedial measures. Ongoing construction practices should be carefully monitored by the design engineer, a soil scientist, or both, to prevent soil compaction within the basins or use of improper construction techniques. Past experience has shown that construction schedules and deadlines often dictate when site work takes place rather than when conditions are favorable.

The approved area must be properly cared for between now and the time of system installation. At the time of Soil Investigative Report submittal to the Department, portions of the RIB areas were wooded. These areas must be cleared in accordance with the Lot Clearing Guidelines as published by DNREC. It is recommended that the clearing activities be supervised by a Class D, Site Evaluator.

All on-site wastewater disposal systems must be greater than 100 feet from individual wells or greater than 150 feet from community or public wells. The Department may approve lesser well isolation distances where deep wells are constructed into confined aquifers. Setbacks of 50 feet are required between stormwater management structures (ditches, ponds, catch basins) when the invert of the structure intersects the seasonal high water table.

#### **4.0 HYDROLOGY/OBSERVATION WELL/PIEZOMETER MONITORING**

Seven (7) piezometers were installed by or under the direct supervision of Eastern Geosciences, Inc. in the fall of 2007 within or very near the proposed RIB Area A. The weekly data are included in Appendix D. These piezometers were monitored weekly from November 28, 2007 through April 28, 2008 and again from February 5, 2009 through May 15, 2009. The highest water levels recorded ranged from 17.53 feet to 23.38 feet beneath the soil surface. These data support the presence of deep, well drained surficial soils and the ability to excavate the RIB inverts beneath the less permeable, argillic horizons.

Three (3) piezometers were installed within proposed RIB Area B. They were also monitored during the same timeframe previously mentioned for RIB Area A. The highest water levels recorded ranged from 9.81 to 10.60 feet beneath the soil surface. The shallowest depth was observed nearest the shoulder of the slope to the un-named tributary. These data confirm that the redoximorphic features observed within the soil profiles are likely the result of seasonal saturation and not the fluctuation in the seasonal high water table.

It is important to note that a couple of seasons of direct observation of water levels in piezometers and/or monitoring wells do not necessarily represent year to year conditions. Long-term observations are required to adequately use well data to characterize the hydrology of a site. Further, well monitoring does not address potential seasonal saturation often observed in profiles as a result of textural discontinuities and/ or preferential flow. Interpretations of soil behavior should not be made based solely on well monitoring exclusive of the soil morphological characteristics. Soil morphology, in most cases, is a better indicator of the long-term moisture and drainage conditions of a site. Where observation well data has been collected, soil morphology is used in concert with the observation well data to make professional judgments as to the suitability of the Design Areas.

A more detailed analysis and discussion of the well monitoring data will be included in the detailed hydrogeological report to be submitted under separate cover.

## **5.0 USE LIMITATIONS**

This soil investigation was directed at assessing the technical feasibility of using the area of investigation for LOWTDS as a spare/ replacement system only in accordance with Regulations and guidelines of DNREC—Large Systems Branch. The findings and conclusions presented in this report are the result of surficial soils work and analyses conducted for a maximum daily wastewater flow of 934,000 gallons per day based on the projected loading rates by Eastern Geosciences, Inc. to date. This report shall not be utilized for any purpose other than as stated in this report. Should the project scope change, this report is null and void unless otherwise approved by TFCI. There may be subsurface and groundwater conditions not disclosed by this investigation. A full hydrogeological assessment with groundwater mounding analysis/ modeling has been conducted by Eastern Geosciences, Inc. Interpretations and siting criteria may be subject to change pending the results of that investigation. Terra Firma Consulting, Inc. does not represent nor warrant the operation or proper functioning of any wastewater disposal system for any period of time.

This Report has been prepared in accordance with DNREC requirements and generally accepted soil practices used in the evaluation of sites for wastewater disposal in Delaware. This investigation was prepared for the exclusive use of Tidewater Environmental Services, Inc. and their assigns. No other warranty, expressed or implied, is given.

# **PART 2**

## **SITE SELECTION AND EVALUATION REPORT FOR SPRAY IRRIGATION**

**FOR THE**

**LANDS OF WANDENDALE FARMS, INC.**

**SUSSEX COUNTY, DELAWARE**

**Tax Map 2-34-7.00 Parcels 127.00 and 130.00  
and Tax Map 2-34-11.00 Parcels 48.00 and 50.00**

## TABLE OF CONTENTS

<b>1.0 SITE DESCRIPTION.....</b>	<b>2</b>
1.1 LOCATION MAP .....	2
1.2 TOPOGRAPHIC MAP .....	3
1.3 SOIL SURVEY MAP .....	3
1.4 GEOLOGIC AND HYDROLOGIC CONDITIONS.....	5
1.5 KNOWN CULTURAL OR HISTORIC RESOURCES .....	7
<b>2.0 SITE SOIL CHARACTERISTICS.....</b>	<b>7</b>
2.1 USDA SOIL CHARACTERISTICS.....	7
2.2 NARRATIVE DESCRIPTION OF SOIL SERIES IDENTIFIED .....	7
<b>3.0 EXISTING VEGETATIVE COVER.....</b>	<b>14</b>
<b>4.0 EXISTING LAND USE.....</b>	<b>14</b>
<b>5.0 PRESENT LAND OWNER.....</b>	<b>15</b>
<b>6.0 CONCLUSION .....</b>	<b>15</b>

## 1.0 SITE DESCRIPTION

### 1.1 Location Map

Several parcels of land were identified for potential consideration for Rapid Infiltration Basins (RIB's), spray irrigation and/ or micro-irrigation "drip" disposal for the proposed regional wastewater disposal facility to serve the Angola area off State Route 24 (John J. Williams Highway) in Sussex County, DE. The evaluated area includes four separate tax map parcels. Tax Map 2-34-11.00 Parcel 48.00 is located on the west side of State Route 24 (John J. Williams Highway); the eastern boundary is contiguous to County Road 277 (Robinsville Road) and includes 48.53± acres. Tax Map 2-34-11.00 Parcel 50.00 is located east of State Route 24 (John J. Williams Highway), north of County Road 277 (Angola Road) and south and contiguous to County Road 289 (Jolyns Way) and includes 147.74± acres. Tax Map 2-34-7.00 Parcel 127.00 is located north and contiguous to County Road 289 (Jolyns Way), and west and contiguous to County Road 279 (Camp Arrowhead Road) and includes 29.17± acres. Tax Map 2-34-7.00 Parcel 130.00 is located east and contiguous to County Road 279 (Camp Arrowhead Road), and is bordered on the northeastern boundary by Love Creek, and includes 94.77± acres. Parcel 48.00 is bordered by some scattered residences, farmland and woods. Parcels 50.00 and 127.00 are bordered mostly by farmland and woods, and a few scattered residences. Parcel 130.00 is bordered on the north by a residential development, on the south by a golf course (Marsh Island GC); and Love Creek borders the east northeast.

## **1.2 Topographic Map**

A reproduction of the USGS Fairmount Quadrangle Topographic Map is included in Appendix A. The elevations are based on mean sea level and the contour intervals depicted range from 0 to 35 feet. Love Creek and its associated tributary as well as Sarah Run appear to be at or near sea level.

The vast majority of the project site consists of agricultural lands currently in production. Approximately 54.16 acres of the total 150.91 acres (roughly 36%) proposed for spray irrigation is situated within wooded portions of the site.

There are three blue-line (perennial) streams depicted within the evaluated area: Sarah Run which runs along the southern boundary of Tax Map 2-34-11.00 Parcel 48.00 and encroaches slightly onto Tax Map 2-34-11.00 Parcel 50.00, and Love Creek which runs along the northeastern boundary of Tax Map 2-34-7.00 Parcel 130.00, and an un-named tributary of Love Creek which reaches Tax Map 2-34-7.00 Parcel 127.00.

## **1.3 Soil Survey Map**

Soil mapping of the project site is adapted from the most recent Sussex County Legend as published by NRCS Soil Survey Geographic (SSURGO) – DE005. A reproduction of the sheet is attached in Appendix A. From the soil survey mapping, ten (10) soil mapping units are shown within the vicinity of the evaluated area:

- 1) Downer sandy loam, 0 to 2 percent slopes (DoA); well drained
- 2) Greenwich loam, 0 to 2 percent slopes (GrA); well drained
- 3) Downer sandy loam, 2 to 5 percent slopes (DoB); well drained

- 4) Broadkill mucky peat, very frequently flooded, tidal (Br), very poorly drained
- 5) Downer loamy sand, 5 to 10 percent slopes (DnC), well drained
- 6) Longmarsh and Indiantown soils, frequently flooded (LO), very poorly drained
- 7) Downer sandy loam, 5 to 10 percent slopes (DoC), well drained
- 8) Fallsington loam, 0 to 2 percent slopes (FgA), poorly drained
- 9) Fort Mott loamy sand, 2 to 5 percent slopes (FmB), well drained
- 10) Evesboro loamy sand, 5 to 15 percent slopes (EvD), excessively drained

The project site is primarily mapped as Downer sandy loam, 0 to 2 and 2 to 5 percent slopes and Greenwich loam, 0 to 2 percent slopes. Both of these soil series are deep, well drained soils with only slight limitations for on-site wastewater disposal. These soils are coarse loamy and are classified as Typic Hapludults.

This investigation revealed soils similar to those mapped and consisted of the following Soil Series:

- 1) Ingleside loamy sand, 0 to 2 percent slopes (IgA)
- 2) Sassafras sandy loam, 0 to 2 percent slopes (SaA)
- 3) Downer loamy sand, 0 to 2 percent slopes (DnA)
- 4) Hambrook sandy loam, 0 to 2 percent slopes (HbA)
- 5) Fort Mott loamy sand, 0 to 2 percent slopes (FmA)
- 6) Greenwich loam, 0 to 2 percent slopes (GrA)
- 7) Hambrook sandy loam, 2 to 5 percent slopes (HbB)
- 8) Galestown loamy sand, 0 to 5 percent slopes (GaB)
- 9) Greenwich loam, 2 to 5 percent slopes (GrB)
- 10) Unicorn loam, 0 to 2 percent slopes (UIA)
- 11) Henlopen loamy sand, 2 to 5 percent slopes (HpB)

#### **1.4 Geologic and Hydrologic Conditions**

A preliminary hydrogeologic evaluation was performed by Eastern Geosciences, Inc. (EGI) in February 2008. Based on information contained within the report, the project site is located within the Atlantic Coastal Plain physiographic province in southern Delaware within the outcrop area of the Lynch Heights formation. This formation is described as a “heterogeneous unit of light gray to brown to light yellowish brown, medium to fine sand with discontinuous beds of coarse sand, gravel, silt, fine to very fine sand, and organic-rich clayey silt to silty sand”. The Lynch Heights Formation is mapped as being underlain by the Beaverdam Formation. Additional information can be found in the report entitled Preliminary Hydrogeologic Evaluation for Subsurface Wastewater Discharge Capacity at the Russell Marsh Property, prepared by Eastern Geosciences, Inc. and dated February 2008.

A wetland delineation/ determination was beyond the scope of this investigation. The National Wetlands Inventory Map (Appendix A), however, depicts four wetland polygons identified within the project boundaries: PF01A on Parcel 48.00; PF01E on parcel 50.00; PF01C on Parcel 127.00 and PF01E on Parcel 130.00. No other wetlands are identified within the project boundaries.

According to the USGS Hydrologic Atlas HA-109 (Appendix A), the project site is mapped as AM 2/24 – nonplastic to slightly plastic sandy and silty soil derived from fluvial deposits of Pleistocene age associated with AM24 soil. The marshy land associated with Love Creek is mapped as MTM – Marine tidal marsh deposits and the

Love Creek tributary border is mapped as AR/Z – Flood-plain deposits associated with swamp deposits. Based on the groundwater contour intervals shown on the hydrologic atlas, regional groundwater flow can be interpreted in the area of the project site to flow generally from the northwest to the southeast toward Love Creek. The nearest observation well, located north/north west of the study area on the Hydrologic Atlas Map, indicates groundwater elevations ranged between six (6) and thirteen (13) feet above mean sea level. A second well located south/southeast of the evaluated area indicates groundwater elevations ranged between four (4) and ten (10) feet above mean sea level. The project site is situated at a groundwater contour of ten (10) feet or less.

A network of observation/ monitoring wells and piezometers were installed by or under the direct supervision of EGI in the fall of 2007. All wells and piezometers were read by ARM and/or Terra Firma Consulting, Inc. (TFCI) weekly throughout the 2007-2008 wet season beginning November 28, 2007. Additional wet season data was collected by TFCI for the 2008-2009 wet season beginning in February 2009. The well data will be provided during the DDR phase of the investigations. Data collected within proposed RIB areas is included in Appendix D with a discussion in Part 1 of this combined document.

A calibrated numerical model was used by EGI to run a preliminary wastewater loading simulation within the proposed spray irrigation areas. Approximately 134 acres of potential spray irrigation area within the cleared portions of the site was simulated with a maximum loading rate of 1.25 inches per week. Calculated groundwater mounding

within the potential spray areas is reportedly between approximately 2.5 feet and less than 0.2 feet.

### **1.5 Known Cultural or Historic Resources**

There are no **known** cultural or historic resources at the project site. A review and search for such at this phase in the planning was beyond the scope of this investigation.

## **2.0 SITE SOIL CHARACTERISTICS**

### **2.1 USDA Soil Characteristics**

As previously mentioned, soil mapping of the site per the USDA-NRCS is presented in Appendix A. The project site is primarily mapped as Downer sandy loam, 0 to 2 and 2 to 5 percent slopes and Greenwich loam, 0 to 2 percent slopes. Both of these soil series are deep, well drained soils with only slight limitations for on-site wastewater disposal. These soils are coarse loamy and are classified as Typic Hapludults.

### **2.2 Narrative Description of Soil Series Identified**

#### Hydrology

This investigation occurred from December 19<sup>th</sup> through December 27<sup>th</sup> of 2006 under near normal to slightly above normal precipitation conditions based on precipitation data reported for the 2006-2007 water year by the Delaware Geological Survey. Based on the data reported, precipitation levels through December 2006 were 2.10 inches above normal for the 2006-2007 water year (October 1, 2006 through December 31, 2007). The preceding water year (2005-2006) was 4.19 inches above normal. Based on the

precipitation levels reported, free water levels were likely near normal for that time of the year.

### Soil Units Defined

The preliminary soil mapping was conducted by Atlantic Resource Management, Inc. (ARM) using a landscape based approach, with soil boring locations established using a differential GPS unit and public domain GIS data. Preliminary hand auger borings were completed. The investigation consisted of an evaluation of soil morphological characteristics using a 3.25 inch bucket auger. Soil borings were generally conducted on an offset 600 foot grid located with a GPS unit. Additional off-grid points were added as necessary to delineate mapping unit and/or slope break boundaries. All soil borings are shown on the plan entitled Preliminary Soils Reconnaissance, dated December 28, 2006. Also included on this plan is pertinent point soil data including depth to limiting zone (as evidenced by soil morphology), estimated subsoil permeability rate (based on hand textures and/or structure and consistence), soil series to which the soil profile is most similar (current Sussex County legend), and depth to free water (where observed) on the respective dates of investigation.

Eleven (11) soil series were identified at the individual point borings during this preliminary investigation. Soil series were identified based on limiting zone, control section particle-size class, agricultural drainage class (depth to the seasonal high water table/ seasonal saturation), and slope phase. A soil series name implies a host of soil properties, which are commonly published in soil survey reports. The soils identified

rarely have all of the properties consistent with the soil series identified. The intent of this level of investigation was not to create an Order One soils map but rather to log/characterize selected soil properties at known locations for interpretation of suitability for spray irrigation under current regulatory requirements. For this initial investigation, then, there were no soil mapping lines delineated on the referenced site plan.

The soils encountered during this preliminary investigation were similar to those mapped by the NRCS, though they were generally less well drained. A high degree of heterogeneity was encountered as is evidenced by the identification of eleven (11) soil series among the sixty three (63) soil profiles examined. Following are the soil series identified at the grid point locations:

1. Sassafras sandy loam, 0 to 2 percent slopes and 2 to 5 percent slopes (SaA, SaB)
2. Hambrook sandy loam, 0 to 2 percent slopes and 2 to 5 percent slopes (HbA, HbB)
3. Hammonton sandy loam, 0 to 2 percent slopes (HnA)
4. Pepperbox loamy sand, 2 to 5 percent slopes (PpB)
5. Marshyhope sandy loam, 0 to 2 percent slopes (MdA)
6. Downer sandy loam, 0 to 2 percent slopes and 2 to 5 percent slopes (DoA, DoB)
7. Pineyneck loam, 0 to 2 percent slopes (PyA)
8. Unicorn loam, 0 to 2 percent slopes (UIA)
9. Greenwich loam, 0 to 2 percent slopes (GrA)
10. Ingleside sandy loam, 0 to 2 percent slopes (IgA)
11. Lenni sandy loam, 0 to 2 percent slopes (LfA)

### **Interpretive Mapping Units**

Suitability for wastewater disposal via spray irrigation or rapid infiltration was mapped into three (3) planning areas as noted on the attached "Preliminary Soils Reconnaissance"

plan. In addition, one unit, "AVOID", was mapped as areas to be avoided. Following are the Interpretive Mapping Units and corresponding design criteria (See the attached plan for legend/ mapping) for spray irrigation:

**Design Area # A:** Soils generally suitable for wastewater disposal with Limiting Zones of 72 inches or greater and assigned permeability/percolation rates of 35 to 50 Minutes per Inch

**Design Area # B:** Soils generally suitable for wastewater disposal with Limiting Zones of 48 inches or greater and assigned permeability/percolation rates of 45 to 60 Minutes per Inch

**Design Area # C:** Soils generally suitable for wastewater disposal with Limiting Zones of 36 inches or greater and assigned permeability/percolation rates of 50 to 75 Minutes per Inch

**AVOID:** Soils generally unsuited (denial) for wastewater disposal due to limiting zones generally less than 11 inches, poor (depressional/concave) landscape positions and/or excessive slopes.

### **Summary of Soils Investigations by Parcel**

#### **Parcel 130.00**

This parcel is characterized by a broad upland flat landscape position toward the southwest and a sandy ridge (dunal remnant) situated toward the northeast. The landscape

then slopes to a low elevation, wetland area adjacent to Love Creek. Site elevations range from 5 to 20 feet above mean sea level based on the USGS Topographic Map – Fairmount Quadrangle. The summit of the ridge is an elevation 20. The lower elevations are associated with the short, steep slopes along the wetlands associated with Love Creek.

Numerous off grid points were logged along the ridge top to delineate the suitability based on landscape position and observed hydrology (depth to free water). Most soil borings were extended beyond 72 inches to encounter free water. General notes were taken regarding substratum textures beneath 72 inches to aid in the interpretation of the potential for groundwater mounding.

In general, the ridge appears to be underlain by a fine textured, clay loam or loam at depths ranging from 76 to 124 inches. This material was usually underlain by coarse textured sediments, loamy sands and sands, some dense and cemented in situ. The substratum materials may be problematic for groundwater mounding and should be appropriately evaluated by a Professional Geologist.

The parcel was mapped in Design Areas “B”, “C”, and “AVOID”. These Design Areas were created based on observed soil morphological characteristics and estimated permeability/ percolation rates. Some of the soil characteristics observed may be lithologic or geogenic (inherited from the parent material) rather than redoximorphic features formed through pedogenesis. Therefore, wet season monitoring of the parcel is recommended to empirically characterize present-day water table fluctuations. Depths to

free water ranged from 35 inches (SB B-2) to 150 inches (SB C-1) at the time of this initial investigation. Depths to free water were generally related to elevational differences and substratum textures. Within Design Area “B” free water ranged from 105 to 150 inches beneath the soil surface. In Area “C”, free water ranged from 52 to 140 inches beneath the surface. A piezometer (PZ-1) is located on the adjoining property, Marsh Island Golf Course. This piezometer was monitored through part of the 2005-2006 wet season as part of a Soil Investigative Report submitted to DNREC. The maximum height of the water table was 130.74 inches. It is important to note that the 2004-2005 wet season (October 1, 2004-September 30, 2005) was significantly drier than normal and well monitoring data was not accepted by DNREC as a result. Precipitation levels for the end of the 2005-2006 water year (ending September 30, 2006) were 3.75 inches above normal. In addition, precipitation levels for October 2006 and November 2006 were slightly above normal.

### **Parcel 50.00**

This parcel is situated on a high elevation, upland flat within an undulating landscape. Elevations range from 15 to 35 feet above mean sea level based on the USGS Topographic Map – Fairmount Quadrangle. The lowest elevations are associated with Sarah Run, a small branch which cuts through the southwestern corner of the property.

The soils were mapped in Design Areas “A”, “B”, and “C” with a small area of “AVOID” associated with Sarah Run. In Design Area “A”, the soils were well drained,

Greenwich, Downer, and Sassafras. Depths to limiting zones were greater than 72 inches as evidenced by soil morphology. Several soil borings were extended to 124 inches with no free water encountered. Two test pits were evaluated on the adjoining parcel in the summer of 2006. Free water was encountered at SW-2 at 268.8 inches beneath the surface, supporting the limiting zones interpreted from soil morphology on this site within Area "A". In Design Area "B" depths to limiting zones were generally 48 inches or greater as evidenced by soil morphology. Limiting zones were based on the presence of weathered coarse fragments (likely feldspathic) and/ or stripped sand grains. These features may be lithologic or geogenic and not the result of pedogenesis. Therefore, wet season monitoring may empirically prove the limiting zones are deeper than indicated by soil characteristics.

#### **Parcel 48.00**

This parcel is situated on an undulating flat which slopes to Sarah Run, located in the southwestern portion of the property. The parcel is mapped in Design Areas "A", "B", and "AVOID". The "A" Area is situated on the summit and shoulder of a sandy ridge found in the northern corner of the parcel. Area "B" is situated on the backslope and lower backslope. Within the wooded portions of the tract, complex slopes exist that do not appear on the USGS Topographic Map. One distinct, closed depression was mapped. Others may exist within the hummocky and undulating woods. The "AVOID" Area was mapped along the shoulder slope of the short, steep slope with Sarah Run at the nadir.

Soils were flooded/ ponded at the time of this investigation and should be avoided for wastewater disposal.

### **Parcel 127.00**

This parcel was subsequently added to the project scope. The soils were found to be similar to the soils encountered on the other parcels. The majority of the parcel was mapped in Design Area “A”. A significant portion was also mapped in Design Area “B”. There is a steep slope located along the un-named tributary of Love Creek. This area was mapped within the “Avoid” mapping unit.

## **3.0 EXISTING VEGETATIVE COVER**

Approximately seventy five (75) percent of the project site is cleared, agricultural land. The remaining twenty five (25) percent is wooded. The wooded lands are vacant and are used only for hunting purposes. Of the 150.91 acres of land proposed for spray irrigation, 54.16 acres are wooded. This represents thirty six (36) percent.

## **4.0 EXISTING LAND USE**

The cleared portions of the project site are currently being utilized for agricultural production. The wooded portions of the site are being used for hunting. There are farm buildings and storage buildings located on Parcel 130.00. No other structures were identified within the project boundaries.

## **5.0 PRESENT LAND OWNER**

Sussex County Tax Map numbers 2-34-7.00-127.00 and 130.00 and 2-34-11.00-48.00 and 50.00 are all owned by Wandendale Farms, Inc. This information is based on the Tax Summary found on-line at [www.sussexcounty.net/e-gov/propertytaxes](http://www.sussexcounty.net/e-gov/propertytaxes).

## **6.0 CONCLUSION**

Based on the soils investigations completed to date, the referenced project site is well suited to year-round spray irrigation of treated wastewater. The depths to the seasonal high water table/ seasonal saturation are generally beneath 40 inches. The majority of the site (as identified by Design Areas A and B) are not restricted either from a permeability or limiting zone standpoint. Ongoing soils investigations and hydraulic testing of both the proposed RIB areas and the spray irrigation area will be used to refine the overall interpretations of site suitability.

**APPENDIX A**

**PUBLIC INFORMATION SITE DATA**

**Zoning Information  
Letter of Intent  
General Location Map  
Sussex County Tax Map  
USGS Topographic Map  
Soil Survey Map  
National Wetlands Inventory Map  
USGS Hydrologic Atlas Map**

**LANDS OF WANDENDALE FARMS, INC.**

**SUSSEX COUNTY, DELAWARE**

**Tax Maps 2-34-7.00-127.00 and 130.00 and 2-34-11.00-48.00 and 50.00**

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<b>Owner First Name:</b>	<input type="text" value="Farms"/>
<b>Billing Zip Code:</b>	<input type="text"/>
<input type="button" value="Search!"/>	<input type="button" value="Clear Fields"/>

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<b>WANDENDALE FARMS INC</b>	<b>RD.ANGOLA TO LEWES,30 1/2 ACRES</b>	<b><u>2-34 7.00 127.00</u></b>
<b>WANDENDALE FARMS INC</b>	<b>RD.ANGOLA TO LEWES 93.67 AC.S. WITH IMP.</b>	<b><u>2-34 7.00 130.00</u></b>
<b>WANDENDALE FARMS INC</b>	<b>W/RT. 24 E/RT 277</b>	<b><u>2-34 11.00 48.00</u></b>
<b>WANDENDALE FARMS INC</b>	<b>E/RT 24 2000' N/RT 277</b>	<b><u>2-34 11.00 50.00</u></b>

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# TERRA FIRMA CONSULTING, INC.

---

March 3, 2008

Mr. Jack Hayes  
DNREC  
89 Kings Highway  
Dover, DE 19901

Re: Letter of Intent to Conduct a Site Investigation Report for a Large On-Site Wastewater Treatment and Disposal System and a Site Selection and Evaluation Report for Spray Irrigation for a Planned Regional Wastewater Disposal Facility; Sussex County Tax Map 2-34-7.00 Parcels 127.00 and 130.00 and Tax Map 2-34-11.00 Parcels 48.00 and 50.00

Dear Mr. Hayes:

This letter is to serve as Terra Firma Consulting Inc.'s (TFCI) Notice of Intent to begin detailed investigations on the above referenced parcels relative to completion of a Site Investigation Report for a Large On-Site Wastewater Treatment and Disposal System in two (2) areas proposed for Rapid Infiltration Basins (RIBS). The larger of the two areas is approximately fifteen (15) acres in size while the smaller area is approximately five (5) acres in size. Preliminary design calculations provided by CABA Associates, Inc. indicate the RIB areas combined could handle up to 1,985,826 gallons per day. This represents the maximum potential capacity of the RIB areas, realizing there are numerous factors that could come to light during the detailed investigations that would effectively reduce these numbers. All work shall be conducted in accordance with Section 5.12000 of the Regulations Governing the Design, Installation and Operation of On-Site Wastewater Treatment and Disposal Systems, amended March 11, 2002.

TFCI will concurrently be preparing a Site Selection and Evaluation Report for the areas of the project site proposed for spray irrigation. It is estimated that approximately 170 acres of land area will be used for spray irrigation. Preliminary design calculations provided by CABA Associates, Inc. indicates the spray irrigation could result in the disposal of up to 1,632,911 gallons per day, subject to the same considerations as expressed above.

The total project site, then, has an estimated maximum capacity of 3.62 MGD. Tom Dwyer at EGI has performed significant on-site preliminary testing and a mounding analysis that determined negligible mounding for approximately 1.124 MGD. The detailed analysis has not yet been completed to maximize the disposal potential.

This project is being undertaken for Tidewater Environmental Services, Inc., under the direct management of Mr. Bruce Patrick. The design engineers are CABA Associates, Inc. with Mr. Steve Lewandowski serving as the project manager and lead engineer for the project. CABA Associates, Inc. has completed some conceptual engineering designs based on the soils and hydro-geological work completed to date. Mr. Tom Dwyer of Eastern Geosciences, Inc. is the Professional Geologist of record. He and his team have already undertaken a significant amount of in-situ testing. I would encourage the DNREC assigned Hydrologist to work directly with Mr. Dwyer. TFCI, under the direction of myself, will be completing the detailed soils investigations for both the RIBS and the spray irrigation facility. To date, a detailed soils reconnaissance has been completed. That work served as the basis for the hydro-

---

**P.O. Box 938 • Ocean View, DE 19970**  
office: (302) 539-1501 • fax: (302) 539-1315 • cell: (302) 236-2389

e-mail: [lisa@terrafirmaconsultinginc.com](mailto:lisa@terrafirmaconsultinginc.com)

geological investigations and the selection of the two (2) potential RIB areas. Charles Murphy and Associates, Inc. performed the site surveying and grid stakeout for the detailed investigations. The potential RIB areas have been staked, as required by regulation in a 75 foot by 75 foot grid pattern.

The detailed soils investigations are scheduled to begin the week of March 10<sup>th</sup>, 2008. I previously provided you with the dates scheduled for infiltration testing and test pit excavations. If any of those dates change, I will notify you of the change. I do not have the work schedule for EGI but I encourage you to contact Mr. Dwyer directly at 856-719-8500 to obtain a proposed schedule of work to be completed.

Enclosed for your information are a tax map, a general location map, and a plan provided by EGI depicting the locations of the monitoring and observation wells currently being read weekly as well as the additional geoprobe boring locations. Also included are some representative cross-section provided by Mr. Dwyer and used to delineate the potential RIB areas. Finally, a zoning form indicating the current owner of the properties is Wandendale Farms. Our contact for the owners is Mr. Russell Marsh.

If you have any questions regarding this information or need any additional information, please contact me at 302-539-1501 (Office) or 302-236-2389 (Cellular).

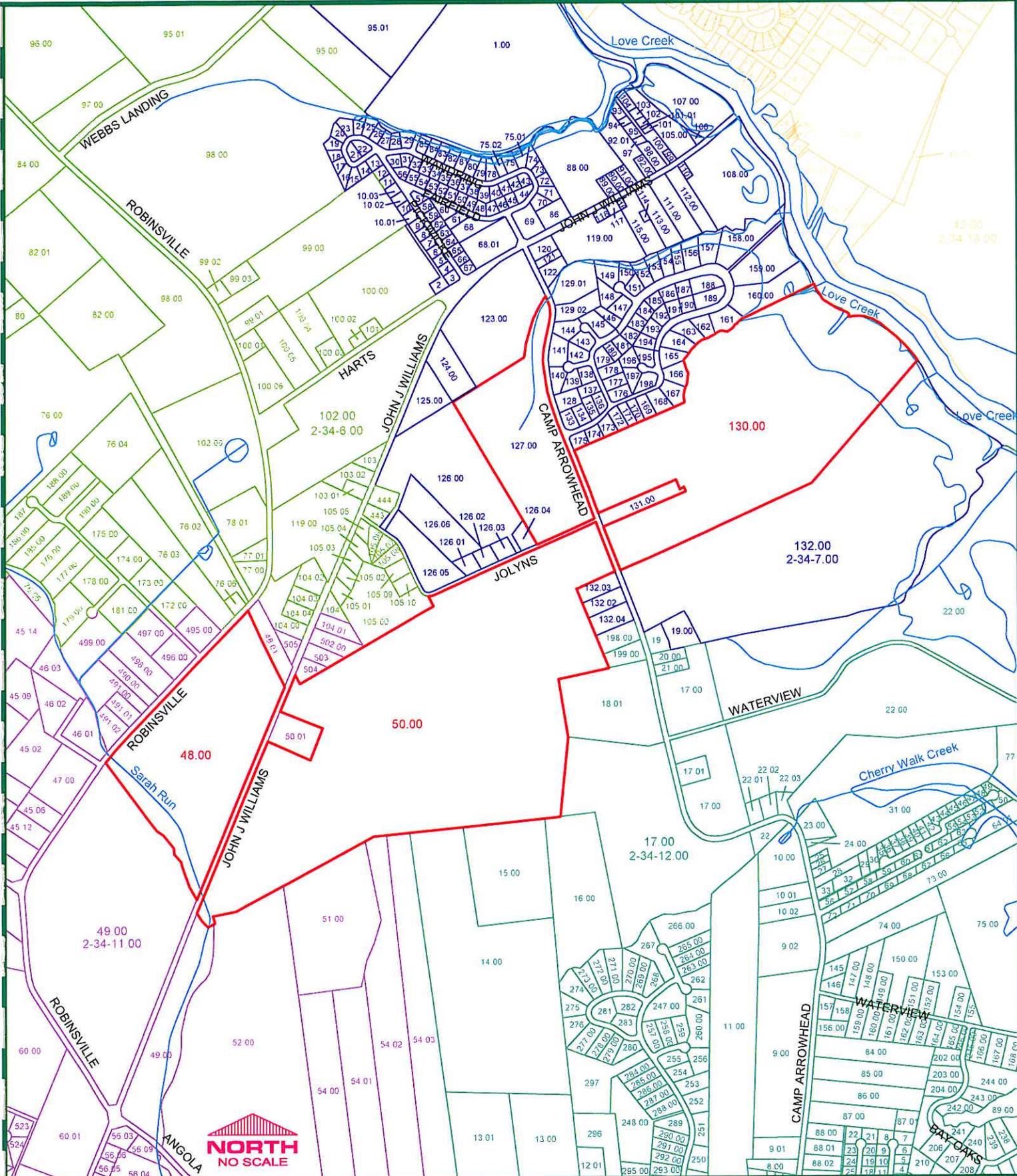
Sincerely,

**For Terra Firma Consulting, Inc.,**



Lisa S. Wood, CPSS/SC  
Soil Scientist





**TERRA FIRMA CONSULTING, INC.**

Post Office Box 938  
 Ocean View, DE 19970

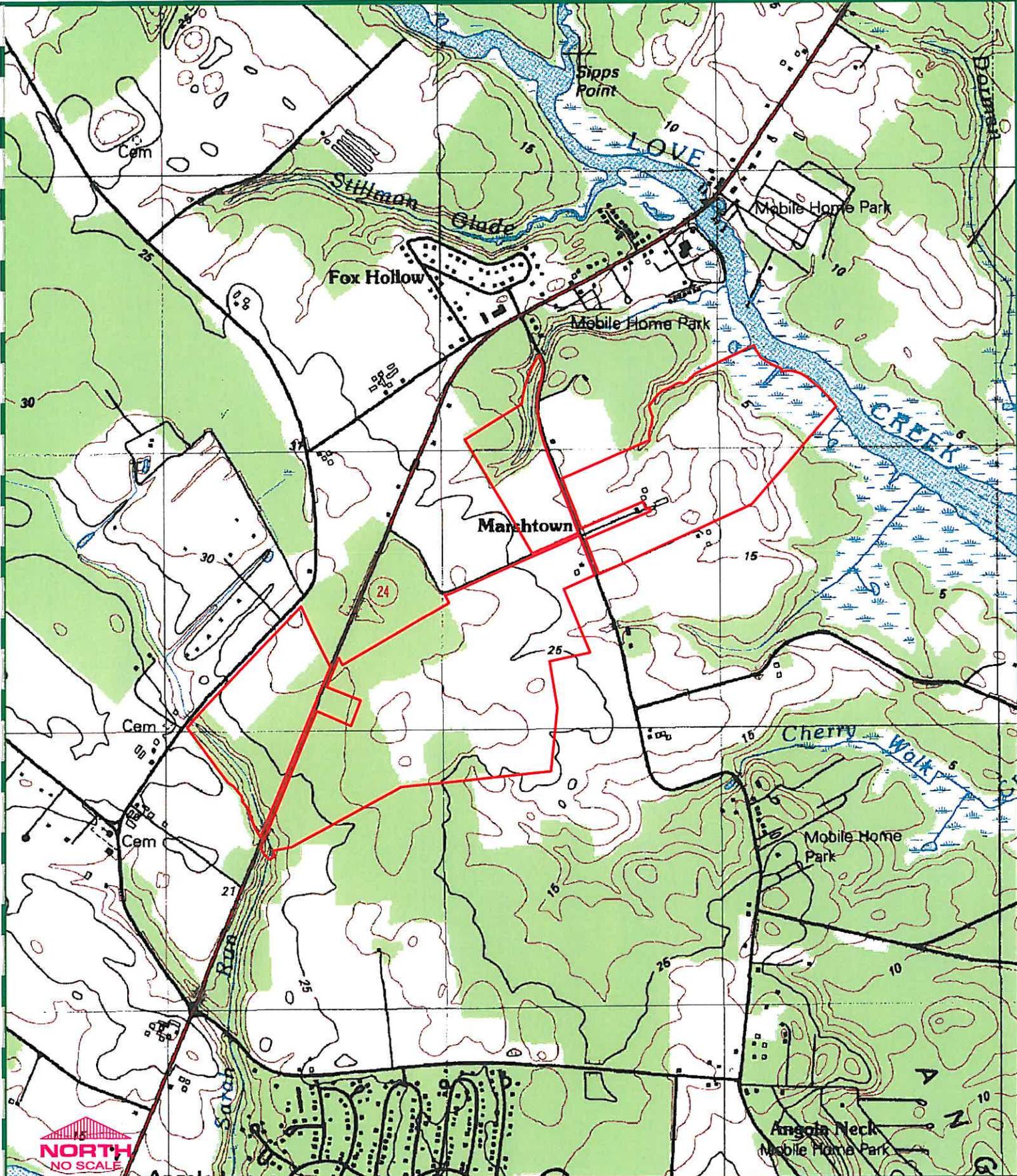


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 SOIL CONSULTANTS

**LANDS OF WANDENDALE FARMS, INC.**  
 TAX MAP # 2-34-7.00, PARCELS 127.00 & 130.00  
 TAX MAP # 2-34-11.00, PARCELS 48.00 & 50.00

**SUSSEX COUNTY TAX MAP**  
 PER DELAWARE DATAMIL (10/06)



**TERRA FIRMA CONSULTING, INC.**

Post Office Box 938  
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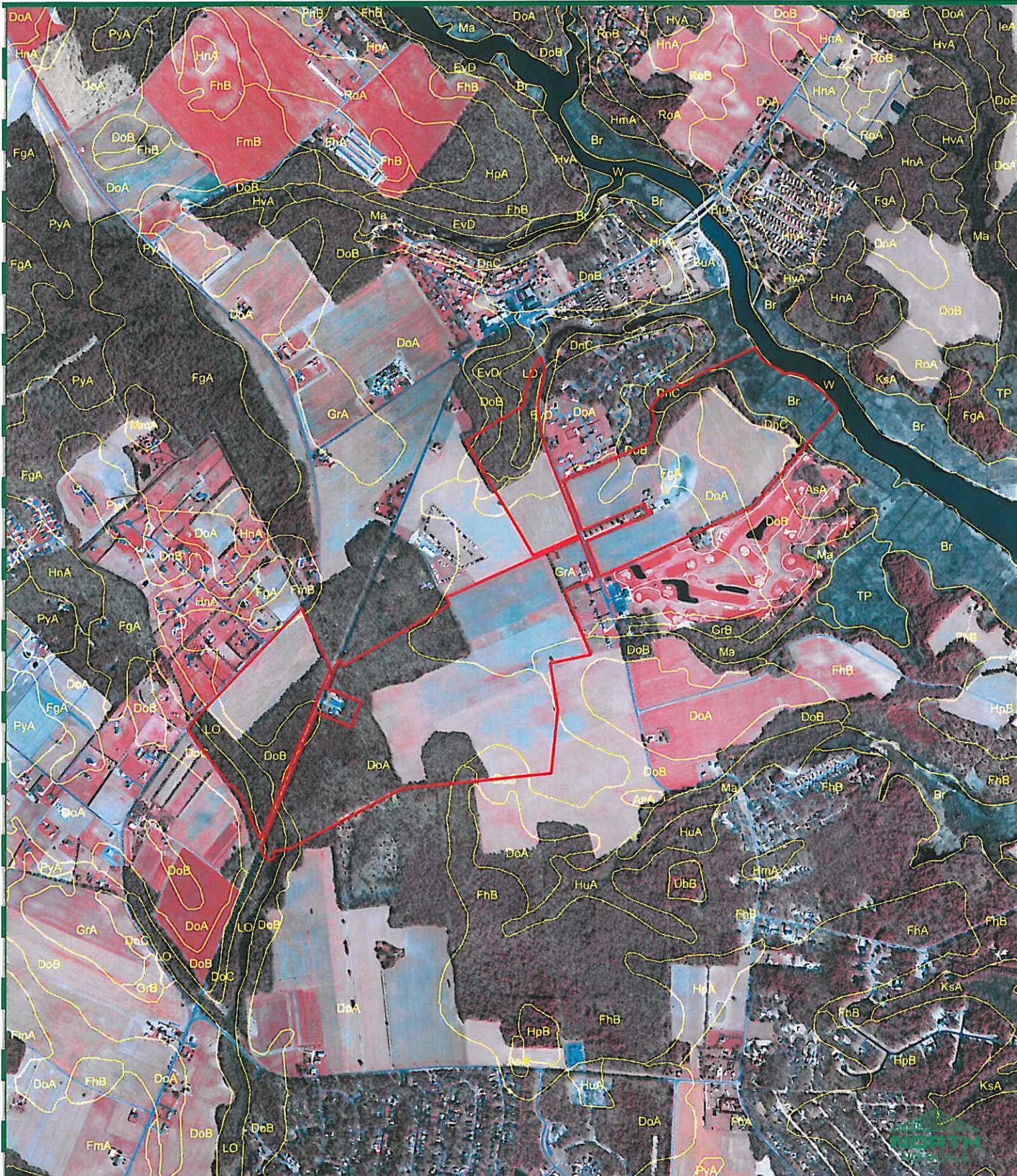
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[lisa@terrafirmaconsultinginc.com](mailto:lisa@terrafirmaconsultinginc.com)

SOIL CONSULTANTS

LANDS OF WANDENDALE FARMS, INC.  
TAX MAP # 2-34-7.00, PARCELS 127.00 & 130.00  
TAX MAP # 2-34-11.00, PARCELS 48.00 & 50.00

USGS TOPOGRAPHICAL MAP  
FAIRMOUNT QUADRANGLE



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SOIL CONSULTANTS

**LANDS OF WANDENDALE FARMS, INC.**  
TAX MAP # 2-34-7.00, PARCELS 127.00 & 130.00  
TAX MAP # 2-34-11.00, PARCELS 48.00 & 50.00

U.S. DEPT. OF AGRICULTURE, NRCS  
SOIL SURVEY GEOGRAPHIC (SSURGO) - DE005





**APPENDIX B**

**SOILS DATA**

**Particle Size Analysis  
Soil Boring Analyses  
Elevational Analysis  
Logged Profile Descriptions**

**LANDS OF WANDENDALE FARMS, INC.**

**SUSSEX COUNTY, DELAWARE**

**Tax Maps 2-34-7.00-127.00 and 130.00 and 2-34-11.00-48.00 and 50.00**

Particle Size Analysis  
Wandendale Farms, Inc.

TFCI Job #: 55-DS08-SIR

Analysis Performed by A & L Eastern Agricultural Laboratories, Inc.  
7621 Whitepine Road, Richmond, VA 23237

Sample Depth (Inches)	Textural Classification	Sand Percent	Silt Percent	Clay Percent	#10 Coarse Fragments 2 mm	#18 Very Coarse Sand 2 - 1 mm	#35 Coarse Sand 1 - 0.5 mm	#60 Medium Sand 0.5 - 0.25 mm	#140 Fine Sand 0.25 - 0.1 mm	#270 Very Fine Sand 0.1 - 0.05 mm
56	Loamy Sand	82.0	10.0	8.0						
15	Sandy Loam	60.0	24.0	16.0						
26	Loam	44.0	36.0	20.0						
31	Sandy Clay Loam	60.0	20.0	20.0						
Bt	Sandy Clay Loam	58.0	20.0	22.0						
Bt	Loam	42.0	32.0	26.0						
38	Sand	92.0	4.0	4.0						
64	Sandy Loam	70.0	20.0	10.0	0.0	0.1	1.6	15.8	24.2	12.3
Bt	Sandy Clay Loam	48.0	28.0	24.0						
E	Sand	90.0	6.0	4.0						
Ap	Sandy Loam	74.0	16.0	10.0						
E	Sandy Loam	60.0	26.0	14.0						
Bt-20"	Loam	46.0	32.0	22.0						
Bt	Sandy Loam	68.0	14.0	18.0						
Bt	Sandy Clay Loam	56.0	20.0	24.0						
Bt	Sandy Clay Loam	58.0	22.0	20.0						

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Soil Boring Analysis  
Wandendale Farms, Inc.

TFCI Job #: 55-DS-08-SIR

Soil Boring / Test Pit	Mapped Taxon	Soil Series	Depth to Limiting Zone (inches)	Depth - Free Water (inches)	Estimated Permeability (minutes per inch)	Agricultural Drainage Class	Ground Surface Elevation (feet msl)
SB 836	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	40	Well drained	32.29
SB 837	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	35	Well drained	30.11
SB 838	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	40	Well drained	30.61
SB 839	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	40	Well drained	31.62
SB 840	Typic Hapludult	Downer sandy loam, 0 to 2 percent slopes (DoA)	>72	>72	30	Well drained	30.63
SB 841	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	40	Well drained	31.01
SB 842	Psammentic Hapludult	Galeslown loamy sand, 0 to 5 percent slopes (GaB)	>72	>72	25	Somewhat excessively drained	31.83
TP 843	Arenic Hapludult	Fort Mott loamy sand, 0 to 2 percent slopes (FmA)	>72	>72	30	Well drained	30.28
TP 844	Typic Hapludult	Downer loamy sand, 0 to 2 percent slopes (DnA)	>72	>72	30	Well drained	32.21
TP 845	Lamellic Hapludult	Henlopen loamy sand, 0 to 5 percent slopes (HpB)	>72	>72	25	Somewhat well drained	30.87
SB 846	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	40	Well drained	31.36
SB 847	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	45	Well drained	31.70
SB 848	Arenic Hapludult	Fort Mott loamy sand, 0 to 2 percent slopes (FmA)	>72	>72	30	Well drained	30.51
SB 849	Arenic Hapludult	Fort Mott loamy sand, 0 to 2 percent slopes (FmA)	>72	>72	35	Well drained	31.96
TP 850	Typic Hapludult	Downer loamy sand, 0 to 2 percent slopes (DnA)	>72	>72	30	Well drained	30.96



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Soil Boring Analysis  
Wandendale Farms, Inc.

Soil Boring / Test Pit	Mapped Taxon	Soil Series	Depth to Limiting Zone (inches)	Depth - Free Water (inches)	Estimated Permeability (minutes per inch)	Agricultural Drainage Class	Ground Surface Elevation (feet msl)
SB 791	Arenic Hapludult	Fort Mott loamy sand, 0 to 2 percent slopes (FmA)	>72	>72	30	Well drained	33.84
SB 792	Arenic Hapludult	Fort Mott loamy sand, 0 to 2 percent slopes (FmA)	>72	>72	30	Well drained	33.35
SB 793	Lamellic Hapludult	Henlopen loamy sand, 2 to 5 percent slopes (HpB)	>72	>72	25	Somewhat excessively drained	31.14
TP 794	Typic Hapludult	Downer loamy sand, 0 to 2 percent slopes (DnA)	> 72	>72	30	Well drained	34.25
SB 795	Typic Hapludult	Downer loamy sand, 0 to 2 percent slopes (DnA)	>72	>72	35	Well drained	32.78
SB 796	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	50	Well drained	31.00
SB 797	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	60	Well drained	29.85
SB 798	Arenic Hapludult	Fort Mott loamy sand, 0 to 2 percent slopes (FmA)	>72	>72	60	Well drained	29.70
SB 799	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	60	Well drained	29.95
SB 800	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	40	Well drained	30.22
SB 801	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	40	Well drained	30.63
SB 802	Typic Hapludult	Downer loamy sand, 0 to 2 percent slopes (DnA)	>72	>72	30	Well drained	32.21
SB 803	Typic Hapludult	Downer loamy sand, 0 to 2 percent slopes (DnA)	>72	>72	30	Well drained	33.86
SB 804	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	35	Well drained	33.76
SB 805	Typic Hapludult	Sassafras sandy loam, 2 to 5 percent slopes (SaB)	>72	>72	50	Well drained	32.14
SB 806	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	30	Well drained	33.20
TP 807	Typic Hapludult	Downer loamy sand, 0 to 2 percent slopes (DnA)	>72	>75	30	Well drained	33.33
TP 808	Typic Hapludult	Downer loamy sand, 0 to 2 percent slopes (DnA)	>72	>72	30	Well drained	31.46
TP 809	Typic Hapludult	Downer loamy sand, 0 to 2 percent slopes (DnA)	>72	>72	35	Well drained	30.70
TP 810	Typic Hapludult	Downer loamy sand, 0 to 2 percent slopes (DnA)	>72	>80	40	Well drained	30.60
SB 811	Typic Hapludult	Hambrook sandy loam, 0 to 2 percent slopes (HbA)	66	>72	50	Well drained	30.55
SB 812	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	35	Well drained	31.39
SB 813	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	40	Well drained	32.20
SB 814	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	35	Well drained	33.65
SB 815	Arenic Hapludult	Fort Mott loamy sand, 0 to 2 percent slopes (FmA)	>72	>72	35	Well drained	33.89
SB 816	Typic Hapludult	Hambrook sandy loam, 2 to 5 percent slopes (HbB)	66	>72	35	Well drained	31.32
SB 817	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	50	Well drained	33.50
SB 818	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	60	Well drained	32.70
SB 819	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	60	Well drained	31.61
SB 820	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	60	Well drained	30.82
SB 821	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	60	Well drained	30.75
SB 822	Typic Hapludult	Hambrook sandy loam, 0 to 2 percent slopes (HbA)	67	>72	35	Well drained	30.50
TP 823	Typic Hapludult	Greenwich loam, 0 to 2 percent slopes (GrA)	>72	>72	40	Well drained	31.26
SB 824	Typic Hapludult	Downer loamy sand, 0 to 2 percent slopes (DnA)	>72	>72	30	Well drained	32.25
TP 825	Arenic Hapludult	Fort Mott loamy sand, 0 to 2 percent slopes (FmA)	>72	>72	25	Well drained	32.10
SB 826	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	50	Well drained	32.71
SB 827	Arenic Hapludult	Fort Mott loamy sand, 0 to 2 percent slopes (FmA)	>72	>72	35	Well drained	31.82
SB 828	Arenic Hapludult	Fort Mott loamy sand, 0 to 2 percent slopes (FmA)	>72	>72	30	Well drained	32.05
SB 829	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	60	Well drained	31.31
SB 830	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	60	Well drained	30.65
SB 832	Psammentic Hapludult	Henlopen loamy sand, 0 to 2 percent slopes (HpA)	>72	>72	25	Somewhat excessively drained	30.00
SB 833	Typic Hapludult	Greenwich loam, 0 to 2 percent slopes (GrA)	>72	>72	60	Well drained	30.94
TP 834	Typic Hapludult	Downer loamy sand, 0 to 2 percent slopes (DnA)	>72	>72	35	Well drained	31.76
SB 835	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	35	Well drained	30.43



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Soil Boring Analysis  
Wandendale Farms, Inc.

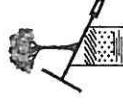
TFCI Job #: 55-DS08-SIR

Soil Boring / Test Pit	Mapped Taxon	Soil Series	Depth to Limiting Zone (inches)	Depth - Free Water (inches)	Estimated Permeability (minutes per inch)	Agricultural Drainage Class	Ground Surface Elevation (feet msl)
SB 746	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	35	Well drained	31.50
SB 747	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	35	Well drained	32.14
TP 748	Typic Hapludult	Downer loamy sand, 0 to 2 percent slopes (DnA)	>72	>72	30	Well drained	30.84
SB 749	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	40	Well drained	32.15
SB 750	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	50	Well drained	31.58
SB 751	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	60	Well drained	30.77
SB 752	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	60	Well drained	29.70
SB 753	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	50	Well drained	28.94
SB 754	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	45	Well drained	30.30
SB 755	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	50	Well drained	30.84
SB 756	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	40	Well drained	31.98
SB 757	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	40	Well drained	32.22
TP 758	Arenic Hapludult	Fort Mott loamy sand, 0 to 2 percent slopes (FmA)	>72	>72	25	Well drained	31.70
TP 759	Typic Hapludult	Downer loamy sand, 0 to 2 percent slopes (DnA)	>72	>72	30	Well drained	32.53
TP 760	Typic Hapludult	Downer loamy sand, 0 to 2 percent slopes (DnA)	>72	>72	30	Well drained	31.40
TP 761	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	50	Well drained	30.95
TP 762	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	41	Well drained	29.67
SB 765	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	45	Well drained	30.49
SB 766	Typic Hapludult	Greenwich loam, 0 to 2 percent slopes (GrA)	>72	>72	60	Well drained	31.05
SB 767	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	60	Well drained	31.96
SB 768	Arenic Hapludult	Fort Mott loamy sand, 0 to 2 percent slopes (FmA)	>72	>72	30	Well drained	32.98
SB 769	Arenic Hapludult	Fort Mott loamy sand, 0 to 2 percent slopes (FmA)	>72	>72	30	Well drained	33.04
SB 770	Typic Hapludult	Downer loamy sand, 0 to 2 percent slopes (DnA)	>72	>72	35	Well drained	32.90
SB 771	Typic Hapludult	Greenwich loam, 0 to 2 percent slopes (GrA)	>72	>72	75	Well drained	31.41
SB 772	Typic Hapludult	Greenwich loam, 0 to 2 percent slopes (GrA)	>72	>72	60	Well drained	30.34
SB 773	Typic Hapludult	Downer loamy sand, 0 to 2 percent slopes (DnA)	>72	>72	30	Well drained	29.43
TP 774	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	40	Well drained	28.40
SB 775	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	60	Well drained	28.90
SB 776	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	60	Well drained	29.76
TP 777	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	35	Well drained	30.16
SB 778	Arenic Hapludult	Fort Mott loamy sand, 0 to 2 percent slopes (FmA)	>72	>72	30	Well drained	31.83
TP 779	Typic Hapludult	Downer loamy sand, 0 to 2 percent slopes (DnA)	>72	>72	30	Well drained	33.48
TP 780	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	40	Well drained	32.08
SB 781	Lamellic Hapludult	Fort Mott loamy sand, 0 to 2 percent slopes (FmA)	>72	>72	25	Well drained	33.74
SB 782	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	40	Well drained	32.67
SB 783	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	60	Well drained	30.63
SB 784	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	60	Well drained	29.74
SB 785	Typic Hapludult	Greenwich loam, 0 to 2 percent slopes (GrA)	>72	>72	75	Well drained	29.28
SB 786	Typic Hapludult	Greenwich loam, 0 to 2 percent slopes (GrA)	>72	>72	75	Well drained	28.50
TP 787	Typic Hapludult	Greenwich loam, 0 to 2 percent slopes (GrA)	>72	>72	50	Well drained	29.23
TP 788	Typic Hapludult	Sassafras sandy loam, 0 to 2 percent slopes (SaA)	>72	>72	30	Well drained	29.44
SB 789	Typic Hapludult	Downer loamy sand, 0 to 2 percent slopes (DnA)	>72	>72	35	Well drained	30.12
TP 790	Typic Hapludult	Downer loamy sand, 0 to 2 percent slopes (DnA)	>72	>72	30	Well drained	31.46



**Minimum Invert Elevation  
Wandendale Farms, Inc.**

Soil Boring / Test Pit	Ground Surface Elevation (feet msl)	Minimum Depth of Excavation (inches)	Minimum RIB Invert Elevation (feet, msl)
SB 733	30.48	34	27.65
SB 734	31.27	44	27.60
TP 735	30.22	45	26.47
SB 736	28.56	36	25.56
SB 737	29.58	36	26.58
SB 738	31.22	37	28.14
TP 739	31.60	34	28.77
SB 740	31.50	38	28.33
SB 741	32.11	38	28.94
SB 742	30.80	50	26.63
SB 743	29.27	34	26.44
TP 744	28.71	38	25.54
TP 745	30.08	38	26.91
SB 746	31.50	38	28.33
SB 747	32.14	40	28.81
TP 748	30.84	31	28.26
SB 749	32.15	37	29.07
SB 750	31.58	36	28.58
SB 751	30.77	34	27.94
SB 752	29.70	37	26.62
SB 753	28.94	40	25.61
SB 754	30.30	36	27.30
SB 755	30.84	40	27.51
SB 756	31.98	38	28.81
SB 757	32.22	35	29.30
TP 758	31.70	39	28.45
TP 759	32.53	37	29.45
TP 760	31.40	38	28.23
TP 761	30.95	46	27.12
TP 762	29.67	40	26.34
SB 765	30.49	52	26.16
SB 766	31.05	36	28.05
SB 767	31.96	36	28.96
SB 768	32.98	36	29.98
SB 769	33.04	44	29.37
SB 770	32.90	36	29.90
SB 771	31.41	44	27.74
SB 772	30.34	34	27.51
SB 773	29.43	32	26.76
TP 774	28.40	22	26.57
SB 775	28.90	35	25.98

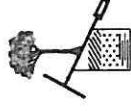


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Soil Boring / Test Pit	Ground Surface Elevation (feet msl)	Minimum Depth of Excavation (inches)	Minimum RIB Invert Elevation (feet, msl)
SB 776	29.76	37	26.68
TP 777	30.16	42	26.66
SB 778	31.83	38	28.66
TP 779	33.48	37	30.40
TP 780	32.08	32	29.41
SB 781	33.74	51	29.49
SB 782	32.67	36	29.67
SB 783	30.63	40	27.30
SB 784	29.74	37	26.66
SB 785	29.28	45	25.53
SB 786	28.50	34	25.67
TP 787	29.23	36	26.23
TP 788	29.44	37	26.36
SB 789	30.12	36	27.12
TP 790	31.46	34	28.63
SB 791	33.84	38	30.67
SB 792	33.35	35	30.43
SB 793	31.14	N/A	N/A
TP 794	34.25	35	31.33
SB 795	32.78	36	29.78
SB 796	31.00	38	27.83
SB 797	29.85	39	26.60
SB 798	29.70	46	25.87
SB 799	29.95	36	26.95
SB 800	30.22	37	27.14
SB 801	30.63	37	27.55
SB 802	32.21	38	29.04
SB 803	33.86	26	31.69
SB 804	33.76	45	30.01
SB 805	32.14	40	28.81
SB 806	33.20	36	30.20
TP 807	33.33	32	30.66
TP 808	31.46	34	28.63
TP 809	30.70	30	28.20
TP 810	30.60	41	27.18
SB 811	30.55	47	26.63
SB 812	31.39	38	28.22
SB 813	32.20	36	29.20
SB 814	33.65	40	30.32
SB 815	33.89	38	30.72
SB 816	31.32	40	27.99
SB 817	33.50	41	30.08
SB 818	32.70	36	29.70
SB 819	31.61	36	28.61

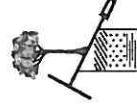


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Soil Boring / Test Pit	Ground Surface Elevation (feet msl)	Minimum Depth of Excavation (inches)	Minimum RIB Invert Elevation (feet, msl)
SB 820	30.82	37	27.74
SB 821	30.75	37	27.67
SB 822	30.50	46	26.67
TP 823	31.26	40	27.93
SB 824	32.25	36	29.25
TP 825	32.10	33	29.35
SB 826	32.71	38	29.54
SB 827	31.82	50	27.65
SB 828	32.05	44	28.38
SB 829	31.31	42	27.81
SB 830	30.65	40	27.32
SB 832	30.00	N/A	N/A
SB 833	30.94	49	26.86
TP 834	31.76	34	28.93
SB 835	30.43	38	27.26
SB 836	32.29	44	28.62
SB 837	30.11	45	26.36
SB 838	30.61	41	27.19
SB 839	31.62	38	28.45
SB 840	30.63	38	27.46
SB 841	31.01	34	28.18
SB 842	31.83	N/A	N/A
TP 843	30.28	37	27.20
TP 844	32.21	38	29.04
TP 845	30.87	N/A	N/A
SB 846	31.36	N/A	N/A
SB 847	31.70	30	29.20
SB 848	30.51	40	27.18
SB 849	31.96	37	28.88
TP 850	30.96	32	28.29



Terra Firma Consulting, Inc.  
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Ocean View, DE 19970

**APPENDIX C**

**INFILTRATION TEST DATA**

**LANDS OF WANDENDALE FARMS, INC.**

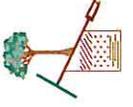
**SUSSEX COUNTY, DELAWARE**

**Tax Maps 2-34-7.00-127.00 and 130.00 and 2-34-11.00-48.00 and 50.00**

Double-Ring Infiltrometer Testing  
Wandendale Farms, Inc.

Name/ Number: 704			Name/ Number: 706			Name/ Number: 710					
3/26/2008			3/25/2008			3/26/2008					
Depth: 22"			Depth: 64"			Depth: 30"					
Saturated for 4.0 hours			Saturated for 4.0 hours			Saturated for 4.0 hours					
Start Time	Time Interval	Drop in inches	Depth of head	Start Time	Time Interval	Drop in inches	Depth of head	Start Time	Time Interval	Drop in inches	Depth of head
<b>DOUBLE RING INFILTROMETER</b>											
		Presoak	8"			Presoak	8"			Presoak	8"
10:45 AM				11:00 AM				11:15 AM			
	Hours	Start Time	6"		Minutes	Start Time	6"		Minutes	Start Time	6"
	1:00	$\frac{3}{8}$	6"		20	$\frac{1}{4}$	6"		10	$\frac{3}{2}$ "	6"
	1:00	$\frac{3}{8}$	6"		30	$\frac{1}{6}$	6"		5	$\frac{1}{4}$	6"
	1:00	$\frac{3}{8}$	6"		30	$\frac{1}{6}$	6"		2:48	1"	6"
	1:00	$\frac{3}{8}$	6"		10	$\frac{5}{8}$	6"		2:43	1"	6"
			6"		10	$\frac{5}{8}$	6"		2:42	1"	6"
			6"		10	$\frac{5}{8}$	6"		2:45	1"	6"
			6"		10	$\frac{5}{8}$	6"		2:46	1"	6"
			6"				6"		2:44	1"	6"
			6"				6"		2:40	1"	6"
			6"				6"		2:43	1"	6"
			6"				6"		2:45	1"	6"
			6"				6"		2:42	1"	6"
			6"				6"		2:46	1"	6"
			6"				6"		2:47	1"	6"
			6"				6"		2:41	1"	6"
			6"				6"		2:42	1"	6"
			6"				6"		2:44	1"	6"
			6"				6"		2:45	1"	6"
			6"				6"		2:45	1"	6"
			6"				6"		2:45	1"	6"
			6"				6"		2:45	1"	6"
<b>160 Minutes per inch</b>				<b>16 Minutes per inch</b>				<b>2.75 Minutes per inch</b>			

CONDUCTED BY: Lisa Wood and/or Douglas Boozer



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302-539-1501



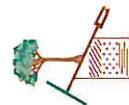




Double-Ring Infiltrometer Testing  
Wandendale Farms, Inc.

Name/ Number: 774				Name/ Number: 777				Name/ Number: 788			
Date: 3/17/08				Date: 3/13/08				Date: 3/13/08			
Depth: 36"				Depth: 32"				Depth: 25"			
Saturated for 4.0 hours				Saturated for 4.0 hours				Saturated for 4.0 hours			
Start Time	Time Interval	Drop in inches	Depth of head	Start Time	Time Interval	Drop in inches	Depth of head	Start Time	Time Interval	Drop in inches	Depth of head
<b>DOUBLE RING INFILTRMETER</b>											
10:00 AM		Presoak	8"	9:38 AM		Presoak	8"	9:50 AM		Presoak	8"
	Minutes	Start Time	6"		Minutes	Start Time	6"		Minutes	Start Time	6"
	10	4½"	6"		10	3¾	6"		10	2¼	6"
	1:48	1"	6"		10	3¾	6"		10	2¼	6"
	1:58	1"	6"		10	3½	6"		10	2¼	6"
	1:54	1"	6"		10	3½	6"		10	2¼	6"
	1:56	1"	6"		10	3½	6"		10	2¼	6"
	2:01	1"	6"		10	3½	6"		10	2¼	6"
	2:00	1"	6"		10	3½	6"		10	2¼	6"
	2:03	1"	6"		10	3½	6"		10	2¼	6"
	1:59	1"	6"		10	3½	6"		10	2¼	6"
	2:01	1"	6"		10	3½	6"		10	2¼	6"
	2:03	1"	6"		10	3½	6"		10	2¼	6"
	2:03	1"	6"		10	3½	6"		10	2¼	6"
	2:09	1"	6"		10	3½	6"		10	2¼	6"
	2:13	1"	6"		10	3½	6"		10	2¼	6"
	2:10	1"	6"		10	3½	6"		10	2¼	6"
	2:14	1"	6"		10	3½	6"		10	2¼	6"
	2:09	1"	6"		10	3½	6"		10	2¼	6"
<b>2.5 Minutes per inch</b>				<b>2.85 Minutes per inch</b>				<b>4.7 Minutes per inch</b>			

CONDUCTED BY: Lisa Wood and/or Douglas Boozer



Terra Firma Consulting, Inc.  
P.O. Box 938  
Ocean View, DE 19970  
302-539-1501





**APPENDIX D**

**OBSERVATION WELL/PIEZOMETER DATA**

**LANDS OF WANDENDALE FARMS, INC.**

**SUSSEX COUNTY, DELAWARE**

**Tax Maps 2-34-7.00-127.00 and 130.00 and 2-34-11.00-48.00 and 50.00**

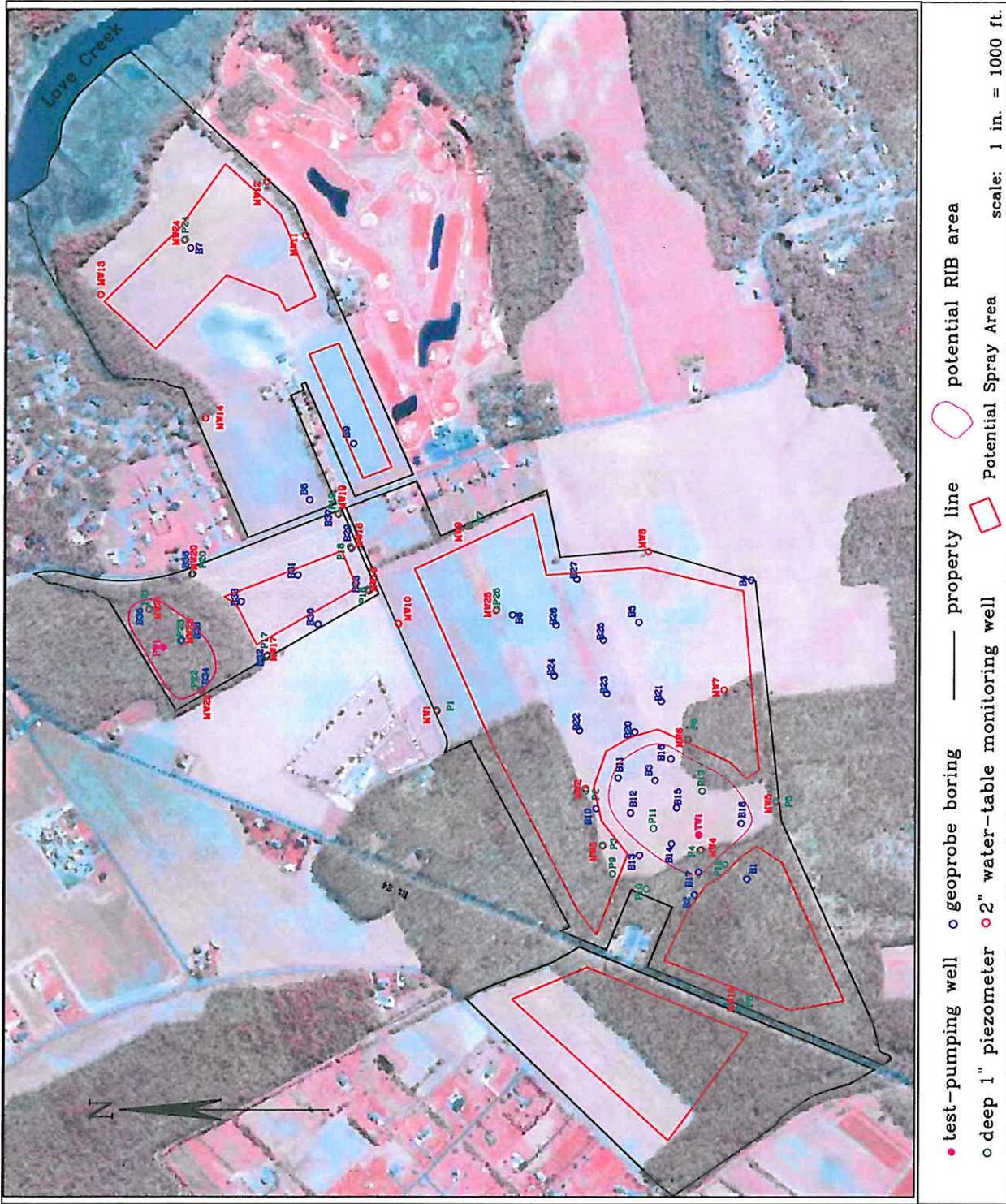


Figure 2: Test Boring and Well Locations

**Table 1. Well, Piezometer, and Geoprobe Summary**

ID	Stickup (ft)	PVC Elev. (ft-msl)	Gnd Elev. (ft-msl)	March 3, 2008		GW Elevation (ft-msl)	Bore Depth (ft)	Screen Int. (ft)	DE State Plane (ft)	
				DTW from PVC (ft)	DTW from Grade (ft)				Easting	Northing
MW1	2.80	29.72	26.92	23.39	20.59	6.33	40	15 - 25	726139	251796
MW2	2.90	31.01	28.11	24.95	22.05	6.06	40	15 - 25	725628	250763
MW3	2.90	32.82	29.92	26.57	23.67	6.25	40	15 - 25	725291	250588
MW4	2.71	35.18	32.47	28.96	26.25	6.22	40	20 - 30	725208	249987
MW5	2.80	31.88	29.08	26.09	23.29	5.79	40	15 - 25	725536	249467
MW6	2.80	31.75	28.95	25.91	23.11	5.84	40	15 - 25	725963	250099
MW7	2.81	30.17	27.36	24.60	21.79	5.57	40	15 - 25	726312	249818
MW8	2.90	28.98	26.08	23.64	20.74	5.34	40	15 - 25	727192	250337
MW9	2.70	24.74	22.04	17.85	15.15	6.89	40	10 - 20	727371	251553
MW10	2.80	24.38	21.58	18.22	15.42	6.16	40	10 - 20	726696	252016
MW11	2.71	15.30	12.59	11.87	9.16	3.43	40	10 - 20	729315	252681
MW12	2.83	17.30	14.47	14.62	11.79	2.68	40	10 - 20	729691	252948
MW13	2.46	17.61	15.15	15.45	12.99	2.16	40	10 - 20	728941	254005
MW14	2.76	15.78	13.02	11.31	8.55	4.47	40	10 - 20	728071	253394
MW15	2.70	25.61	22.91	18.85	16.15	6.76	40	15 - 25	724143	249729
MW16	2.71	22.78	20.07	15.75	13.04	7.03	40	15 - 25	726930	252227
MW17	2.87	21.33	18.46	15.16	12.29	6.17	40	15 - 25	726498	252910
MW18	2.25	20.44	18.19	14.80	12.55	5.64	40	15 - 20	727215	252345
MW19	2.47	20.02	17.55	14.53	12.06	5.49	40	15 - 25	727445	252433
MW20	1.78	19.72	17.94	14.42	12.64	5.30	40	15 - 20	727044	253415
MW21	1.65	17.97	16.32	12.95	11.30	5.02	40	15 - 20	726809	253706
MW22	1.40	20.18	18.78	14.25	12.85	5.93	40	15 - 25	726269	253349
MW23	1.64	20.00	18.36	14.41	12.77	5.59	40	13 - 18	726594	253489
MW24	1.91	18.07	16.16	13.23	11.32	4.84	40	8 - 13	729285	253478
MW25	2.17	26.86	24.69	20.93	18.76	5.93	40	15 - 20	726800	251373
P1	2.50	29.38	26.88	23.04	20.54	6.34	40	30 - 40	726139	251796
P2	2.50	30.62	28.12	24.58	22.08	6.04	40	28 - 38	725593	250768
P3	2.90	32.96	30.06	26.74	23.84	6.22	40	34 - 40	725228	250655
P4	3.00	35.54	32.54	29.40	26.40	6.14	40	35 - 40	725193	250002
P5	3.30	32.39	29.09	26.60	23.30	5.79	40	35 - 40	725524	249487
P6	3.10	32.05	28.95	26.20	23.10	5.85	40	35 - 40	725932	250084
P7	2.70	24.69	21.99	19.22	16.52	5.47	40	26 - 36	727368	251555
P8	2.90	25.88	22.98	19.15	16.25	6.73	40	35 - 40	724178	249724
P9	3.01	31.45	28.44	25.07	22.06	6.38	40	35 - 40	725035	250588
P10	2.76	32.06	29.30	25.75	22.99	6.31	40	35 - 40	724933	250361
P11	2.75	35.00	32.25	28.83	26.08	6.17	40	35 - 40	725339	250313
P12	3.03	34.31	31.28	28.18	25.15	6.13	40	35 - 40	725097	249833
P13	3.08	34.08	31.00	28.10	25.02	5.98	40	35 - 40	725591	249988
P16	2.29	22.33	20.04	16.44	14.15	5.89	40	35 - 40	726930	252227
P17	2.88	21.34	18.46	15.28	12.40	6.06	40	35 - 40	726498	252910
P18	2.40	20.59	18.19	14.95	12.55	5.64	40	35 - 40	727215	252345
P19	2.08	19.61	17.53	14.14	12.06	5.47	40	35 - 40	727445	252433
P20	1.90	19.85	17.95	14.66	12.76	5.19	40	35 - 40	727044	253415
P21	2.05	18.35	16.30	13.35	11.30	5.00	40	35 - 40	726809	253706
P22	1.95	20.85	18.90	15.00	13.05	5.85	40	35 - 40	726269	253349
P23	1.85	19.98	18.13	14.43	12.58	5.55	40	35 - 40	726594	253489
P24	2.24	18.36	16.12	15.80	13.56	2.56	40	35 - 40	729285	253478
P25	2.13	26.90	24.77	20.94	18.81	5.96	40	35 - 40	726800	251373



Well #		P-4		P-6		
Casing Height Above Grade (Ft)	Ground Surface Elevation (Ft-MSL)	Water Top Of Casing Feet	Water from Ground Surface Feet	Water Top Of Casing Feet	Water from Ground Surface Feet	
3	32.54			3.1		
Date						
GW Elevation Feet-MSL						
11/28/2007	28.00	31.00	28.00	27.62	24.52	4.43
12/4/2007	28.52	31.02	28.52	27.92	24.82	4.13
12/18/2007	28.52	31.02	28.52	27.95	24.85	4.10
12/27/2007	28.36	30.86	28.36	27.74	24.64	4.31
1/4/2008	28.21	30.71	28.21	27.60	24.50	4.45
1/10/2008	28.11	30.61	28.11	27.51	24.41	4.54
1/14/2008	28.05	30.55	28.05	27.45	24.35	4.60
1/18/2008	27.98	30.48	27.98	27.36	24.26	4.69
2/8/2008	27.66	30.16	27.66	27.01	23.91	5.04
2/15/2008	27.53	30.03	27.53	26.90	23.80	5.15
2/29/2008	26.59	29.09	26.59	26.29	23.19	5.76
3/3/2008	26.90	29.40	26.90	26.20	23.10	5.85
3/7/2008	26.75	29.25	26.75	26.02	22.92	6.03
3/14/2008	26.42	28.92	26.42	25.73	22.63	6.32
3/28/2008	25.97	28.47	25.97	25.30	22.20	6.75
3/31/2008	25.95	28.45	25.95	25.30	22.20	6.75
4/4/2008	25.81	28.31	25.81	25.15	22.05	6.90
4/11/2008	25.70	28.20	25.70	25.09	21.99	6.96
4/18/2008	25.67	28.17	25.67	25.10	22.00	6.95
4/24/2008	25.70	28.20	25.70	25.14	22.04	6.91
4/28/2008	25.70	28.20	25.70	25.15	22.05	6.90
2/5/2009	24.67	27.17	24.67	24.20	21.10	7.85
2/13/2009	24.71	27.21	24.71	24.25	21.15	7.80
2/27/2009	24.88	27.38	24.88	24.44	21.34	7.61
3/10/2009	25.08	27.58	25.08	24.64	21.54	7.41
3/20/2009	25.19	27.69	25.19	24.76	21.66	7.29
3/27/2009	25.24	27.74	25.24	24.84	21.74	7.21
4/3/2009	25.18	27.68	25.18	24.78	21.68	7.27
4/17/2009	25.22	27.72	25.22	24.83	21.73	7.22
4/24/2009	24.73	27.23	24.73	24.35	21.25	7.70
5/1/2009	24.21	26.71	24.21	23.79	20.69	8.26
5/8/2009	23.72	26.22	23.72	23.24	20.14	8.81
5/15/2009	23.38	25.88	23.38	22.91	19.81	9.14

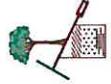


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Ocean View, DE 19970



Wandendale Well Data

Well #	P-13	Casing Height Above Grade (Ft)	3.08	Ground Surface Elevation (Ft-MSL)	31	Water Top Of Casing		Water from Ground Surface		GW Elevation	
						Feet	Feet	Feet	Feet-MSL	Feet-MSL	Feet-MSL
<b>Date</b>											
11/28/2007											
12/4/2007		29.75		26.67							4.33
12/18/2007		29.81		26.73							4.27
12/27/2007		29.59		26.51							4.49
1/4/2008		29.45		26.37							4.63
1/10/2008		29.34		26.26							4.74
1/14/2008		29.29		26.21							4.79
1/18/2008		29.21		26.13							4.87
2/8/2008		28.88		25.80							5.20
2/15/2008		28.75		25.67							5.33
2/29/2008		28.20		25.12							5.88
3/3/2008		28.10		25.02							5.98
3/7/2008		27.92		24.84							6.16
3/14/2008		27.63		24.55							6.45
3/28/2008		27.20		24.12							6.88
3/31/2008		27.17		24.09							6.91
4/4/2008		27.04		23.96							7.04
4/11/2008		26.94		23.86							7.14
4/18/2008		26.93		23.85							7.15
4/24/2008		26.97		23.89							7.11
4/28/2008		27.00		23.92							7.08
2/5/2009		25.97		22.89							8.11
2/13/2009		26.05		22.97							8.03
2/27/2009		26.21		23.13							7.87
3/10/2009		26.42		23.34							7.66
3/20/2009		26.53		23.45							7.55
3/27/2009		26.60		23.52							7.48
4/3/2009		26.53		23.45							7.55
4/17/2009		26.58		23.50							7.50
4/24/2009		26.06		22.98							8.02
5/1/2009		25.56		22.48							8.52
5/8/2009		25.08		22.00							9.00
5/15/2009		24.71		21.63							9.37



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Ocean View, DE 19970

Wandendale Well Data

Well #		P-21		P-22	
Casing Height Above Grade (Ft)	Ground Surface Elevation (Ft-MSL)	Water Top Of Casing Feet	Water from Ground Surface Feet	Water Top Of Casing Feet	Water from Ground Feet
GW Elevation Feet-MSL		GW Elevation Feet-MSL		GW Elevation Feet-MSL	
Date		Date		Date	
11/28/2007	3.14	15.21	13.16	17.15	15.20
12/4/2007	3.35	15.00	12.95	16.92	14.97
12/18/2007	3.45	14.90	12.85	16.89	14.94
12/27/2007	3.64	14.71	12.66	16.66	14.71
1/4/2008	4.26	14.09	12.04	16.41	14.46
1/10/2008	3.94	14.41	12.36	16.27	14.32
1/14/2008	4.01	14.34	12.29	16.20	14.25
1/18/2008	4.09	14.26	12.21	16.08	14.13
2/8/2008	4.32	14.03	11.98	15.84	13.89
2/15/2008	4.46	13.89	11.84	15.70	13.75
2/29/2008	4.98	13.37	11.32	16.03	14.08
3/3/2008	5.00	13.35	11.30	15.00	13.05
3/7/2008	5.07	13.28	11.23	14.88	12.93
3/14/2008	5.25	13.10	11.05	14.62	12.67
3/28/2008	5.39	12.96	10.91	14.35	12.40
3/31/2008	5.31	13.04	10.99	14.40	12.45
4/4/2008	5.35	13.00	10.95	14.36	12.41
4/11/2008	5.29	13.06	11.01	14.41	12.46
4/18/2008	5.17	13.18	11.13	14.56	12.61
4/24/2008	5.46	12.89	10.84	14.67	12.72
4/28/2008	4.90	13.45	11.40	14.70	12.75
2/5/2009	5.60	12.75	10.70	13.91	11.96
2/13/2009	5.52	12.83	10.78	14.01	12.06
2/27/2009	5.37	12.98	10.93	14.21	12.26
3/10/2009	5.25	13.10	11.05	14.38	12.43
3/20/2009	5.16	13.19	11.14	14.49	12.54
3/27/2009	5.13	13.22	11.17	14.55	12.60
4/3/2009	5.24	13.11	11.06	14.45	12.50
4/17/2009	5.65	12.70	10.65	14.15	12.20
4/24/2009	6.24	12.11	10.06	14.22	11.27
5/1/2009	6.49	11.86	9.81	12.70	10.75
5/8/2009	6.51	11.84	9.79	12.57	10.62
5/15/2009	6.44	11.91	9.86	12.55	10.60



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P.O. Box 938  
Ocean View, DE 19970

Wandendale Well Data

Well #	P-23	
Casing Height Above Grade (Ft)	1.85	
Ground Surface Elevation (Ft-MSL)	18.13	
	Water Top Of Casing Feet	Water from Ground Surface Feet
		GW Elevation Feet-MSL
Date		
11/28/2007		
12/4/2007		
12/18/2007		
12/27/2007		
1/4/2008		
1/10/2008		
1/14/2008		
1/18/2008		
2/8/2008	15.23	13.38
2/15/2008	15.10	13.25
2/29/2008	14.44	12.59
3/3/2008	14.43	12.58
3/7/2008	14.31	12.46
3/14/2008	14.09	12.24
3/28/2008	13.83	11.98
3/31/2008	13.94	12.09
4/4/2008	13.90	12.05
4/11/2008	13.95	12.10
4/18/2008	14.09	12.24
4/24/2008	14.20	12.35
4/28/2008	14.26	12.41
2/5/2009	13.52	11.67
2/13/2009	13.62	11.77
2/27/2009	13.80	11.96
3/10/2009	13.96	12.11
3/20/2009	14.07	12.22
3/27/2009	14.11	12.26
4/3/2009	13.98	12.13
4/17/2009	13.63	11.78
4/24/2009	12.81	10.96
5/1/2009	12.38	10.53
5/8/2009	12.32	10.47
5/15/2009	12.34	10.49



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P.O. Box 938  
Ocean View, DE 19970

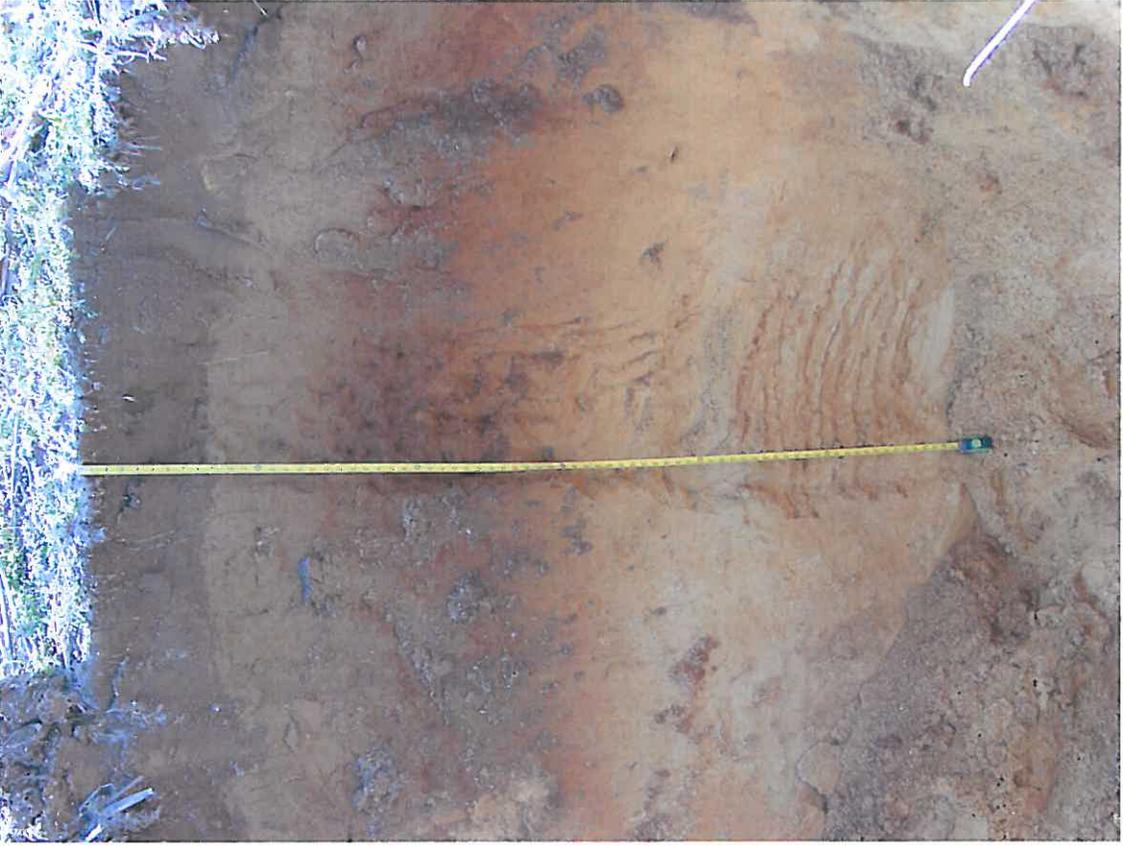
**APPENDIX E**

**SITE PHOTOGRAPHS**

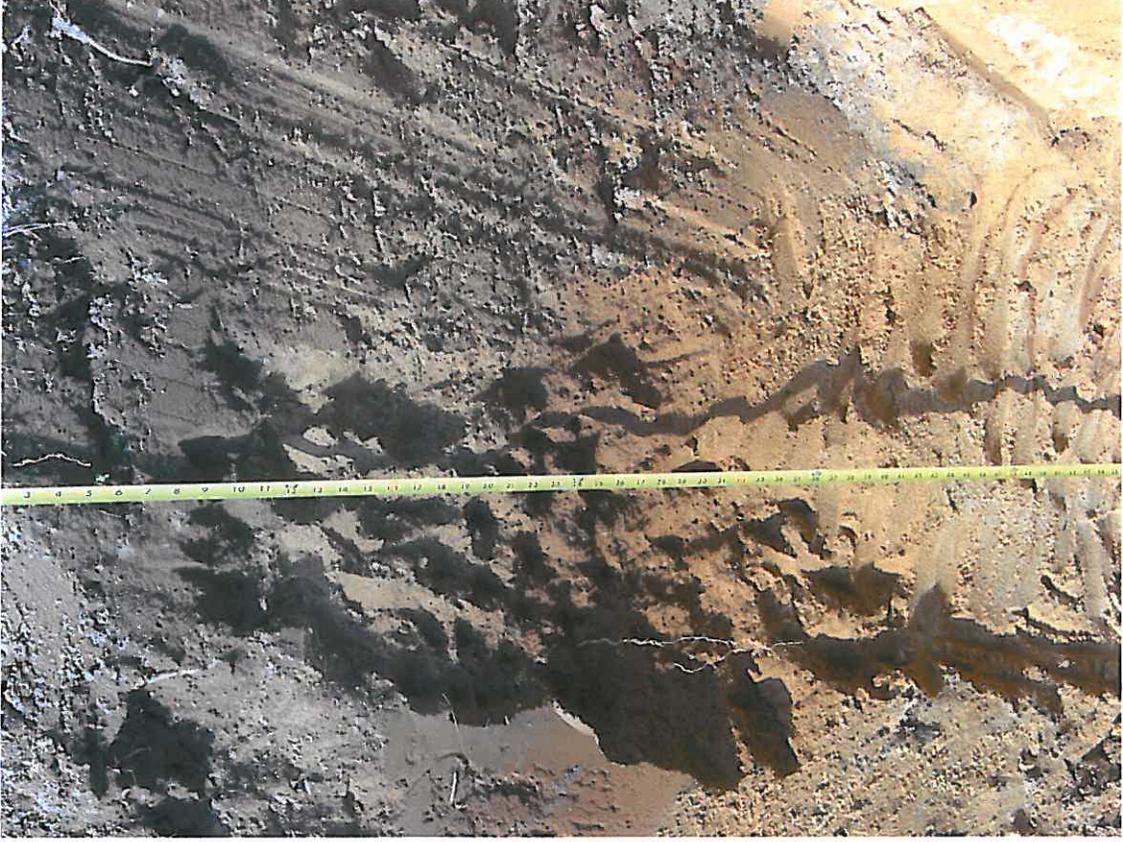
**LANDS OF WANDENDALE FARMS, INC.**

**SUSSEX COUNTY, DELAWARE**

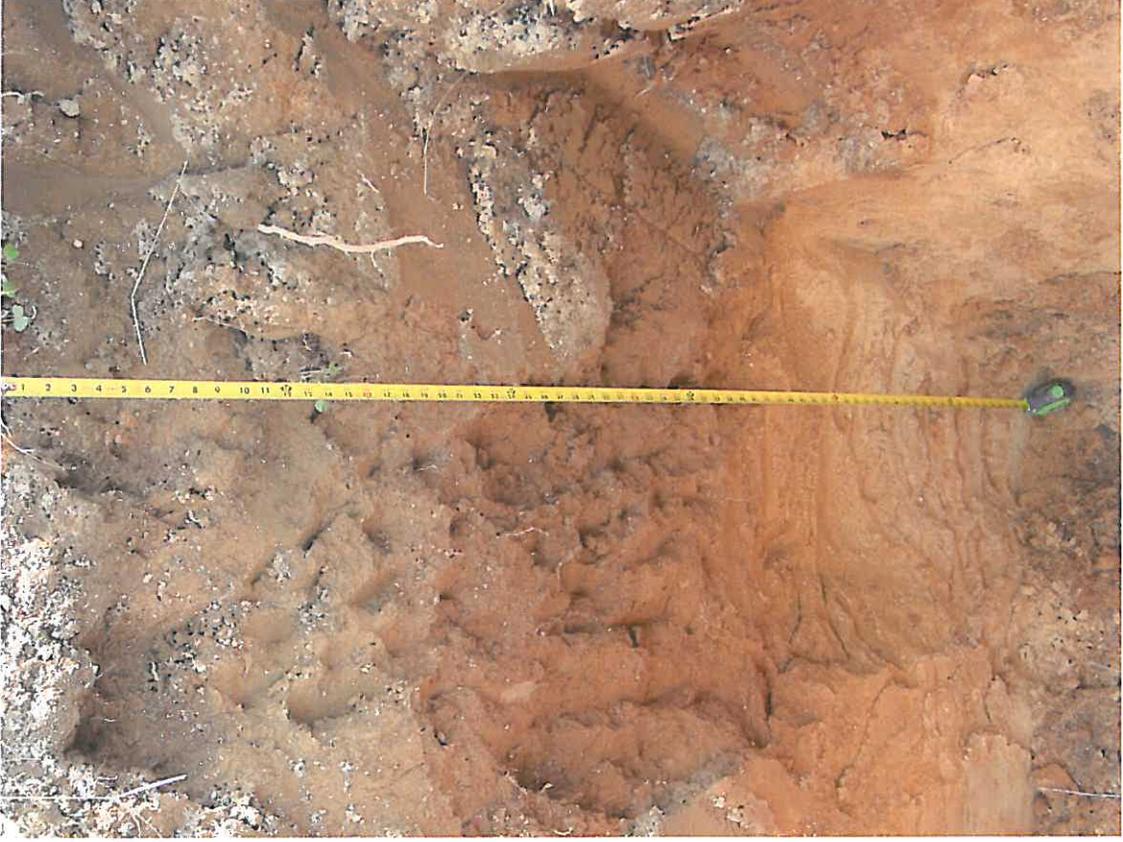
**Tax Maps 2-34-7.00-127.00 and 130.00 and 2-34-11.00-48.00 and 50.00**



Test Pit 807



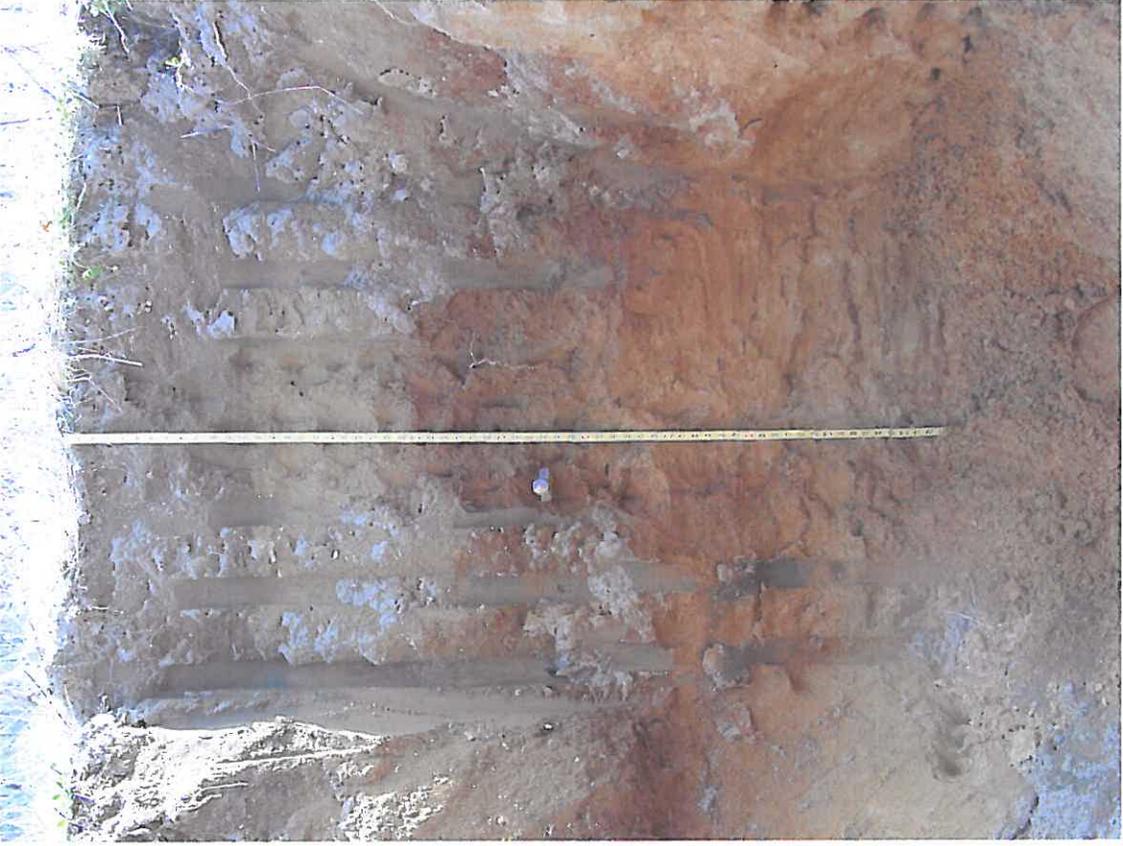
Test Pit 808



Test Pit 823



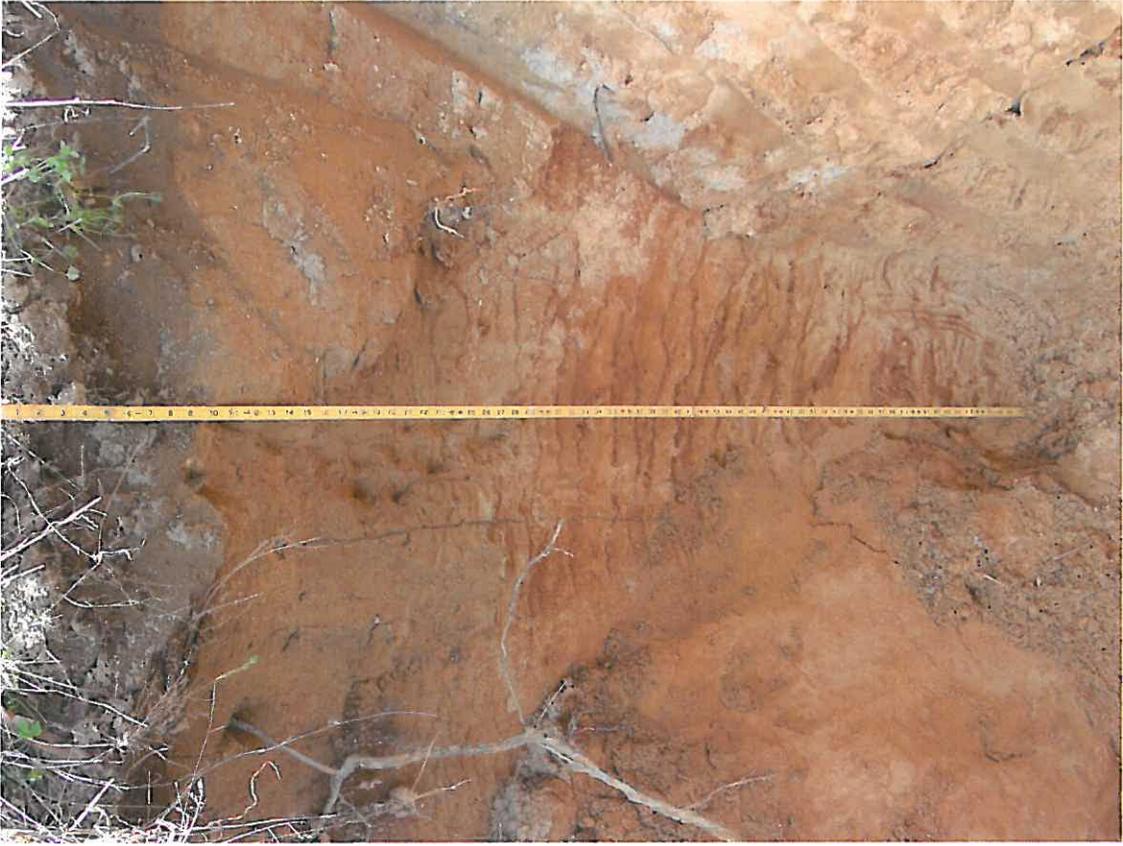
Test Pit 809



Test Pit 850



Test Pit 844



Test PIT 845



Test Pit 788



Test Pit 761



Test Pit 787



Test Pit 774



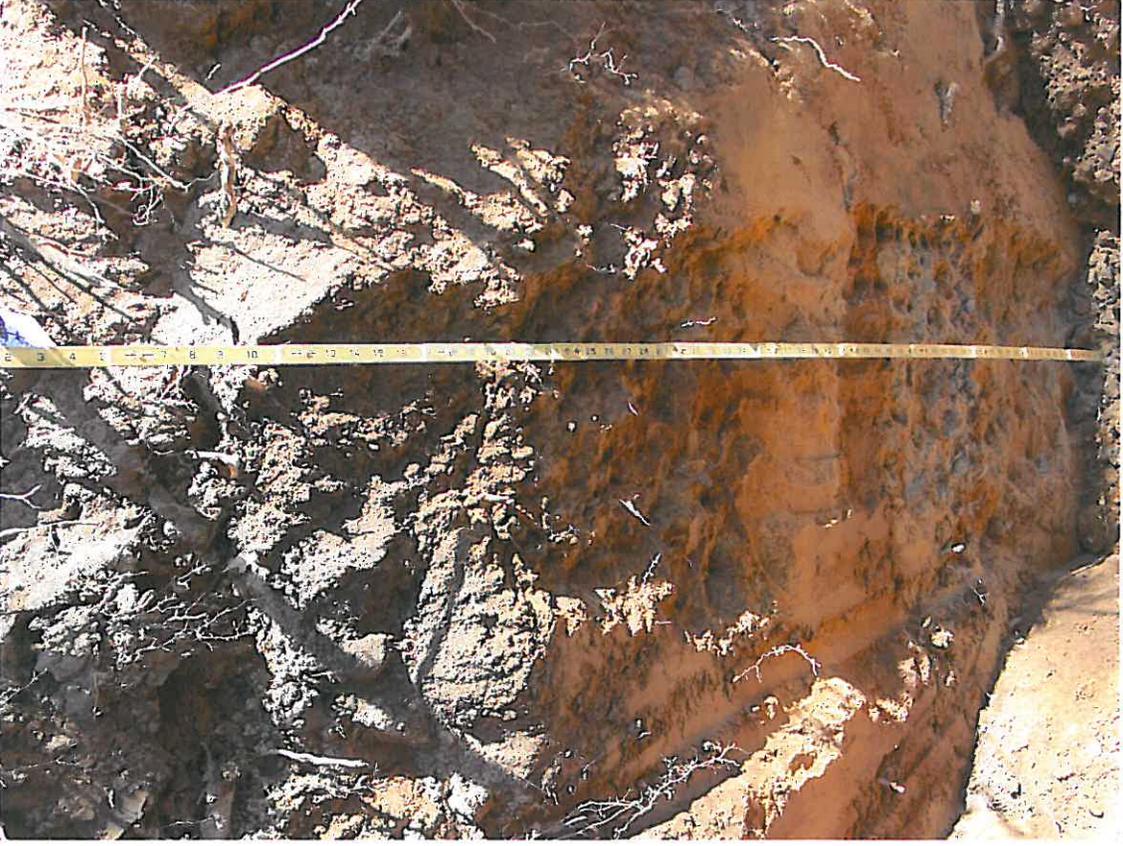
Test Pit 745



Test Pit 725



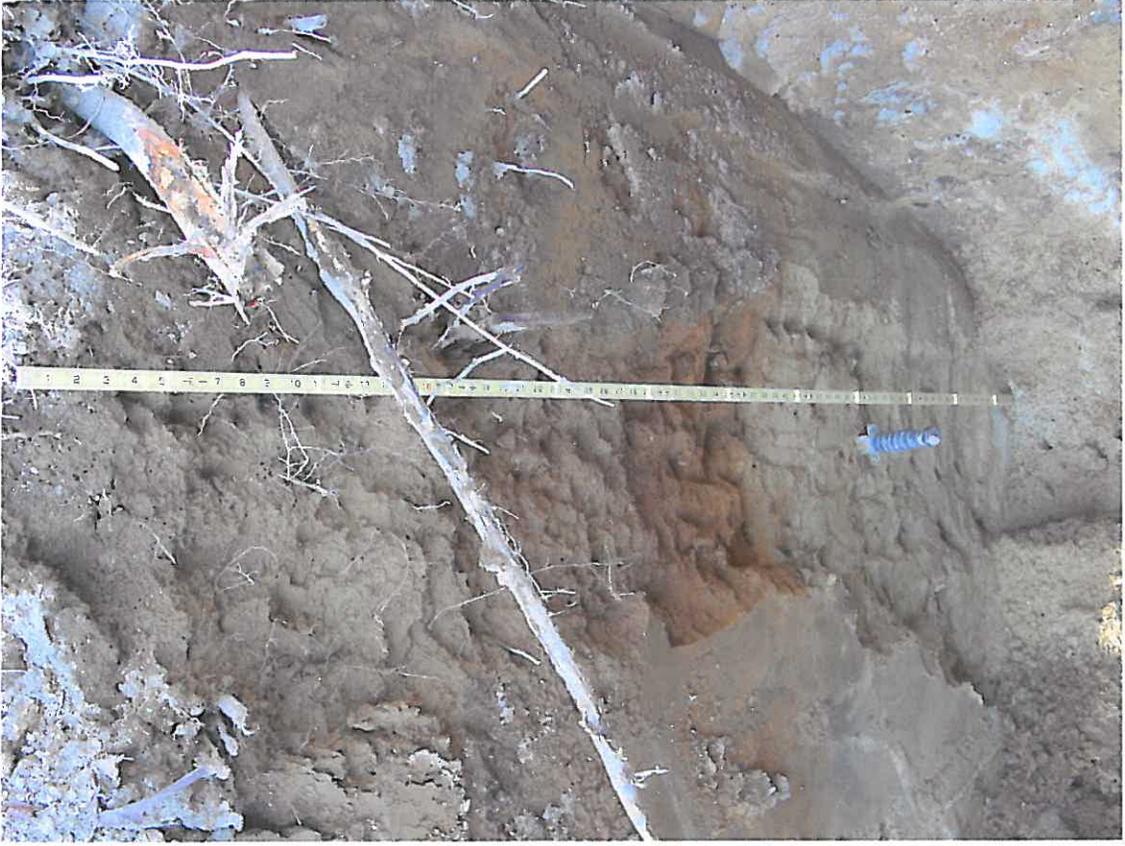
Test Pit 748



Test Pit 732



Test Pit 732-Close up of fine textured substratum material



Test Pit 720

