Geotechnical Engineering Report

Ledyard High School Track and Field Renovations
Ledyard, Connecticut
March 25, 2019
Terracon Project No. J2195027

Prepared for:
Ledyard Public Schools
Ledyard, Connecticut

Prepared by:
Terracon Consultants, Inc.
Rocky Hill, Connecticut

March 25, 2019

Ledyard Public Schools
4 Blonders Boulevard
Ledyard, Connecticut 06339

Attn: Mr. Samuel C. Kilpatrick III
P: (860) 464-9255
E: samkilpatrick@ledyard.net

Re: Geotechnical Engineering Report
Ledyard High School Track and Field Renovations
24 Gallup Hill Road
Ledyard, Connecticut
Terracon Project No. J2195027

Dear Mr. Kilpatrick:

We have completed the Geotechnical Engineering services for the above-referenced project. This study was performed in general accordance with Terracon Proposal No. PJ2195027, dated March 11, 2019. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and pavements for the proposed project. An environmental assessment was not part of this project.

We appreciate the opportunity to be of service to you on this project. If you have questions concerning this report or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

Christian B. Rice, P.E.
Senior Staff Geotechnical Engineer

Stephen C. Lanne, P.E.
Geotechnical Department Manager

REPORT TOPICS

Note: This report was originally delivered in a web-based format. For more interactive features, please view your project online at client.terracon.com.

ATTACHMENTS

Note: Refer to each individual Attachment for a listing of contents.

Geotechnical Engineering Report

Ledyard High School Track and Field Renovations
24 Gallup Hill Road
Ledyard, Connecticut
Terracon Project No. J2195027
March 25, 2019

INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed Ledyard High School track and field renovations located at 24 Gallup Hill Road in Ledyard, Connecticut. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Site preparation and earthwork
- Excavation considerations
- Pavement design and construction
- Frost considerations

The geotechnical engineering Scope of Services for this project included the advancement of eight test borings to a depth of approximately 8 feet below existing site grades.

Maps showing the site and boring locations are shown in **Site Location** and **Exploration Plan**. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring logs and/or as separate graphs in **Exploration Results**.

SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project is located at 24 Gallup Hill Road in Ledyard, Connecticut. Area of track and football field: approximately 3.5 acres. See **Site Location**
Existing Improvements	Football field with running track around perimeter and associated bleachers.
Current Ground Cover	■ Football field: grass ■ Track: bituminous concrete covered with layer of rubber

Item	Description
Existing Topography (from Progress Prints dated February 19, 2019, prepared by KBA)	The field and track slopes gradually downward to the northwest from approximate ground surface elevation (El) = 301 feet to El 299 feet.
Geology	The *Surficial Materials Map of Connecticut, 1992,* depicts soils within the vicinity of the site consist of glacial till. The *Bedrock Geological Map of Connecticut, 1985,* identifies that bedrock underlying the site consists of gneiss and granite, however bedrock was not encountered in the explorations.

PROJECT DESCRIPTION

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Information Provided	■ "*Request for Proposal*" dated February 19, 2019 ■ "*Existing Aerial Photo*" dated February 19, 2019. ■ "*Existing Aerial Photo – Proposed Geotechnical Borings*" dated February 19, 2019. ■ *"Site Layout & Materials"* progress prints, Drawing No. L1.01, dated February 19, 2019, prepared by KBA.
Project Description	The project involves a feasibility study for renovating the existing track and field, with a possible conversion of the field to synthetic turf. We anticipate the existing track will be replaced.
Track and Field Construction	The new field is expected to consist of new grass, or synthetic turf underlain by a free-draining aggregate base. The track is expected to be replaced with bituminous concrete pavement with a rubber surface.
Grading	Minor grading, up to a couple feet or so, is anticipated to re-develop the track and field.
Estimated Start of Construction	Summer/Fall 2019.

GEOTECHNICAL CHARACTERIZATION

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting, and our understanding of the project. This characterization, termed GeoModel, forms the basis of our evaluation of site preparation. Conditions encountered at each exploration point are indicated on the individual logs. The individual logs can be found in **Exploration Results** and the GeoModel can be found in **Figures**.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the GeoModel.

Model Layer	Layer Name	General Description
1	**Surface Material**	Topsoil, bituminous concrete, and rubber track surface.
2	**Fill**	Imported or reworked native soil, poorly graded sand, medium dense.
3	**Native Soil**	Poorly graded sand with varying amounts of silt and gravel, occasional cobbles, typically medium dense to very dense.

Groundwater Conditions

The boreholes were observed while drilling and after completion for the presence and level of groundwater. Groundwater was not observed at the time of the explorations. However, groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Additionally, water may become temporarily perched above silty or dense soil layers. Therefore, groundwater levels during construction or at other times in the life of the track and field may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

GEOTECHNICAL OVERVIEW

In general, subsurface conditions encountered in the explorations consisted of medium dense to dense (occasionally surficially loose) native sand directly below the surface material (topsoil or pavement track material). At select borings, approximately 2 feet of fill was encountered above the native soil. Based on the relative density and granular nature of the native soil, we consider the material suitable for support of the track and field. Portions of the existing fill may be suitable for re-use as Structural Fill. Additional site preparation recommendations, including subgrade improvement and fill placement, are provided in the **Earthwork**.

A bituminous concrete pavement system is recommended for the track. The **Pavements** section addresses the design of pavement systems. Support of pavements on or above existing fill materials is discussed in this report. However, even with the recommended construction procedures, there is inherent risk for the owner that compressible fill or unsuitable material, within or buried by the fill, will not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill, but can be reduced by performing additional testing and evaluation.

We recommend exposed subgrades be evaluated after excavation to proposed grade. We recommend Terracon be retained to evaluate the bearing material for track and field subgrade soils.

Subsurface conditions in the explorations have been reviewed and evaluated with respect to the proposed construction plans known to us at this time.

The **General Comments** section provides an understanding of the report limitations.

EARTHWORK

Earthwork is anticipated to include clearing, excavations, and fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for foundations, floor slabs, and pavements.

Site Preparation

Existing pavement, vegetation, and root mat should be removed prior to placing fill. Complete stripping of the topsoil and existing track surface should be performed in the track and football field areas.

The subgrade should be completed with at least six passes of a minimum 10-ton vibratory roller. Following compaction, the subgrade should be proofrolled with an adequately loaded vehicle such as a fully-loaded tandem-axle dump truck. The proofrolling should be performed under the direction of the Geotechnical Engineer. Areas of soft or otherwise unsuitable material should be undercut and replaced with either new Structural Fill or suitable, existing on site materials. Excessively wet or dry material should either be removed or moisture conditioned and recompacted.

As noted in **Geotechnical Characterization**, borings T-3 and T-4 encountered fill to a depth of approximately 2 feet. Based on the limited explorations, the fill appears suitable to support the track pavement, but we have no records to indicate the degree of control used during fill placement.

Fill Material Types

Fill should meet the following material property requirements.

Fill Type [1]	USCS Classification	Acceptable Location for Placement
Structural Fill [2]	GW, GW-GM, SW, SW-SM, SP, GP	All locations and elevations. Imported Structural Fill should meet the gradation requirements in Note 2 (below). Cobbles and boulders should be culled prior to reuse.

Fill Type [1]	USCS Classification	Acceptable Location for Placement
Pavement Subbase	GW, GW-GM, SW, SW-SM, SP, GP	Imported material used as select fill beneath pavements should meet the gradation requirements of CTDOT M.02.06, Grading B.
Common Fill [3]	Varies	Common Fill may be used for general site grading. Common Fill should not be used under settlement or frost-sensitive structures. Cobbles and boulders should be culled prior to reuse.
Crushed Stone	GP	For use on wet subgrades, as a replacement for Structural Fill (if desired), and as drainage fill. Should be uniform ¾-inch angular crushed stone.

1. Compacted fill should consist of approved materials free of organic matter and debris. Frozen material should not be used. Fill should not be placed on a frozen subgrade.
2. Imported Structural Fill should consist of inorganic, readily compactable, well-graded granular soils with a maximum particle size of 6 inches and no more than 15 percent by weight passing the No. 200 sieve.
3. Common Fill should have a maximum particle size of 6 inches and no more than 25 percent by weight passing the No. 200 sieve.

Fill Compaction Requirements

Structural and Common Fill should meet the following compaction requirements.

Item	Description
Maximum Fill Lift Thickness	■ 12 inches or less in loose thickness when heavy, self-propelled compaction equipment is used. ■ 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is used.
Compaction Requirements [1]	95 percent maximum dry density as determined by ASTM D1557, Method C.
Moisture Content – Granular Material	Workable moisture levels.

1. We recommend fill be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested, as required, until the specified moisture and compaction requirements are achieved.

Utility Trench Backfill

Trench excavations should be made with sufficient working space to permit construction, including backfill placement and compaction. As utility trenches can provide a conduit for groundwater flow, trenches should be backfilled with material approximately matching the permeability characteristics of the surrounding soil. Should higher permeability fill be used in trenches, consideration should be given to installing seepage collars and/or check dams to reduce the likelihood of migration of water through the trenches. Fill placed as backfill for utilities located below the slab should consist of compacted Structural Fill or suitable bedding material.

Grading and Drainage

Adequate drainage should be provided at the site to reduce the likelihood of an increase in moisture content of the subgrade soils. The prepared subgrades and track pavement should be sloped to drain water and reduce the likelihood of water ponding on the field or the track. Dedicated track and field drainage piping should be incorporated into the design.

Earthwork Construction Considerations

Unstable subgrade conditions could develop during general construction operations, particularly if the soils are wetted and/or subjected to repetitive construction traffic. Should unstable subgrade conditions develop, stabilization measures will need to be employed.

Construction traffic over the completed subgrade should be avoided to the extent practical. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. If the subgrade should become frozen, wet, or disturbed, the affected material should be removed, or should be scarified, moisture conditioned, and recompacted.

As a minimum, temporary excavations should be sloped or braced, as required by Occupational Safety and Health Administration (OSHA) regulations, to provide stability and safe working conditions. The contractor, by his contract, is usually responsible for designing and constructing stable, temporary excavations and should shore, slope or bench the sides of the excavations, as required, to maintain stability of both the excavation sides and bottom. All excavations should comply with applicable local, State, and federal safety regulations, including the current OSHA Excavation and Trench Safety Standards.

Terracon should be retained during the construction phase of the project to observe earthwork and to perform necessary tests and observations during subgrade preparation; proofrolling; placement and compaction of controlled compacted fills; backfilling of excavations in the completed subgrade; and just prior to construction of foundations.

Construction Observation and Testing

The earthwork efforts should be monitored under the direction of the Geotechnical Engineer. Monitoring should include documentation of adequate removal of vegetation and topsoil, proofrolling, and mitigation of areas delineated by the proofroll to require mitigation.

Each lift of compacted fill should be tested, evaluated, and reworked, as necessary, until approved by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content at a frequency of at least one test for every 2,500 square feet of compacted fill in the track and field areas. One density and water content test should be performed for every 50 linear feet of compacted utility trench backfill.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions, including assessing variations and associated design changes.

PAVEMENTS

General Pavement Comments

Pavement designs are provided for the pavement life conditions as noted in **Project Description** and in the following sections of this report. A critical aspect of pavement performance is site preparation. Subgrade preparation should be completed under the observation of the Geotechnical Engineer. The pavement designs noted in this section must be applied to the site, which has been prepared as recommended in **Earthwork**.

Pavement Section Thicknesses

Traffic Area	Bituminous Concrete Wearing Course (inches)	Bituminous Concrete Binder Course (inches)	Portland Cement Concrete (inches)	Granular Base Course (inches)	Granular Subbase Course (inches)	Total Thickness (inches) [1]
Track	1.5	1.5	N/A	6	6	15

1. We expect a rubber track surface may be installed above the bituminous concrete pavement, as was observed on the existing track.

Pavement Design Recommendations

The thickness of each course is a function of subgrade strength, traffic, design life, serviceability factors, and frost susceptibility. The design of pavement thickness was based on the following:

- Soil characterization of "fair", based on the encountered subsurface conditions
- Design life of 20 years

The base and subbase should be compacted to at least 95 percent of the maximum dry density, as determined by ASTM D1557, Method C. The bituminous concrete should be placed in accordance with the *Connecticut Department of Transportation (CTDOT) Standard Specifications for Road, Bridges, and Incidental Construction (Form 816), 2004*. Bituminous concrete should be placed within the temperature range specified therein and compacted to between 92 percent of the Marshall Density for the job mix formula. Pavement components should meet the following material specifications from *CTDOT Form 816*:

Pavement Component	Specification
Bituminous concrete wearing course	CTDOT M.04.02 Class 2
Bituminous concrete binder course	CTDOT M.04.02 Class 1
Granular base course	CTDOT M.05.01
Granular subbase course	CTDOT M.02.06, Grading B

Pavement Construction Considerations

Pavement subgrades prepared early in the project should be carefully evaluated as the time for pavement construction approaches. We recommend the pavement areas be stripped of unsuitable materials and thoroughly compacted with at least six passes with a minimum 10-ton (static weight) vibratory roller compactor, before being proofrolled with a loaded tandem-axle dump truck. Particular attention should be paid to high traffic areas that were rutted and disturbed and in areas where backfilled trenches are located. Areas with unsuitable conditions should be repaired by replacing the materials with properly compacted fill. When proofrolling/subgrade stabilization has been completed to the satisfaction of the geotechnical engineer, the subbase may be placed.

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade, contributing to frost action and premature pavement deterioration. Future performance of pavements constructed on the site will be dependent upon maintaining stable moisture content of the base course soils. The performance of pavements may be enhanced by reducing excess moisture that can reach the base soils. The following recommendations should be considered a minimum:

- Grading the site to a minimum 2 percent slope away from the pavements;
- Installing an edge drain at the edge of the pavement on the higher side(s) of the site;
- Placing compacted backfill against the exterior side of curb and gutter; and,
- Placing curb and gutter directly on subgrade soils without the use of base course materials.

Preventative maintenance should be planned and provided through an on-going pavement management program in order to enhance future pavement performance, slow the rate of pavement deterioration, and preserve the pavement investment. Preventative maintenance, which consists of both localized maintenance, e.g., crack and joint sealing and patching, and global maintenance, e.g., surface sealing, is usually the first priority when implementing a planned pavement maintenance program, and provides the highest return on investment for pavements. Prior to implementing such a program, additional engineering observation is recommended to assess the type and extent of preventative maintenance.

GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client, and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

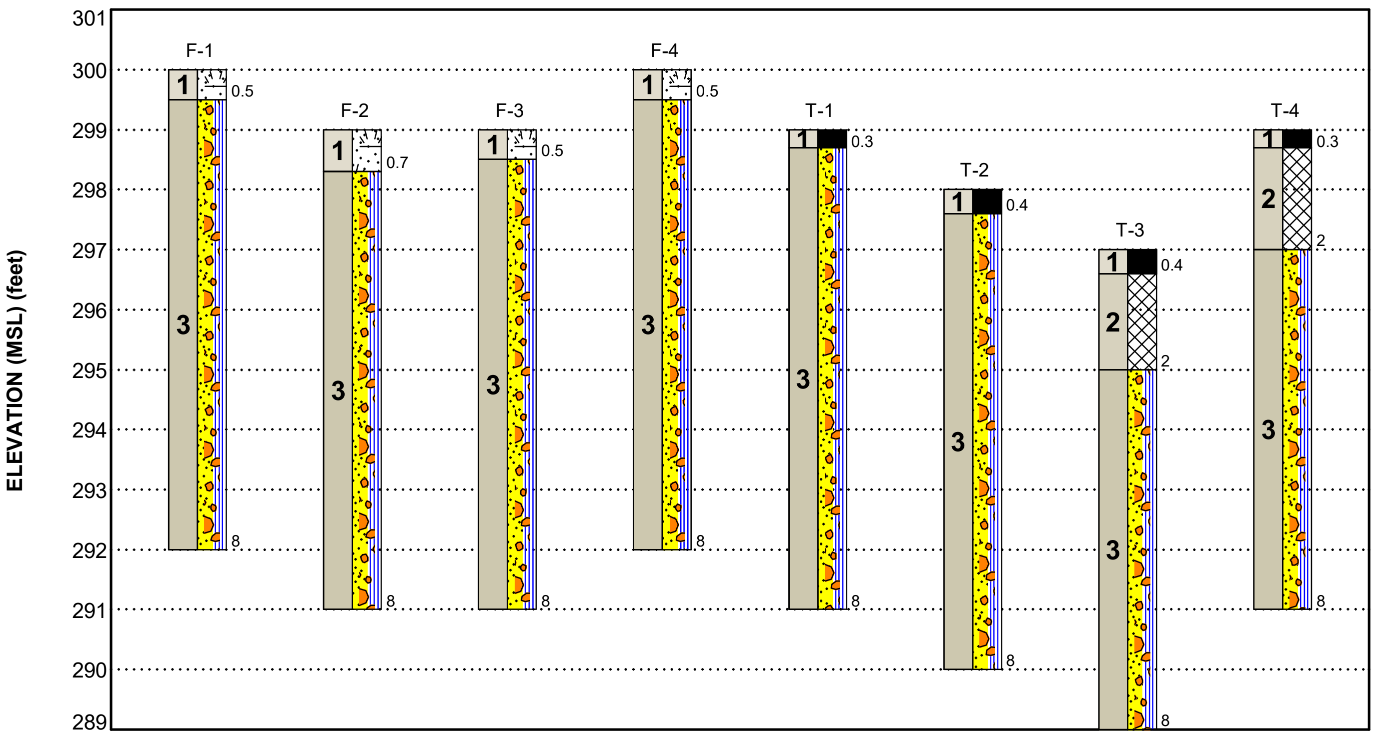
FIGURES

Contents:

GEOMODEL

Ledyard High School Track and Field Renovations ■ Ledyard, CT
3/18/2019 ■ Terracon Project No. J2195027

Terracon GeoReport



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	Surface Material	Topsoil, bituminous concrete, and rubber track surface.
2	Fill	Imported or reworked native soil, poorly graded sand, medium dense
3	Native Soil	Poorly graded sand with varying amounts of silt and gravel, occasional cobbles, typically medium dense to very dense

LEGEND

- Topsoil
- Fill
- Poorly-graded Sand with Silt and Gravel
- Asphalt

- First Water Observation
- Second Water Observation
- Final Water Observation

Groundwater levels are temporal. The levels shown are representative of the date and time of our exploration. Significant changes are possible over time.
Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project.
Numbers adjacent to soil column indicate depth below ground surface.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES

Field Exploration

Number of Borings	Boring Depth (feet)	Location
4 (F-1 through F-4)	8	Football field
4 (T-1 through T-4)	8	Track

Boring Layout and Elevations: Terracon personnel provided the boring layout. Coordinates were obtained with a handheld GPS unit (estimated horizontal accuracy of about ±10 feet) and approximate ground surface elevations presented on the boring logs were obtained by interpolation from the *"Site Layout & Materials"* progress print by Kaestle Boos Associates, Inc. of New Britain, Connecticut, Drawing No. L1.01, February 19, 2019.

Subsurface Exploration Procedures: Terracon advanced eight test borings (F-1 through F-4 and T-1 through T-4) throughout the site on March 14, 2019 using an all-terrain vehicle (ATV)-mounted Diedrich D-50 rotary drill rig. The borings were advanced using 4-inch outside diameter continuous flight solid-stem augers.

In the split-barrel sampling procedure, which was used to take soil samples in the test borings, the number of blows required to advance a standard 2-inch O.D. split-barrel sampler typically the middle 12 inches of the total 24-inch penetration by means of a 140-pound safety hammer with a free fall of 30 inches is the Standard Penetration Test (SPT) resistance value "N". An automatic SPT hammer was used to advance the split-barrel sampler in the borings performed on this site. A significantly greater efficiency is achieved with the automatic hammer compared to the conventional safety hammer operated with a cathead and rope. This higher efficiency has an appreciable effect on the SPT-N value.

The soil samples were placed in labeled glass jars and taken to our laboratory for further review and classification by a Terracon Geotechnical Engineer. Information provided on the exploration logs attached to this report includes soil descriptions, relative density and/or consistency evaluations, exploration depths, sampling intervals, and groundwater conditions. The borings were backfilled with auger cuttings and the pavement was repaired using "cold patch" asphalt prior to the drill crew leaving the site.

Field logs of the explorations were prepared by a Terracon field engineer. These logs included visual classifications of the materials encountered during drilling as well as interpretation by our field engineer of the subsurface conditions between samples. Final exploration logs included with this report represent further interpretation by the Geotechnical Engineer of the field logs and incorporate, where appropriate, modifications based on laboratory classification and testing of the samples.

Laboratory Testing

Descriptive classifications of the soils indicated on the boring logs are in accordance with the General Notes and the Unified Soil Classification System (USCS). USCS symbols are also shown. A brief description of the USCS is attached to this report. Classification was generally by visual/manual procedures, aided by laboratory testing.

Laboratory testing, consisting of four moisture content determinations (ASTM D2216) and four grain size distribution tests (ASTM D422), was performed on representative samples recovered from the borings. The moisture contents are included on the individual boring logs. The grain size distribution tests are presented in the **Exploration Results** section.

SITE LOCATION AND EXPLORATION PLANS

Contents:

Note: All attachments are one page unless noted above.

SITE LOCATION

Ledyard High School Track and Field Renovations ■ Ledyard, CT

March 25, 2019 ■ Terracon Project No. J2195027

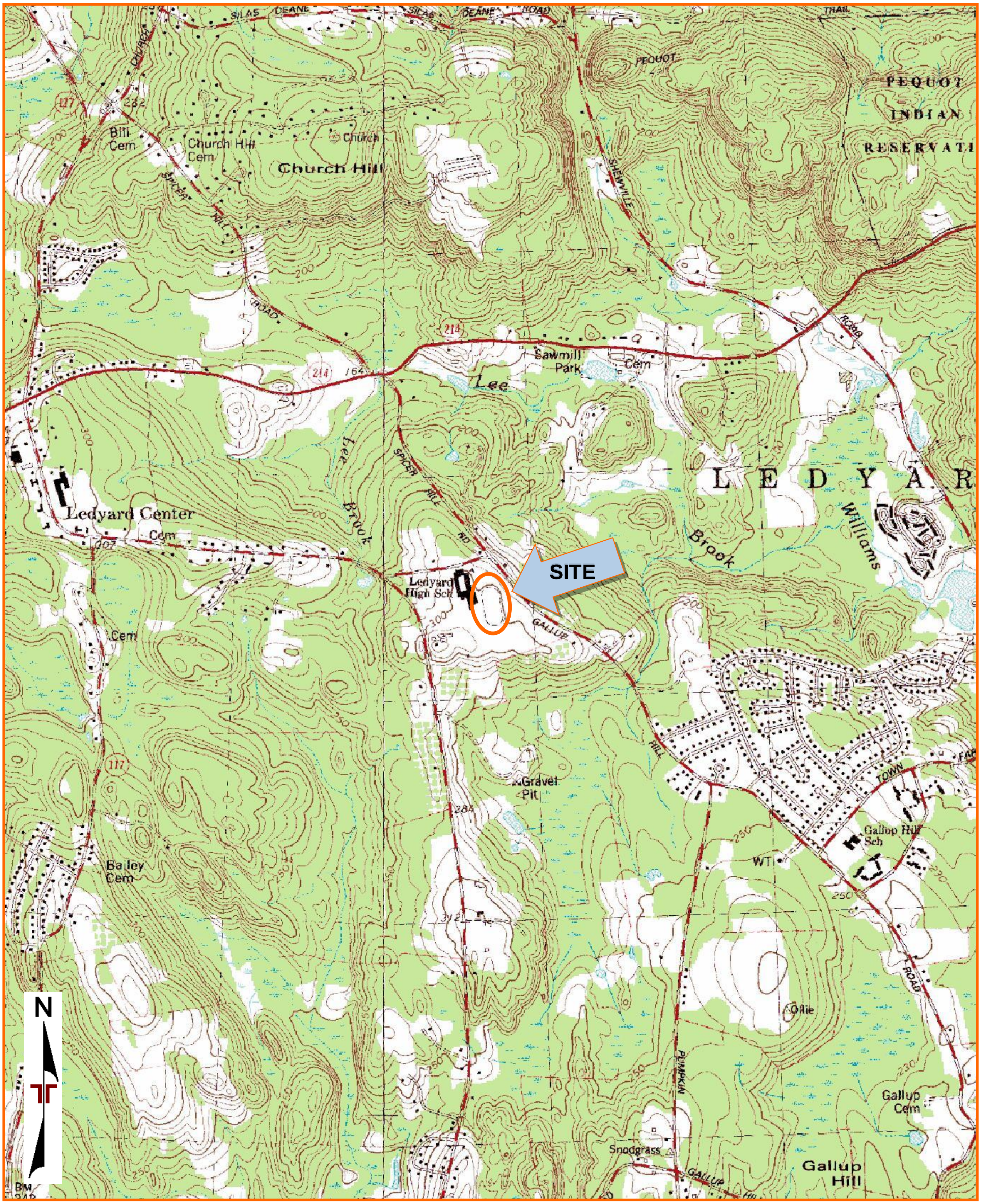


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGICAL SURVEY QUADRANGLES INCLUDE: UNCASVILLE, CT (1984) and OLD MYSTIC, CT (1983).

EXPLORATION PLAN

Ledyard High School Track and Field Renovations ■ Ledyard, CT
March 25, 2019 ■ Terracon Project No. J2195027

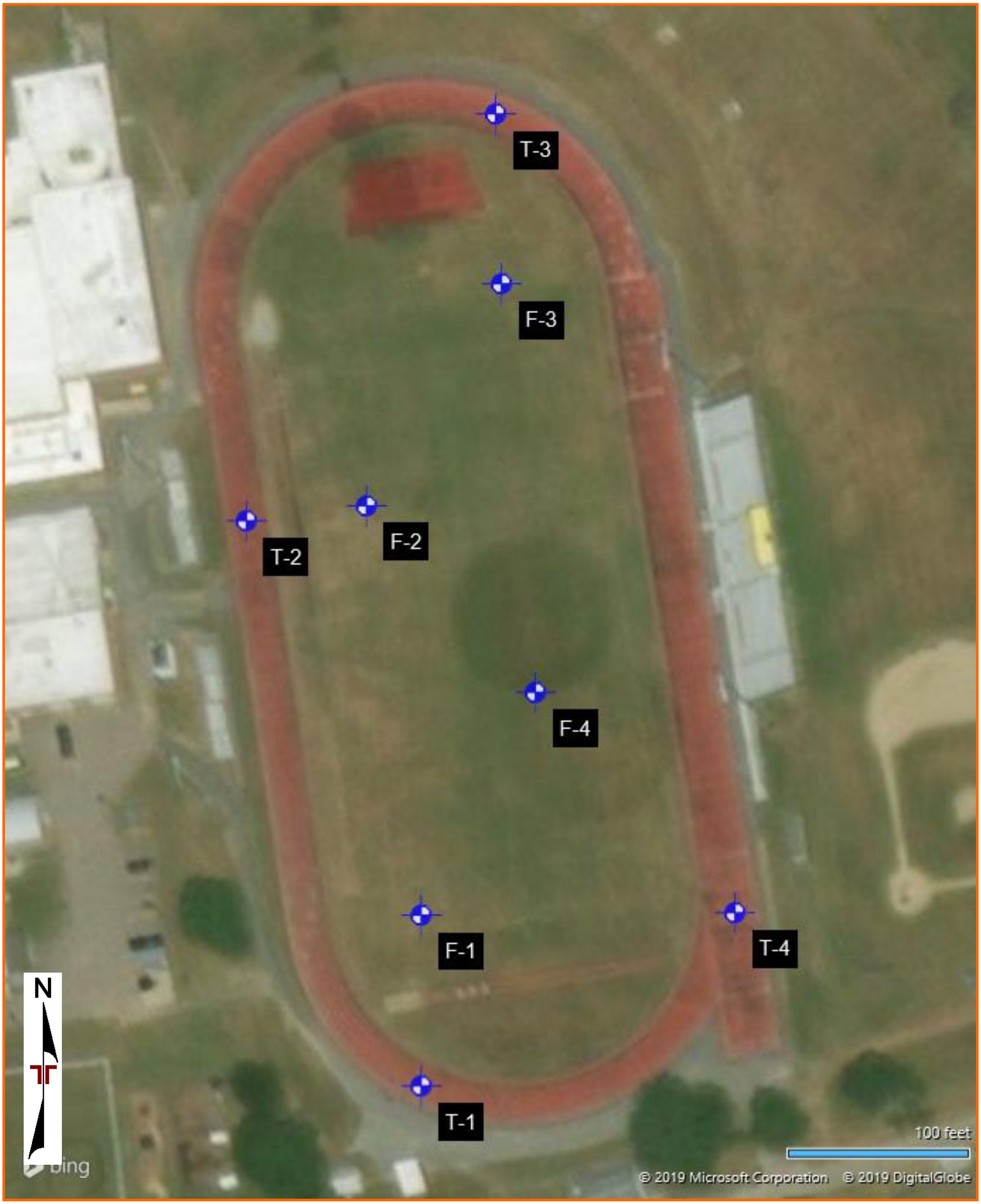


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

EXPLORATION RESULTS

Contents:

Boring Logs (F-1 through F-4, and T-1 through T-4)
Grain Size Distribution

Note: All attachments are one page unless noted above.

BORING LOG NO. F-1

PROJECT: Ledyard High School Track and Field Renovations

SITE: 24 Gallup Hill Road Ledyard, CT

CLIENT: Ledyard Public Schools Ledyard, CT

LOCATION See Exploration Plan

Latitude: 41.437° Longitude: -71.9941°

Approximate Surface Elev.: 300 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
1		0.5	**6 INCHES TOPSOIL**	299.5+/-						
3			**POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)**, occasional cobbles, tan to light brown, medium dense				X	14	WOH-5-6-6 N=11	
							X	20	10-12-17-15 N=29	
			Note: Soil damp at approximately 5 feet in depth.		5		X	16	11-11-11-11 N=22	
							X	2	50/4"	
		8.0		292+/-						
			Boring Terminated at 8 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.
Soil samples obtained with 2.0-inch O.D. split spoon sampler.

Hammer Type: Automatic

Advancement Method:
4-inch outside diameter solid-stem augers

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WOH = Weight of Hammer

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
201 Hammer Mill Rd
Rocky Hill, CT

Boring Started: 03-14-2019	Boring Completed: 03-14-2019
Drill Rig: Diedrich D-50	Driller: C. Johnston
Project No.: J2195027	

BORING LOG NO. F-2

PROJECT: Ledyard High School Track and Field Renovations

SITE: 24 Gallup Hill Road, Ledyard, CT

CLIENT: Ledyard Public Schools, Ledyard, CT

LOCATION See Exploration Plan

Latitude: 41.4376° Longitude: -71.9942°

Approximate Surface Elev.: 299 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
1		0.7	**8 INCHES TOPSOIL**	298.5+/-						
3			**POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)**, tan to light brown, medium dense to dense				X	20	WOH-4-8-8 N=12	
							X	22	11-16-22-17 N=38	
			Note: Soil damp at approximately 5 feet in depth.		5		X	14	16-15-17-13 N=32	
		8.0		291+/-			X	16	12-17-24-34 N=41	
			Boring Terminated at 8 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.
Soil samples obtained with 2.0-inch O.D. split spoon sampler.

Hammer Type: Automatic

Advancement Method:
4-inch outside diameter solid-stem augers

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:
WOH = Weight of Hammer

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
201 Hammer Mill Rd
Rocky Hill, CT

Boring Started: 03-14-2019	Boring Completed: 03-14-2019
Drill Rig: Diedrich D-50	Driller: C. Johnston
Project No.: J2195027	

BORING LOG NO. F-3

PROJECT: Ledyard High School Track and Field Renovations

CLIENT: Ledyard Public Schools, Ledyard, CT

SITE: 24 Gallup Hill Road, Ledyard, CT

LOCATION See Exploration Plan

Latitude: 41.4379° Longitude: -71.9939°

Approximate Surface Elev.: 299 (Ft.) +/-

MODEL LAYER	DEPTH	DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
1	0.5	**6 INCHES TOPSOIL**	298.5+/-						
3		**POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)**, tan to light brown, medium dense (surficially loose)				X	16	WOH-3-3-3 N=6	
						X	14	3-3-10-10 N=13	
				5		X	14	4-6-6-12 N=12	
	8.0	Note: Soil damp at approximately 6 feet in depth.	291+/-			X	14	11-12-14-16 N=26	

Boring Terminated at 8 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.
Soil samples obtained with 2.0-inch O.D. split spoon sampler.

Hammer Type: Automatic

Advancement Method:
4-inch outside diameter solid-stem augers

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:
WOH = Weight of Hammer

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
201 Hammer Mill Rd
Rocky Hill, CT

Boring Started: 03-14-2019	Boring Completed: 03-14-2019
Drill Rig: Diedrich D-50	Driller: C. Johnston
Project No.: J2195027	

BORING LOG NO. F-4

PROJECT: Ledyard High School Track and Field Renovations

CLIENT: Ledyard Public Schools Ledyard, CT

SITE: 24 Gallup Hill Road Ledyard, CT

LOCATION See Exploration Plan

Latitude: 41.4373° Longitude: -71.9939°

Approximate Surface Elev.: 300 (Ft.) +/-

MODEL LAYER	DEPTH	DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
1	0.5	**6 INCHES TOPSOIL**	299.5+/-						
3		**POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)**, occasional cobbles, tan to light brown, medium dense (surficially loose)				X	14	WOH-4-5-9 N=9	
						X	18	11-10-7-9 N=17	
		Note: Soil damp at approximately 5 feet in depth.		5		X	18	8-10-12-12 N=22	
	8.0		292+/-			X	16	12-14-14-11 N=28	

Boring Terminated at 8 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.
Soil samples obtained with 2.0-inch O.D. split spoon sampler.

Hammer Type: Automatic

Advancement Method:
4-inch outside diameter solid-stem augers

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:
WOH = Weight of Hammer

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
201 Hammer Mill Rd
Rocky Hill, CT

Boring Started: 03-14-2019	Boring Completed: 03-14-2019
Drill Rig: Diedrich D-50	Driller: C. Johnston
Project No.: J2195027	

BORING LOG NO. T-1

PROJECT: Ledyard High School Track and Field Renovations

CLIENT: Ledyard Public Schools, Ledyard, CT

SITE: 24 Gallup Hill Road, Ledyard, CT

LOCATION See Exploration Plan

Latitude: 41.4367° Longitude: -71.9941°

Approximate Surface Elev.: 299 (Ft.) +/-

MODEL LAYER	DEPTH	MATERIAL DESCRIPTION	ELEVATION (Ft.)
1	0.3	**3/4 INCHES RUBBER over 3 INCHES BITUMINOUS CONCRETE**	298.5+/-
3	8.0	**POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)**, occasional cobbles, tan to light brown, medium dense to dense Note: Soil damp at approximately 6 feet in depth.	291+/-

Boring Terminated at 8 Feet

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
		Split spoon	18	6-8-7 N=15	
		Split spoon	14	12-12-20-15 N=32	
5		Split spoon	14	16-20-19-17 N=39	
		Split spoon	14	13-19-17-36 N=36	

Stratification lines are approximate. In-situ, the transition may be gradual.
Soil samples obtained with 2.0-inch O.D. split spoon sampler.

Hammer Type: Automatic

Advancement Method:
4-inch outside diameter solid-stem augers

Abandonment Method:
Boring backfilled with auger cuttings and capped with "cold patch" asphalt upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
201 Hammer Mill Rd
Rocky Hill, CT

Boring Started: 03-14-2019	Boring Completed: 03-14-2019
Drill Rig: Diedrich D-50	Driller: C. Johnston
Project No.: J2195027	

BORING LOG NO. T-2

PROJECT: Ledyard High School Track and Field Renovations

CLIENT: Ledyard Public Schools, Ledyard, CT

SITE: 24 Gallup Hill Road, Ledyard, CT

LOCATION See Exploration Plan

Latitude: 41.4376° Longitude: -71.9944°

Approximate Surface Elev.: 298 (Ft.) +/-

MODEL LAYER	DEPTH	DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
1	0.4	**3/4 INCHES RUBBER over 3.5 INCHES BITUMINOUS CONCRETE**	297.5+/-						
3		**POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)**, occasional cobbles, tan to light brown, medium dense to very dense					12	9-8-13 N=21	
							12	17-35-17-16 N=52	
				5			18	7-12-16-32 N=28	
		Note: Soil damp at approximately 5.5 feet in depth.					10	39-36-36-36 N=72	
	8.0		290+/-						

Boring Terminated at 8 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Soil samples obtained with 2.0-inch O.D. split spoon sampler.

Hammer Type: Automatic

Advancement Method:
4-inch outside diameter solid-stem augers

Abandonment Method:
Boring backfilled with auger cuttings and capped with "cold patch" asphalt upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
201 Hammer Mill Rd
Rocky Hill, CT

Boring Started: 03-14-2019	Boring Completed: 03-14-2019
Drill Rig: Diedrich D-50	Driller: C. Johnston
Project No.: J2195027	

BORING LOG NO. T-3

PROJECT: Ledyard High School Track and Field Renovations

CLIENT: Ledyard Public Schools Ledyard, CT

SITE: 24 Gallup Hill Road Ledyard, CT

LOCATION See Exploration Plan

Latitude: 41.4382° Longitude: -71.9939°

Approximate Surface Elev.: 297 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
1		0.4	**3/4 INCHES RUBBER over 4 INCHES BITUMINOUS CONCRETE**	296.5+/-						
2		2.0	**FILL - POORLY GRADED SAND**, light gray to black, medium dense	295+/-			X	14	17-12-15 N=27	
3		8.0	**POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)**, tan to light brown, loose to dense Note: Soil damp at approximately 5 feet in depth.	289+/-			X	18	18-9-8-6 N=17	
					5		X	12	4-2-2-4 N=4	
							X	24	14-15-16-17 N=31	
			Boring Terminated at 8 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.
Soil samples obtained with 2.0-inch O.D. split spoon sampler.

Hammer Type: Automatic

Advancement Method:
4-inch outside diameter solid-stem augers

Abandonment Method:
Boring backfilled with auger cuttings and capped with "cold patch" asphalt upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
201 Hammer Mill Rd
Rocky Hill, CT

Boring Started: 03-14-2019	Boring Completed: 03-14-2019
Drill Rig: Diedrich D-50	Driller: C. Johnston
Project No.: J2195027	

BORING LOG NO. T-4

PROJECT: Ledyard High School Track and Field Renovations

CLIENT: Ledyard Public Schools, Ledyard, CT

SITE: 24 Gallup Hill Road, Ledyard, CT

LOCATION See Exploration Plan

Latitude: 41.437° Longitude: -71.9935°

Approximate Surface Elev.: 299 (Ft.) +/-

Model Layer	Depth (Ft.)	Description	Elevation (Ft.)
1	0.3	**3/4 INCHES RUBBER over 3 INCHES BITUMINOUS CONCRETE**	298.5+/-
2	2.0	**FILL - POORLY GRADED SAND**, dark brown to tan, medium dense	297+/-
3	8.0	**POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)**, tan to light brown, medium dense to very dense Note: Soil damp at approximately 5 feet in depth.	291+/-
		Boring Terminated at 8 Feet	

Sample	Recovery (In.)	Field Test Results	Water Content (%)
1	12	6-5-10 N=15	
2	18	13-11-14-13 N=25	
3	18	14-11-50/4"	
4	2	50/2"	

Stratification lines are approximate. In-situ, the transition may be gradual.
Soil samples obtained with 2.0-inch O.D. split spoon sampler.

Hammer Type: Automatic

Advancement Method:
4-inch outside diameter solid-stem augers

Abandonment Method:
Boring backfilled with auger cuttings and capped with "cold patch" asphalt upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
201 Hammer Mill Rd
Rocky Hill, CT

Boring Started: 03-14-2019	Boring Completed: 03-14-2019
Drill Rig: Diedrich D-50	Driller: C. Johnston
Project No.: J2195027	

SUPPORTING INFORMATION

Contents:

Note: All attachments are one page unless noted above.

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

Ledyard High School Track and Field Renovations ■ Ledyard, CT
March 25, 2019 ■ Terracon Project No. J2195027

Terracon GeoReport

SAMPLING	WATER LEVEL		FIELD TESTS	
Standard Penetration Test	▽	**Water Initially Encountered**	**N**	**Standard Penetration Test Resistance (Blows/Ft.)**
	▽	**Water Level After a Specified Period of Time**	**(HP)**	**Hand Penetrometer**
	▼	**Water Level After a Specified Period of Time**	**(T)**	**Torvane**
		Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.	**(DCP)**	**Dynamic Cone Penetrometer**
			UC	**Unconfined Compressive Strength**
			(PID)	**Photo-Ionization Detector**
			(OVA)	**Organic Vapor Analyzer**

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength Qu, (tsf)**	**Standard Penetration or N-Value Blows/Ft.**
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	4 - 8
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	> 4.00	> 30

RELATIVE PROPORTIONS OF SAND AND GRAVEL		RELATIVE PROPORTIONS OF FINES	
Descriptive Term(s) of other constituents	Percent of Dry Weight	**Descriptive Term(s) of other constituents**	**Percent of Dry Weight**
Trace	<15	Trace	<5
With	15-29	With	5-12
Modifier	>30	Modifier	>12

GRAIN SIZE TERMINOLOGY		PLASTICITY DESCRIPTION	
Major Component of Sample	**Particle Size**	**Term**	**Plasticity Index**
Boulders	Over 12 in. (300 mm)	Non-plastic	0
Cobbles	12 in. to 3 in. (300mm to 75mm)	Low	1 - 10
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)	Medium	11 - 30
Sand	#4 to #200 sieve (4.75mm to 0.075mm	High	> 30
Silt or Clay	Passing #200 sieve (0.075mm)		

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]				Soil Classification: Group Symbol	Soil Classification: Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]	GW	Well-graded gravel [F]
			$Cu < 4$ and/or $[Cc<1$ or $Cc>3.0]$ [E]	GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH	GM	Silty gravel [F, G, H]
			Fines classify as CL or CH	GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]	SW	Well-graded sand [I]
			$Cu < 6$ and/or $[Cc<1$ or $Cc>3.0]$ [E]	SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH	SM	Silty sand [G, H, I]
			Fines classify as CL or CH	SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	$PI > 7$ and plots on or above “A” line [J]	CL	Lean clay [K, L, M]
			$PI < 4$ or plots below “A” line [J]	ML	Silt [K, L, M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OL	Organic clay [K, L, M, N]
					Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above “A” line	CH	Fat clay [K, L, M]
			PI plots below “A” line	MH	Elastic Silt [K, L, M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OH	Organic clay [K, L, M, P]
					Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add “with cobbles or boulders, or both” to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains $\geq$ 15% sand, add “with sand” to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add “with organic fines” to group name.

[I] If soil contains $\geq$ 15% gravel, add “with gravel” to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add “with sand” or “with gravel,” whichever is predominant.

[L] If soil contains $\geq$ 30% plus No. 200 predominantly sand, add “sandy” to group name.

[M] If soil contains $\geq$ 30% plus No. 200, predominantly gravel, add “gravelly” to group name.

[N] $PI \geq 4$ and plots on or above “A” line.

[O] $PI < 4$ or plots below “A” line.

[P] PI plots on or above “A” line.

[Q] PI plots below “A” line.