

# **Exhibit H**

## **Geotechnical**

Geotechnical Report  
Slope Stability Analysis Report

Pages 2-85  
Pages 86-204

May 4, 2023

John Ford  
President  
Three Leaf Partners  
504 W. Juneau Avenue  
Milwaukee WI, 53203



Subject: Geotechnical Subsurface Investigation  
Hartland Quarry Apartments  
700/701 W. Capitol Drive, Hartland, Wisconsin

Dear Mr. Ford:

GeoTest, Inc. (GeoTest) has prepared this geotechnical engineering report related to the above-referenced project. This report describes the subsurface exploration and laboratory testing programs and presents recommendations regarding foundation support of the proposed structures, construction of floor slabs, pavements, and stormwater management systems, bluff stabilization, and includes other construction considerations. All environmental-related services are being provided by others.

### **Project Description**

Three Leaf Partners is proposing to develop the property located at 700/701 W. Capitol Drive in the Village of Hartland, Wisconsin. The location of the project is illustrated in Figure 1 in Appendix A. The boundaries of the combined 45-acre property are illustrated in Figure 2 in Appendix A.

The proposed development consists of eighteen separate buildings, including a single-story club house, two- and three-story apartment buildings (some slab-on-grade and some with below-grade parking), and single-story garage buildings. The development will also include parking and drive paved areas and multiple stormwater management devices. The proposed development is illustrated in Figure 3 in Appendix A.

Structural loads have not been provided. However, we anticipate that column and wall loads will not exceed 300 kips and 5 kips per linear foot, respectively.

The finished floor elevations for the new buildings have not been provided but are expected to vary across the property. The preliminary civil engineering plans indicate cuts and fills of up to 15 feet are anticipated to achieve the final site grades.

The stormwater management facilities are designed, on a preliminary basis, to consist of four infiltration ponds. The entire development will be internally drained.

The perimeter bluffs currently have slopes steeper than 1h:1v, with many sections close to 0.75h:1v. The proposed development plan assumes the final slopes will be designed for 2h:1v.

### **Property History**

To develop an appropriate geotechnical scope of work for this project, research and a site walk-through were completed. The research included reviewing local well logs (available from Waukesha County), a past environmental investigation report (produced by Drake Environmental, Inc.), and construction materials testing reports (produced by Gestra Engineering, Inc.). The Well logs and Drake and Gestra documents are included in Appendix B.

We interviewed individuals familiar with past activities at the property, including Jason Palmer with Cass Custom Crushing and Ed Troxell with Riv/Crete Ready Mix. We also toured the property with Jason and Ed, along with employees from Walbec Group, the project's civil engineering consultant.

The geologic setting at the property was described as granular (primarily sand and gravel) glacial deposits. The property was mined for road gravel from the 1930's to the 1960's (known as Palmer Sand & Gravel), after which it became a concrete plant under multiple company names. The concrete plant operations were located in the southwest corner of the property but are no longer active.

The property owners began accepting fill materials in the 1970's, which still occurs. Most of the fills appear to consist of soil and concrete wastes, but also occasional inert materials that include asphalt, building materials, wood, and metal. It is currently being used as an operational base for a trucking company and to store construction equipment.

Most of the property perimeter was lined with bluffs formed by past mining operations. Although the property's ground surface was near the adjacent property elevations in the southwest corner, the remaining elevation differences were as high as 85 feet. Therefore, an integral aspect of the development plan includes addressing the substantial perimeter embankments, not only for safety but also to maximize the buildable area.

Two areas that were unusual, with an unknown history, were the apparent overburden stockpiled soils forming the north boundary of the former concrete plant area at the southwest corner of the property, and the bluff peninsula in the east portion of the former pit that extends northward from the south property boundary. It was believed that the overburden stockpiled soils were placed as a buffer between the adjacent residential area to the west and to serve as a ramp for trucks to unload into a crusher. No one had an explanation for why the bluff peninsula was not excavated during the

mining operations, other than maybe they were unsuitable for production. These two areas were identified for evaluation, in addition to the overall pit base and bluffs.

### **Scope of Work**

#### **Geotechnical Subsurface Exploration**

The research identified five areas with different soils and materials to be targeted for evaluation. These areas (described below) are illustrated on Figure 4 in Appendix A. This figure does not illustrate the bluff areas, although they also warranted evaluation.

- Industrial Development Area (including the apparent overburden stockpiled soils)
- Construction Debris Fill
- Soft Clay/Silt Sediment
- Compacted Imported Soil Fill
- Native Soils – Pit Base

The following geotechnical exploration program was developed to evaluate these areas:

- Nine test pits were excavated to depths of about 6 to 11 feet.
- Nineteen surface samples were collected from the perimeter bluffs.

The approximate sampling locations are identified on the Sampling Location Diagram (Figure 5) in Appendix A. Representative samples from the test pits and bluffs were collected in buckets and returned to GeoTest for laboratory testing and classification.

The test pit locations, the ground surface elevations at the test pits, and their depths were measured by a Walbec surveyor at the time they were excavated. Their locations and the elevation/depth data are represented on two figures provided by Walbec, which are included in Appendix B.

#### **Laboratory Testing**

The laboratory testing program consisted of the following:

- Modified Proctor testing of four samples.
- Grain Size Analyses of twenty-three samples.
- Atterberg Limits testing of one sample.

All laboratory results are presented in reports included in Appendix C.

In addition, a GeoTest geotechnical engineer examined and visually classified each sample, based on texture and plasticity, in accordance with the Unified Soil Classification System (USCS). General notes and a description of the USCS

classification system are included in Appendix C. The soil descriptions are presented in this report.

The recovered soil samples will be retained for 60 days after the date of this report. Unless other instructions as to their disposition are received, they will be discarded at that point.

### **Soil and Groundwater Conditions**

The following narrative is a generalization of the subsurface conditions encountered on the property. Please recognize that the conditions can vary in areas between the sample locations.

#### **Subsurface Conditions**

The dominant geology on the property was described as well-grade granular glacial deposits, consisting of sand and gravel with variable percentages of fines (clay and silt), along with occasional cobbles and boulders. Differences from these native deposits included the placement of imported fill soils and man-made materials, primarily concrete in various forms.

The results of the test pit and bluff sampling programs are presented below. Following that information, the five ground surface areas are discussed.

*Test Pits* - The GeoTest test pit exploration program was designed to evaluate the subsurface conditions at each of the five areas where different soils or materials were expected. The following table summarizes the soils/materials encountered at the test pits.

<b>Test Pit</b>	<b>Depth, ft</b>	<b>Description</b>
TP-1 & TP-2 <sup>1</sup>	0-6.4	SC-SM: Fine to coarse sand, some gravel, little clay and silt, occasional cobbles and boulders; brown; moist (32.8% gravel, 43.6% sand, 23.6% fines) – appeared to be native soil deposits.
TP-3 <sup>3</sup>	0-5.6	SW-SM: Fine to coarse sand and gravel, few clay and silt, occasional cobbles; brown; moist (43.0% gravel, 46.4% sand, 12.6% fines) – appeared to be native soil deposits.
TP-4 <sup>2</sup>	0-11.3	FILL (Rubble): Concrete and asphalt fragments, metal, wood, intermixed sand and gravel.
TP-5 <sup>2</sup>	0-3	FILL (Rubble): Concrete fragments intermixed sand and gravel.
TP-5 <sup>3</sup>	3-9.1	FILL (SP-SM): Fine sand, little medium to coarse sand, little gravel, few silt; brown; moist (20.7% gravel, 66.9% sand, 12.4% fines) – appeared to be fill soils.
TP-6 <sup>4</sup>	8.1	GW: Fine to coarse gravel, some fine to coarse sand, trace silt, occasional cobbles and boulders; brown; moist (61.8% gravel, 35.3% sand, 2.9% fines) – appeared to be native soil deposits.

TP-7 <sup>5</sup>	0-9	FILL (SW-SM): Fine to coarse sand, some gravel, few silt; brown; moist – compacted fill (tested by Gestra) that originated from a local utility construction project.
TP-7 <sup>4</sup>	9-10.4	GW: Fine to coarse gravel, some fine to coarse sand, trace silt, occasional cobbles and boulders; brown; moist – appeared to be native soil deposits.
TP-8 <sup>6</sup>	0-5.5	SEDIMENT (CL-ML): Clayey silt, trace fine sand; orange-brown; saturated; soft – appeared to be sediment run-off from the adjacent bluff peninsula and concrete fill area.
TP-8 <sup>4</sup>	5.5-6.2	GW: Fine to coarse gravel, some fine to coarse sand, trace silt, occasional cobbles and boulders; brown; moist – appeared to be native soil deposits.
TP-9	6.6	GW: Fine to coarse gravel, some fine to coarse sand, few silt, occasional cobbles and boulders; brown; moist (56.2% gravel, 37.0% sand, 6.8% fines) – appeared to be native soil deposits.

Notes:

- 1- The samples from TP-1 and TP-2 were composited because these soils are expected to be excavated and reused as an engineered fill.
- 2- No sample was collected because these materials will be segregated, and the soil and concrete will be crushed for reuse as an engineered fill.
- 3- This sample was subjected to the Modified Proctor test because it is projected to be excavated and reused as an engineered fill.
- 4- This sample was not subjected to the Modified Proctor test because it will not be excavated for reuse as an engineered fill.
- 5- This sample was not tested because it will not be excavated for reuse as an engineered fill (the Gestra field density test results passed).
- 6- This sample was not tested because it should be excavated and is not suitable for reuse as an engineered fill.

*Bluff Samples* - The samples collected from the perimeter bluffs were subjected to Grain Size Analyses (sieve testing) to understand the grain size distribution and determine certain material coefficients that can be used in slope stability analyses. The following table summarizes the distribution of gravel, sand, and fines.

Bluff Sample	Percent Gravel	Percent Sand	Percent Fines	USCS Class
1	54.9	44.0	1.1	GW
2	0.0	3.2	96.8	CL
3	55.1	38.6	6.3	GW-GM
4	56.3	40.6	3.1	GW
5	36.1	57.4	6.5	SW-SM
6	28.5	62.2	9.3	SW-SM
7	8.0	84.3	7.7	SW-SM
8	11.5	57.6	30.9	SM

9	9.4	61.7	28.9	SM
10	42.7	47.9	9.4	SW-SM
11	11.6	61.4	27.0	SM
12	20.1	69.1	10.8	SW-SM
13	54.6	40.9	4.5	GW-GM
14	18.5	45.6	35.9	SM
15	29.5	52.3	18.2	SM
16	13.5	62.1	24.4	SC
17	9.3	67.4	23.3	SC
18	42.4	43.9	13.7	SM
19	42.9	46.2	10.9	SM

In summary, the above results indicate that the bluff soils are almost entirely granular and vary in their fine content. Only one sample was a fine soil (clay), present along the south side of the bluff peninsula in the east portion of the property that extends from the south property boundary. The majority of the bluff soils met the OSHA definition of Type C, which requires a minimum slope of 1.5h:1v. Some areas met Type B, which require a minimum slope of 1h:1v.

*Industrial Development Area* - The boring logs generated by Drake during their environmental investigation indicated that the soils present in the southwest portion of the property primarily consisted of layered sands, with variable clay, silt, and gravel content. Occasional silt layers were also noted. Most of the soil to depths of 10 to 15 feet was described as fill or possible fill, which could have been placed to facilitate the existing development, including backfill in the former underground storage tank (UST) cavities.

The Drake boring logs indicated the granular soils exhibited very loose to very dense relative densities, with N-values ranging from 1 to 72. The lowest values (less than 5) were located at the former UST cavity. Excluding the UST backfill soils, all N-values (except two) exceeded 10 and averaged 32. The relatively uniform and high N-values suggest most of the soils are likely native deposits and not fills.

Two test pits were excavated (TP-1 and TP-2) and two bluff samples (B18 and B19) were collected to evaluate the nature of the apparent overburden stockpiled soils. The test pit and bluff samples were similar in nature, and all appeared to be native soil. A visual evaluation of the soils making up this area concluded that there is a combination of both native glacial deposits and fills soils that make up this higher ground.

One test pit (TP-3) was excavated to determine if the former concrete plant area is underlain by native or fill soils. This sample appeared to be native and were similar to the samples from TP-1 and TP-2.

*Construction Debris Fill Area* – Two test pits (TP-4 and TP-5) were excavated in this area. As anticipated, the materials at TP-4 were mostly buried concrete rubble and concrete truck washouts. The profile also included other inert materials, such as asphalt, metal, wood, and intermixed sand and gravel soil. The fill extended deeper than could be excavated. The materials at TP-5 consisted of concrete rubble overlying fine sand fill. The sand fill likely is the remnant of a stockpile created during the past mining and concrete plant operations.

*Compacted Soil Fill Area* - The soils placed in this area are represented by the Gestra documents and the sample from TP-7. This soil was imported from a local utility construction project by Musson Brothers and described as sandy gravel. We were told that the soil was placed in 1-foot lifts and compacted. Gestra tested them for compaction at three surface locations, which passed the 95% specification. The test pit exposed soils also described as sand and gravel fill to a depth of about 9 feet overlying native sand and gravel. The test pit walls remained vertical, and the soil appeared to be dense and well compacted.

*Soft Clay/Silt Sediment* – The soils in this area are represented by the sample from TP-8. They appeared to have accumulated as run-off from the adjacent higher finger bluff and concrete rubble fill areas. They were fine grained clay and silt that were saturated. While traversing this area with the backhoe, it sank about 3 feet, prompting the decision to excavate the test pit. The soft, saturated sediments extended to a depth of about 5.5 feet and overlay native sand and gravel soil.

*Native Soils – Pit Base Area* – Two test pits (TP-6 and TP-9) were excavated in the areas believed to be the final base of the original mining pit. These two samples were similar in nature and both described as mostly well-graded gravel with some sand and trace to few silt fines. These soils were also similar to bluff samples B1, B3, B4, and B13, where the original pit was terminated due to property boundary restrictions.

#### Groundwater Conditions

Free groundwater was not encountered in any of the test pits. Groundwater was noted in the Drake report at depths of 8 to 10 feet. The nearby potable well reports indicated the depth to groundwater ranged from 55 to 135 feet, from ground surface elevations up to 85 feet above the pit base. Based on this data, the normal groundwater table likely exists at a depth of about 10 to 20 feet below the pit base.

Fluctuations in the groundwater table elevation should be expected with variations in precipitation, evapotranspiration, surface runoff, etc. Also, shallow perched groundwater conditions should be expected where relatively permeable granular soils are underlain by relatively impermeable cohesive soils, especially following precipitation events.

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### **Analysis and Recommendations**

There are eight primary issues that should be considered when planning this project.

- Fill materials exist on the property. The fills vary from construction soil placed in the developed area, UST backfill, construction rubble, compacted imported soil, and general grading materials. Other than the compacted imported soil, most other fills are not suitable for support of engineered fill and structural elements.
- Most building foundations will bear upon engineered fill placed to raise low areas of the property. It will be important to plan for sufficient quality-control measures during site grading and construction to ensure competent bearing conditions.
- Saturated clay and silt soils exist in the "Sediment" area, which are highly sensitive to construction activity and are not suitable for the support of engineered fill and structural elements.
- The compacted imported soil area only had three field density tests. Additional testing should be conducted to confirm they are consistent and suitable for the support of engineered fill and structural elements.
- Unexpected materials or items could be buried on the property that would not be suitable for reuse, such as construction equipment, organic material such as timber and vegetation.
- Subsurface elements related to past developments exist, including foundations, slabs, and utilities. These features should be identified and removed within structural areas.
- Although not encountered during this evaluation, it is possible that clay and silt soils could be encountered during the site improvement activities. These soil types are sensitive to moisture variations and could cause construction challenges and schedule delays.
- Although the perimeter bluffs vary in soil type, they should all be uniformly designed for safety and stability.

#### **Foundation Support**

Once the property has been properly prepared (described below), the proposed buildings can be supported on conventional, shallow spread footings. The foundations can likely be designed using an allowable bearing capacity value of 3,000 psf to 6,000 psf, depending on the final grades and localized bearing conditions. Properly designed and constructed footings should experience total and differential settlements of less than 1 inch and  $\frac{3}{4}$  inch, respectively.

Traditionally, perimeter footings and interior footings in unheated areas should bear at a depth of at least 48 inches below the final exterior grade to provide adequate frost protection. If desired, exterior footings can bear at shallower depths by following ASCE 32-01 (American Society of Civil Engineers, Design and Construction of Frost-Protected Shallow Foundations, 2001). Interior footings not subject to frost can bear directly beneath the floor slab.

### Seismic Design

The soil conditions present at a site are utilized in determining the Seismic Design Category (SDC) for structures. Part of selecting the SDC is determining the Site Class for the soils, which categorizes common soil conditions into broad classes, where typical ground motion attenuation and amplification effects are assigned. Site Class is determined based on the average properties of the soil within 100 feet of the ground surface. Geotechnical engineers use a variety of parameters to characterize the engineering properties of these soils, including general soil classifications (e.g., hard rock, soft clay, etc.), N-values, and laboratory testing.

Site Class A includes hard rock that is typically found only in the eastern United States. The types of rock typically found in the western states include various volcanic deposits, sandstones, shales, and granites that commonly have the characteristic appropriate to either Site Class B or C. Sites with very dense sands and gravels or very stiff to hard clay deposits also may qualify as Site Class C. Sites with relatively stiff cohesive or medium dense non-cohesive soils, including mixtures of clays, silts, and sands, are categorized as Site Class D. Site Class D is the most common site class throughout the United States. Sites along rivers or other waterways underlain by deep soft clay deposits are categorized as Site Class E. Sites where soils are subject to liquefaction or other ground instabilities are categorized as Site Class F and site-specific analyses are required.

Based on the types of soils present at the boring locations at this property, and their apparent engineering properties, Site Class D is assigned to the site, as defined in the International Building Code (2015) Section 1613.

### Floor Slab Support

The expected final subgrade soils should be suitable for support of concrete floor slabs. However, the floor slab areas should be proof-rolled and soft areas removed or improved prior to the placement of base course materials. An average subgrade modulus value of 150 pounds per cubic inch (pci) is appropriate.

### Below-grade Walls

A coefficient of friction of 0.35 may be used with dead load forces for wall footings that bear on suitable (as defined in the geotechnical report) native soils or engineered fill.

The lateral earth pressure value ranges presented below assume that the walls are vertical, that a clean, free-draining granular fill (P200 <6%) is used as backfill within 2 feet behind the wall, the backfill condition at the ground surface is level, and that adequate drainage is provided to prevent the buildup of hydrostatic pressures.

<b>Retaining Wall Design Parameters</b>	
Soil Unit Weight	140 pcf
Angle of Internal Friction	35°
Soil Cohesion	0 psf
<b>Earth Pressure Coefficient</b>	
At Rest Design Parameters	0.46
Active Design Parameters	0.30
Passive Design Parameters	3.35

We recommend using a minimum safety factor of 2.0 in passive earth pressure calculations, ignoring the upper 2 feet of soil in frost protected areas and 4 feet of soil in other areas. For walls that are free to rotate at least 0.001 times the height of the wall, such as a temporary earth retention system and retaining walls, an active earth pressure condition will develop. For walls that will be restrained, such as permanent below-grade walls, an at-rest condition will develop. For walls that rotate towards the soil, a passive condition will develop. Below-grade and retaining wall design should also consider surface and subgrade surcharge loading.

Special attention should be employed during placement of backfill against below-grade and retaining walls. Inadequate placement and compaction of backfill will result in at-grade structural elements and slab/pavement settlement and distress. To achieve a balance between minimizing excessive pressures against the walls during construction and reducing the settlement of the wall backfill, the granular backfill should be compacted to at least 90 percent of the maximum dry density obtained in accordance with ASTM Specification D1557, Modified Proctor Method. Where backfill supports structural elements, sidewalks, or pavements, the upper 4 feet should be compacted to 95% of the maximum dry density (Modified Proctor). Lifts of 4 to 6 inches can be effective in achieving compaction requirements.

Drainage should be provided behind below-grade walls to prevent the buildup of hydrostatic pressures. We recommend that free-draining granular drainage aggregate be placed within 2 feet behind the back face of the walls.

A relatively impermeable barrier at the ground surface is recommended, such as a minimum 2-foot-thick clay cap or Bituminous or Portland cement concrete (i.e., walkways and drives) to minimize surface water infiltration into backfill against walls. The impermeable barrier should slope away from the structure at a minimum 2 percent grade.

#### Engineered Fill, Wall, and Utility Trench Backfill

The on-site soil and materials (if processed properly) can be reused as engineered fill. All engineered fill, wall, and utility trench backfill should consist of inorganic materials,

free of debris, not exceed 3 inches in size, and should be placed in 8 to 10-inch loose lifts compacted to a minimum of 95 percent of the maximum dry density (Modified Proctor). If the engineered fills are less than 7 feet in thickness, they should be moisture conditioned to be within +/- 3% of the optimum moisture content. Where engineered fills exceed 7 feet, they should be moisture conditioned to be at the optimum moisture to + 3% above.

Pavement Design

The Wisconsin Asphalt Pavement Association (WAPA) Design Guide should be utilized to design the new asphalt surface parking areas. Traffic Class I was assumed for parking areas that are mainly used by light passenger vehicles and Traffic Class II for medium-loaded drive areas.

The minimum pavement section should consist of the following:

<b>Material</b>	<b>Traffic Class I</b>	<b>Traffic Class II</b>	<b>WisDOT Specification</b>
Asphalt Surface Course	2 inches	2 inches	Section 460
Asphalt Binder Course	2 inches	2.5 inches	Section 460
Dense Graded Base Course	8 inches	10 inches	Section 305

The pavement sections above are not intended to support on-going construction traffic. Also, the pavement sections presented above should not be used for areas that experience heavy truck traffic, equipment or truck parking areas, entrances and exit aprons, or trash-dumpster loading zones. In these areas, a Portland Cement Concrete (PCC) pavement should be used. The PCC layer thickness is recommended to be 7 inches with a minimum of 6-inch-thick crushed stone base course. The reinforcement details for PCC layers and final pavement section should be designed by the project design engineer.

These recommendations assume the subgrade is prepared as described in this report. Additional corrective action may be warranted at the time of construction, depending on the site conditions. If any clay or silt soils exist in pavement areas, it may be beneficial to install a geotextile fabric (e.g., GEOTEX 315) as a separating layer between such a subgrade and the base course after the subgrade has been evaluated by proof-roll testing.

Stormwater Management

Three stormwater management devices are proposed for the development. Based on the soil descriptions at two of those areas (TP-6 and TP-9), the prevailing soils were classified as “Coarse Sand and Gravel”. Consequently, the devices would be exempt from the Wisconsin Department of Natural Resources (WDNR) infiltration requirements. The estimated static infiltration rate based on the Standard 1002 – Table 2 would be 3.60 inches per hour (in/hr).

### Bluff Stability

The prevailing soil type making up the perimeter bluffs is described as sand and gravel that meet the OSHA definition for Type C. Some soils meet the Type B description, but they are not consistent. Therefore, the bluffs should be designed for minimum slopes of 1.5h:1v for safety and stability.

### Construction Considerations

Because of the presence of undocumented fill on the property, extra caution should be exercised during construction. All poor soil/fills should be stripped from structural and engineered fill areas prior to any construction activities. Additional effort should also be taken to identify the former UST cavities, which were likely backfilled with soils that are not suitable for the support of engineered fill and structural elements. The exposed subgrade soils and all engineered fills should be observed, tested, and documented by a representative of the geotechnical engineer. Large structural areas, such as building footprints and beneath engineered fill and pavements, should be proof-rolled to identify low-strength or disturbed areas that need to be removed or improved.

Footing excavations and all engineered fill subgrade soils should be evaluated to confirm the bearing materials are consistent with those identified in this report and anticipated by the geotechnical and structural engineers. If unanticipated conditions are encountered, the geotechnical and structural engineers should be notified immediately. All footing pads must bear upon suitable native soils or engineered fill soils that have been confirmed in the field by a representative of the geotechnical engineer. Where unsuitable bearing soils, such as organic, disturbed, wet, frozen, or low-strength (less than the design bearing capacity) soils are encountered, the excavation should be extended to competent bearing soil. If extended, the footing pads can be constructed at the base of the excavations, or the excavations can be backfilled with clean, crushed stone or lean concrete.

Buried structural elements from past developments exist. Therefore, efforts should be taken during site grading to identify all existing structural elements and undocumented fills. Existing foundations should be removed to a depth of at least 4 feet below proposed foundations. Existing concrete slabs below a depth of 4 feet should be removed or broken into minimum 1-foot pieces to avoid water pooling. Utilities may also exist that could require abandonment.

It is unlikely that excavations will encounter groundwater. However, if any do or if perched water is encountered, filtered sump pumps and drawing water from sump pits should be adequate to remove water that collects in excavations. Excavated sump pits should be lined with a geotextile and filled with open-graded, free-draining aggregate.

Surface water should not be allowed to be collected in excavations or on prepared subgrades during or after construction. Areas should be sloped to facilitate removal of

collected surface runoff. Positive site drainage should be provided to reduce infiltration of surface water around the perimeter of structures and within pavement areas.

Excavation walls may need to be sloped or braced for stability and safety reasons. The Owner and Contractor should be aware of, and become familiar with, applicable local, state, and federal safety regulations, including current OSHA Excavation and Trench Safety Standards. Construction-site safety generally is the responsibility of the Contractor, who should also be responsible for the means, methods, and sequencing of construction operations.

The Contractor should be aware that slope height, slope inclination, or excavation depths should in no case exceed those specified in local, state, or federal safety regulations, (e.g., OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926), or successor regulations. The on-site soils are generally considered Type C soils when applying the OSHA regulations. Such regulations are strictly enforced, and if they are not followed, the Owner, Contractor, and/or earthwork Subcontractor(s) could be liable for substantial penalties.

### **General Qualifications**

The services provided by GeoTest on this project were performed with the degree of skill and care typically performed by other members of the geotechnical engineering profession, practicing in this locale, at this time. No other warranty, expressed or implied, is given.

We appreciate the opportunity to provide geotechnical engineering services for this project. If you have any questions, or require any further assistance, please feel free to contact us.

Sincerely,

A handwritten signature in black ink, appearing to read "Michael D. Frede".

Michael D. Frede, P.E.  
Technical Director/Senior Engineer



## Appendix A

Figure 1 – Site Location Diagram

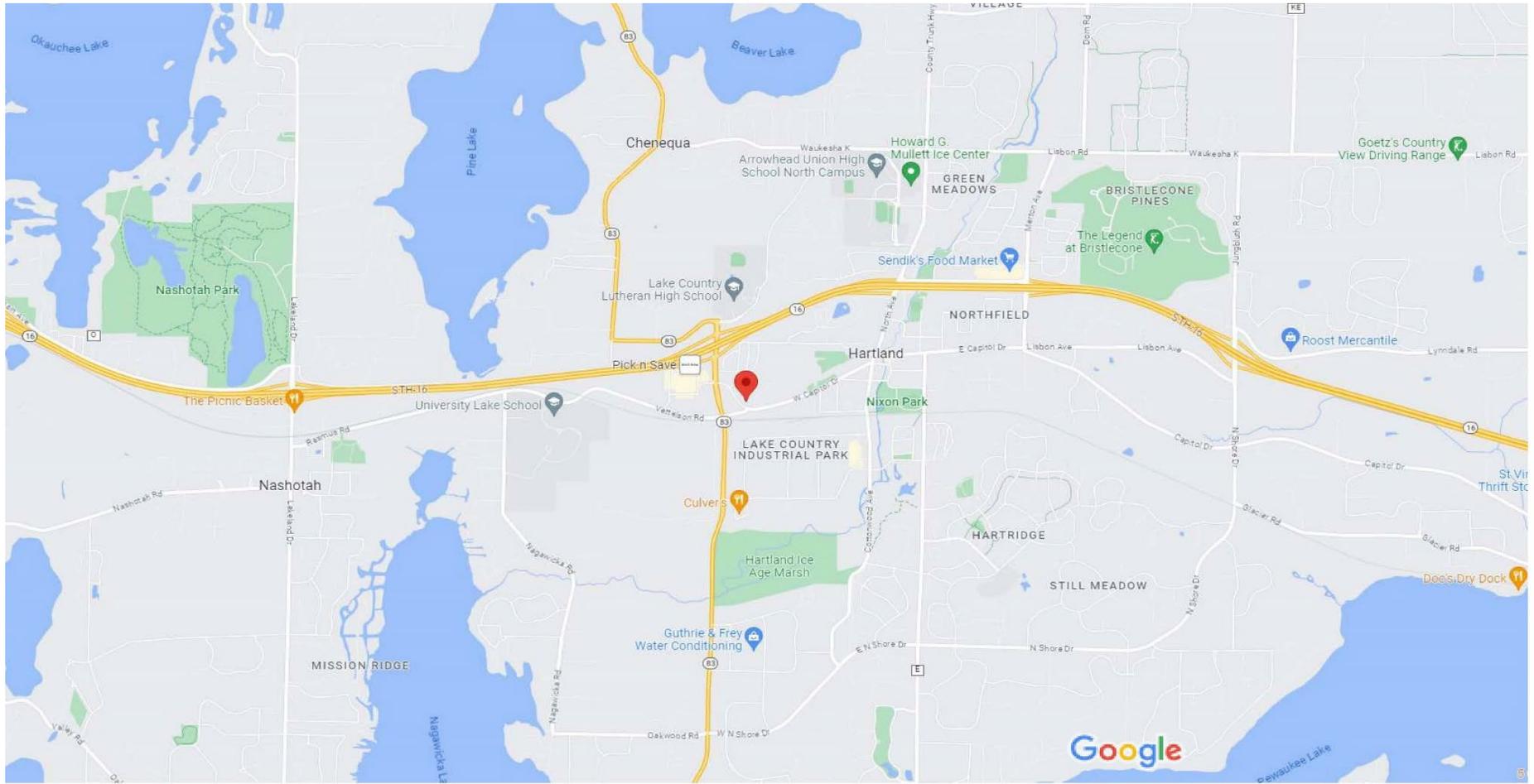
Figure 2 – Property Boundary Diagram

Figure 3 – Proposed Development Diagram

Figure 4 – Geotechnical Areas of Interest Diagram

Figure 5 – Sampling Location Diagram





Map data ©2023 Google 2000 ft



**Project Name:** Hartland Quarry Apartments  
**Project Location:** 700/701 W. Capitol Drive  
Hartland, Wisconsin  
Waukesha County

**Project No.:** 7708  
**Date:** 4/29/23  
**Drawn By:** MDF  
**Scale:** NTS

**FIGURE 1**  
**Site Location**  
**Diagram**



Legend

- Municipal Boundary\_2K
- Parcel\_Dimension\_2K
- Note\_Text\_2K
- Lots\_2K
  - Lot
  - Unit
  - General Common Element
  - Or lot
- Simultaneous Conveyance
  - Assessor Plat
  - CS#
  - Condominium
  - Subdivision
- Cartline\_2K
  - EA-Easement\_Line
  - PL-DA
  - PL-Excluded\_Tk\_Line
  - PL-Meandere\_Line
  - PL-Note
  - PL-Tk
  - PL-Tk\_Line
  - <all other utilities>
- Railroad\_2K



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Notes:

Printed: 2/14/2023



**Project Name:** Hartland Quarry Apartments  
**Project Location:** 700/701 W. Capitol Drive  
 Hartland, Wisconsin  
 Waukesha County

**Project No.:** 7708  
**Date:** 4/29/23  
**Drawn By:** MDF  
**Scale:** NTS

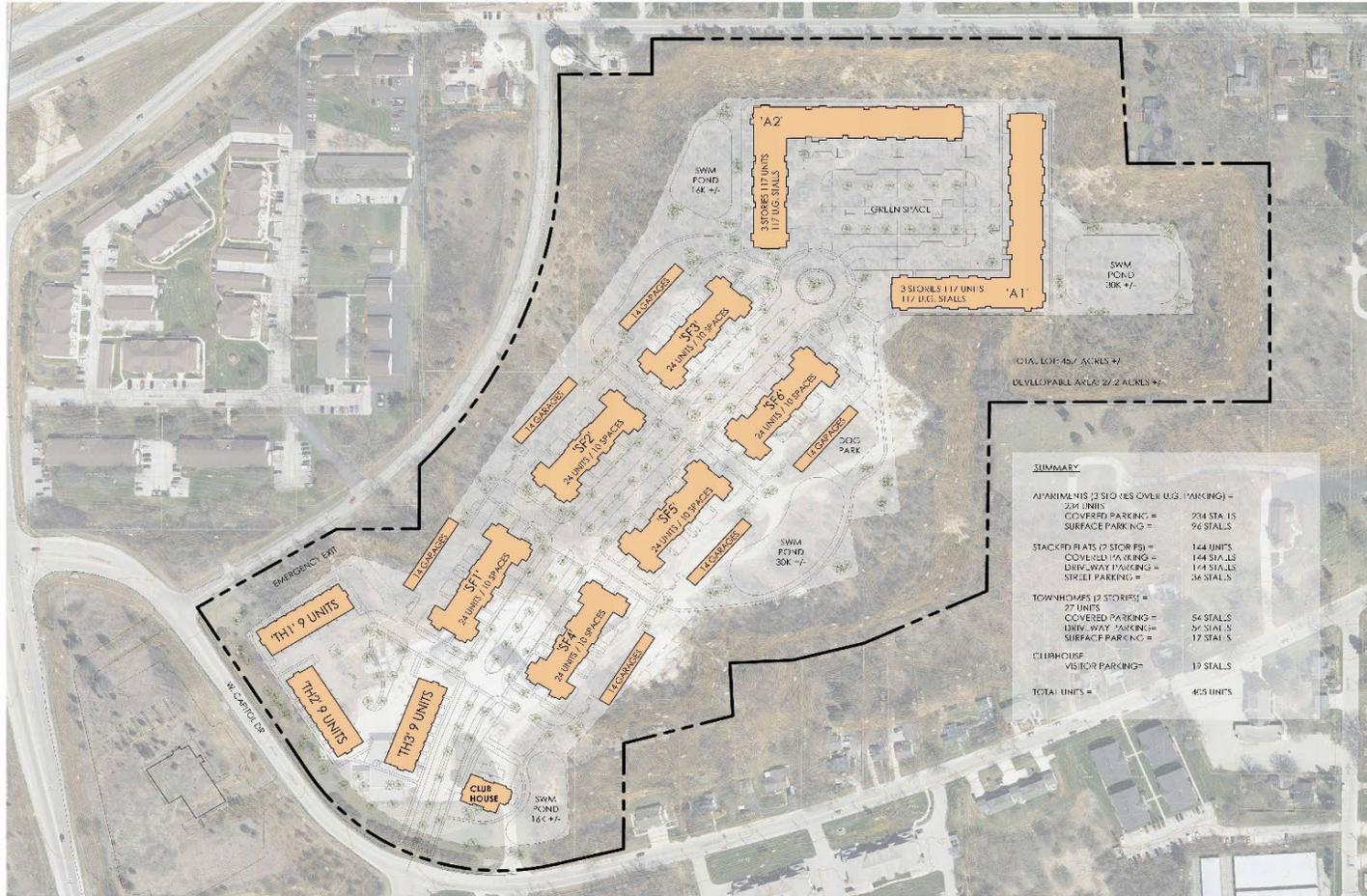
**FIGURE 2**  
**Property Boundary**  
**Diagram**



**JLA ARCHITECTS**  
 MADISON | MILWAUKEE | DENVER  
 JLA-AP.COM

JLA PROJECT NUMBER: 22-013

**HARTLAND QUARRY APARTMENTS**  
 Plan Commission Submittal



**SUMMARY**

APARTMENTS (2 STORIES OVER U.S. PARKING) =	234 UNITS
COVERED PARKING =	234 STALLS
SURFACE PARKING =	96 STALLS
STACKED PLATS (2 STORIES) =	144 UNITS
COVERED PARKING =	144 STALLS
DRIVEWAY PARKING =	174 STALLS
STREET PARKING =	36 STALLS
TOWNHOMES (2 STORIES) =	27 UNITS
COVERED PARKING =	54 STALLS
DRIVEWAY PARKING =	59 STALLS
SURFACE PARKING =	17 STALLS
CLUBHOUSE VISITOR PARKING =	13 STALLS
<b>TOTAL UNITS =</b>	<b>465 UNITS</b>

ARCHITECTURAL SITE PLAN  
 1" = 100'

**PROGRESS DOCUMENTS**  
 These documents reflect progress and in final form may be subject to change, including modifications. Use at the user's own risk. No liability shall be assumed for any errors or omissions.

DATE OF ISSUE	04/11/2022
REVISION SCHEDULE	N/A

**ARCHITECTURAL SITE LAYOUT PLAN**

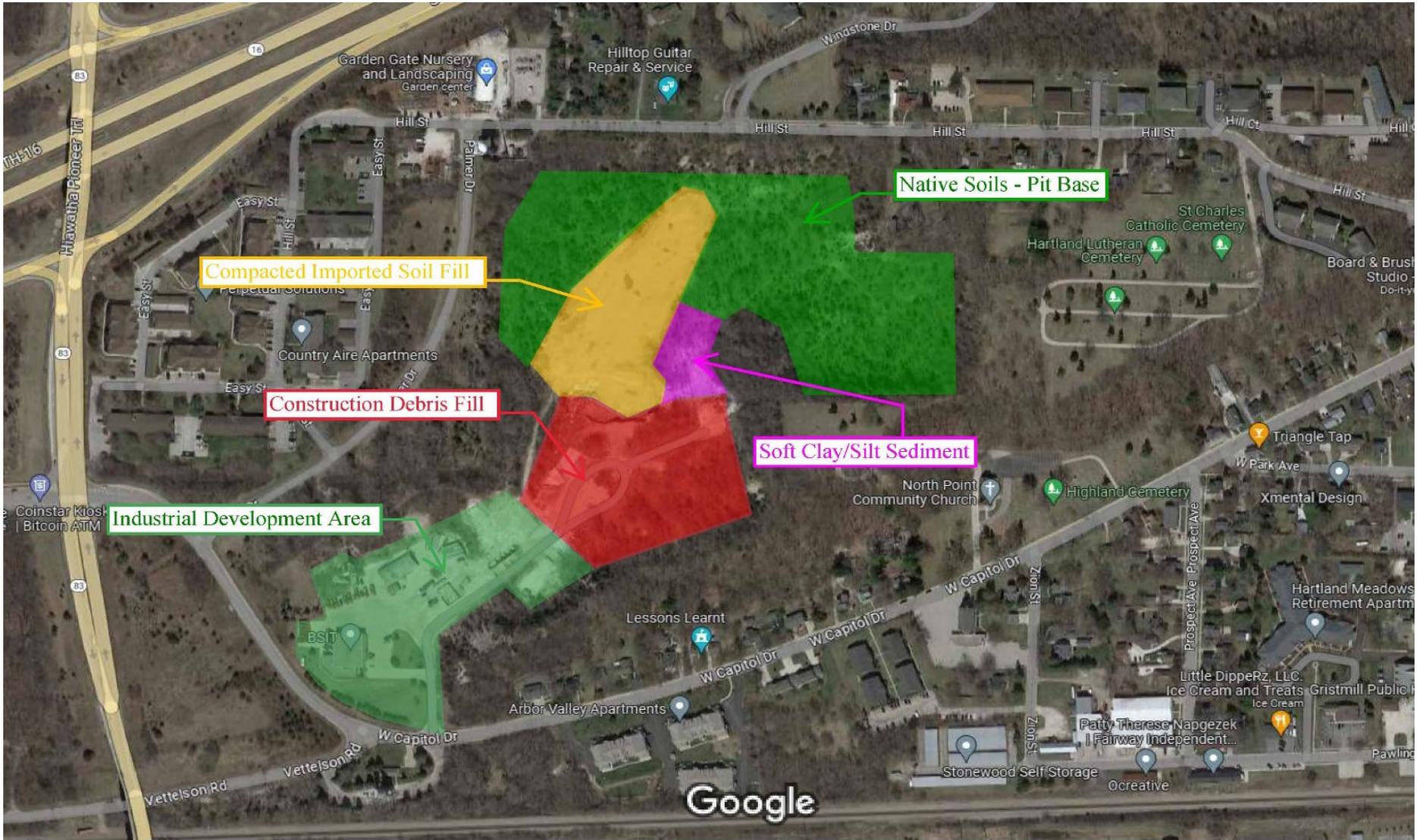
ASP-100



**Project Name:** Hartland Quarry Apartments  
**Project Location:** 700/701 W. Capitol Drive  
 Hartland, Wisconsin  
 Waukesha County

**Project No.:** 7708  
**Date:** 4/29/23  
**Drawn By:** MDF  
**Scale:** NTS

**FIGURE 3**  
**Proposed**  
**Development**  
**Diagram**



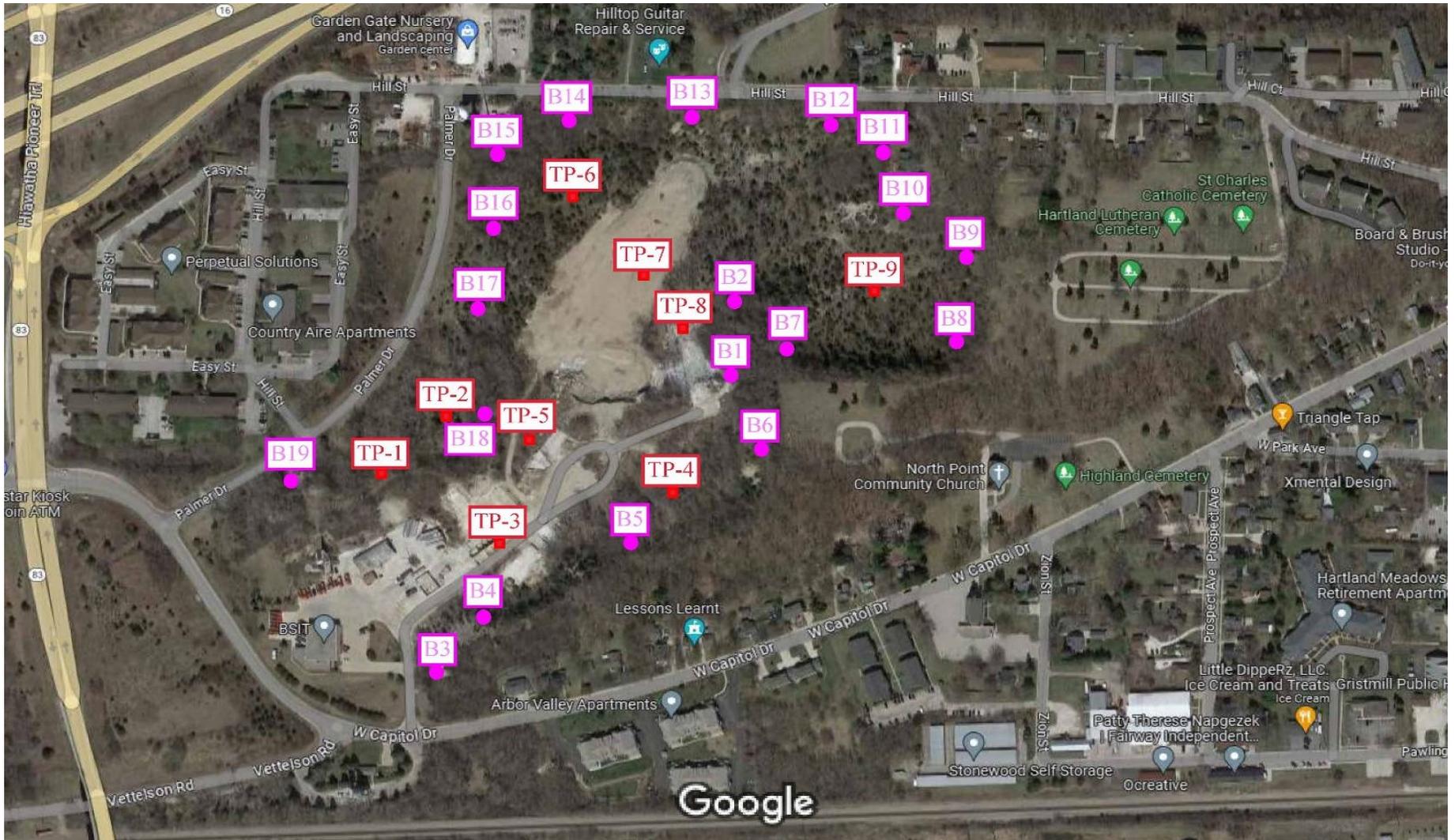
Imagery ©2023 CNES / Airbus, Maxar Technologies, U.S. Geological Survey, USDA/FPAC/GEO, Map data ©2023



**Project Name:** Hartland Quarry Apartments  
**Project Location:** 700/701 W. Capitol Drive  
Hartland, Wisconsin  
Waukesha County

**Project No.:** 7708  
**Date:** 4/29/23  
**Drawn By:** MDF  
**Scale:** NTS

**FIGURE 4**  
**Geotechnical Areas**  
**of Interest Diagram**



- Test Pit Locations
- Bluff Samples

Imagery ©2023 CNES / Airbus, Maxar Technologies, U.S. Geological Survey, USDA/FPAC/GEO, Map data ©2023



**Project Name:** Hartland Quarry Apartments  
**Project Location:** 700/701 W. Capitol Drive  
Hartland, Wisconsin  
Waukesha County

**Project No.:** 7708  
**Date:** 4/29/23  
**Drawn By:** MDF  
**Scale:** NTS

**FIGURE 5**  
**Sampling Location**  
**Diagram**



## Appendix B

### Well Logs

- 8KM754\_WCR
- 8KM755\_WCR
- 8KM756\_WCR
- 8NM185\_WCR
- 8NN038\_WCR
- IJ288\_WCR

### Drake Environmental Geologic Information

- Diagrams
- Boring Logs

### Gestra Laboratory Reports

- Proctor Analysis (D1557)
- Field Density Testing

### Walbec Test Pit Survey Diagrams

- Test Pits 1 through 5
- Test Pits 6 through 9



WELL CONSTRUCTOR'S REPORT

WISCONSIN STATE BOARD OF HEALTH

Wel 6

1. COUNTY Waushara CHECK ONE  Town  Village  City NAME DeLafield

2. LOCATION (Number and Street or 1/4 section, section, township and range. Also give subdivision name, lot and block numbers when available) N 1/4 Sec 3 T 7 N R 18 E. RECEIVED

3. OWNER AT TIME OF DRILLING Robert Steinman JUN 24 1966

4. OWNER'S COMPLETE MAIL ADDRESS Hill St Hartland Wisc

5. Distance in feet from well to nearest: (Record answer in appropriate block)

BUILDING	SANITARY SEWER	FLOOR DRAIN	FOUNDATION DRAIN	LINE WATER DRAIN
	C. I.	TILE	C. I.	TILE
			SEWER CONNECTED	INDEPENDENT
			C. I.	TILE

CLEAR WATER DRAIN	SEPTIC TANK	PRIVY	SEEPAGE PIT	ABSORPTION FIELD	BARN	SILO	ABANDONED WELL	SINK HOLE
C. I.	TILE							
			60	75				

OTHER POLLUTION SOURCES (Give description such as dump, quarry, drainage well, stream, pond, lake, etc.)

6. Well is intended to supply water for: Home Service Station

7. DRILLHOLE

Dia. (in.)	From (ft.)	To (ft.)	Dia. (in.)	From (ft.)	To (ft.)
6"	Surface	268			

10. FORMATIONS

Kind	From (ft.)	To (ft.)
Sand & gravel Brown	Surface	120
Gray sand & gravel	120	170
Clay & sand	170	233
Sand & gravel	233	268

8. CASING, LINER, CURBING, AND SCREEN

Dia. (in.)	Kind and Weight	From (ft.)	To (ft.)
6"	Standard Steel	Surface	268

9. GROUT OR OTHER SEALING MATERIAL

Kind	From (ft.)	To (ft.)
	Surface	



11. MISCELLANEOUS DATA

Yield test: 12 Hrs. at 12 GPM

Depth from surface to normal water level 120 ft.

Depth to water level when pumping 130 ft.

Well construction completed on May 11 1966

Well is terminated 8 inches  above  below final grade

Well disinfected upon completion  Yes  No

Well sealed watertight upon completion  Yes  No

Water sample sent to Madison laboratory on: May 11 1966

Your opinion concerning other pollution hazards, information concerning difficulties encountered, and data relating to nearby wells, screens, seals, type of casing joints, method of finishing the well, amount of cement used in grouting, blasting, sub-surface pumphrooms, access pits, etc., should be given on reverse side.

SIGNATURE [Signature] Registered Well Driller COMPLETE MAIL ADDRESS Hartland Wisc

Please do not write in space below

COLIFORM TEST RESULT	GAS - 24 HRS.	GAS - 48 HRS.	CONFIRMED	REMARKS
				plot 752104

1. COUNTY Waushara CHECK ONE  Town  Village  City NAME Delafield

2. LOCATION (Number and Street or 1/4 section, section, township and range. Also give subdivision name, lot and block numbers when available.)  
Hartland HY 16 & Hill St T1N R18 E NW 1/4 Sec 3

3. OWNER AT TIME OF DRILLING  
Bob Steinman

4. OWNER'S COMPLETE MAIL ADDRESS  
Hartland Wis

RECEIVED

5. Distance in feet from well to nearest: (Record answer in appropriate block)

BUILDING	SANITARY SEWER	FLOOR DRAIN	FOUNDATION DRAIN	WASTE WATER DRAIN
<u>10</u>	C. I. TILE	C. I. TILE	SEWER CONNECTED INDEPENDENT	<u>11</u> <u>1966</u>

CLEAR WATER DRAIN	SEPTIC TANK	PRIVY	SEEPAGE PIT	ABSORPTION FIELD	BARN	SILO	ABANDONED WELL	SINK
C. I. TILE	<u>60</u>		<u>70</u>					<u>SECRET</u> ENCLOSURE

OTHER POLLUTION SOURCES (Give description such as dump, quarry, drainage well, stream, pond, lake, etc.)

6. Well is intended to supply water for:  
Service Station

7. DRILLHOLE

Dia. (in.)	From (ft.)	To (ft.)	Dia. (in.)	From (ft.)	To (ft.)
<u>6</u>	Surface	<u>268</u>			

10. FORMATIONS

Kind	From (ft.)	To (ft.)
Surface		
Sand & gravel	-	120
Down sand & gravel	120	140
Gray sand & gravel	140	170
Gray clay & sand	170	185
Brown sand	185	225
Gray sand & clay	225	233
Brown sand & gravel	233	268

8. CASING, LINER, CURBING, AND SCREEN

Dia. (in.)	Kind and Weight	From (ft.)	To (ft.)
<u>6</u>	<u>Standard steel</u>	Surface	<u>268</u>

9. GROUT OR OTHER SEALING MATERIAL

Kind	From (ft.)	To (ft.)
Surface		



Well construction completed on April 13 1966

11. MISCELLANEOUS DATA

Yield test: 6 Hrs. at 20 GPM

Well is terminated 6 inches  above  below final grade

Depth from surface to normal water level 104 ft.

Well disinfected upon completion  Yes  No

Depth to water level when pumping 120 ft.

Well sealed watertight upon completion  Yes  No

Water sample sent to Madison laboratory on: April 13 1966

Your opinion concerning other pollution hazards, information concerning difficulties encountered, and data relating to nearby wells, screens, seals, type of casing joints, method of finishing the well, amount of cement used in grouting, blasting, sub-surface pumphouses, access pits, etc., should be given on reverse side.

SIGNATURE [Signature] Registered Well Driller

COMPLETE MAIL ADDRESS Hartland Wis

Please do not write in space below

COLIFORM TEST RESULT	GAS - 24 HRS.	GAS - 48 HRS.	CONFIRMED	REMARKS
				<u>plot 762103</u>

NW, Sec 3 T7N R18E

WELL CONSTRUCTOR'S REPORT TO WISCONSIN STATE BOARD OF HEALTH
See Instructions on Reverse Side

1. County Waubesa Town Village City Hartland
Check one and give name

2. Location SW 1/4 NW 1/4 Sec 3 T7N R18E
Name of street and number of premise or Section, Town and Range numbers

3. Owner or Agent Hartland Washed Sand & Gravel
Name of individual, partnership or firm

4. Mail Address Hartland
Complete address required

5. From well to nearest: Building 10 ft; sewer ft; drain ft; septic tank ft;
dry well or filter bed ft; abandoned well ft.

6. Well is intended to supply water for: Office

7. DRILLHOLE: Table with columns for Dia. (in.), From (ft.), To (ft.)

8. CASING AND LINER PIPE OR CURBING: Table with columns for Dia. (in.), Kind and Weight, From (ft.), To (ft.)

9. GROUT: Table with columns for Kind, From (ft.), To (ft.)

11. MISCELLANEOUS DATA: Yield test: 3 Hrs. at 10 GPM. Depth from surface to water-level: 55 ft. Water-level when pumping: 58 ft. Water sample was sent to the state laboratory at: Madison on 19

10. FORMATIONS: Table with columns for Kind, From (ft.), To (ft.) containing 'Gravel' and a 'RECEIVED' stamp dated NOV 2 1950.

Construction of the well was completed on: Jan 6 1950

The well is terminated inches above, below the permanent ground surface. Was the well disinfected upon completion? Yes No. Was the well sealed watertight upon completion? Yes No.

Signature H. A. BUTLER WELL CONTRACTOR DELAFIELD, WIS. Registered Well Driller Complete Mail Address

Rec'd No. Ans'd Interpretation Barcode W K 3 5 6 4 9

10 ml 10 ml 10 ml 10 ml 10 ml Gas-24 hrs. 48 hrs. Confirm B. Coli Examiner

1. COUNTY Waukesha CHECK ONE  Town  Village  City NAME Delafield

2. LOCATION (Number and Street or 1/4 section, section, township and range. Also give subdivision name, lot and block numbers when available.)  
 SW, NW, NW 1/4 Section 3 T 7N R 18 E PER APPROVAL LETTER Sw, NW, NW, Sec 3

3. OWNER AT TIME OF DRILLING Hegas Construction Co. (W.F. Hegas + Linda D. Hegas, Owners)

4. OWNER'S COMPLETE MAIL ADDRESS Route #1, Box #63, Delafield, Wis

5. Distance in feet from well to nearest:  
 BUILDING C.I. SANITARY SEWER TILE C.I. TILE FLOOR DRAIN C.I. TILE FOUNDATION DRAIN SEWER CONNECTED INDEPENDENT WASTE WATER DRAIN C.I. TILE  
 (Record answer in appropriate block) 18 ✓ ✓ 45 ✓ ✓ ✓ ✓ ✓ ✓

CLEAR WATER DRAIN C.I. TILE SEPTIC TANK PRIVY SEEPAGE PIT ABSORPTION FIELD BARN SILO ABANDONED WELL SINK HOLE  
 ✓ ✓ 306 ✓ ✓ 330 ✓ ✓ ✓ Perm Well #88024

6. OTHER POLLUTION SOURCES (Give description such as dump, quarry, drainage well, stream, pond, lake, etc.)  
None Well #3

7. Well is intended to supply water for:  
2 Apartment Houses Misc #26

9. DRILLHOLE				10. FORMATIONS				
Dia. (in.)	From (ft.)	To (ft.)	Dia. (in.)	From (ft.)	To (ft.)	Kind	From (ft.)	To (ft.)
<u>10</u>	<u>Surface</u>	<u>20</u>				<u>Clay top soil</u>	<u>Surface</u>	<u>8</u>
<u>6</u>	<u>20</u>	<u>120</u>				<u>Gravel</u>	<u>8</u>	<u>104</u>

8. CASING, LINER, CURBING, AND SCREEN			
Dia. (in.)	Kind and Weight	From (ft.)	To (ft.)
<u>10</u>	<u>ASTM-A53 Grade B</u>	<u>Surface</u>	<u>20</u>
<u>6</u>	<u>ASTM-A53 Grade B</u>	<u>20</u>	<u>106</u>
	<u>1280 P/E</u>		
	<u>welded jts</u>		
<u>6</u>	<u>Silica Brass screen</u>	<u>106</u>	<u>120</u>

7. GROUT OR OTHER SEALING MATERIAL			
Kind	From (ft.)	To (ft.)	
<u>Cement slurry</u>	<u>Surface</u>	<u>20</u>	

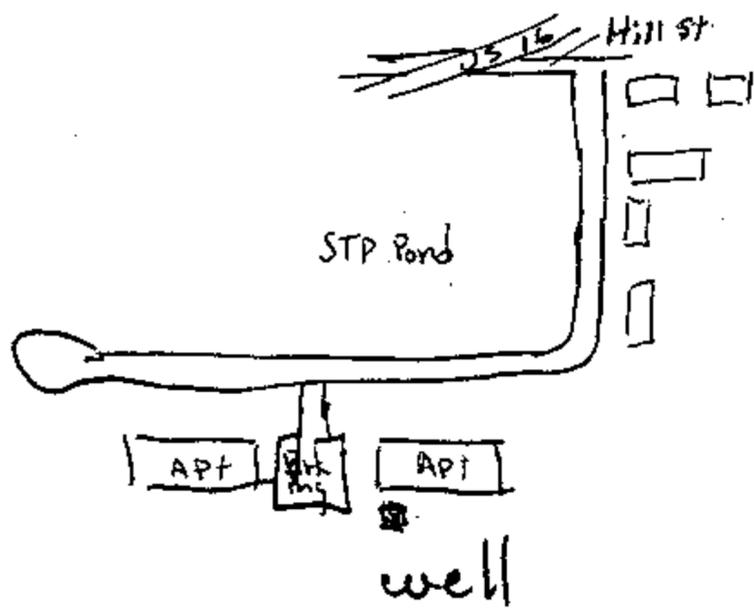
11. MISCELLANEOUS DATA  
 Yield test: 24 Hrs. at 60 GPM Well is terminated 20 inches  above  below final grade  
 Depth from surface to normal water level 87 ft. Well disinfected upon completion  Yes  No  
 Depth to water level when pumping 88'-6" ft. Well sealed watertight upon completion  Yes  No

Water sample sent to Madison laboratory on: 10/26 1968

Your opinion concerning other pollution hazards, information concerning difficulties encountered, and data relating to nearby wells, screens, seals, type of casing joints, method of finishing the well, amount of cement used in grouting, blasting, sub-surface pumprooms, access pits, etc., should be given on reverse side.

SIGNATURE Linda D. Hegas COMPLETE MAIL ADDRESS Rte. 1, Waukesha, Wis.  
Fred. Bollmann Registered Well Driller

COLIFORM TEST RESULT 10 Capacity Well. Approved 12-1-68 GAS - 24 HRS. 100 GAS - 48 HRS. 100 CONFIRMED SEE OTHER SIDE plot 702105 REMARKS As: M. E. Ostrom 12-8-68



8

A/E 934  
 D > 520  
 < 814  
 W - 87  


---

 847 + 10/68  
  
 775  


---

 159

**WELL CONSTRUCTOR'S REPORT**  
 Wel-6.

WHITE COPY - DIVISION'S COPY  
 GREEN COPY - DRILLER'S COPY  
 YELLOW COPY - OWNER'S COPY

STATE OF WISCONSIN  
 DEPARTMENT OF NATURAL RESOURCES  
 Box 450  
 Madison, Wisconsin 53701

1. COUNTY: WAUKESHA CHECK ONE:  Town  Village  City NAME: MERTON

2. LOCATION (Number and Street or 1/4 section, section, township and range. Also give subdivision name, lot and block numbers when available.)  
N. 48 W. 30756 HILL ST. TOWN OF MERTON. T8N R18E

3. OWNER AT TIME OF DRILLING: WAGEN REALTY CO. SE, SE, SW, SW, Sec. 34

4. OWNER'S COMPLETE MAIL ADDRESS: 318 LAKE RD, OCONOMOWOC, WIS.

5. Distance in feet from well to nearest: (Record answer in appropriate block)

BUILDING	SANITARY SEWER		FLOOR DRAIN		FOUNDATION DRAIN		WASTE WATER DRAIN	
	C. I.	TILE	C. I.	TILE	SEWER CONNECTED	INDEPENDENT	C. I.	TILE
8	40	-	60	-	-	-	45	-

CLEAR WATER DRAIN	SEPTIC TANK	PRIVY	SEEPAGE PIT	ABSORPTION FIELD	BARN	SILO	ABANDONED WELL	SINK HOLE
-	-	70	-	95	-	-	-	-

OTHER POLLUTION SOURCES (Give description such as dump, quarry, drainage well, stream, pond, lake, etc.)

6. Well is intended to supply water for: FURNITURE STORE

7. DRILLHOLE						10. FORMATIONS			
Dia. (in.)	From (ft.)	To (ft.)	Dia. (in.)	From (ft.)	To (ft.)	Kind	From (ft.)	To (ft.)	
<del>6</del>	Surface		UNKNOWN			UNKNOWN	Surface	126	
	Redrill					SAND	126	160	

8. CASING, LINER, CURBING, AND SCREEN			
Dia. (in.)	Kind and Weight	From (ft.)	To (ft.)
6	NEW BLK. STEEL	Surface	134
	T&C .0.280		
6	UNKNOWN	134	260

9. GROUT OR OTHER SEALING MATERIAL		
Kind	From (ft.)	To (ft.)
UNKNOWN	Surface	<del>134</del>



11. MISCELLANEOUS DATA

Well construction completed on Aug 29 1974

Yield test: 8 Hrs. at 10 GPM Well is terminated 8 inches  above  below final grade

Depth from surface to normal water level 135 ft. Well disinfected upon completion  Yes  No

Depth to water level when pumping 135 ft. Well sealed watertight upon completion  Yes  No

Water sample sent to Madison, WIS. laboratory on: Sept 16 1974

Your opinion concerning other pollution hazards, information concerning difficulties encountered, and data relating to nearby wells, screens, seals, type of casing joints, method of finishing the well, amount of cement used in grouting, blasting, sub-surface pumphrooms, access pits, etc., should be given on reverse side.

SIGNATURE: Dennis Hartman Registered Well Driller COMPLETE MAIL ADDRESS: 5100 N. 56 ST. MILWAUKEE, WIS.

Please do not write in space below

COLIFORM TEST RESULT	GAS - 24 HRS.	GAS - 48 HRS.	CONFIRMED	REMARKS
			9/29/74	plot 782049

SEP 17 1974 OCT 2 1974

WELL CONSTRUCTOR'S REPORT  
FORM 3300-15

STATE OF WISCONSIN  
DEPARTMENT OF NATURAL RESOURCES  
Box 450  
Madison, Wisconsin 53701

NOTE  
WHITE COPY - DIVISION'S COPY  
GREEN COPY - DRILLER'S COPY  
YELLOW COPY - OWNER'S COPY

1. COUNTY WAUKESHA CHECK ONE  Town  Village  City NAME MERTON

2. LOCATION - 1/4 Section Section Township Range  
SE, SE, SW SW 34 8N 18E  
OR - Grid or street no. Street name  
N. 48 W 30756 HILL ST  
AND - If available subdivision name, lot & block no.  
SE, SE, SW, SW Sec 34

3. OWNER AT TIME OF DRILLING  
WASEN REALTY CO.  
ADDRESS  
318 LAKE RD.  
POST OFFICE  
DEONOMOUC, WIS

4. Distance in feet from well to nearest:  
(Record answer in appropriate block)

BUILDING	SANITARY SEWER	FLOOR DRAIN	FOUNDATION DRAIN	WASTE WATER DRAIN
C.I.	C.I.	C.I.	SEWER CONNECTED	C.I.
TILE	TILE	TILE	INDEPENDENT	TILE
<u>8</u>	<u>40</u>	<u>60</u>	<u>-</u>	<u>45</u>

CLEAR WATER DRAIN	SEPTIC TANK	PRIVY	SEEPAGE PIT	ABSORPTION FIELD	BARN	SILLO	ABANDONED WELL	SINK HOLE
C.I.	TILE							
<u>-</u>	<u>-</u>	<u>70</u>	<u>-</u>	<u>95</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>

OTHER POLLUTION SOURCES (Give description such as dump, quarry, drainage well, stream, pond, lake, etc.)

5. Well is intended to supply water for: STORE FURNITURE

6. DRILLHOLE

Dia. (in.)	From (ft.)	To (ft.)	Dia. (in.)	From (ft.)	To (ft.)
	Surface	<u>REDRILL</u>			

7. CASING, LINER, CURBING, AND SCREEN

Dia. (in.)	Kind and Weight	From (ft.)	To (ft.)
<u>6</u>	<u>UNKNOWN</u>	Surface	<u>126</u>
<u>6" New, Steel, BLK, TFC</u>	<u>0.280</u>	<u>126</u>	<u>260</u>

9. FORMATIONS

Kind	From (ft.)	To (ft.)
<u>UNKNOWN</u>	Surface	<u>126</u>
<u>SAND</u>	<u>126</u>	<u>160</u>
<u>HARD PAW</u>	<u>160</u>	<u>205</u>
<u>GRAVEL</u>	<u>205</u>	<u>260</u>

8. GROUT OR OTHER SEALING MATERIAL

Kind	From (ft.)	To (ft.)
<u>X</u>	Surface	<u>X</u>

10. TYPE OF DRILLING MACHINE USED

<input checked="" type="checkbox"/> Cable Tool	<input type="checkbox"/> Direct Rotary	<input type="checkbox"/> Reverse Rotary
<input type="checkbox"/> Rotary - air w/drilling mud	<input type="checkbox"/> Rotary - hammer with drilling mud & air	<input type="checkbox"/> Jetting with Air <input type="checkbox"/> Water

Well construction completed on aug 29 1974

11. MISCELLANEOUS DATA

Yield test: 8 Hrs. at 10 GPM

Depth from surface to normal water level 135 ft.

Depth to water level when pumping 135 ft.

Well is terminated 8 inches  above  below final grade

Well disinfected upon completion  Yes  No

Well sealed watertight upon completion  Yes  No

Water sample sent to Madison, Wis laboratory on: Sept 16 1974

Your opinion concerning other pollution hazards, information concerning difficulties encountered, and data relating to nearby wells, screens, seals, type of casing joints, method of finishing the well, amount of cement used in grouting, blasting, sub-surface pumprooms, access pits, etc., should be given on reverse side.

SIGNATURE Henry Hartman Registered Well Driller COMPLETE MAIL ADDRESS 5100 N. 56 St. Milwaukee, Wis

COLIFORM TEST RESULT WK 31760-2 REV. 3-71

GAS - 24 HRS.	GAS - 48 HRS.	CONFIRMED	REMARKS
---------------	---------------	-----------	---------

<b>Well Construction Report</b> <b>WISCONSIN UNIQUE WELL NUMBER</b>				<b>IJ288</b>		<b>Drinking Water and Groundwater - DG/5</b> Department of Natural Resources, Box 7921 Madison WI 53707				Form 3300-077A			
Property Owner GARDEN GATE NURSERY					Phone #			<b>1. Well Location</b>			Fire # (if avail.)		
Mailing Address N48 W30756 HILL ST					Town of MERTON			Street Address or Road Name and Number					
City HARTLAND					State WI		Zip Code 53029				N48 W30756 HILL ST		
County Waukesha		Co. Permit #		Notification #		Completed 06-22-1995		Subdivision Name		Lot #	Block #		
Well Constructor (Business Name) MICHAEL HARTMAN				Lic. # 436	Facility ID # (Public Wells)			Latitude / Longitude in Decimal Degree (DD)		Method Code			
Address W82 N28280 MARSHALL HARTLAND WI 53029				Well Plan Approval #			SW	SW	Section 34	Township 8 N	Range 18 E		
				Approval Date (mm-dd-yyyy)			or Govt Lot #	34	8	N	18	E	
Hicap Permanent Well #		Common Well #		Specific Capacity 0.8			<b>2. Well Type</b> Replacement						
Hicap Well ? No		Hicap Property ? No		Hicap Potable ?			of previous unique well # constructed in						
Heat Exchange ___ # of drillholes		Reason for replaced or reconstructed well ?			OUT OF WATER								
<b>3. Well serves</b> 1 # of NURSERY		Construction Type Drilled											
Non-community													
<b>4. Potential Contamination Sources - ON REVERSE SIDE</b>													
<b>5. Drillhole Dimensions and Construction Method</b>						<b>8. Geology</b>							
Dia. (in.)	From (ft.)	To (ft.)	Upper Enlarged Drillhole			Lower Open Bedrock			Geology Codes	<b>8. Geology</b> Type, Caving/Noncaving, Color, Hardness, etc...		From (ft.)	To (ft.)
6	Surface	278	Rotary - Mud Circulation .....						C	CLAY		Surface	10
			Rotary - Air .....						Y	SAND @ GRAVEL		10	50
			Rotary - Air & Foam .....						P	HARDPAN		50	90
			Drill-Through Casing Hammer						S	SAND		90	125
			Reverse Rotary						P	HARDPAN		125	145
			Cable-tool Bit ___in. dia...						Y	SAND @ GRAVEL		145	170
			Dual Rotary .....						P	HARDPAN		170	250
			Temp. Outer Casing ___in. dia						Y	SAND @ GRAVEL		250	278
			Removed? ___depth ft. (If NO explain on back side)										
<b>6. Casing, Liner, Screen</b>						<b>9. Static Water Level</b>			<b>11. Well Is</b>				
Dia. (in.)	Material, Weight, Specification			From (ft.)	To (ft.)	120 ft. below ground surface			18 in. above grade				
6	0 280 A 53 GRB SAWHILL STEEL WELDED			Surface	278	<b>10. Pump Test</b>			Developed ? Yes				
Dia. (in.)	Screen type, material & slot size			From (ft.)	To (ft.)	Pumping level 180 ft. below surface			Disinfected ? Yes				
						Pumping at 50 GP M for 4 Hrs.			Capped ? Yes				
						Pumping Method ?							
<b>7. Grout or Other Sealing Material</b>						<b>12. Notified Owner of need to fill &amp; seal ?</b>							
Method MOUNDED						Filled & Sealed Well(s) as needed? No							
Kind of Sealing Material		From (ft.)	To (ft.)	# Sacks Cement		PUMP MAN TO DO							
CRUMBLES DRILL		Surface	0			<b>13. Constructor / Supervisory Driller</b>							
						MH		Lic #	Date Signed				
						Drill Rig Operator		Lic or Reg #	Date Signed				
						MA							

**4a. Potential Contamination Sources**Is the well located in floodplain ? No

Type	Qualifier	Distance	Type	Qualifier	Distance
Building Overhang		9	Collector Sewer - San or Storm		90
			Sewer - Building Sanitary		40

Comment:

Water Quality Text:

Water Quantity Text:

Difficulty Text:

Created On: 10-10-1995

Created by: HFRC LOAD

Updated On: 07-12-2019

Updated by: PARCEL\_MATCH

HILL STREET

U.S. HWY 16

PALMER DRIVE

WEST

LAFARGE - WISCONSIN DIVISION  
PROPERTY

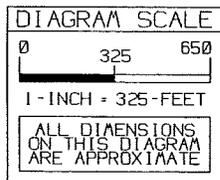
PROPERTY  
BOUNDARY

INVESTIGATION  
AREA

SEE  
FIGURE 3

CAPITOL DRIVE

C. A. S. P. & P. RAILROAD



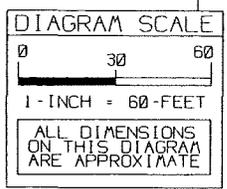
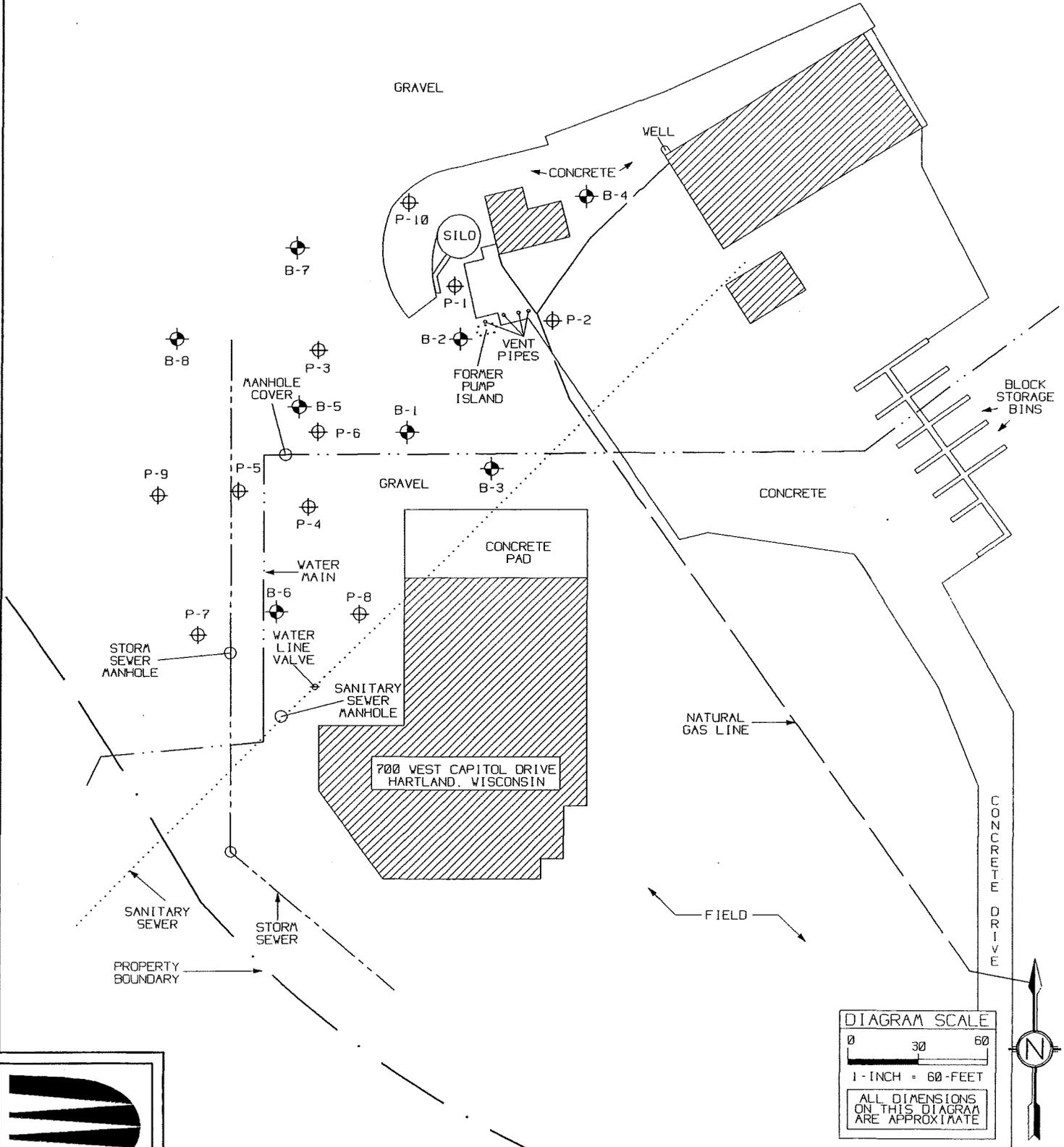
LAFARGE - HARTLAND  
REMEDIAL INVESTIGATION

PROJECT NO. J98109	PA DWF
DRAWN BY JMM DATE: 11/18/98	
CHKD BY <i>DWF</i> DATE: <i>12-2-98</i>	
APRVD BY <i>MT</i>	DATE: <i>7-9-99</i>

LOCATION  
DIAGRAM

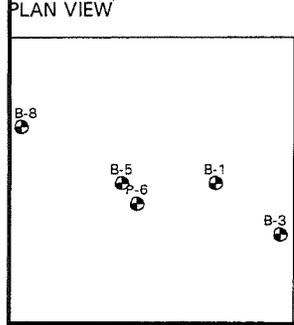
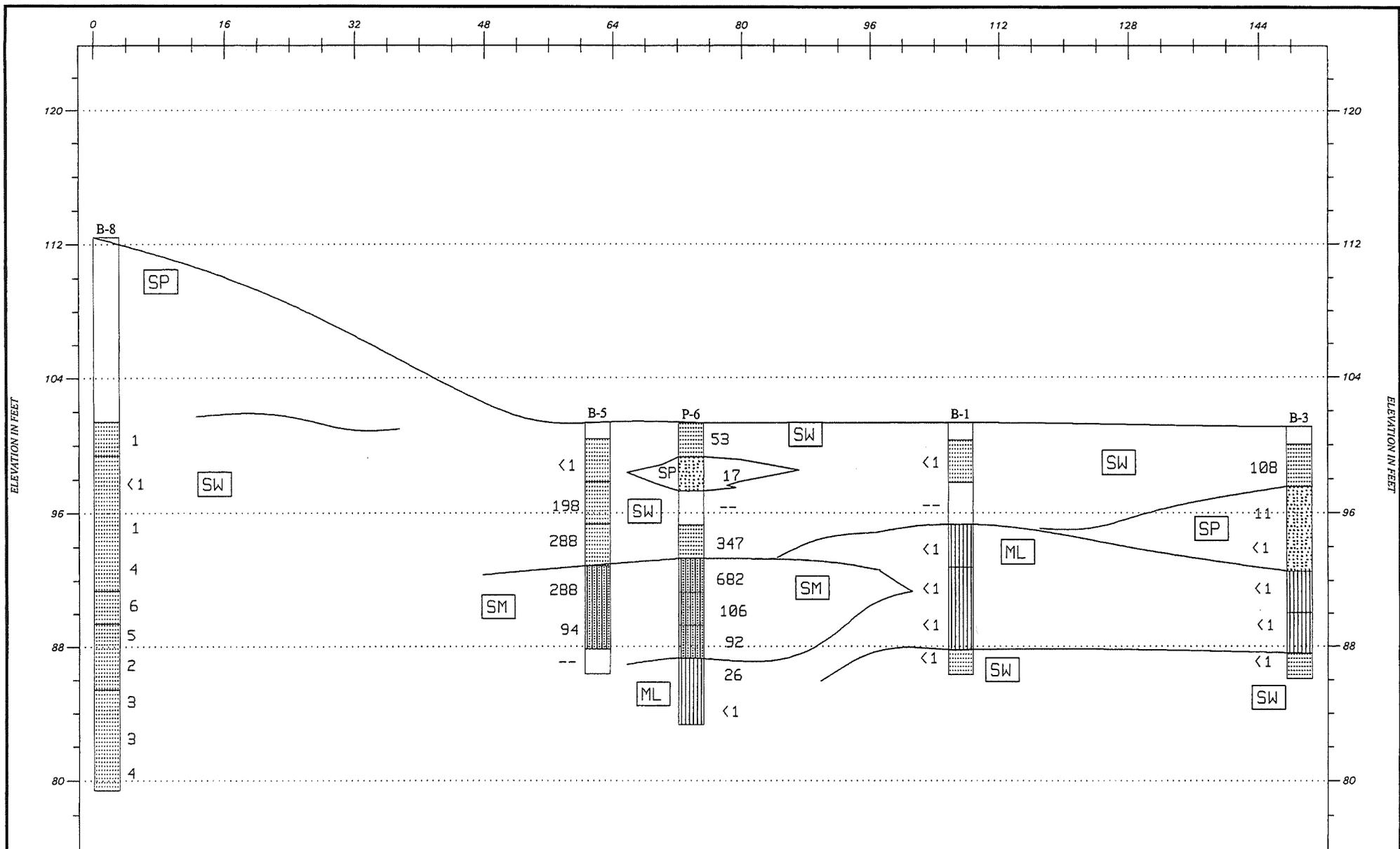
FIGURE
2

⊕ = PROBEHOLE LOCATION  
 ⊙ = BORING LOCATION

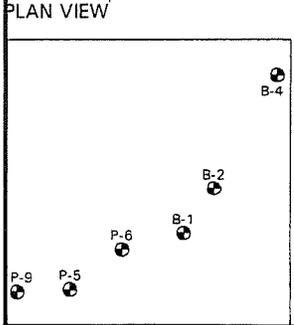
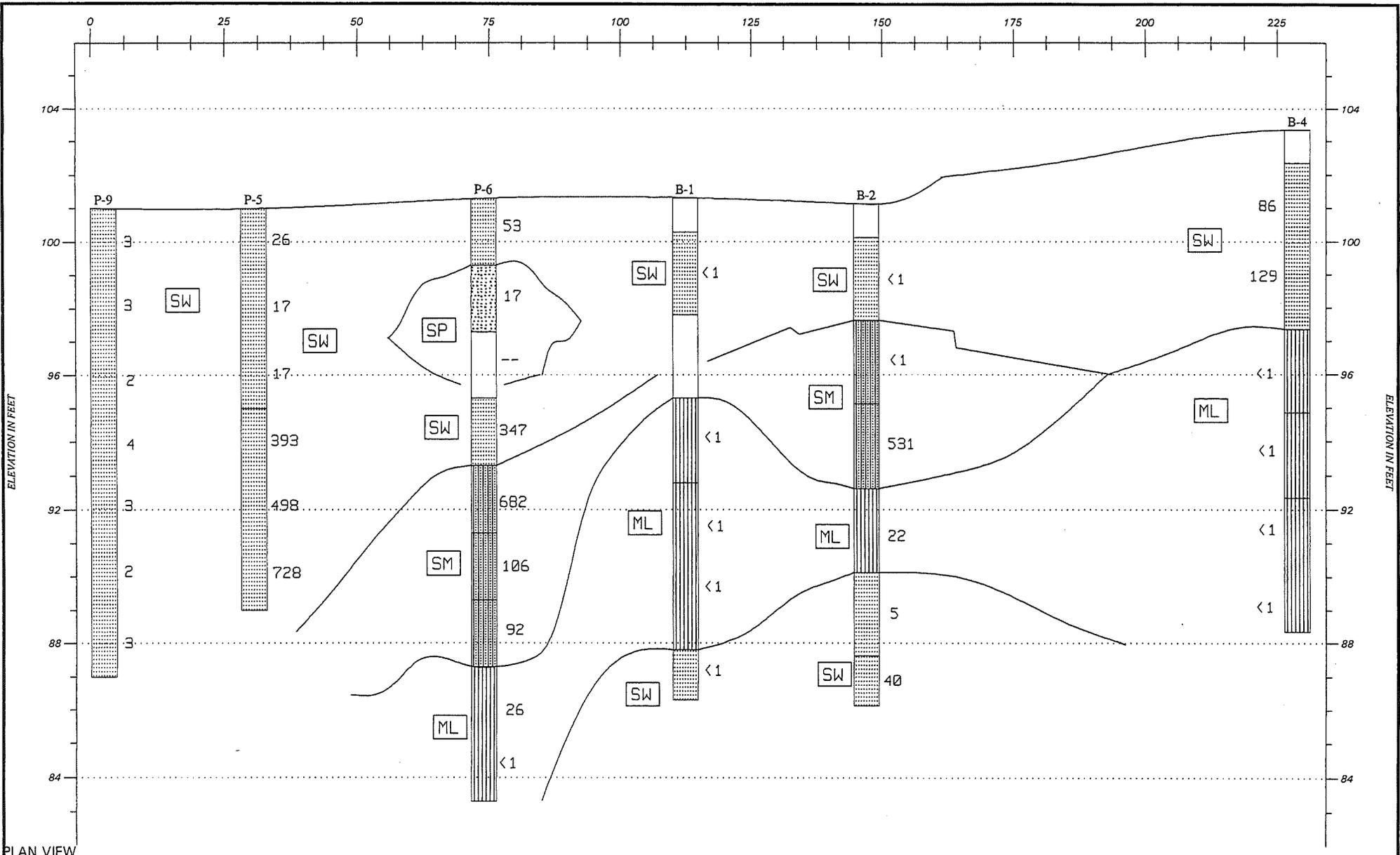


LAFARGE - HARTLAND REMEDIAL INVESTIGATION	PROJECT NO. J98109 PA DVF	PROBEHOLE AND BORING LOCATIONS DIAGRAM	FIGURE 4
	DRAWN BY JAM DATE: 07/30/99		
	CHKD BY <i>DVF</i> DATE 7-21-99		
	APRVD BY <i>TLO</i> DATE 9-21-99		



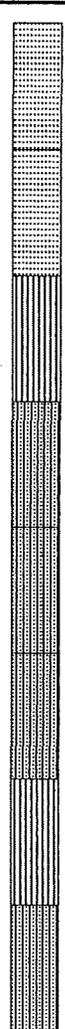


<b>DRAKE ENVIRONMENTAL, INC.</b>		
GEOLOGICAL CROSS SECTION		
HORIZONTAL SCALE: 1"=(proportional)'	FIELD TECHNICIAN	DATE DRAWN
VERTICAL SCALE: 1"=8'	TJO	8/23/1999
LAFARGE - HARTLAND		
PROJECT NUMBER: J98109	FIGURE NUMBER	
	7	



<b>DRAKE ENVIRONMENTAL, INC.</b>		
GEOLOGICAL CROSS SECTION		
HORIZONTAL SCALE: 1" = (proportional)	FIELD TECHNICIAN	DATE DRAWN
VERTICAL SCALE: 1" = 4'	TJO	8/22/1999
LAFARGE - HARTLAND		
PROJECT NUMBER: J98109		FIGURE NUMBER
		8

PROJECT NAME LAFARGE - HARTLAND		FIELD TEC TJO	DRAWN BY DWP	PROBE NUMBER
CLIENT LAFARGE - WISCONSIN DIVISION		PROJECT NUMBER J98109		<b>P-1</b>
LOCATION 700 W CAPITOL DR, HARTLAND, WI NW 1/4 NW 1/4 SEC 3 T7N R18E		LOCATION DESCRIPTION 25 FEET NE OF FORMER UST		

DEPTH	SAMPLE	TYPE	N	QP	DESCRIPTION	USCS	PID	GRAPHIC
0					MEDIUM TO COARSE SAND WITH SILTY FINE SAND AND FINE TO COARSE GRAVEL, TRACE ROOTS - YELLOWISH BROWN (10YR 5/4) - MOIST TO WET (FILL)	SW	<1	
1	1	PR	--	--				
2					MEDIUM TO COARSE SAND, WITH FINE SAND; FEW FINE TO COARSE GRAVEL - YELLOWISH BROWN (10YR 5/4) - MOIST (FILL), FINE SANDY SILT TO SILTY CLAY; FEW MEDIUM TO COARSE SAND, DAMP TO MOIST (POSSIBLE FILL)	SW	<1	
3	2	PR	--	--				
4					SILT, TRACE COARSE SAND TO FINE GRAVEL - DARK YELLOWISH BROWN (10YR 4/6) - DAMP (POSSIBLE FILL)	ML	17	
5	3	PR	--	--				
6					SILTY FINE TO MEDIUM SAND, TRACE COARSE SAND AND FINE GRAVEL - GRAYISH BROWN (10YR 5/2) - DAMP, PETROLEUM ODOR (POSSIBLE FILL)	SM	*2260	
7	4	PR	--	--				
8					SILTY FINE TO MEDIUM SAND, TRACE COARSE SAND, TRACE FINE GRAVEL - GRAYISH BROWN (10YR 5/2) - DAMP TO MOIST, PETROLEUM ODOR (POSSIBLE FILL)	SM	1,073	
9	5	PR	--	--				
10					SILTY FINE SAND TO FINE SANDY SILT, TRACE COARSE SAND - YELLOWISH BROWN (10YR 5/4) - MOIST TO WET, SLIGHT ODOR	SM	70	
11	6	PR	--	--				
12					FINE SANDY SILT, TRACE COARSE SAND AND FINE GRAVEL - YELLOWISH BROWN (10YR 5/4) - WET	ML	17	
13	7	PR	--	--				
14					SILTY FINE SAND, TRACE MEDIUM AND COARSE SAND, TRACE FINE GRAVEL - YELLOWISH BROWN (10YR 5/4) - MOIST, PETROLEUM ODOR	SM	*365	
15	8	PR	--	--				
16					PROBEHOLE TERMINATED AT 16.0 FEET			
17								
18								
19								
20								
21								

NOTE: THE STRATIFICATION LINES ARE APPROXIMATE BOUNDARIES. ACTUAL TRANSITION MAY BE GRADUAL.

DRILLING DATE: 1-25-99	DRILL RIG: Geoprobe Model 5400	NOTES *SUBMITTED FOR LABORATORY ANALYSIS
DRILLED BY: UNDERGROUND POWER CORP.		
BORING DRILLED WITH GEOPROBE 2' INTERVALS		
PROBEHOLE ABANDONED WITH BENTONITE		
GROUND SURFACE AT 0.0 DURING DRILLING		
GROUNDWATER AT APPROX 10' DURING DRILLING		

PROJECT NAME LAFARGE - HARTLAND		FIELD TEC TJO	DRAWN BY DWF	PROBE NUMBER
CLIENT LAFARGE - WISCONSIN DIVISION		PROJECT NUMBER J98109		<b>P-2</b>
LOCATION 700 W CAPITOL DR, HARTLAND, WI NW 1/4 NW 1/4 SEC 3 T7N R18E		LOCATION DESCRIPTION 30 FEET EAST OF FORMER UST		

DEPTH	SAMPLE	TYPE	N	QP	DESCRIPTION	USCS	PID	GRAPHIC
0					8 INCHES CONCRETE			
1					SILTY FINE SAND, FEW MEDIUM TO COARSE SND, TRACE FINE GRAVEL - YELLOWISH BROWN (10YR 5/4) - DAMP (FILL)	SM		
2	1	PR	--	--			<1	
3					FINE SAND, TRACE MEDIUM TO COARSE SAND, TRACE FINE GRAVEL - YELLOWISH BROWN (10YR 5/6) - DAMP (FILL)	SW		
4	2	PR	--	--			<1	
5					SILTY FINE SAND, TRACE MEDIUM TO COARSE SAND AND FINE GRAVEL - PALE BROWN (10YR 6/3) - DAMP (FILL)	SM		
6	3	PR	--	--			<1	
7					SILTY FINE SAND, TRACE MEDIUM TO COARSE SAND AND FINE GRAVEL - PALE BROWN (10YR 6/3) - DAMP (FILL), LITTLE RECOVERY	SM		
8	4	PR	--	--			*<1	
9					SILTY FINE SAND, FINE MEDIUM TO COARSE SAND AND FINE GRAVEL - YELLOWISH BROWN (10YR 5/4) - WET, FILL	SM		
10	5	PR	--	--	FINE SANDY SILT, TRACE COARSE SAND - YELLOWISH BROWN (10YR 5/4) - WET	ML		<1
11					FINE SANDY SILT, TRACE COARSE SAND AND FINE GRAVEL - BROWN (10YR 5/3)	ML		
12	6	PR	--	--	SILTY CLAY, TRACE SILT, TRACE COARSE SAND AND FINE GRAVEL - DARK GRAY (10YR 4/1) - MOIST TO WET	CL		*<1
13					PROBEHOLE TERMINATED AT 13.0 FEET			
14								
15								
16								
17								
18								
19								
20								
21								



<b>NOTE: THE STRATIFICATION LINES ARE APPROXIMATE BOUNDARIES. ACTUAL TRANSITION MAY BE GRADUAL.</b>		
DRILLING DATE: 1-25-99	DRILL RIG: Geoprobe Model 5400	NOTES *SUBMITTED FOR LABORATORY ANALYSIS
DRILLED BY: UNDERGROUND POWER CORP.		
BORING DRILLED WITH GEOPROBE 2' INTERVALS		
PROBEHOLE ABANDONED WITH BENTONITE		
GROUND SURFACE AT 0.0 DURING DRILLING		
GROUNDWATER AT APPROX 9' DURING DRILLING		

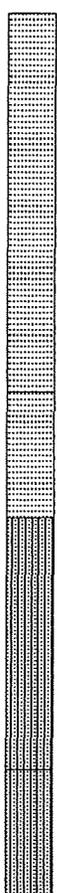


PROJECT NAME LAFARGE - HARTLAND		FIELD TEC TJO	DRAWN BY DWF	PROBE NUMBER
CLIENT LAFARGE - WISCONSIN DIVISION		PROJECT NUMBER J98109		<b>P-3</b>
LOCATION 700 W CAPITOL DR, HARTLAND, WI NW 1/4 NW 1/4 SEC 3 T7N R18E		LOCATION DESCRIPTION 70 FEET WEST OF FORMER UST		

DEPTH	SAMPLE	TYPE	N	QP	DESCRIPTION	USCS	PID	GRAPHIC
0					MEDIUM TO COARSE SAND WITH SILTY FINE SAND AND FINE TO COARSE GRAVEL, TRACE ROOTS - YELLOWISH BROWN (10YR 5/4) - MOIST TO WET (FILL)	SW	<1	
1	1	PR	--	--				
2								
3	2	PR	--	--			<1	
4								
5	3	PR	--	--			8	
6					SILTY FINE SAND WITH MEDIUM SAND, TRACE COARSE SAND AND FINE GRAVEL - GRAY BROWN (10YR 5/2) - WET, PETROLEUM ODOR (FILL)	SM	610	
7	4	PR	--	--				
8								
9	5	PR	--	--			*697	
10					FINE TO MEDIUM SAND, TRACE COARSE SAND AND FINE GRAVEL - GRAYISH BROWN (10YR 5/2) - WET, PETROLEUM ODOR (FILL)	SW	610	
11	6	PR	--	--				
12					SILTY FINE SAND, FEW MEDIUM SAND, TRACE COARSE SAND AND FINE GRAVEL, TRACE FINE SANDY SILT - YELLOWISH BROWN (10YR 5/4) - WET, PETROLEUM ODOR (FILL)	SM	346	
13	7	PR	--	--				
14					PEA GRAVEL, TRACE SILTY FINE AND MEDIUM SAND - DARK GRAY TO VERY DARK GRAY (10YR 3.5/1) - WET, PETROLEUM ODOR (FILL)	SP	1,192	
15	8	PR	--	--				
16								
17	9	PR	--	--			*433	
18					PROBEHOLE TERMINATED AT 18.0 FEET			
19								
20								
21								

NOTE: THE STRATIFICATION LINES ARE APPROXIMATE BOUNDARIES. ACTUAL TRANSITION MAY BE GRADUAL.		
DRILLING DATE: 1-25-99	DRILL RIG: Geoprobe Model 5400	NOTES *SUBMITTED FOR LABORATORY ANALYSIS
DRILLED BY: UNDERGROUND POWER CORP.		
BORING DRILLED WITH GEOPROBE 2' INTERVALS		
PROBEHOLE ABANDONED WITH BENTONITE		
GROUND SURFACE AT 0.0 DURING DRILLING		
GROUNDWATER AT APPROX 7' DURING DRILLING		

PROJECT NAME LAFARGE - HARTLAND		FIELD TEC TJO	DRAWN BY DWF	PROBE NUMBER
CLIENT LAFARGE - WISCONSIN DIVISION		PROJECT NUMBER J98109		P-4
LOCATION 700 W CAPITOL DR, HARTLAND, WI NW 1/4 NW 1/4 SEC 3 T7N R18E		LOCATION DESCRIPTION 100 FEET SW OF FORMER UST		

DEPTH	SAMPLE	TYPE	N	QP	DESCRIPTION	USCS	PID	GRAPHIC
0								
1	1	PR	--	--	MEDIUM TO COARSE SAND WITH SILTY FINE SAND AND FINE TO COARSE GRAVEL, TRACE ROOTS - YELLOWISH BROWN (10YR 5/4) - MOIST TO WET (FILL)	SW	70	
2								
3	2	PR	--	--			26	
4								
5	3	PR	--	--			62	
6								
7	4	PR	--	--	FINE SAND WITH MEDIUM TO COARSE SAND, TRACE FINE GRAVEL - GREYISH BROWN (10YR 5/2) - MOIST, PETROLEUM ODOR, WET	SW	*571	
8								
9	5	PR	--	--	SILTY FINE SAND, TRACE COARSE SAND AND FINE GRAVEL - YELLOWISH BROWN (10YR 5/4) - MOIST, PETROLEUM ODOR (FILL)	SM	465	
10								
11	6	PR	--	--			149	
12								
13	7	PR	--	--	SILTY FINE SAND TO SANDY SILT, TRACE COARSE SAND AND FINE GRAVEL - YELLOWISH BROWN (10YR 5/4) - MOIST, PETROLEUM ODOR, FILL	SM	*248	
14					PROBEHOLE TERMINATED AT 14.0 FEET			
15								
16								
17								
18								
19								
20								
21								

<b>NOTE: THE STRATIFICATION LINES ARE APPROXIMATE BOUNDARIES. ACTUAL TRANSITION MAY BE GRADUAL.</b>		
DRILLING DATE: 1-25-99	DRILL RIG: Geoprobe Model 5400	NOTES *SUBMITTED FOR LABORATORY ANALYSIS
DRILLED BY: UNDERGROUND POWER CORP.		
BORING DRILLED WITH GEOPROBE 2' INTERVALS		
PROBEHOLE ABANDONED WITH BENTONITE		
GROUND SURFACE AT 0.0 DURING DRILLING		
GROUNDWATER AT APPROX. DURING DRILLING		

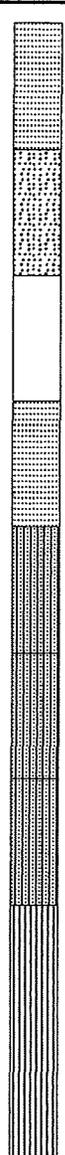


PROJECT NAME LAFARGE - HARTLAND		FIELD TEC TJO	DRAWN BY DWF	PROBE NUMBER
CLIENT LAFARGE - WISCONSIN DIVISION		PROJECT NUMBER J98109		<b>P-5</b>
LOCATION 700 W CAPITOL DR, HARTLAND, WI NW 1/4 NW 1/4 SEC 3 T7N R18E			LOCATION DESCRIPTION 110 FEET SW OF FORMER UST	

DEPTH	SAMPLE	TYPE	N	QP	DESCRIPTION	USCS	PID	GRAPHIC
0					MEDIUM TO COARSE SAND WITH SILTY FINE SAND AND FINE TO COARSE GRAVEL, TRACE ROOTS - YELLOWISH BROWN (10YR 5/4) - MOIST TO WET (FILL)	SW	26	
1	1	PR	--	--				
2								
3	2	PR	--	--				
4								
5	3	PR	--	--				
6					MEDIUM TO COARSE SAND, WITH SILTY FINE SAND AND FINE GRAVEL - GRAYISH BROWN (10YR 5/2) - MOIST TO WET, PETROLEUM ODOR (FILL)	SW	*393	
7	4	PR	--	--				
8								
9	5	PR	--	--				
10								
11	6	PR	--	--				
12					PROBEHOLE TERMINATED AT 12.0 FEET			
13								
14								
15								
16								
17								
18								
19								
20								
21								

<b>NOTE: THE STRATIFICATION LINES ARE APPROXIMATE BOUNDARIES. ACTUAL TRANSITION MAY BE GRADUAL.</b>		
DRILLING DATE: 1-25-99	DRILL RIG: Geoprobe Model 5400	<b>NOTES</b> *SUBMITTED FOR LABORATORY ANALYSIS
DRILLED BY: UNDERGROUND POWER CORP.		
BORING DRILLED WITH GEOPROBE 2' INTERVALS		
PROBEHOLE ABANDONED WITH BENTONITE		
GROUND SURFACE AT 0.0 DURING DRILLING		
GROUNDWATER AT APPROX. DURING DRILLING		

PROJECT NAME LAFARGE - HARTLAND		FIELD TEC TJO	DRAWN BY DWF	PROBE NUMBER
CLIENT LAFARGE - WISCONSIN DIVISION		PROJECT NUMBER J98109		<b>P-6</b>
LOCATION 700 W CAPITOL DR, HARTLAND, WI NW 1/4 NW 1/4 SEC 3 T7N R18E		LOCATION DESCRIPTION 80 FEET SW OF FORMER UST		

DEPTH	SAMPLE	TYPE	N	QP	DESCRIPTION	USCS	PID	GRAPHIC
0					MEDIUM TO COARSE SAND WITH SILTY FINE SAND AND FINE TO COARSE GRAVEL, TRACE ROOTS - YELLOWISH BROWN (10YR 5/4) - MOIST TO WET (FILL)	SW	53	
1	1	PR	--	--				
2					FINE GRAVEL, TRACE FINE SAND - YELLOWISH BROWN (10YR 5/4) -DAMP (FILL)	SP	17	
3	2	PR	--	--				
4					NO RECOVERY		--	
5	3	PR	--	--				
6					FINE TO COARSE SAND, TRACE FINE GRAVEL - YELLOWISH BROWN (10YR 5/4) - MOIST TO WET, PETROLEUM ODOR (FILL)	SW	347	
7	4	PR	--	--				
8					SILTY FINE SAND, TRACE MEDIUM AND COARSE SAND - YELLOWISH BROWN (10YR 5/4) - MOIST, PETROLEUM ODOR (FILL)	SM	*682	
9	5	PR	--	--				
10					SILTY FINE SAND, TRACE MEDIUM TO COARSE SAND AND FINE GRAVEL - GRAYISH BROWN (10YR 5/2) - WET, PETROLEUM ODOR (FILL)	SM	106	
11	6	PR	--	--				
12					SILTY FINE SAND, TRACE FINE SANDY SILT, TRACE MEDIUM TO COARSE SAND AND FINE GRAVEL - GRAYISH BROWN (10YR 5/2) - WET, PETROLEUM ODOR (FILL)	SM	92	
13	7	PR	--	--				
14					FINE SANDY SILT, TRACE MEDIUM TO COARSE SAND AND FINE GRAVEL - YELLOWISH BROWN (10YR 5/4) - WET	ML	26	
15	8	PR	--	--				
16								
17	9	PR	--	--			*<1	
18					PROBEHOLE TERMINATED AT 18.0 FEET			
19								
20								
21								

<b>NOTE: THE STRATIFICATION LINES ARE APPROXIMATE BOUNDARIES. ACTUAL TRANSITION MAY BE GRADUAL.</b>		
DRILLING DATE: 1-25-99	DRILL RIG: Geoprobe Model 5400	NOTES *SUBMITTED FOR LABORATORY ANALYSIS
DRILLED BY: UNDERGROUND POWER CORP.		
BORING DRILLED WITH GEOPROBE 2' INTERVALS		
PROBEHOLE ABANDONED WITH BENTONITE		
GROUND SURFACE AT 0.0 DURING DRILLING		
GROUNDWATER AT APPROX 10' DURING DRILLING		



PROJECT NAME LAFARGE - HARTLAND		FIELD TEC TJO	DRAWN BY DWF	PROBE NUMBER
CLIENT LAFARGE - WISCONSIN DIVISION		PROJECT NUMBER J98109		<b>P-7</b>
LOCATION 700 W CAPITOL DR, HARTLAND, WI NW 1/4 NW 1/4 SEC 3 T7N R18E		LOCATION DESCRIPTION 170 FEET SW OF FORMER UST		

DEPTH	SAMPLE	TYPE	N	QP	DESCRIPTION	USCS	PID	GRAPHIC
0					MEDIUM TO COARSE SAND, WITH SILTY FINE SAND AND FINE TO COARSE GRAVEL, TRACE ROOTS - YELLOWISH BROWN (10YR 5/4) - MOIST TO WET (FILL)	SW	1	
1	1	PR	--	--				
2					FINE TO MEDIUM SAND, TRACE COARSE SAND AND FINE GRAVEL - YELLOWISH BROWN (10YR 5/4) - MOIST (FILL)	SW	2	
3	2	PR	--	--				
4								
5	3	PR	--	--			5	
6								
7	4	PR	--	--			*4	
8					FINE TO MEDIUM SAND, TRACE COARSE SAND AND FINE GRAVEL, BLACK SILTY SAND LAYER - YELLOWISH BROWN (10YR 5/4) - MOIST (FILL)	SW	3	
9	5	PR	--	--				
10					FINE SILTY SAND, TRACE COARSE SAND AND FINE GRAVEL - LIGHT YELLOWISH BROWN (10YR 6/4) - MOIST (FILL)	SM	5	
11	6	PR	--	--				
12					FINE SAND, TRACE MEDIUM TO COARSE SAND AND FINE GRAVEL - YELLOWISH BROWN (10YR 5/4) - WET (FILL)	SW	2	
13	7	PR	--	--				
14					PROBEHOLE TERMINATED AT 14.0 FEET			
15								
16								
17								
18								
19								
20								
21								

<b>NOTE: THE STRATIFICATION LINES ARE APPROXIMATE BOUNDARIES. ACTUAL TRANSITION MAY BE GRADUAL.</b>		
DRILLING DATE: 1-26-99	DRILL RIG: Geoprobe Model 5400	NOTES *SUBMITTED FOR LABORATORY ANALYSIS
DRILLED BY: UNDERGROUND POWER CORP.		
BORING DRILLED WITH GEOPROBE 2' INTERVALS		
PROBEHOLE ABANDONED WITH BENTONITE		
GROUND SURFACE AT 0.0 DURING DRILLING		
GROUNDWATER AT APPROX 12' DURING DRILLING		



PROJECT NAME LAFARGE - HARTLAND		FIELD TEC TJO	DRAWN BY DWF	PROBE NUMBER
CLIENT LAFARGE - WISCONSIN DIVISION		PROJECT NUMBER J98109		<b>P-8</b>
LOCATION 700 W CAPITOL DR, HARTLAND, WI NW 1/4 NW 1/4 SEC 3 T7N R18E		LOCATION DESCRIPTION 130 FEET SW OF FORMER UST		

DEPTH	SAMPLE	TYPE	N	QP	DESCRIPTION	USCS	PID	GRAPHIC
0								
1	1	PR	--	--	FINE TO MEDIUM SAND, TRACE COARSE SAND AND FINE GRAVEL - DARK YELLOWISH BROWN (10YR 4/4) - MOIST (FILL)	SW	*55	
2								
3	2	PR	--	--	FINE SAND, TRACE MEDIUM TO COARSE SAND AND FINE GRAVEL - YELLOWISH BROWN (10YR 5/4) - MOIST (FILL)	SW	8	
4								
5	3	PR	--	--			4	
6								
7	4	PR	--	--	FINE SAND, TRACE MEDIUM TO COARSE SAND AND FINE GRAVEL - YELLOWISH BROWN (10YR 5/4) - MOIST (FILL), LITTLE RECOVERY	SW	*4	
8								
9	5	PR	--	--			3	
10								
11	6	PR	--	--	FINE SILTY SAND TO SANDY SILT, TRACE MEDIUM AND COARSE SAND, TRACE FINE GRAVEL - YELLOWISH BROWN (10YR 5/4) - MOIST TO WET (FILL)	SM	2	
12								
13	7	PR	--	--	SILTY FINE TO MEDIUM SAND, TRACE COARSE SAND, TRACE FINE GRAVEL - YELLOWISH BROWN (10YR 5/4) - WET, FILL	SM	3	
14					PROBEHOLE TERMINATED AT 14.0 FEET			
15								
16								
17								
18								
19								
20								
21								

<b>NOTE: THE STRATIFICATION LINES ARE APPROXIMATE BOUNDARIES. ACTUAL TRANSITION MAY BE GRADUAL.</b>		
DRILLING DATE: 1-26-99	DRILL RIG: Geoprobe Model 5400	<b>NOTES</b> *SUBMITTED FOR LABORATORY ANALYSIS
DRILLED BY: UNDERGROUND POWER CORP.		
BORING DRILLED WITH GEOPROBE 2' INTERVALS		
PROBEHOLE ABANDONED WITH BENTONITE		
GROUND SURFACE AT 0.0 DURING DRILLING		
GROUNDWATER AT APPROX 11' DURING DRILLING		



PROJECT NAME LAFARGE - HARTLAND		FIELD TEC TJO	DRAWN BY DWF	PROBE NUMBER
CLIENT LAFARGE - WISCONSIN DIVISION		PROJECT NUMBER J98109		<b>P-9</b>
LOCATION 700 W CAPITOL DR, HARTLAND, WI NW 1/4 NW 1/4 SEC 3 T7N R18E		LOCATION DESCRIPTION 150 FEET SW OF FORMER UST		

DEPTH	SAMPLE	TYPE	N	QP	DESCRIPTION	USCS	PID	GRAPHIC
0					FINE TO MEDIUM SAND, TRACE COARSE SAND AND FINE GRAVEL - YELLOWISH BROWN (10YR 5/4) - DAMP TO MOIST (FILL)	SW		
1	1	PR	--	--			3	
2								
3	2	PR	--	--			3	
4								
5	3	PR	--	--			2	
6								
7	4	PR	--	--	*4			
8								
9	5	PR	--	--	3			
10								
11	6	PR	--	--	2			
12								
13	7	PR	--	--	3			
14					PROBEHOLE TERMINATED AT 14.0 FEET			
15								
16								
17								
18								
19								
20								
21								

<b>NOTE: THE STRATIFICATION LINES ARE APPROXIMATE BOUNDARIES. ACTUAL TRANSITION MAY BE GRADUAL.</b>		
DRILLING DATE: 1-26-99	DRILL RIG: Geoprobe Model 5400	NOTES *SUBMITTED FOR LABORATORY ANALYSIS
DRILLED BY: UNDERGROUND POWER CORP.		
BORING DRILLED WITH GEOPROBE 2' INTERVALS		
PROBEHOLE ABANDONED WITH BENTONITE		
GROUND SURFACE AT 0.0 DURING DRILLING		
GROUNDWATER AT APPROX. DURING DRILLING		



PROJECT NAME LAFARGE - HARTLAND		FIELD TEC TJO	DRAWN BY DWF	PROBE NUMBER
CLIENT LAFARGE - WISCONSIN DIVISION		PROJECT NUMBER J98109		<b>P-10</b>
LOCATION 700 W CAPITOL DR, HARTLAND, WI NW 1/4 NW 1/4 SEC 3 T7N R18E		LOCATION DESCRIPTION 65 FEET NW OF FORMER UST		

DEPTH	SAMPLE	TYPE	N	QP	DESCRIPTION	USCS	PID	GRAPHIC
0					FINE TO MEDIUM SAND, TRACE COARSE SAND AND FINE GRAVEL - GRAY (10YR 5/1) - WET, CEMENT ODOR (FILL)	SW		
1	1	PR	--	--			351	
2					SILTY FINE SAND, TRACE MEDIUM TO COARSE SAND AND FINE GRAVEL - GRAY (10YR 6/1) - WET, CEMENT ODOR (FILL)	SM		
3	2	PR	--	--			381	
4								
5	3	PR	--	--			483	
6					SILTY FINE SAND, TRACE MEDIUM TO COARSE SAND AND FINE GRAVEL - GRAY (10YR 6/1) - WET, CEMENT AND PETROLEUM ODOR (FILL)	SM		
7	4	PR	--	--			*723	
8					FINE SILTY SAND, FEW MEDIUM TO COARSE SAND AND FINE GRAVEL - VERY DARK GRAYISH BROWN (10YR 3/2) - WET, PETROLEUM ODOR (FILL)	SM		
9	5	PR	--	--			767	
10					FINE TO MEDIUM SILTY SAND, TRACE COARSE SAND - GRAY (10YR 5/1) - WET, PETROLEUM ODOR (FILL)	SM		
11	6	PR	--	--			307	
12								
13	7	PR	--	--			398	
14								
15	8	PR	--	--			*556	
16					PROBEHOLE TERMINATED AT 16.0 FEET			
17								
18								
19								
20								
21								

<b>NOTE: THE STRATIFICATION LINES ARE APPROXIMATE BOUNDARIES. ACTUAL TRANSITION MAY BE GRADUAL.</b>		
DRILLING DATE: 1-26-99	DRILL RIG: Geoprobe Model 5400	NOTES *SUBMITTED FOR LABORATORY ANALYSIS
DRILLED BY: UNDERGROUND POWER CORP.		
BORING DRILLED WITH GEOPROBE 2' INTERVALS		
PROBEHOLE ABANDONED WITH BENTONITE		
GROUND SURFACE AT 0.0 DURING DRILLING		
GROUNDWATER AT APPROX. DURING DRILLING		



PROJECT NAME LAFARGE - HARTLAND		FIELD TEC TJO	DRAWN BY DWF	BORING NUMBER
CLIENT LAFARGE - WISCONSIN DIVISION		PROJECT NUMBER J98109		<b>B-1</b>
LOCATION 700 W CAPITOL DR, HARTLAND, WI NW 1/4 NW 1/4 SEC 3 T7N R18E		LOCATION DESCRIPTION 75'N, 4'E OF NW CORNER OF BLDG		

DEPTH	SAMPLE	TYPE	N	QP	DESCRIPTION	USCS	PID	GRAPHIC
0								
1	1	SS	22	--	FINE TO COARSE SAND, FINE TO MEDIUM GRAVEL (PEA GRAVEL) - YELLOWISH BROWN (10YR 5/4) - MOIST (FILL)	SW	<1	
2								
3								
4	2	SS	--	--	NO RECOVERY		--	
5								
6								
7	3	SS	15	--	FINE SANDY SILT TO SILTY SAND, TRACE MEDIUM SAND, FINE TO MEDIUM GRAVEL - YELLOWISH BROWN (10YR 5/4) - MOIST TO WET (FILL)	ML	*<1	
8								
9	4	SS	33	--	FINE SANDY SILT TO SILTY SAND, TRACE MEDIUM SAND, FINE TO MEDIUM GRAVEL - YELLOWISH BROWN (10YR 5/4) - MOIST (FILL)	ML	<1	
10								
11								
12	5	SS	31	--			<1	
13								
14	6	SS	25	--	FINE TO COARSE SAND, FINE TO MEDIUM GRAVEL (PEA GRAVEL) - YELLOWISH BROWN (10YR 5/4) - MOIST	SW	<1	
15					BOREHOLE TERMINATED AT 15.0 FEET			
16								
17								
18								
19								
20								
21								

NOTE: THE STRATIFICATION LINES ARE APPROXIMATE BOUNDARIES. ACTUAL TRANSITION MAY BE GRADUAL.		
DRILLING DATE: 3-8-99	DRILL RIG: FOREMOST MOBILE	NOTES *SAMPLE SUBMITTED FOR LABORATORY ANALYSIS SS = SPLIT SPOON
DRILLED BY: BRIOHN ENVIRONMENTAL CONTRACTORS		
BORING DRILLED WITH 4.25 INCH I.D. HSA		
BOREHOLE BACKFILLED WITH BENTONITE		
GROUND SURFACE AT 101.30 DURING DRILLING		



PROJECT NAME LAFARGE - HARTLAND		FIELD TEC TJO	DRAWN BY DWF	BORING NUMBER
CLIENT LAFARGE - WISCONSIN DIVISION		PROJECT NUMBER J98109		B-2
LOCATION 700 W CAPITOL DR, HARTLAND, WI NW 1/4 NW 1/4 SEC 3 T7N R18E		LOCATION DESCRIPTION 105'N, 25'E OF NW CRNR OF BLDG		

DEPTH	SAMPLE	TYPE	N	QP	DESCRIPTION	USCS	PID	GRAPHIC
0								
1	1	SS	72	--	FINE TO COARSE SAND, FINE TO MEDIUM GRAVEL (PEA GRAVEL) - YELLOWISH BROWN (10YR 5/4) - MOIST (FILL)	SW	<1	
2								
3								
4	2	SS	19	--	SILTY FINE SAND TO FINE SANDY SILT, TRACE MEDIUM TO COARSE SAND, TRACE COARSE GRAVEL - YELLOWISH BROWN (10YR 5/4) - DAMP (FILL)	SM	<1	
5								
6								
7	3	SS	20	--	SILTY FINE SAND TO FINE SANDY SILT, TRACE MEDIUM TO COARSE SAND, TRACE COARSE GRAVEL - YELLOWISH BROWN (10YR 5/4) - DAMP (FILL), SLIGHT ODOR, VERY LITTLE RECOVERY	SM	531	
8								
9	4	SS	16	--	FINE SANDY SILT, TRACE MEDIUM TO COARSE SAND - YELLOWISH BROWN (10YR 5/4) - MOIST TO WET (FILL)	ML	*22	
10								
11								
12	5	SS	18	--	FINE TO COARSE SAND, FINE TO MEDIUM GRAVEL (PEA GRAVEL) - YELLOWISH BROWN (10YR 5/4) - WET (FILL)	SW	5	
13								
14	6	SS	16	--	FINE TO COARSE SAND, FINE TO MEDIUM GRAVEL (PEA GRAVEL) - YELLOWISH BROWN (10YR 5/4) - WET (FILL), SLIGHT ODOR	SW	*40	
15					BOREHOLE TERMINATED AT 15.0 FEET			
16								
17								
18								
19								
20								
21								

NOTE: THE STRATIFICATION LINES ARE APPROXIMATE BOUNDARIES. ACTUAL TRANSITION MAY BE GRADUAL.		
DRILLING DATE: 3-8-99	DRILL RIG: FOREMOST MOBILE	NOTES *SAMPLE SUBMITTED FOR LABORATORY ANALYSIS SS = SPLIT SPOON WELL SET AT 15' WITH 10' SCREEN DNR UID #JN379
DRILLED BY: BRIOHN ENVIRONMENTAL CONTRACTORS		
BORING DRILLED WITH 4.25 INCH I.D. HSA		
BOREHOLE BACKFILLED WITH BENTONITE		
GROUND SURFACE AT 101.13 DURING DRILLING		



PROJECT NAME LAFARGE - HARTLAND		FIELD TEC TJO	DRAWN BY DWF	BORING NUMBER
CLIENT LAFARGE - WISCONSIN DIVISION		PROJECT NUMBER J98109		<b>B-3</b>
LOCATION 700 W CAPITOL DR, HARTLAND, WI NW 1/4 NW 1/4 SEC 3 T7N R18E		LOCATION DESCRIPTION 48'N, 38'E OF NW CORNR OF BLDG		

DEPTH	SAMPLE	TYPE	N	QP	DESCRIPTION	USCS	PID	GRAPHIC
0								
1	1	SS	5	--	FINE TO COARSE SAND, FINE TO MEDIUM GRAVEL (PEA GRAVEL) - YELLOWISH BROWN (10YR 5/4) - WET (FILL)	SW	*108	
2								
3								
4	2	SS	1	--	MEDIUM GRAVEL, WET (FILL)	SP	11	
5								
6								
7	3	SS	1	--			<1	
8								
9	4	SS	21	--	FINE SANDY SILT TO SILTY FINE SAND, TRACE MEDIUM TO COARSE SAND, TRACE FINE GRAVEL - YELLOWISH BROWN (10YR 5/4) - DAMP (FILL)	ML	<1	
10								
11	5	SS	41	--	FINE SANDY SILT TO SILTY FINE SAND, TRACE MEDIUM TO COARSE SAND, TRACE FINE TO COARSE GRAVEL - YELLOWISH BROWN (10YR 5/4) - WET (FILL)	ML	<1	
12								
13								
14	6	SS	41	--	FINE SAND, TRACE MEDIUM TO COARSE GRAVEL, DAMP (FILL)	SW	<1	
15					BOREHOLE TERMINATED AT 15.0 FEET			
16								
17								
18								
19								
20								
21								

<b>NOTE: THE STRATIFICATION LINES ARE APPROXIMATE BOUNDARIES. ACTUAL TRANSITION MAY BE GRADUAL.</b>		
DRILLING DATE: 3-8-99	DRILL RIG: FOREMOST MOBILE	<b>NOTES</b> *SAMPLE SUBMITTED FOR LABORATORY ANALYSIS SS = SPLIT SPOON WELL SET AT 15' WITH 10' SCREEN DNR UID #JN378
DRILLED BY: BRIOHN ENVIRONMENTAL CONTRACTORS		
BORING DRILLED WITH 4.25 INCH I.D. HSA		
GROUND SURFACE AT 101.06 DURING DRILLING		



PROJECT NAME LAFARGE - HARTLAND		FIELD TEC TJO	DRAWN BY DWF	BORING NUMBER
CLIENT LAFARGE - WISCONSIN DIVISION		PROJECT NUMBER J98109		<b>B-4</b>
LOCATION 700 W CAPITOL DR, HARTLAND, WI NW 1/4 NW 1/4 SEC 3 T7N R18E		LOCATION DESCRIPTION 15' N OF NE CORNER OF SILO BLDG		

DEPTH	SAMPLE	TYPE	N	QP	DESCRIPTION	USCS	PID	GRAPHIC
0								
1								
2	1	SS	47	--	FINE TO COARSE SAND, FINE TO MEDIUM GRAVEL (PEA GRAVEL), COARSE GRAVEL - YELLOWISH BROWN (10YR 5/4) - MOIST (FILL), CEMENT ODOR	SW	86	
3								
4	2	SS	27	--			*129	
5								
6								
7	3	SS	34	--	FINE SANDY SILT, TRACE SILTY CLAY, TRACE MEDIUM TO COARSE SAND, TRACE FINE TO MEDIUM GRAVEL - BROWN (10YR 5/3) - DAMP (FILL)	ML	<1	
8								
9	4	SS	9	--	FINE SANDY SILT, TRACE SANDY CLAY, TRACE MEDIUM SAND AND FINE GRAVEL - BROWN (10YR 5/3) - WET	ML	<1	
10								
11								
12	5	SS	14	--	FINE SANDY SILT TO SILTY CLAY, TRACE MEDIUM TO COARSE SAND AND FINE GRAVEL - BROWN (10YR 5/3) - WET	ML	<1	
13								
14	6	SS	21	--			<1	
15					BOREHOLE TERMINATED AT 15.0 FEET			
16								
17								
18								
19								
20								
21								

<b>NOTE: THE STRATIFICATION LINES ARE APPROXIMATE BOUNDARIES. ACTUAL TRANSITION MAY BE GRADUAL.</b>		
DRILLING DATE: 3-8-99	DRILL RIG: FOREMOST MOBILE	<b>NOTES</b> *SAMPLE SUBMITTED FOR LABORATORY ANALYSIS SS = SPLIT SPOON WELL SET AT 15' WITH 10' SCREEN DNR UID #JN377
DRILLED BY: BRIOHN ENVIRONMENTAL CONTRACTORS		
BORING DRILLED WITH 4.25 INCH I.D. HSA		
GROUND SURFACE AT 103.36 DURING DRILLING		



PROJECT NAME LAFARGE - HARTLAND		FIELD TEC TJO	DRAWN BY DWF	BORING NUMBER
CLIENT LAFARGE - WISCONSIN DIVISION		PROJECT NUMBER J98109		<b>B-5</b>
LOCATION 700 W CAPITOL DR, HARTLAND, WI NW 1/4 NW 1/4 SEC 3 T7N R18E		LOCATION DESCRIPTION 75'N, 45'W OF NW CORNR OF BLDG		

DEPTH	SAMPLE	TYPE	N	QP	DESCRIPTION	USCS	PID	GRAPHIC
0								
1	1	SS	38	--	FINE TO COARSE SAND, FINE TO MEDIUM GRAVEL (PEA GRAVEL) - YELLOWISH BROWN (10YR 5/4) - DAMP	SW	<1	
2								
3								
4	2	SS	38	--	FINE TO COARSE SAND, FINE TO MEDIUM GRAVEL (PEA GRAVEL) - YELLOWISH BROWN (10YR 5/4) - MOIST	SW	198	
5								
6								
7	3	SS	9	--	FINE TO COARSE SAND, FINE TO MEDIUM GRAVEL (PEA GRAVEL) - YELLOWISH BROWN (10YR 5/4) - MOIST, ODOR	SW	*288	
8								
9	4	SS	3	--	FINE SILTY SAND, TRACE MEDIUM TO COARSE SAND, TRACE FINE GRAVEL - BROWN (10YR 5/3) - WET (FILL), ODOR	SM	288	
10								
11								
12	5	SS	28	--			*94	
13								
14	6	SS	22	--	NO RECOVERY		--	
15					BOREHOLE TERMINATED AT 15.0 FEET			
16								
17								
18								
19								
20								
21								

NOTE: THE STRATIFICATION LINES ARE APPROXIMATE BOUNDARIES. ACTUAL TRANSITION MAY BE GRADUAL.

DRILLING DATE: 3-8-99	DRILL RIG: FOREMOST MOBILE	NOTES *SAMPLE SUBMITTED FOR LABORATORY ANALYSIS SS = SPLIT SPOON WELL SET AT 15' WITH 10' SCREEN DNR UID #JK522
DRILLED BY: BRIOHN ENVIRONMENTAL CONTRACTORS		
BORING DRILLED WITH 4.25 INCH I.D. HSA		
GROUND SURFACE AT 101.37 DURING DRILLING		



PROJECT NAME LAFARGE - HARTLAND		FIELD TEC TJO	DRAWN BY DWF	BORING NUMBER
CLIENT LAFARGE - WISCONSIN DIVISION		PROJECT NUMBER J98109		<b>B-6</b>
LOCATION 700 W CAPITOL DR, HARTLAND, WI NW 1/4 NW 1/4 SEC 3 T7N R18E		LOCATION DESCRIPTION 15'S, 55'W OF NW CORNR OF BLDG		

DEPTH	SAMPLE	TYPE	N	QP	DESCRIPTION	USCS	PID	GRAPHIC
0								
1	1	SS	30	--	FINE TO MEDIUM SAND, TRACE COARSE SAND, TRACE FINE GRAVEL - DARK BROWN (10YR 4/3) - DAMP (FILL)	SW	48	
2								
3								
4	2	SS	30	--	FINE TO MEDIUM SAND, TRACE COARSE SAND, TRACE FINE GRAVEL - YELLOWISH BROWN (10YR 5/4) - DAMP (FILL)	SW	41	
5								
6								
7	3	SS	51	--			11	
8								
9	4	SS	16	--	FINE SANDY SILT, TRACE COARSE SAND TO FINE GRAVEL - BROWN (10YR 5/3) - MOIST TO WET	ML	*3	
10								
11	5	SS	18	--	FINE SANDY SILT TO SILTY FINE SAND, TRACE COARSE SAND AND FINE GRAVEL - BROWN (10YR 5/3) - 3 INCH SEAM, SILT, TRACE SILTY CLAY - DARK GRAY (10YR 4/1) - MOIST	ML	3	
12								
13								
14	6	SS	28	--	FINE SAND, MEDIUM TO COARSE SAND, TRACE FINE GRAVEL - BROWN (10YR 5/3) - MOIST	SW	25	
15								
16								
17	7	SS	30	--			*167	
18								
19					BOREHOLE TERMINATED AT 19.0 FEET			
20								
21								

NOTE: THE STRATIFICATION LINES ARE APPROXIMATE BOUNDARIES. ACTUAL TRANSITION MAY BE GRADUAL.

DRILLING DATE: 3-26-99	DRILL RIG: FOREMOST MOBILE	NOTES *SAMPLE SUBMITTED FOR LABORATORY ANALYSIS SS = SPLIT SPOON WELL SET AT 19' WITH 10' SCREEN DNR UID #JK523
DRILLED BY: BRIOHN ENVIRONMENTAL CONTRACTORS		
BORING DRILLED WITH 4.25 INCH I.D. HSA		
GROUND SURFACE AT 100.02 DURING DRILLING		



PROJECT NAME LAFARGE - HARTLAND		FIELD TEC TJO	DRAWN BY DWF	BORING NUMBER
CLIENT LAFARGE - WISCONSIN DIVISION		PROJECT NUMBER J98109		<b>B-7</b>
LOCATION 700 W CAPITOL DR, HARTLAND, WI NW 1/4 NW 1/4 SEC 3 T7N R18E		LOCATION DESCRIPTION 145'N, 46'W OF NW CRNR OF BLDG		

DEPTH	SAMPLE	TYPE	N	QP	DESCRIPTION	USCS	PID	GRAPHIC
0					BLIND DRILLED TO 11.0 FEET			
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12	1	SS	9	--	FINE SAND TO SILTY FINE SAND WITH MEDIUM TO COARSE SAND AND FINE GRAVEL - YELLOWISH BROWN (10YR 5/4) - MOIST	SW	4	
13								
14	2	SS	10	--			6	
15								
16	3	SS	26	--			4	
17								
18	4	SS	43	--	SILTY FINE SAND, TRACE MEDIUM TO COARSE SAND, TRACE FINE GRAVEL - YELLOWISH BROWN (10YR 5/4) - MOIST	SM	3	
19								
20	5	SS	26	--	SILTY FINE SAND, TRACE MEDIUM TO COARSE SAND - PALE BROWN (10YR 6/3) - MOIST	SM	5	
21								

NOTE: THE STRATIFICATION LINES ARE APPROXIMATE BOUNDARIES. ACTUAL TRANSITION MAY BE GRADUAL.		
DRILLING DATE: 3-26-99	DRILL RIG: TRACKED ATV	NOTES *SAMPLE SUBMITTED FOR LABORATORY ANALYSIS SS = SPLIT SPOON WELL SET AT 33' WITH 15' SCREEN DNR UID #JK524
DRILLED BY: BRIOHN ENVIRONMENTAL CONTRACTORS		
BORING DRILLED WITH 4.25 INCH I.D. HSA		
GROUND SURFACE AT 108.71 DURING DRILLING		



PROJECT NAME LAFARGE - HARTLAND		FIELD TEC TJO	DRAWN BY DWF	BORING NUMBER
CLIENT LAFARGE - WISCONSIN DIVISION		PROJECT NUMBER J98109		<b>B-7</b>
LOCATION 700 W CAPITOL DR, HARTLAND, WI NW 1/4 NW 1/4 SEC 3 T7N R18E		LOCATION DESCRIPTION 145'N, 46'W OF NW CRNR OF BLDG		

DEPTH	SAMPLE	TYPE	N	QP	DESCRIPTION	USCS	PID	GRAPHIC
21					NO RECOVERY		--	
22	6	SS	35	--			--	
23								
24	7	SS	18	--	FINE SAND TO SILTY FINE SAND WITH MEDIUM TO COARSE SAND AND FINE GRAVEL - YELLOWISH BROWN (10YR 5/4) - MOIST	SW	*8	
25								
26	8	SS	32	--	FINE SAND, TRACE MEDIUM TO COARSE SAND, WET	SW	7	
27								
28	9	SS	14	--			4	
29								
30	10	SS	12	--			*3	
31								
32	11	SS	--	--			--	
33					BOREHOLE TERMINATED AT 33.0 FEET			
34								
35								
36								
37								
38								
39								
40								
41								
42								
43								
44								
45								

NOTE: THE STRATIFICATION LINES ARE APPROXIMATE BOUNDARIES. ACTUAL TRANSITION MAY BE GRADUAL.



PROJECT NAME LAFARGE - HARTLAND		FIELD TEC TJO	DRAWN BY DWF	BORING NUMBER
CLIENT LAFARGE - WISCONSIN DIVISION		PROJECT NUMBER J98109		<b>B-8</b>
LOCATION 700 W CAPITOL DR, HARTLAND, WI NW 1/4 NW 1/4 SEC 3 T7N R18E		LOCATION DESCRIPTION 105'N, 98'W OF NW CRNR OF BLDG		

DEPTH	SAMPLE	TYPE	N	QP	DESCRIPTION	USCS	PID	GRAPHIC
0					BLIND DRILLED TO 11.0 FEET			
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12	1	SS	57	--	FINE SAND WITH MEDIUM TO COARSE SAND, TRACE FINE GRAVEL - LIGHT GRAY (10YR 7/2) - DAMP	SW	1	
13								
14	2	SS	68	--	FINE SAND TO FINE SILTY SAND, TRACE MEDIUM TO COARSE SAND, TRACE FINE GRAVEL - BROWN (10YR 5/3) - DAMP	SW	<1	
15								
16	3	SS	53	--			1	
17								
18	4	SS	51	--			4	
19								
20	5	SS	49	--			*6	
21								

NOTE: THE STRATIFICATION LINES ARE APPROXIMATE BOUNDARIES. ACTUAL TRANSITION MAY BE GRADUAL.

DRILLING DATE: 3-26-99	DRILL RIG: TRACKED ATV	NOTES *SAMPLE SUBMITTED FOR LABORATORY ANALYSIS SS = SPLIT SPOON WELL SET AT 33' WITH 15' SCREEN DNR UID #JK525
DRILLED BY: BRIOHN ENVIRONMENTAL CONTRACTORS		
BORING DRILLED WITH 4.25 INCH I.D. HSA		
GROUND SURFACE AT 112.42 DURING DRILLING		



PROJECT NAME LAFARGE - HARTLAND		FIELD TEC TJO	DRAWN BY DWF	BORING NUMBER
CLIENT LAFARGE - WISCONSIN DIVISION		PROJECT NUMBER J98109		<b>B-8</b>
LOCATION 700 W CAPITOL DR, HARTLAND, WI NW 1/4 NW 1/4 SEC 3 T7N R18E		LOCATION DESCRIPTION 105'N, 98'W OF NW CRNR OF BLDG		

DEPTH	SAMPLE	TYPE	N	QP	DESCRIPTION	USCS	PID	GRAPHIC
21	6	SS	50	--	FINE SAND, TRACE MEDIUM TO COARSE SAND, TRACE FINE GRAVEL - BROWN (10YR 5/3) - MOIST, LITTLE RECOVERY	SW	5	
22								
23	7	SS	52	--	FINE TO MEDIUM SAND WITH COARSE SAND, TRACE FINE GRAVEL - BROWN (10YR 5/3) - MOIST	SW	2	
24								
25								
26	8	SS	58	--			3	
27	9	SS	54	--	FINE SAND, TRACE MEDIUM AND COARSE SAND - BROWN (10YR 5/3) - WET	SW	3	
28								
29								
30	10	SS	--	--			*4	
31	11	SS	--	--			--	
32								
33								
34	BOREHOLE TERMINATED AT 33.0 FEET							
35								
36								
37								
38								
39								
40								
41								
42								
43								
44								
45								

NOTE: THE STRATIFICATION LINES ARE APPROXIMATE BOUNDARIES. ACTUAL TRANSITION MAY BE GRADUAL.



Report On: Proctor

Lab No: 20-06843

Report No: 20-06843

Project No: 20072-40

Cust No: 0111

Page 1 of 1

Client: Musson Brothers, Inc.  
Bob Draths  
1522 Pearl St.  
Waukesha, WI 53186

Project: Sunnyslope Dr. Storm Sewer, Sanitary  
Sewer and Water Main.

Engineer: Ruckert Mielke

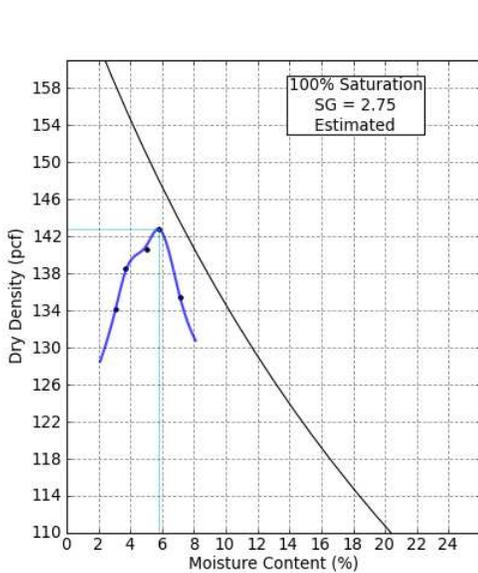
Report Date: 08/11/2020

Location: Fill Site

Sample Date: 08/11/2020

Material: Trench Spoils

Sampled By: Max Piehl



% Moisture	Dry Density Lbs./Cu.Ft.
3.1	134.1
3.7	138.6
5.0	140.6
5.8	142.8
7.1	135.5
5.8	142.8
Optimum	Maximum

Color: Brown  
Description: sandy gravel

Desc of Rammer: Mechanical

Preparation Method: Dry

Oversized Material:

Test Method (As Applicable): AASHTO T-180, AASHTO T-99, ASTM D-1557, ASTM D-1559, ASTM D-2041, ASTM D-558, ASTM D-698 Method-C

Orig: Musson Brothers, Inc. Attn: Bob Draths  
(1-ec copy)  
1-ec Ruckert Mielke Attn: Peter Gesch  
1-cc Laboratory

Respectfully Submitted,

Andrew Davis, Project Manager









## Appendix C

### Laboratory Reports

- Modified Proctor (D1557) & Grain Size Analysis (D6913)
  - TP-1/TP-2 - composite
  - TP-3
  - TP-5
  - B6/B7 - composite (Grain Size Analysis below)
  
- Grain Size Analysis (D6913)
  - TP-6
  - TP-9
  - B1
  - B2 (including Atterberg Limits (D4318))
  - B3
  - B4
  - B5
  - B6
  - B7
  - B8
  - B9
  - B10
  - B11
  - B12
  - B13
  - B14
  - B15
  - B16
  - B17
  - B18
  - B19
  
- General Notes
  
- USCS Description





**West Allis**  
2135 S. 116th Street  
West Allis, WI 53227  
Phone: 888-436-8378  
Fax: 414-321-8359

**Client:**  
Three Leaf Partners  
504 W Juneau Avenue  
Milwaukee, WI 53203

**Project:**  
7708  
Hartland Quarry Apartments  
700/701 Capitol Drive  
Hartland, WI

## Sample Information

**Sample Date:** 04/17/2023  
**Sample No:** 7157  
**Source:** Jobsite  
**Supplier:** Client  
**Sampled By:** Michael Frede  
**Sample From:** Test Pit  
**Sampling Method:** Not Provided  
**Field ID:** TP-1 + TP-2 Combined  
**Application:** Test Pit  
**Visual Description:** Light Brown Silty Sand with few Gravel  
**Specification:**

## Sieve Analysis Data

ASTM C136/C117

Sieve Size	% Passing	Upper/Lower Limits
2 in (50 mm)	100.0	
1-1/2 in (37.5 mm)	100.0	
1-1/4 in (31.75 mm)	93.7	
1 in (25 mm)	91.7	
3/4 in (19 mm)	86.4	
1/2 in (12.5 mm)	79.5	
3/8 in (9.5 mm)	75.3	
No 4 (4.75 mm)	67.2	
No 10 (2 mm)	60.9	
No 20 (850 µm)	55.5	
No 40 (425 µm)	47.5	
No 60 (250 µm)	38.1	
No 100 (150 µm)	30.1	
No 140 (106 µm)	26.3	
No 200 (75 µm)	23.6	

**Test Completed Date:** 04/21/2023

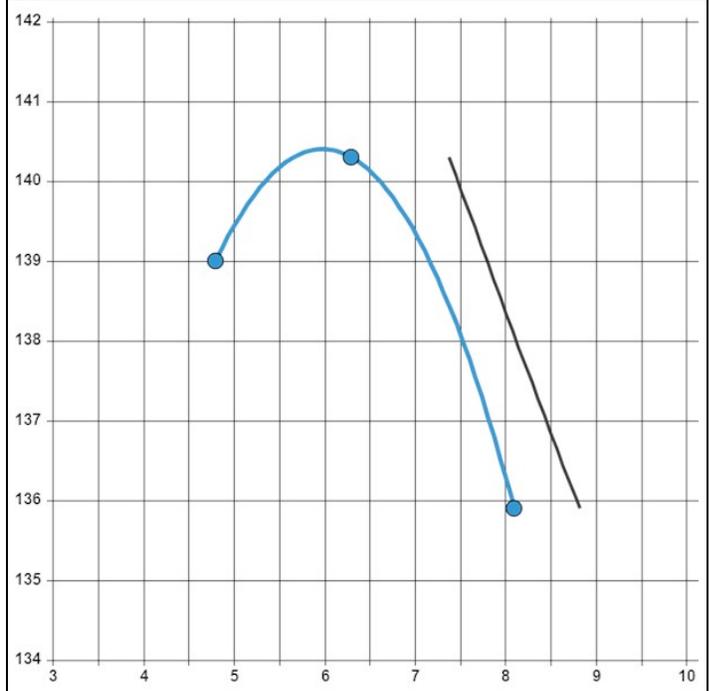
**Test Completed By:** Abdel Deif

## Laboratory Compaction Data (Proctor)

ASTM D1557

**Maximum Dry Density (lb/ft³):** 140.4

**Optimum Moisture (%):** 6.0



**Compaction Method:** B (ASTM D1557)

**Type of Rammer:** Manual

**Est. Specific Gravity:** 2.70

**Oversize Correction Needed:** Yes

## Plasticity Details

ASTM D4318

**Liquid Limit (LL):**                      **Plastic Limit (PL):**

**Plasticity Index (PI):**

Intiaz Ahmed, Laboratory Manager

Apr 27, 2023



# Material Test Report

Report #: CSPL-000002-00

**West Allis**  
2135 S. 116th Street  
West Allis, WI 53227  
Phone: 888-436-8378  
Fax: 414-321-8359

**Client:**  
Three Leaf Partners  
504 W Juneau Avenue  
Milwaukee, WI 53203

**Project:**  
7708  
Hartland Quarry Apartments  
700/701 Capitol Drive  
Hartland, WI

## Sample Information

**Sample Date:** 04/17/2023  
**Sample No:** 7158  
**Source:** Jobsite  
**Supplier:** Client  
**Sampled By:** Michael Frede  
**Sample From:** Test Pit  
**Sampling Method:** Not Provided  
**Field ID:** TP-3  
**Application:** Test Pit  
**Visual Description:** Brown Sand and Gravel, trace Silt  
**Specification:**

## Sieve Analysis Data

ASTM C136/C117

Sieve Size	% Passing	Upper/Lower Limits
2 in (50 mm)	100.0	
1-1/2 in (37.5 mm)	100.0	
1-1/4 in (31.75 mm)	93.4	
1 in (25 mm)	90.7	
3/4 in (19 mm)	84.0	
1/2 in (12.5 mm)	75.2	
3/8 in (9.5 mm)	69.6	
No 4 (4.75 mm)	57.0	
No 10 (2 mm)	47.6	
No 20 (850 µm)	40.3	
No 40 (425 µm)	32.0	
No 60 (250 µm)	23.0	
No 100 (150 µm)	17.3	
No 140 (106 µm)	14.9	
No 200 (75 µm)	12.6	

**Test Completed Date:** 04/25/2023

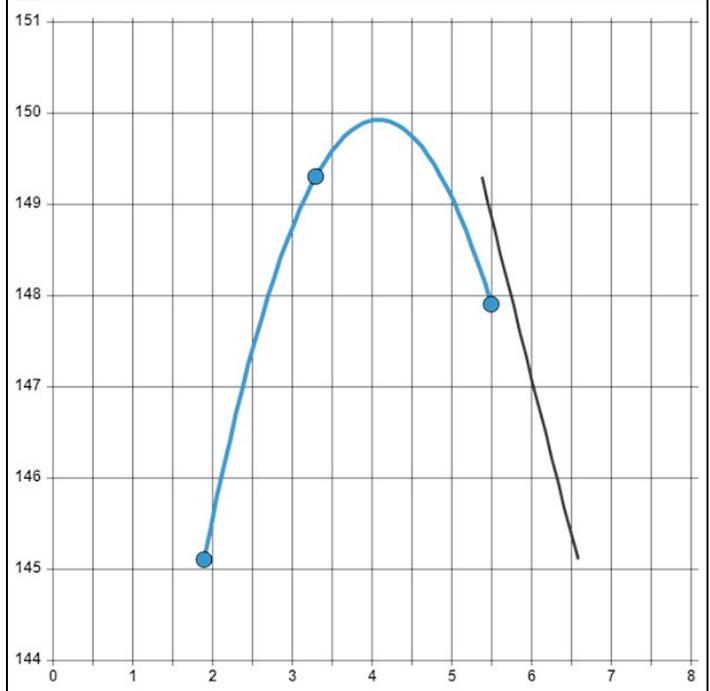
**Test Completed By:** Abdel Deif

## Laboratory Compaction Data (Proctor)

ASTM D1557

**Maximum Dry Density (lb/ft³):** 150.0

**Optimum Moisture (%):** 4.1



**Compaction Method:** C (ASTM D1557)  
**Type of Rammer:** Manual  
**Est. Specific Gravity:** 2.75  
**Oversize Correction Needed:** Yes

## Plasticity Details

ASTM D4318

**Liquid Limit (LL):**                      **Plastic Limit (PL):**  
**Plasticity Index (PI):**

Intiaz Ahmed, Laboratory Manager  
Apr 27, 2023



# Material Test Report

Report #: CSPL-000003-00

**West Allis**  
2135 S. 116th Street  
West Allis, WI 53227  
Phone: 888-436-8378  
Fax: 414-321-8359

**Client:**  
Three Leaf Partners  
504 W Juneau Avenue  
Milwaukee, WI 53203

**Project:**  
7708  
Hartland Quarry Apartments  
700/701 Capitol Drive  
Hartland, WI

## Sample Information

**Sample Date:** 04/17/2023  
**Sample No:** 7159  
**Source:** Jobsite  
**Supplier:** Client  
**Sampled By:** Michael Frede  
**Sample From:** Test Pit  
**Sampling Method:** Not Provided  
**Field ID:** TP-5  
**Application:** Test Pit  
**Visual Description:** Brown Silty Sand with few Gravel  
**Specification:**

## Sieve Analysis Data

ASTM C136/C117

Sieve Size	% Passing	Upper/Lower Limits
2 in (50 mm)	100.0	
1-1/2 in (37.5 mm)	100.0	
1-1/4 in (31.75 mm)	97.6	
1 in (25 mm)	95.1	
3/4 in (19 mm)	92.8	
1/2 in (12.5 mm)	88.6	
3/8 in (9.5 mm)	85.6	
No 4 (4.75 mm)	79.3	
No 10 (2 mm)	73.6	
No 20 (850 µm)	68.2	
No 40 (425 µm)	60.0	
No 60 (250 µm)	43.6	
No 100 (150 µm)	24.4	
No 140 (106 µm)	17.0	
No 200 (75 µm)	12.4	

**Test Completed Date:** 04/24/2023

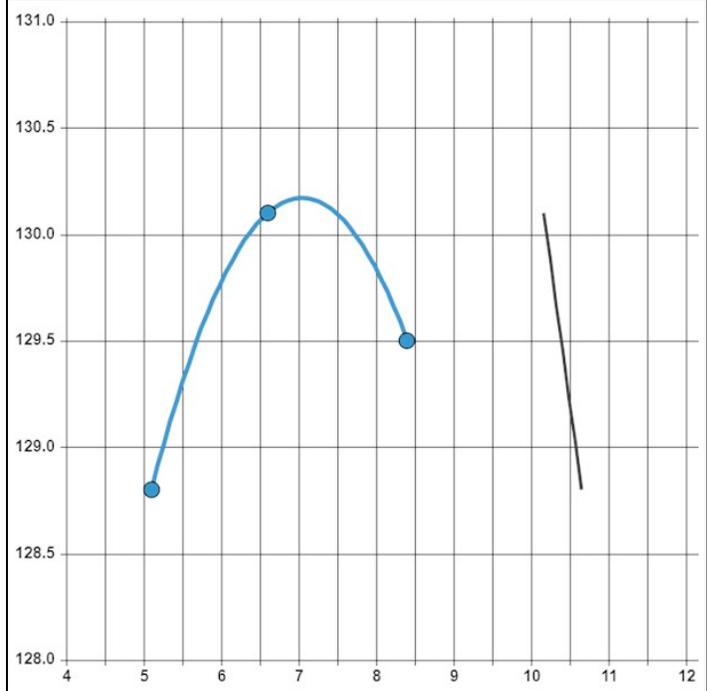
**Test Completed By:** Abdel Deif

## Laboratory Compaction Data (Proctor)

ASTM D1557

**Maximum Dry Density (lb/ft³):** 130.2

**Optimum Moisture (%):** 7.1



**Compaction Method:** A (ASTM D1557)  
**Type of Rammer:** Manual  
**Est. Specific Gravity:** 2.65  
**Oversize Correction Needed:** Yes

## Plasticity Details

ASTM D4318

**Liquid Limit (LL):**                      **Plastic Limit (PL):**  
**Plasticity Index (PI):**

Intiaz Ahmed, Laboratory Manager  
Apr 27, 2023

**West Allis**  
 2135 S. 116th Street  
 West Allis, WI 53227  
 Phone: 888-436-8378  
 Fax: 414-321-8359

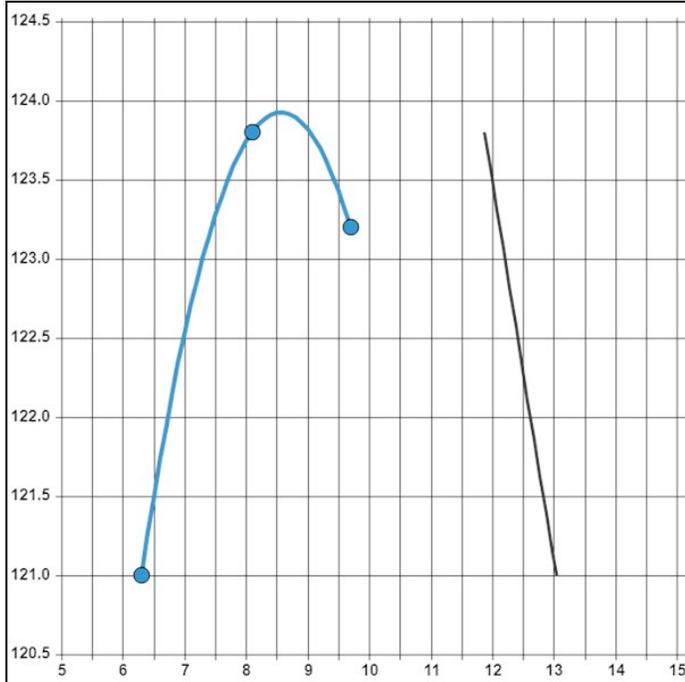
**Client:**  
 Three Leaf Partners  
 504 W Juneau Avenue  
 Milwaukee, WI 53203

**Project:**  
 7708  
 Hartland Quarry Apartments  
 700/701 Capitol Drive  
 Hartland, WI

## Sample Information

<b>Sample Date:</b>	04/18/2023	<b>Sample Number:</b>	7190
<b>Sample From:</b>	Test Pit	<b>Field ID:</b>	Bluff 6 + 7 Combined
<b>Sample Location :</b>	Onsite	<b>Sampled By:</b>	Michael Frede

## Test Results



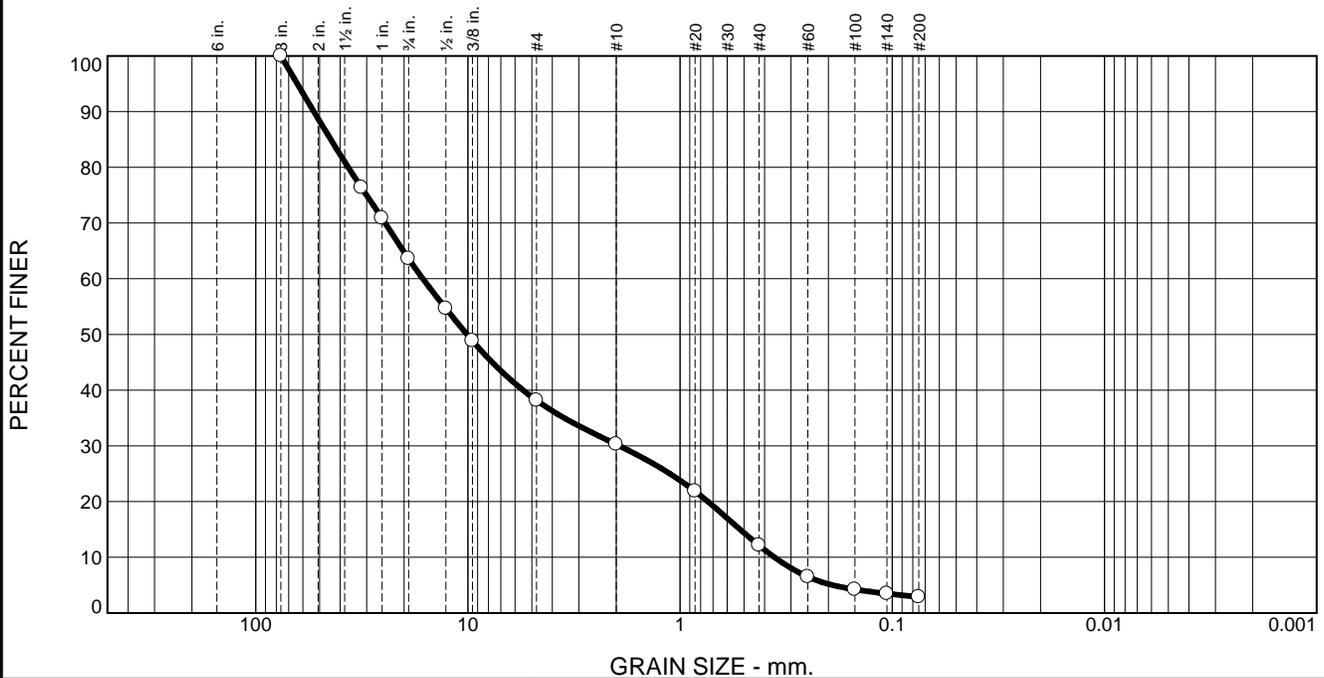
### Sample Photo



<b>Oversize Correction Needed:</b>	Yes	<b>Visual Description:</b>	Dark Brown Silty Clay with Organic
<b>Maximum Dry Density (lb/ft³):</b>	<b>123.9</b>	<b>Compaction Method Used:</b>	A (ASTM D1557)
<b>Optimum Moisture (%):</b>	<b>8.5</b>	<b>Type of Rammer Used:</b>	Manual
<b>Test Date:</b>	04/25/2023	<b>Sp. Gravity (Est):</b>	2.60
<b>Lab Technician:</b>	Abdel Deif		

Intiaz Ahmed, Laboratory Manager  
 Apr 27, 2023

# Sieve Analysis Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	36.4	25.4	7.9	18.2	9.2	2.9	

Test Results (ASTM C136 & ASTM C117)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0		
1 1/4"	76.4		
1"	70.9		
3/4"	63.6		
1/2"	54.7		
3/8"	48.9		
#4	38.2		
#10	30.3		
#20	21.9		
#40	12.1		
#60	6.5		
#100	4.2		
#140	3.5		
#200	2.9		

\* (no specification provided)

**Material Description**

Brown sand and gravel

**Atterberg Limits (ASTM D 4318)**

PL= \_\_\_\_\_ LL= \_\_\_\_\_ PI= \_\_\_\_\_

**Classification**

USCS (D 2487)= \_\_\_\_\_ AASHTO (M 145)= \_\_\_\_\_

**Coefficients**

D<sub>90</sub>= 53.2485      D<sub>85</sub>= 44.3097      D<sub>60</sub>= 16.3112  
D<sub>50</sub>= 10.1019      D<sub>30</sub>= 1.9347      D<sub>15</sub>= 0.5218  
D<sub>10</sub>= 0.3589      C<sub>u</sub>= 45.45      C<sub>c</sub>= 0.64

**Remarks**

F.M.=5.82

Date Received: 4/17/23      Date Tested: 4/27/23

Tested By: Luke Emery

Checked By: Imtiaz Ahmed

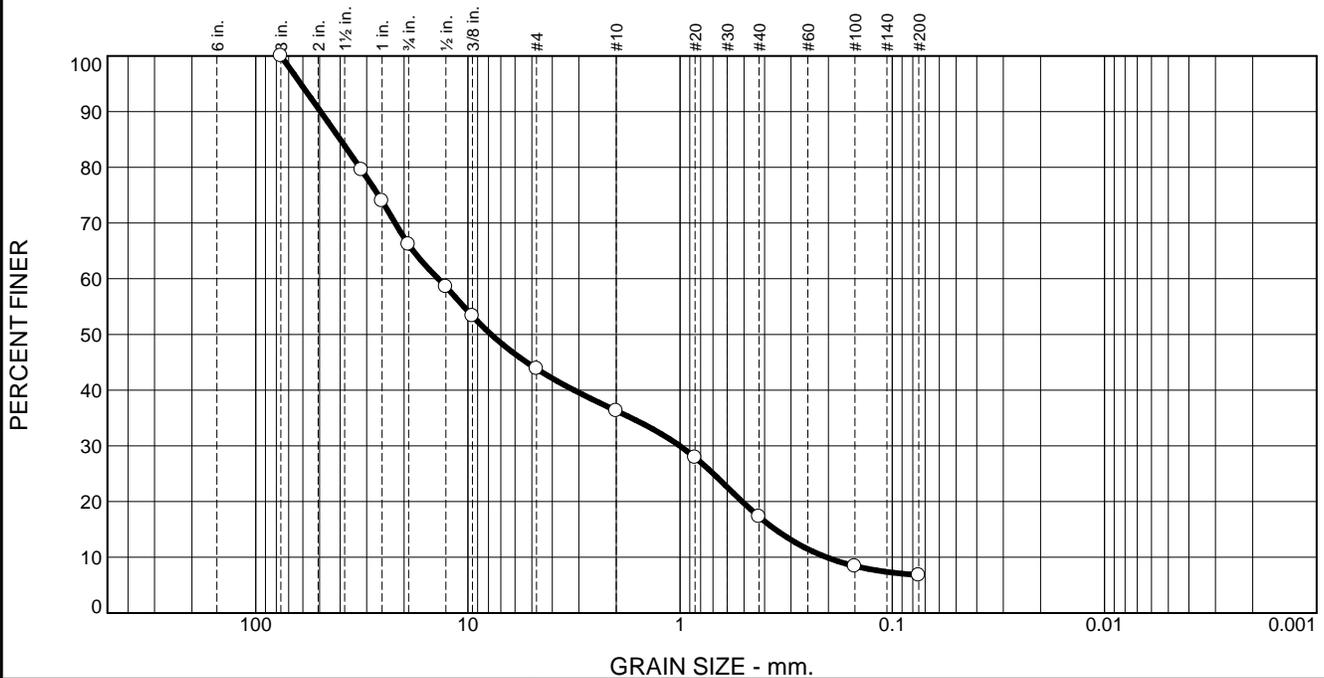
Title: Lab Manager

Source of Sample: TP      Depth: Onsite  
Sample Number: 6

Date Sampled: 4/17/23

<p><b>GeoTest, Inc.</b></p> <p><b>West Allis, WI</b></p>	<p>Client: Three Leaf Partners</p> <p>Project: Hatland Quarry Apartments</p> <p>Project No: 7708</p>	<p>Test No 7160-6836</p>
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# Sieve Analysis Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	33.8	22.4	7.5	19.0	10.5	6.8	

Test Results (ASTM C136 & ASTM C117)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0		
1 1/4"	79.5		
1"	74.0		
3/4"	66.2		
1/2"	58.6		
3/8"	53.3		
#4	43.8		
#10	36.3		
#20	27.9		
#40	17.3		
#100	8.4		
#200	6.8		

\* (no specification provided)

**Material Description**

Brown sand and gravel

**Atterberg Limits (ASTM D 4318)**

PL= \_\_\_\_\_ LL= \_\_\_\_\_ PI= \_\_\_\_\_

**Classification**

USCS (D 2487)= \_\_\_\_\_ AASHTO (M 145)= \_\_\_\_\_

**Coefficients**

D<sub>90</sub>= 49.4912      D<sub>85</sub>= 39.9751      D<sub>60</sub>= 13.8034  
D<sub>50</sub>= 7.7767      D<sub>30</sub>= 1.0033      D<sub>15</sub>= 0.3560  
D<sub>10</sub>= 0.2043      C<sub>u</sub>= 67.57      C<sub>c</sub>= 0.36

**Remarks**

F.M.=5.39

Date Received: 4/17/23      Date Tested: 4/27/23

Tested By: Luke Emery

Checked By: Imtiaz Ahmed

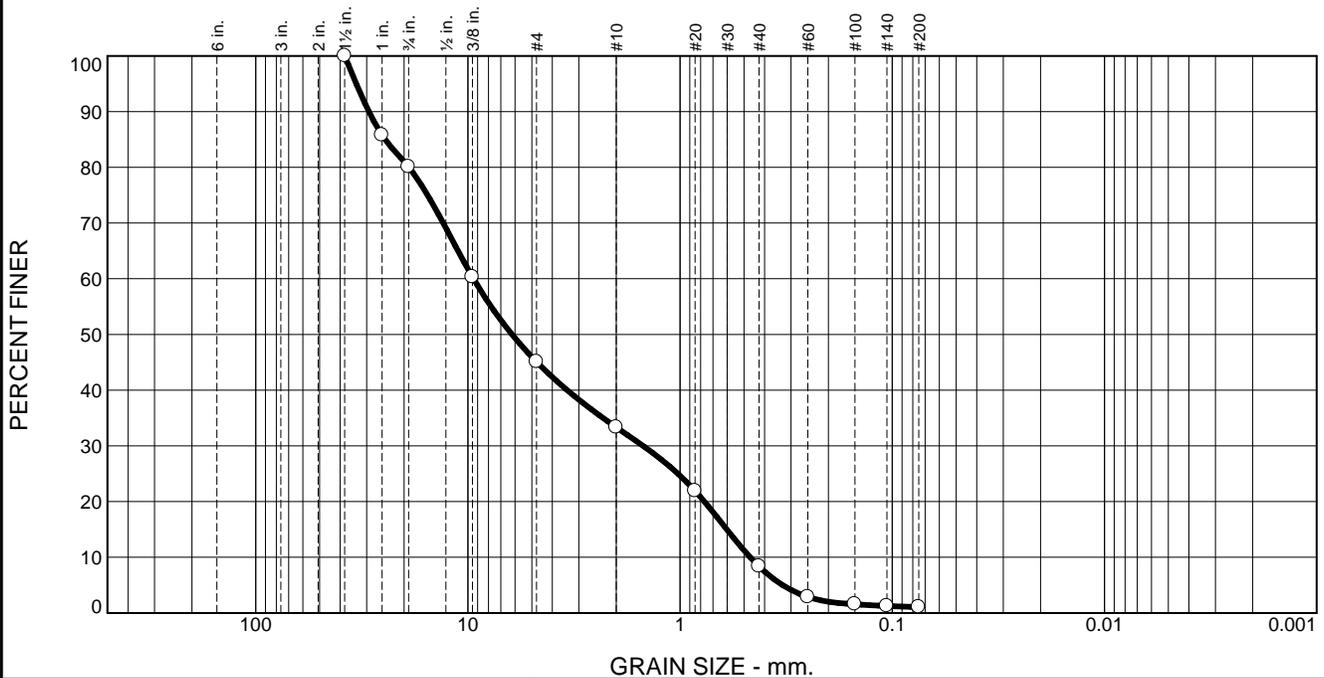
Title: Lab Manager

Source of Sample: TP      Depth: Onsite  
Sample Number: 9

Date Sampled: 4/17/23

<b>GeoTest, Inc.</b>  <b>West Allis, WI</b>	<b>Client:</b> Three Leaf Partners <b>Project:</b> Hatland Quarry Apartments  <b>Project No:</b> 7708 <b>Test No</b> 7162-6838
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# Sieve Analysis Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	19.9	35.0	11.8	24.9	7.3	1.1	

Test Results (ASTM D6913 & ASTM D1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1-1/2"	100.0		
1"	85.8		
3/4"	80.1		
3/8"	60.3		
#4	45.1		
#10	33.3		
#20	21.9		
#40	8.4		
#60	2.9		
#100	1.6		
#140	1.3		
#200	1.1		

\* (no specification provided)

**Material Description**

Brown f to c sand

**Atterberg Limits (ASTM D 4318)**

PL= \_\_\_\_\_ LL= \_\_\_\_\_ PI= \_\_\_\_\_

**Classification**

USCS (D 2487)= \_\_\_\_\_ AASHTO (M 145)= \_\_\_\_\_

**Coefficients**

D<sub>90</sub>= 29.3003      D<sub>85</sub>= 24.5860      D<sub>60</sub>= 9.4124  
D<sub>50</sub>= 6.1982      D<sub>30</sub>= 1.4946      D<sub>15</sub>= 0.6023  
D<sub>10</sub>= 0.4674      C<sub>u</sub>= 20.14      C<sub>c</sub>= 0.51

**Remarks**

F.M.=5.32

Date Received: 4/17/23      Date Tested: 4/19/23

Tested By: Hiten Soni

Checked By: Imtiaz Ahmed

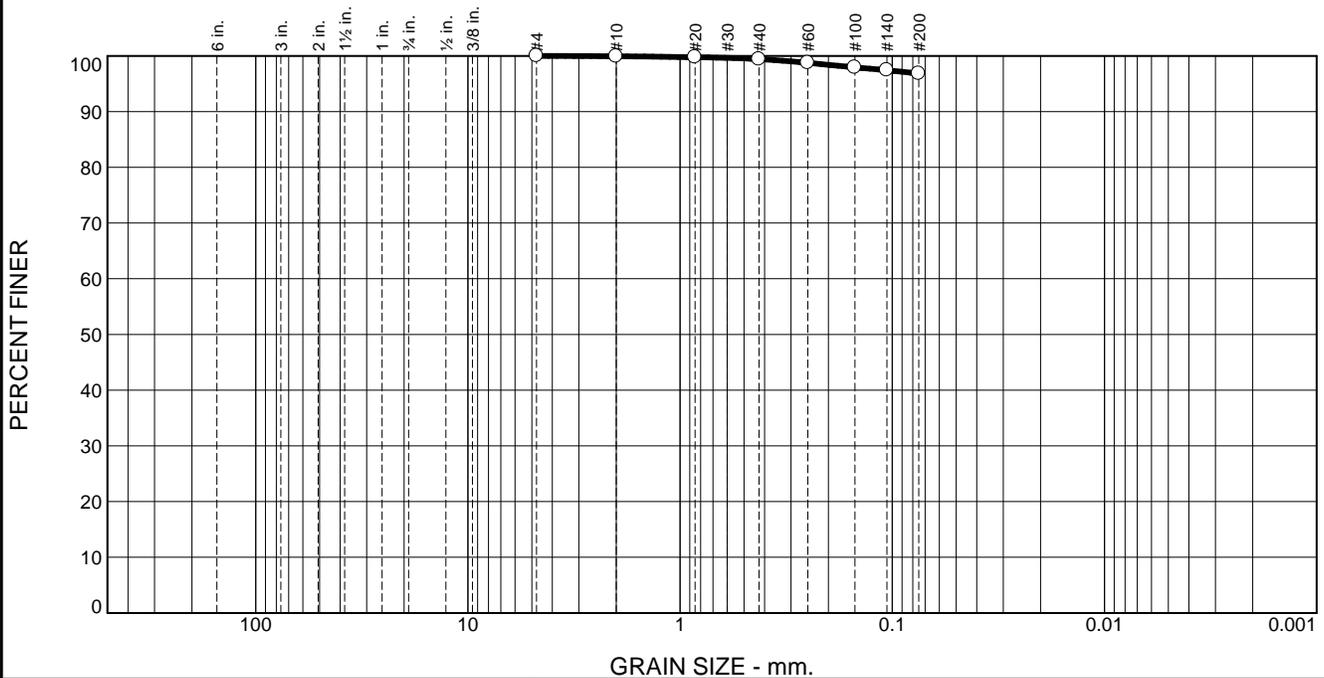
Title: Lab Manager

Source of Sample: Bluff      Depth: Onsite  
Sample Number: 1

Date Sampled: 4/17/23

<b>GeoTest, Inc.</b>  <b>West Allis, WI</b>	<b>Client:</b> Three Leaf Partners <b>Project:</b> Hatland Quarry Apartments  <b>Project No:</b> 7708 <b>Test No</b>
---	---

# Sieve Analysis Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	0.5	2.6	96.8	

Test Results (ASTM D6913 & ASTM D1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.9		
#20	99.8		
#40	99.4		
#60	98.8		
#100	97.9		
#140	97.4		
#200	96.8		

\* (no specification provided)

**Material Description**

Brown lean clay

**Atterberg Limits (ASTM D 4318)**

PL= 22.5      LL= 34.7      PI= 12.2

**Classification**

USCS (D 2487)= CL      AASHTO (M 145)= A-6(13)

**Coefficients**

D<sub>90</sub>=      D<sub>85</sub>=      D<sub>60</sub>=  
D<sub>50</sub>=      D<sub>30</sub>=      D<sub>15</sub>=  
D<sub>10</sub>=      C<sub>u</sub>=      C<sub>c</sub>=

Remarks

F.M.=0.04

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Date Received: 4/17/23      Date Tested: 4/19/23

Tested By: Hiten Soni

Checked By: Imtiaz Ahmed

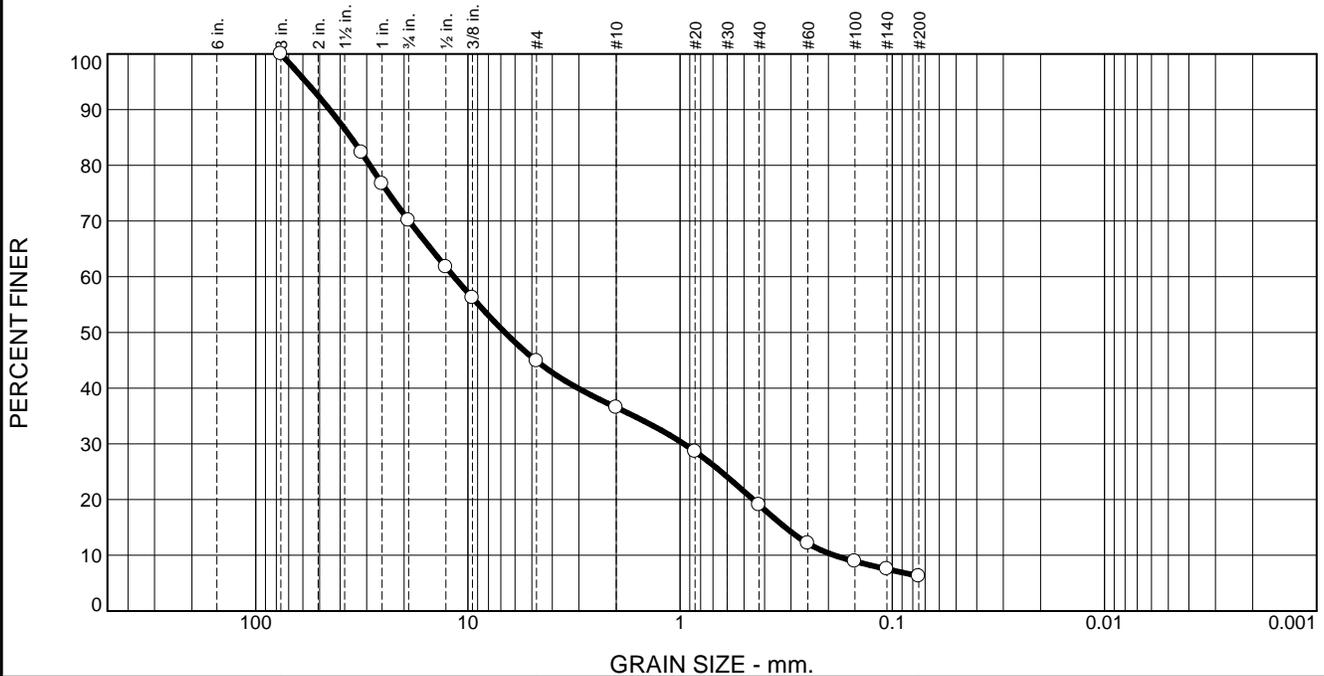
Title: Lab Manager

Source of Sample: Bluff      Depth: Onsite  
Sample Number: 2

Date Sampled: 4/17/23

<p><b>GeoTest, Inc.</b></p> <p><b>West Allis, WI</b></p>	<p><b>Client:</b> Three Leaf Partners</p> <p><b>Project:</b> Hatland Quarry Apartments</p> <p><b>Project No:</b> 7708</p> <p style="text-align: right;"><b>Test No</b> 7164-6840</p>
--	--

# Sieve Analysis Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	29.9	25.2	8.4	17.4	12.8	6.3	

Test Results (ASTM C136 & ASTM C117)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0		
1 1/4"	82.3		
1"	76.7		
3/4"	70.1		
1/2"	61.7		
3/8"	56.2		
#4	44.9		
#10	36.5		
#20	28.6		
#40	19.1		
#60	12.1		
#100	8.9		
#140	7.5		
#200	6.3		

\* (no specification provided)

**Material Description**

Brown sand and gravel

**Atterberg Limits (ASTM D 4318)**

PL= \_\_\_\_\_ LL= \_\_\_\_\_ PI= \_\_\_\_\_

**Classification**

USCS (D 2487)= \_\_\_\_\_ AASHTO (M 145)= \_\_\_\_\_

**Coefficients**

D<sub>90</sub>= 44.8239      D<sub>85</sub>= 35.5744      D<sub>60</sub>= 11.6219  
D<sub>50</sub>= 6.6981      D<sub>30</sub>= 0.9602      D<sub>15</sub>= 0.3195  
D<sub>10</sub>= 0.1880      C<sub>u</sub>= 61.82      C<sub>c</sub>= 0.42

**Remarks**

F.M.=5.25

Date Received: 4/18/23      Date Tested: 4/27/23

Tested By: Craig Englund \_\_\_\_\_

Checked By: Imtiaz Ahmed \_\_\_\_\_

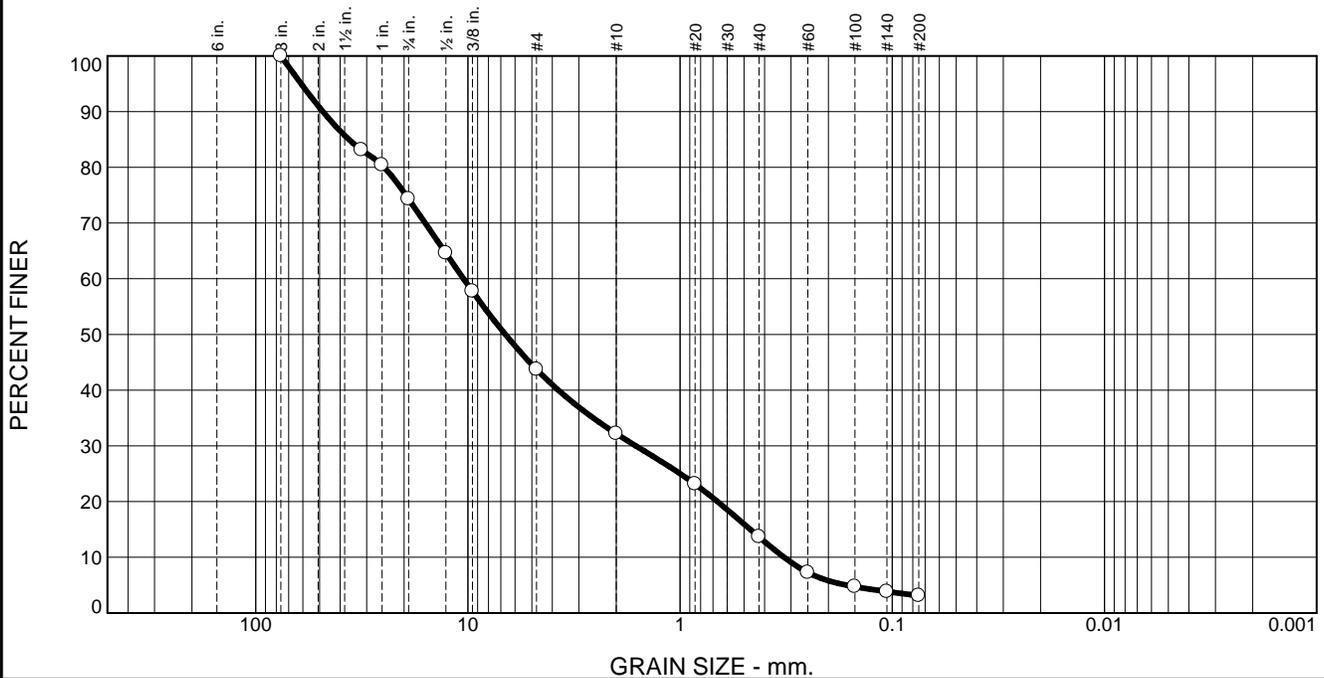
Title: Lab Manager \_\_\_\_\_

Source of Sample: Bluff      Depth: Onsite  
Sample Number: 3

Date Sampled: 4/18/23

<p><b>GeoTest, Inc.</b></p> <p><b>West Allis, WI</b></p>	<p>Client: Three Leaf Partners</p> <p>Project: Hatland Quarry Apartments</p> <p>Project No: 7708</p>	<p>Test No 7173-6848</p>
--	--	--------------------------

# Sieve Analysis Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	25.7	30.6	11.5	18.5	10.6	3.1	

Test Results (ASTM C136 & ASTM C117)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0		
1 1/4"	83.1		
1"	80.4		
3/4"	74.3		
1/2"	64.6		
3/8"	57.7		
#4	43.7		
#10	32.2		
#20	23.1		
#40	13.7		
#60	7.3		
#100	4.7		
#140	3.8		
#200	3.1		

**Material Description**

Brown sand and gravel

**Atterberg Limits (ASTM D 4318)**

PL= \_\_\_\_\_ LL= \_\_\_\_\_ PI= \_\_\_\_\_

**Classification**

USCS (D 2487)= \_\_\_\_\_ AASHTO (M 145)= \_\_\_\_\_

**Coefficients**

D<sub>90</sub>= 48.2763      D<sub>85</sub>= 36.4131      D<sub>60</sub>= 10.4876  
D<sub>50</sub>= 6.6655      D<sub>30</sub>= 1.6184      D<sub>15</sub>= 0.4670  
D<sub>10</sub>= 0.3238      C<sub>u</sub>= 32.39      C<sub>c</sub>= 0.77

**Remarks**

F.M.=5.45

Date Received: 4/18/23      Date Tested: 4/27/23

Tested By: Craig Englund \_\_\_\_\_

Checked By: Imtiaz Ahmed \_\_\_\_\_

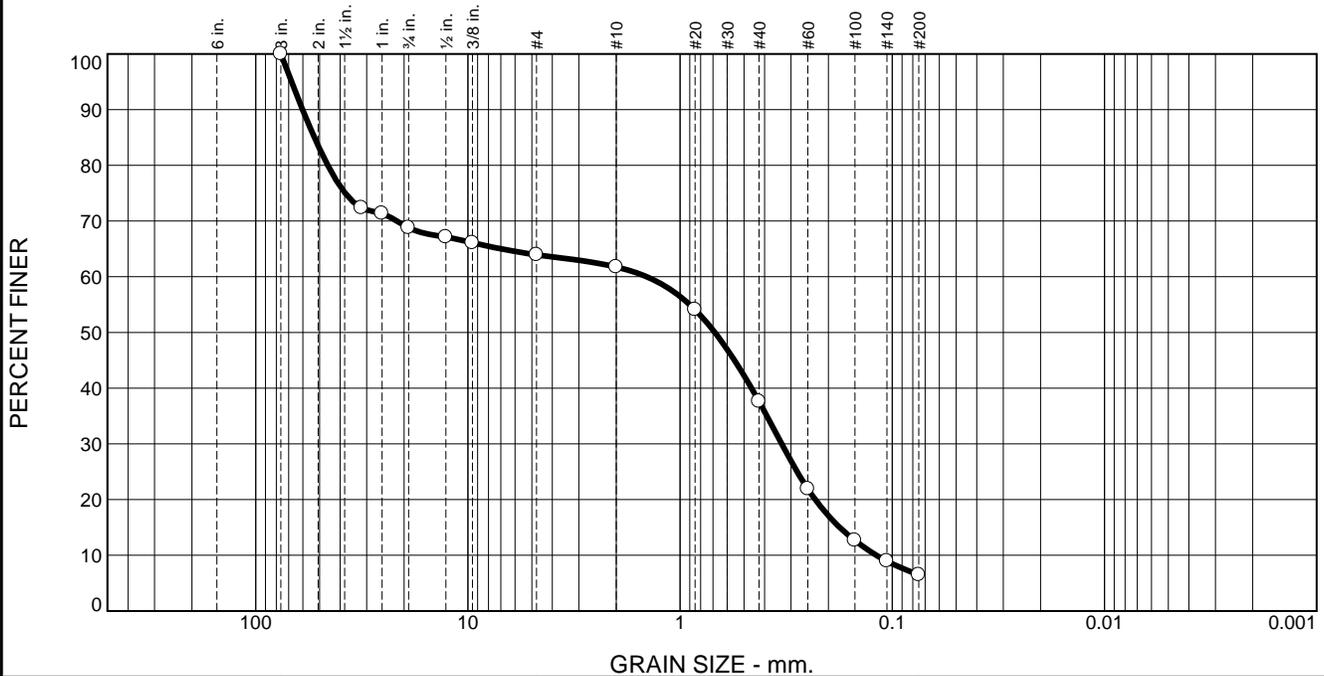
Title: Lab Manager \_\_\_\_\_

\* (no specification provided)

Source of Sample: Bluff      Depth: Onsite      Date Sampled: 4/18/23  
Sample Number: 4

<b>GeoTest, Inc.</b>  <b>West Allis, WI</b>	<b>Client:</b> Three Leaf Partners <b>Project:</b> Hatland Quarry Apartments  <b>Project No:</b> 7708 <b>Test No</b> 7174-6849
---	---

# Sieve Analysis Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	31.2	4.9	2.2	24.1	31.1	6.5	

Test Results (ASTM C136 & ASTM D1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0		
1 1/4"	72.3		
1"	71.3		
3/4"	68.8		
1/2"	67.1		
3/8"	66.1		
#4	63.9		
#10	61.7		
#20	54.1		
#40	37.6		
#60	21.9		
#100	12.7		
#140	8.9		
#200	6.5		

\* (no specification provided)

**Material Description**

Dark Brown sand and gravel

**Atterberg Limits (ASTM D 4318)**

PL= \_\_\_\_\_ LL= \_\_\_\_\_ PI= \_\_\_\_\_

**Classification**

USCS (D 2487)= \_\_\_\_\_ AASHTO (M 145)= \_\_\_\_\_

**Coefficients**

D<sub>90</sub>= 60.1653      D<sub>85</sub>= 52.9287      D<sub>60</sub>= 1.4365  
D<sub>50</sub>= 0.6859      D<sub>30</sub>= 0.3320      D<sub>15</sub>= 0.1768  
D<sub>10</sub>= 0.1188      C<sub>u</sub>= 12.09      C<sub>c</sub>= 0.65

**Remarks**

F.M.=4.19

Date Received: 4/18/23      Date Tested: 4/27/23

Tested By: Craig Englund

Checked By: Imtiaz Ahmed

Title: Lab Manager

Source of Sample: Bluff      Depth: Onsite  
Sample Number: 5

Date Sampled: 4/18/23

**GeoTest, Inc.**

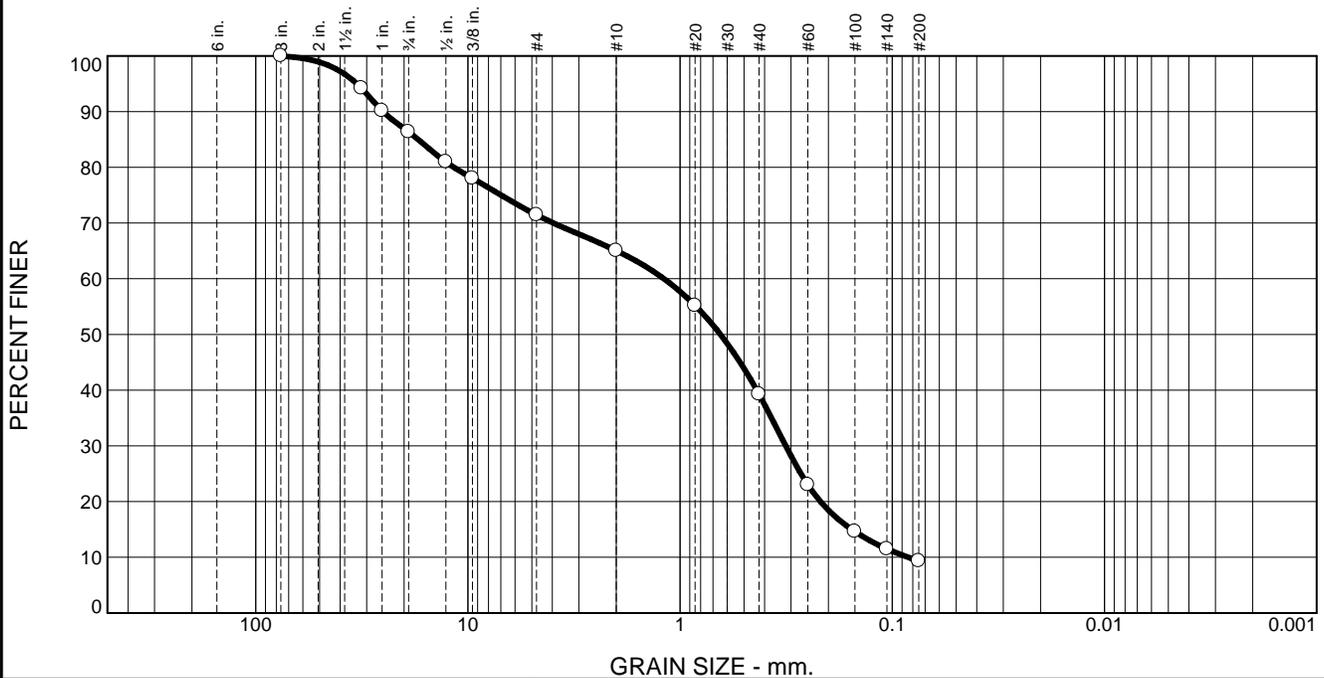
**West Allis, WI**

Client: Three Leaf Partners  
Project: Hatland Quarry Apartments

Project No: 7708

Test No 7175-6850

# Sieve Analysis Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	13.6	14.9	6.5	25.7	30.0	9.3	

Test Results (ASTM C136 & ASTM C117)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0		
1 1/4"	94.2		
1"	90.2		
3/4"	86.4		
1/2"	81.0		
3/8"	78.0		
#4	71.5		
#10	65.0		
#20	55.2		
#40	39.3		
#60	23.0		
#100	14.6		
#140	11.5		
#200	9.3		

\* (no specification provided)

**Material Description**

Brown sand and gravel

**Atterberg Limits (ASTM D 4318)**

PL= \_\_\_\_\_ LL= \_\_\_\_\_ PI= \_\_\_\_\_

**Classification**

USCS (D 2487)= \_\_\_\_\_ AASHTO (M 145)= \_\_\_\_\_

**Coefficients**

D<sub>90</sub>= 25.1604      D<sub>85</sub>= 17.1823      D<sub>60</sub>= 1.1920  
D<sub>50</sub>= 0.6455      D<sub>30</sub>= 0.3180      D<sub>15</sub>= 0.1553  
D<sub>10</sub>= 0.0841      C<sub>u</sub>= 14.17      C<sub>c</sub>= 1.01

**Remarks**

F.M.=3.50

Date Received: 11/18/23      Date Tested: 4/27/23

Tested By: Luke Emery

Checked By: Imtiaz Ahmed

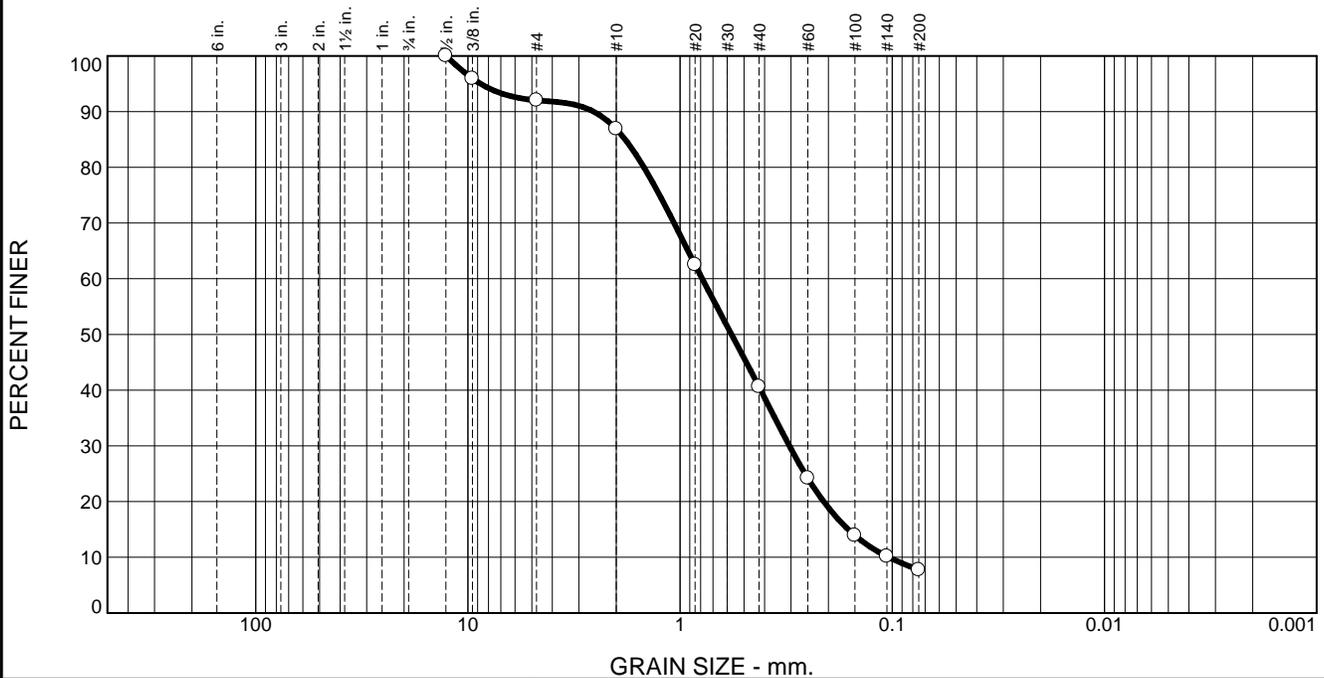
Title: Lab Manager

Source of Sample: Bluff      Depth: Onsite  
Sample Number: 6

Date Sampled: 11/18/23

<p><b>GeoTest, Inc.</b></p> <p><b>West Allis, WI</b></p>	<p>Client: Three Leaf Partners</p> <p>Project: Hatland Quarry Apartments</p> <p>Project No: 7708</p>	<p>Date Tested: 4/27/23</p> <p>Test No: 7176-6851</p>
--	--	---

# Sieve Analysis Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	8.0	5.1	46.3	32.9	7.7	

Test Results (ASTM D6913 & ASTM D1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1/2"	100.0		
3/8"	95.9		
#4	92.0		
#10	86.9		
#20	62.5		
#40	40.6		
#60	24.2		
#100	13.9		
#140	10.2		
#200	7.7		

**Material Description**

Brown f to c sand

**Atterberg Limits (ASTM D 4318)**

PL= \_\_\_\_\_ LL= \_\_\_\_\_ PI= \_\_\_\_\_

**Classification**

USCS (D 2487)= \_\_\_\_\_ AASHTO (M 145)= \_\_\_\_\_

**Coefficients**

D<sub>90</sub>= 2.5558      D<sub>85</sub>= 1.8143      D<sub>60</sub>= 0.7865  
D<sub>50</sub>= 0.5722      D<sub>30</sub>= 0.3055      D<sub>15</sub>= 0.1615  
D<sub>10</sub>= 0.1040      C<sub>u</sub>= 7.56      C<sub>c</sub>= 1.14

**Remarks**

F.M.=2.55

---

Date Received: 4/18/23      Date Tested: 4/27/23

Tested By: Luke Emery

Checked By: Imtiaz Ahmed

Title: Lab Manager

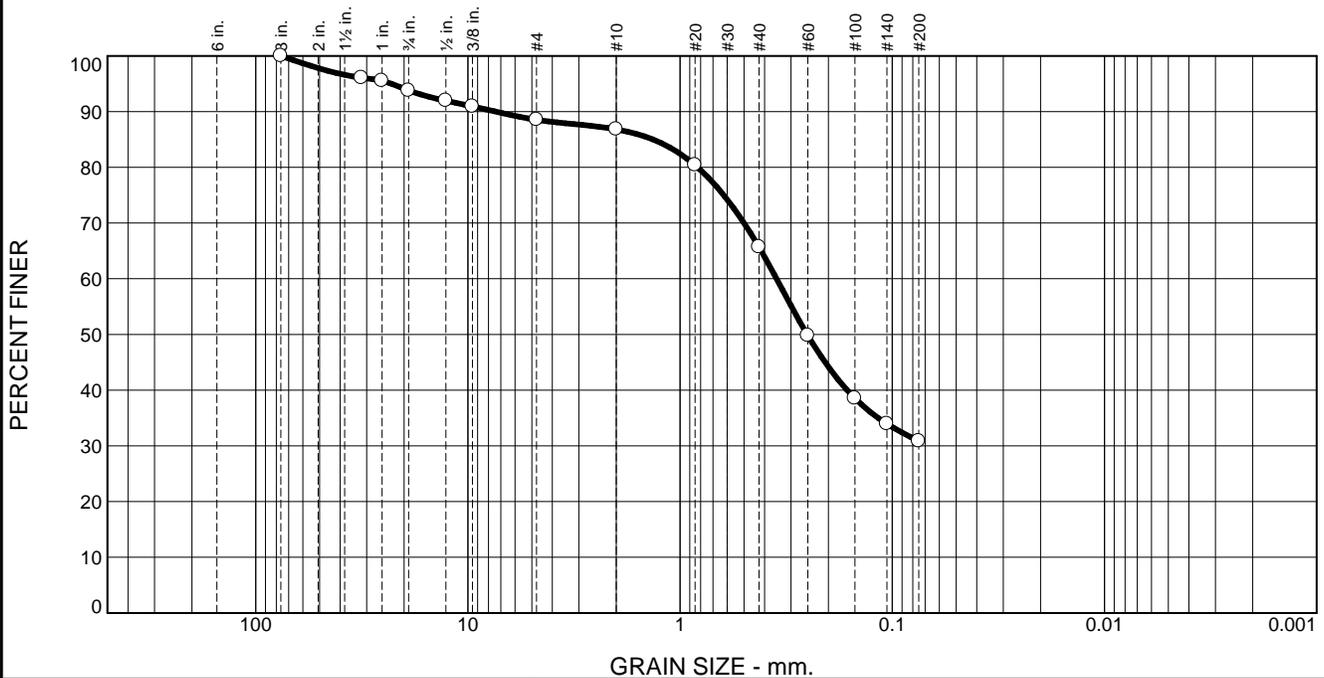
\* (no specification provided)

Source of Sample: Bluff      Depth: Onsite  
Sample Number: 7

Date Sampled: 4/18/23

<b>GeoTest, Inc.</b>  <b>West Allis, WI</b>	<b>Client:</b> Three Leaf Partners <b>Project:</b> Hatland Quarry Apartments  <b>Project No:</b> 7708 <b>Test No</b> 7177-6852
---	---

# Sieve Analysis Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	6.2	5.3	1.7	21.1	34.8	30.9	

Test Results (ASTM C136 & ASTM C117)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0		
1 1/4"	96.1		
1"	95.5		
3/4"	93.8		
1/2"	92.0		
3/8"	90.9		
#4	88.5		
#10	86.8		
#20	80.4		
#40	65.7		
#60	49.8		
#100	38.5		
#140	34.0		
#200	30.9		

**Material Description**

Brown sand and gravel

**Atterberg Limits (ASTM D 4318)**

PL= \_\_\_\_\_ LL= \_\_\_\_\_ PI= \_\_\_\_\_

**Classification**

USCS (D 2487)= \_\_\_\_\_ AASHTO (M 145)= \_\_\_\_\_

**Coefficients**

D<sub>90</sub>= 7.4064      D<sub>85</sub>= 1.3432      D<sub>60</sub>= 0.3512  
D<sub>50</sub>= 0.2518      D<sub>30</sub>= \_\_\_\_\_      D<sub>15</sub>= \_\_\_\_\_  
D<sub>10</sub>= \_\_\_\_\_      C<sub>u</sub>= \_\_\_\_\_      C<sub>c</sub>= \_\_\_\_\_

Remarks

F.M.=1.91

Date Received: 4/18/23      Date Tested: 4/27/23

Tested By: Craig Englund \_\_\_\_\_

Checked By: Imtiaz Ahmed \_\_\_\_\_

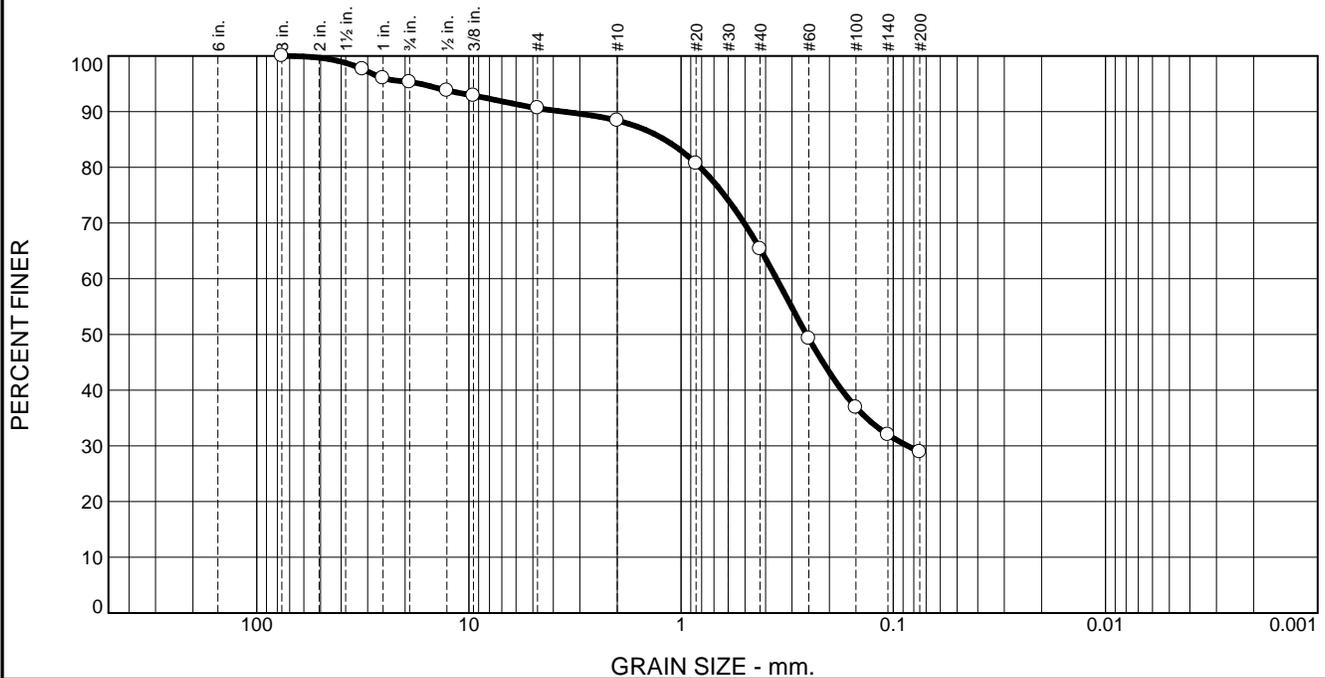
Title: Lab Manager \_\_\_\_\_

\* (no specification provided)

Source of Sample: Bluff      Depth: Onsite      Date Sampled: 4/18/23  
Sample Number: 8

<b>GeoTest, Inc.</b>  <b>West Allis, WI</b>	<b>Client:</b> Three Leaf Partners <b>Project:</b> Hatland Quarry Apartments  <b>Project No:</b> 7708 <b>Test No</b> 7178-6853
---	---

# Sieve Analysis Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.7	4.7	2.2	23.0	36.5	28.9	

Test Results (ASTM C136 & ASTM C117)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0		
1 1/4"	97.6		
1"	96.0		
3/4"	95.3		
1/2"	93.8		
3/8"	92.9		
#4	90.6		
#10	88.4		
#20	80.7		
#40	65.4		
#60	49.3		
#100	36.9		
#140	32.0		
#200	28.9		

\* (no specification provided)

**Material Description**

Brown sand and gravel

**Atterberg Limits (ASTM D 4318)**

PL= \_\_\_\_\_ LL= \_\_\_\_\_ PI= \_\_\_\_\_

**Classification**

USCS (D 2487)= \_\_\_\_\_ AASHTO (M 145)= \_\_\_\_\_

**Coefficients**

D<sub>90</sub>= 3.6204      D<sub>85</sub>= 1.1979      D<sub>60</sub>= 0.3550  
D<sub>50</sub>= 0.2564      D<sub>30</sub>= 0.0857      D<sub>15</sub>= \_\_\_\_\_  
D<sub>10</sub>= \_\_\_\_\_      C<sub>u</sub>= \_\_\_\_\_      C<sub>c</sub>= \_\_\_\_\_

**Remarks**

F.M.=1.83

Date Received: 4/18/23      Date Tested: 4/27/23

Tested By: Craig Englund

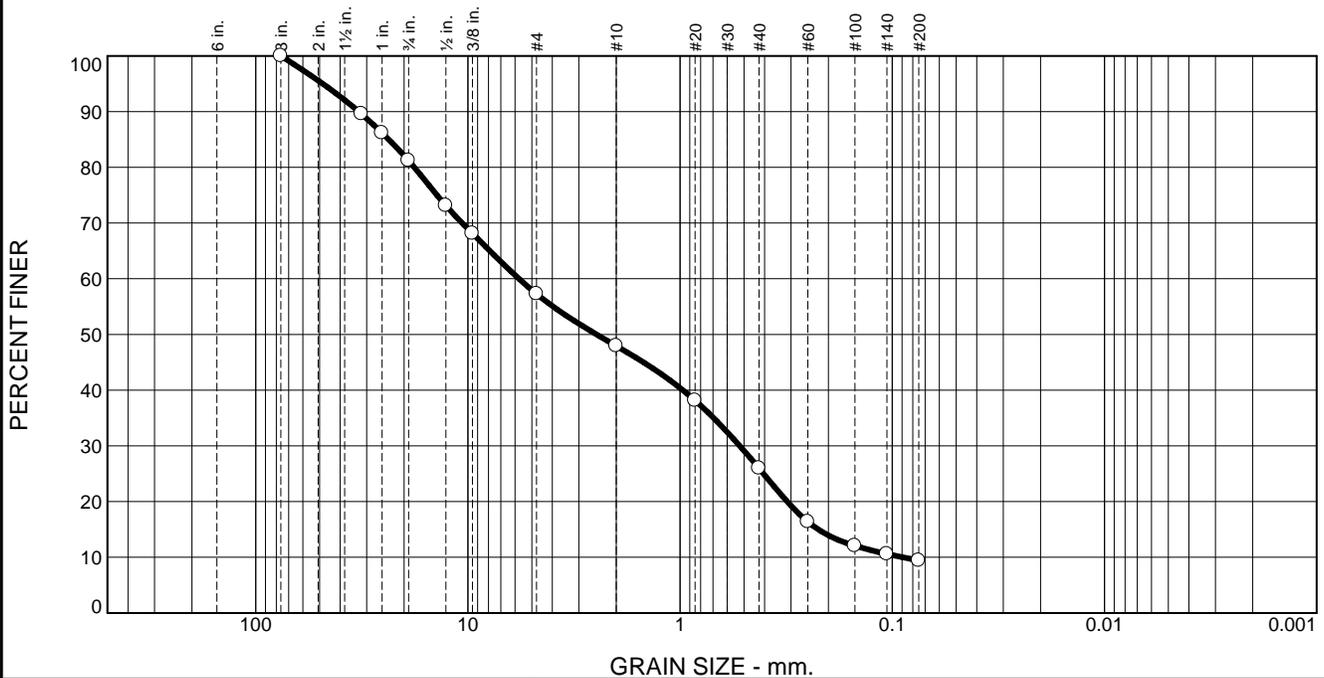
Checked By: Imtiaz Ahmed

Title: Lab Manager

Source of Sample: Bluff      Depth: Onsite      Date Sampled: 4/18/23  
Sample Number: 9

<b>GeoTest, Inc.</b>  <b>West Allis, WI</b>	<b>Client:</b> Three Leaf Partners <b>Project:</b> Hatland Quarry Apartments  <b>Project No:</b> 7708 <b>Test No</b> 7179-6854
---	---

# Sieve Analysis Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	18.8	23.9	9.4	21.9	16.6	9.4	

Test Results (ASTM C136 & ASTM C117)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0		
1 1/4"	89.6		
1"	86.2		
3/4"	81.2		
1/2"	73.1		
3/8"	68.1		
#4	57.3		
#10	47.9		
#20	38.2		
#40	26.0		
#60	16.4		
#100	12.1		
#140	10.6		
#200	9.4		

\* (no specification provided)

**Material Description**

Brown sand and gravel

**Atterberg Limits (ASTM D 4318)**

PL= \_\_\_\_\_ LL= \_\_\_\_\_ PI= \_\_\_\_\_

**Classification**

USCS (D 2487)= \_\_\_\_\_ AASHTO (M 145)= \_\_\_\_\_

**Coefficients**

D<sub>90</sub>= 32.6990      D<sub>85</sub>= 23.6371      D<sub>60</sub>= 5.7505  
D<sub>50</sub>= 2.4748      D<sub>30</sub>= 0.5236      D<sub>15</sub>= 0.2235  
D<sub>10</sub>= 0.0894      C<sub>u</sub>= 64.32      C<sub>c</sub>= 0.53

**Remarks**

F.M.=4.46

Date Received: 4/18/23      Date Tested: 4/27/23

Tested By: Craig Englund \_\_\_\_\_

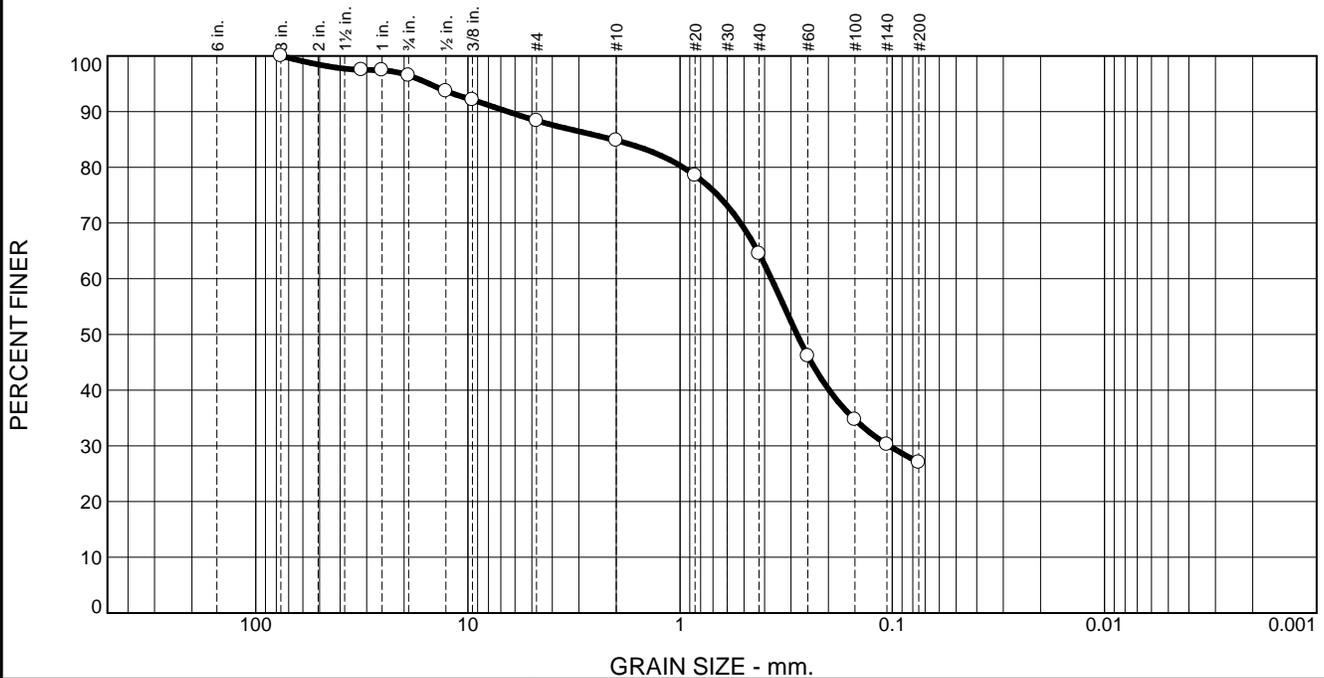
Checked By: Imtiaz Ahmed \_\_\_\_\_

Title: Lab Manager \_\_\_\_\_

Source of Sample: Bluff      Depth: Onsite      Date Sampled: 4/18/23  
Sample Number: 10

<b>GeoTest, Inc.</b>  <b>West Allis, WI</b>	<b>Client:</b> Three Leaf Partners <b>Project:</b> Hatland Quarry Apartments  <b>Project No:</b> 7708 <b>Test No</b> 7180-6855
---	---

# Sieve Analysis Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	3.5	8.1	3.6	20.3	37.5	27.0	

Test Results (ASTM C136 & ASTM C117)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0		
1 1/4"	97.5		
1"	97.4		
3/4"	96.5		
1/2"	93.7		
3/8"	92.1		
#4	88.4		
#10	84.8		
#20	78.5		
#40	64.5		
#60	46.1		
#100	34.7		
#140	30.3		
#200	27.0		

\* (no specification provided)

**Material Description**

Brown sandy silt, little topsoil

**Atterberg Limits (ASTM D 4318)**

PL= \_\_\_\_\_ LL= \_\_\_\_\_ PI= \_\_\_\_\_

**Classification**

USCS (D 2487)= \_\_\_\_\_ AASHTO (M 145)= \_\_\_\_\_

**Coefficients**

D<sub>90</sub>= 6.4931      D<sub>85</sub>= 2.0810      D<sub>60</sub>= 0.3712  
D<sub>50</sub>= 0.2810      D<sub>30</sub>= 0.1034      D<sub>15</sub>= \_\_\_\_\_  
D<sub>10</sub>= \_\_\_\_\_      C<sub>u</sub>= \_\_\_\_\_      C<sub>c</sub>= \_\_\_\_\_

**Remarks**

F.M.=1.98

Date Received: 4/18/23      Date Tested: 4/27/23

Tested By: Craig Englund \_\_\_\_\_

Checked By: Imtiaz Ahmed \_\_\_\_\_

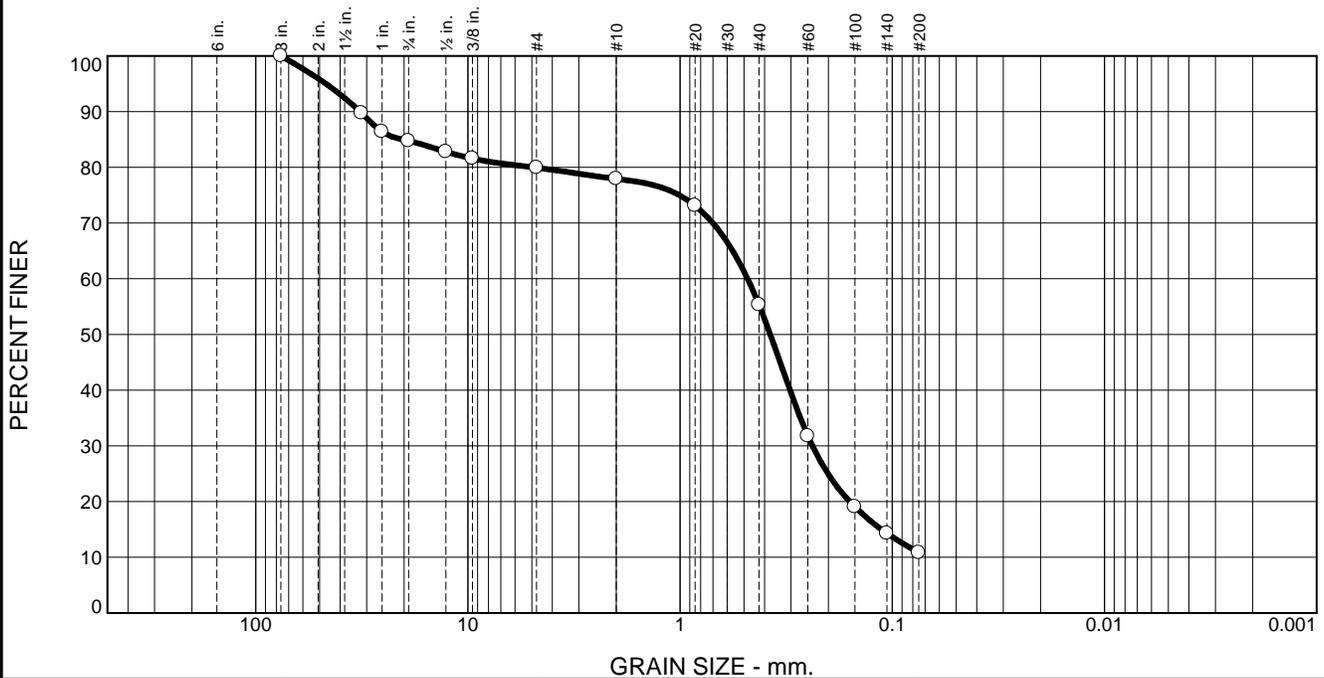
Title: Lab Manager \_\_\_\_\_

Source of Sample: Bluff      Depth: Onsite  
Sample Number: 11

Date Sampled: 4/18/23

<p><b>GeoTest, Inc.</b></p> <p><b>West Allis, WI</b></p>	<p><b>Client:</b> Three Leaf Partners</p> <p><b>Project:</b> Hatland Quarry Apartments</p> <p><b>Project No:</b> 7708</p>	<p><b>Test No</b> 7181-6856</p>
--	---	---------------------------------

# Sieve Analysis Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	15.3	4.8	2.0	22.6	44.5	10.8	

Test Results (ASTM C136 & ASTM C117)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0		
1 1/4"	89.7		
1"	86.4		
3/4"	84.7		
1/2"	82.8		
3/8"	81.6		
#4	79.9		
#10	77.9		
#20	73.1		
#40	55.3		
#60	31.8		
#100	19.1		
#140	14.3		
#200	10.8		

\* (no specification provided)

**Material Description**

Brown sand and gravel

**Atterberg Limits (ASTM D 4318)**

PL= \_\_\_\_\_ LL= \_\_\_\_\_ PI= \_\_\_\_\_

**Classification**

USCS (D 2487)= \_\_\_\_\_ AASHTO (M 145)= \_\_\_\_\_

**Coefficients**

D<sub>90</sub>= 32.2820      D<sub>85</sub>= 20.4121      D<sub>60</sub>= 0.4808  
D<sub>50</sub>= 0.3760      D<sub>30</sub>= 0.2379      D<sub>15</sub>= 0.1125  
D<sub>10</sub>= \_\_\_\_\_      C<sub>u</sub>= \_\_\_\_\_      C<sub>c</sub>= \_\_\_\_\_

**Remarks**

F.M.=2.82

Date Received: 4/18/23      Date Tested: 4/27/23

Tested By: Craig Englund

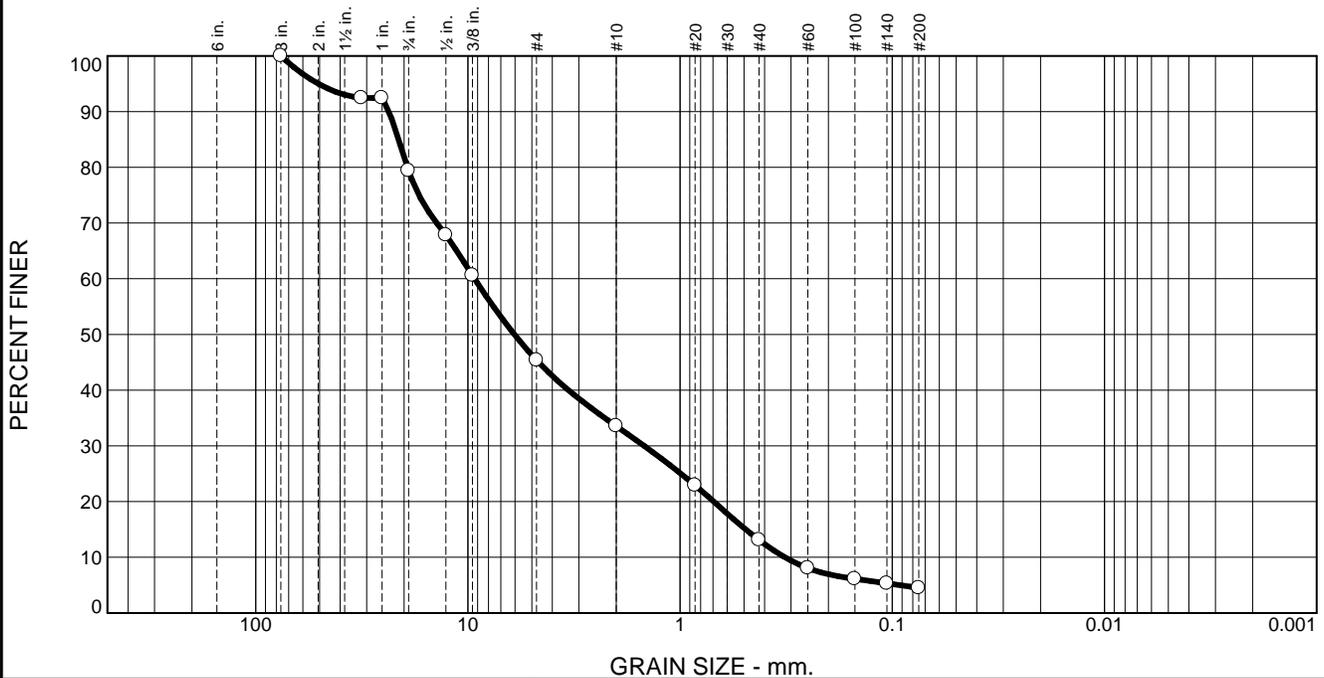
Checked By: Imtiaz Ahmed

Title: Lab Manager

Source of Sample: Bluff      Depth: Onsite      Date Sampled: 4/18/23  
Sample Number: 12

<b>GeoTest, Inc.</b>  <b>West Allis, WI</b>	<b>Client:</b> Three Leaf Partners <b>Project:</b> Hatland Quarry Apartments  <b>Project No:</b> 7708 <b>Test No</b> 7182-6857
---	---

# Sieve Analysis Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	20.6	34.0	11.8	20.5	8.6	4.5	

Test Results (ASTM C136 & ASTM C117)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0		
1 1/4"	92.5		
1"	92.5		
3/4"	79.4		
1/2"	67.8		
3/8"	60.6		
#4	45.4		
#10	33.6		
#20	22.9		
#40	13.1		
#60	8.0		
#100	6.1		
#140	5.3		
#200	4.5		

\* (no specification provided)

**Material Description**

Brown sand and gravel, little topsoil

**Atterberg Limits (ASTM D 4318)**

PL= \_\_\_\_\_ LL= \_\_\_\_\_ PI= \_\_\_\_\_

**Classification**

USCS (D 2487)= \_\_\_\_\_ AASHTO (M 145)= \_\_\_\_\_

**Coefficients**

D<sub>90</sub>= 23.5441      D<sub>85</sub>= 21.2405      D<sub>60</sub>= 9.3029  
D<sub>50</sub>= 6.0393      D<sub>30</sub>= 1.4790      D<sub>15</sub>= 0.4908  
D<sub>10</sub>= 0.3207      C<sub>u</sub>= 29.01      C<sub>c</sub>= 0.73

**Remarks**

F.M.=5.25

Date Received: 4/18/23      Date Tested: 4/27/23

Tested By: Craig Englund

Checked By: Imtiaz Ahmed

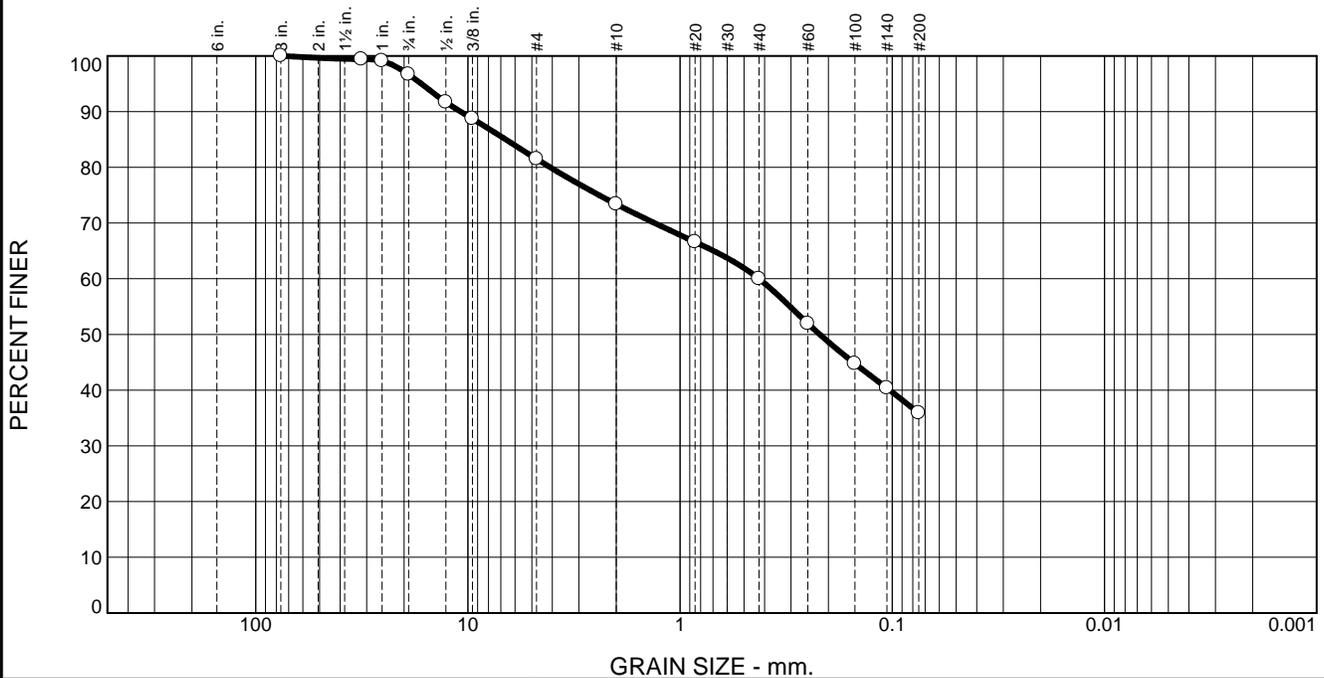
Title: Lab Manager

Source of Sample: Bluff      Depth: Onsite  
Sample Number: 13

Date Sampled: 4/18/23

<p><b>GeoTest, Inc.</b></p> <p><b>West Allis, WI</b></p>	<p>Client: Three Leaf Partners</p> <p>Project: Hatland Quarry Apartments</p> <p>Project No: 7708</p> <p style="text-align: right;">Test No 7183-6858</p>
--	--

# Sieve Analysis Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	3.3	15.2	8.1	13.4	24.1	35.9	

Test Results (ASTM C136 & ASTM C117)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0		
1 1/4"	99.4		
1"	99.1		
3/4"	96.7		
1/2"	91.7		
3/8"	88.7		
#4	81.5		
#10	73.4		
#20	66.6		
#40	60.0		
#60	52.0		
#100	44.8		
#140	40.4		
#200	35.9		

\* (no specification provided)

**Material Description**

Brown sand and gravel

**Atterberg Limits (ASTM D 4318)**

PL= \_\_\_\_\_ LL= \_\_\_\_\_ PI= \_\_\_\_\_

**Classification**

USCS (D 2487)= \_\_\_\_\_ AASHTO (M 145)= \_\_\_\_\_

**Coefficients**

D<sub>90</sub>= 10.8312      D<sub>85</sub>= 6.6383      D<sub>60</sub>= 0.4254  
D<sub>50</sub>= 0.2195      D<sub>30</sub>= \_\_\_\_\_      D<sub>15</sub>= \_\_\_\_\_  
D<sub>10</sub>= \_\_\_\_\_      C<sub>u</sub>= \_\_\_\_\_      C<sub>c</sub>= \_\_\_\_\_

Remarks

F.M.=2.26

Date Received: 4/18/23      Date Tested: 4/27/23

Tested By: Craig Englund \_\_\_\_\_

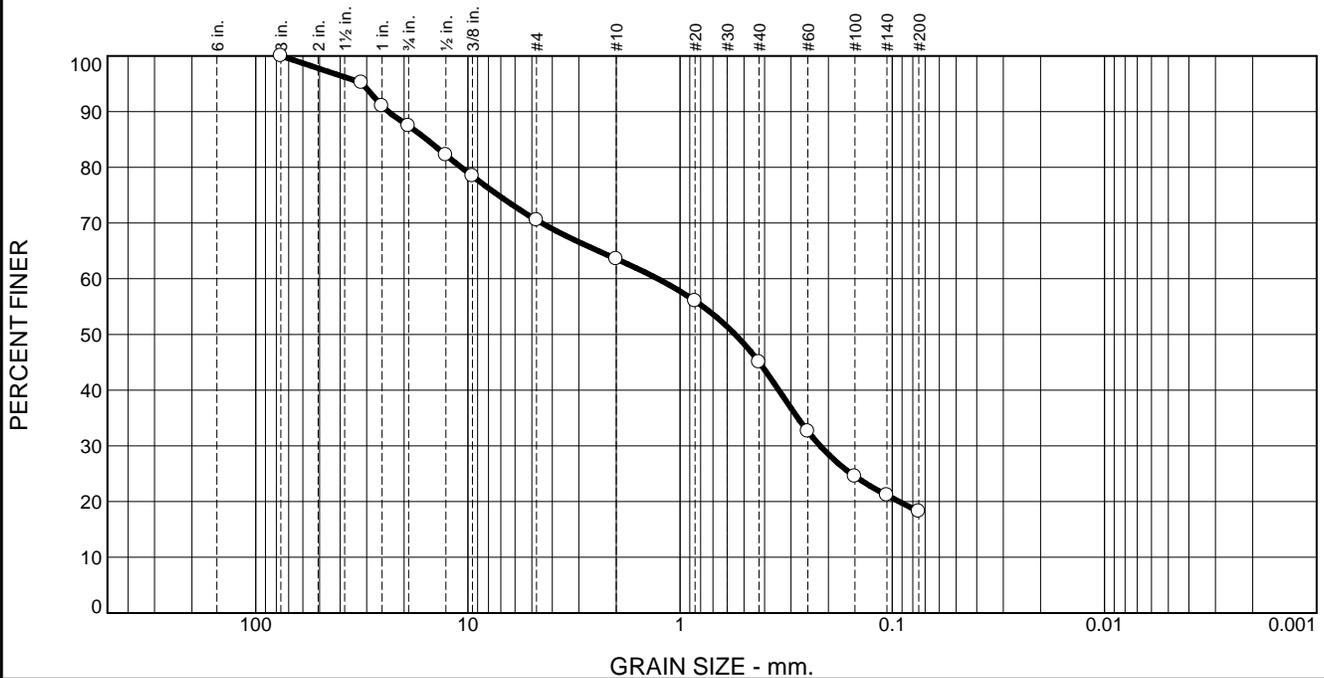
Checked By: Imtiaz Ahmed \_\_\_\_\_

Title: Lab Manager \_\_\_\_\_

Source of Sample: Bluff      Depth: Onsite      Date Sampled: 4/18/23  
Sample Number: 14

<b>GeoTest, Inc.</b>  <b>West Allis, WI</b>	<b>Client:</b> Three Leaf Partners <b>Project:</b> Hatland Quarry Apartments  <b>Project No:</b> 7708 <b>Test No</b> 7184-6859
---	---

# Sieve Analysis Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	12.6	16.9	6.9	18.5	26.9	18.2	

Test Results (ASTM C136 & ASTM C117)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0		
1 1/4"	95.2		
1"	91.0		
3/4"	87.4		
1/2"	82.2		
3/8"	78.4		
#4	70.5		
#10	63.6		
#20	56.0		
#40	45.1		
#60	32.6		
#100	24.5		
#140	21.1		
#200	18.2		

\* (no specification provided)

**Material Description**

Brown sand and gravel

**Atterberg Limits (ASTM D 4318)**

PL= \_\_\_\_\_ LL= \_\_\_\_\_ PI= \_\_\_\_\_

**Classification**

USCS (D 2487)= \_\_\_\_\_ AASHTO (M 145)= \_\_\_\_\_

**Coefficients**

D<sub>90</sub>= 23.7282      D<sub>85</sub>= 15.6351      D<sub>60</sub>= 1.2733  
D<sub>50</sub>= 0.5496      D<sub>30</sub>= 0.2188      D<sub>15</sub>= \_\_\_\_\_  
D<sub>10</sub>= \_\_\_\_\_      C<sub>u</sub>= \_\_\_\_\_      C<sub>c</sub>= \_\_\_\_\_

**Remarks**

F.M.=3.31

Date Received: 4/18/23      Date Tested: 4/27/23

Tested By: Craig Englund \_\_\_\_\_

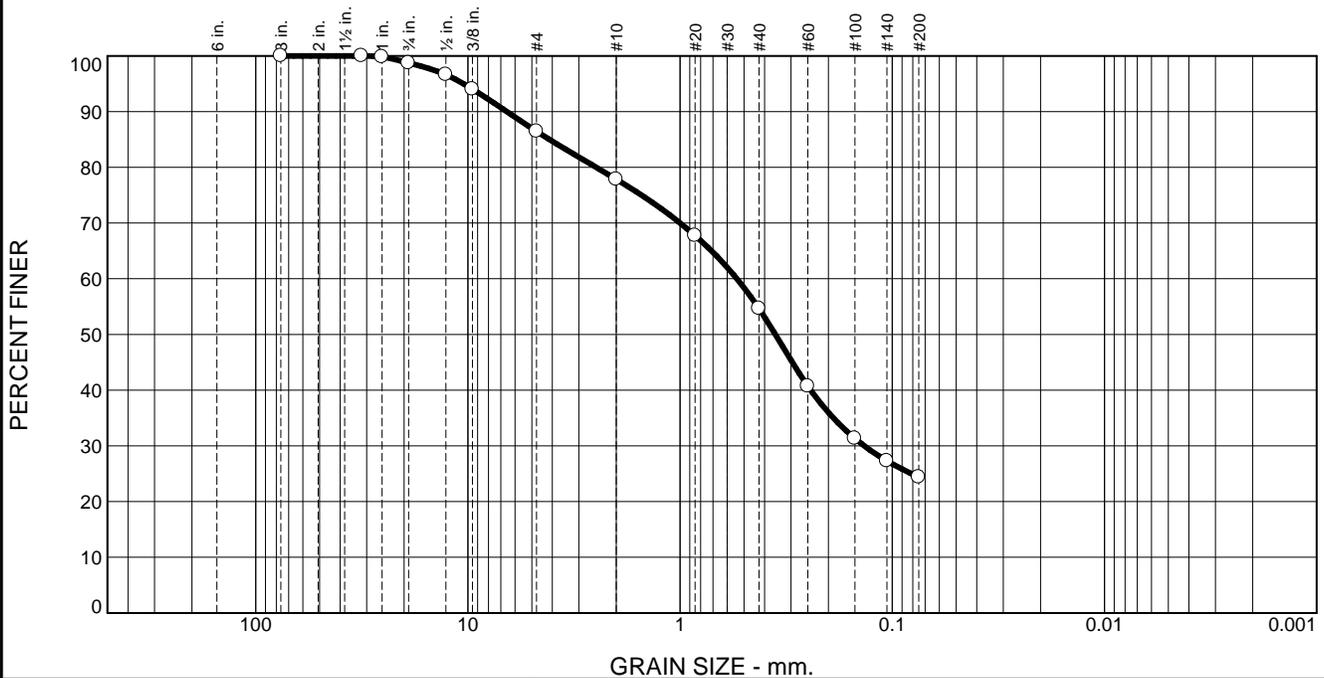
Checked By: Imtiaz Ahmed \_\_\_\_\_

Title: Lab Manager \_\_\_\_\_

Source of Sample: Bluff      Depth: Onsite      Date Sampled: 4/18/23  
Sample Number: 15

<b>GeoTest, Inc.</b>  <b>West Allis, WI</b>	<b>Client:</b> Three Leaf Partners <b>Project:</b> Hatland Quarry Apartments  <b>Project No:</b> 7708 <b>Test No</b> 7185-6860
---	---

# Sieve Analysis Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	1.3	12.2	8.6	23.3	30.2	24.4	

Test Results (ASTM C136 & ASTM C117)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0		
1 1/4"	100.0		
1"	99.8		
3/4"	98.7		
1/2"	96.6		
3/8"	94.0		
#4	86.5		
#10	77.9		
#20	67.7		
#40	54.6		
#60	40.7		
#100	31.3		
#140	27.3		
#200	24.4		

\* (no specification provided)

**Material Description**

Brown clay with gravel

**Atterberg Limits (ASTM D 4318)**

PL= \_\_\_\_\_ LL= \_\_\_\_\_ PI= \_\_\_\_\_

**Classification**

USCS (D 2487)= \_\_\_\_\_ AASHTO (M 145)= \_\_\_\_\_

**Coefficients**

D<sub>90</sub>= 6.5592      D<sub>85</sub>= 4.1299      D<sub>60</sub>= 0.5399  
D<sub>50</sub>= 0.3558      D<sub>30</sub>= 0.1356      D<sub>15</sub>= \_\_\_\_\_  
D<sub>10</sub>= \_\_\_\_\_      C<sub>u</sub>= \_\_\_\_\_      C<sub>c</sub>= \_\_\_\_\_

**Remarks**

F.M.=2.30

Date Received: 4/18/23      Date Tested: 4/27/23

Tested By: Craig Englund

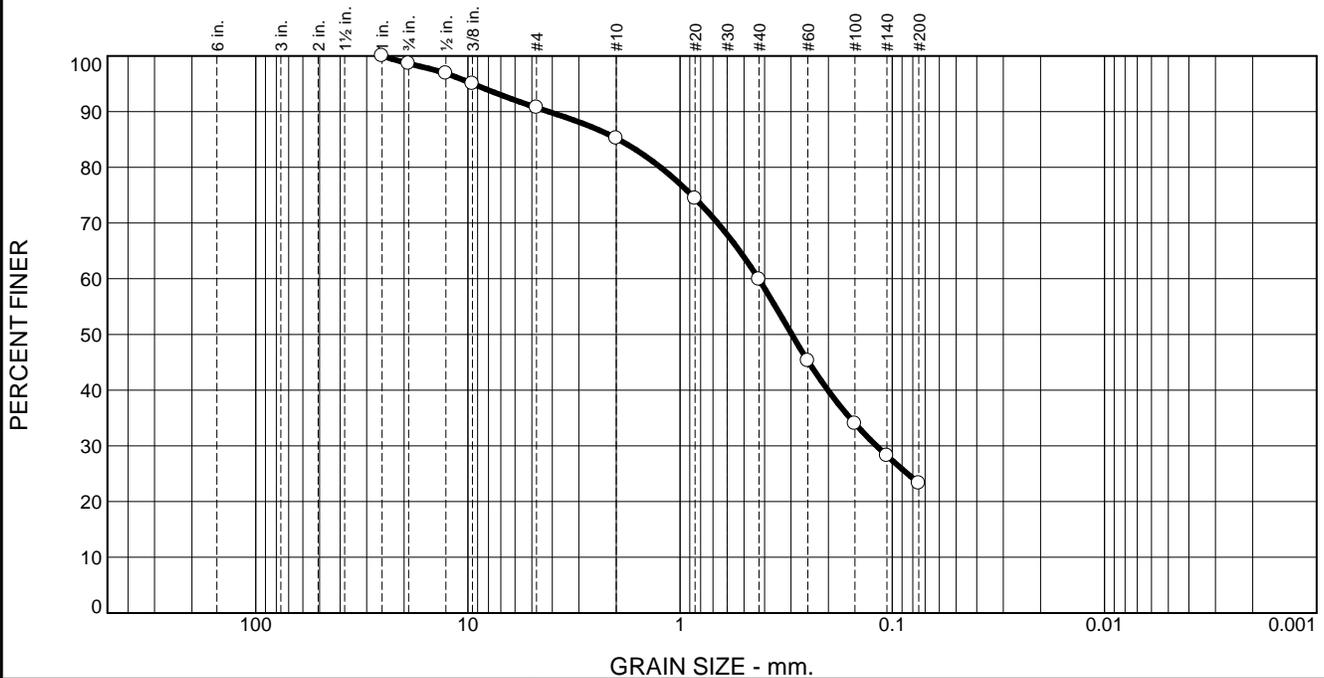
Checked By: Imtiaz Ahmed

Title: Lab Manager

Source of Sample: Bluff      Depth: Onsite      Date Sampled: 4/18/23  
Sample Number: 16

<b>GeoTest, Inc.</b>  <b>West Allis, WI</b>	<b>Client:</b> Three Leaf Partners <b>Project:</b> Hatland Quarry Apartments  <b>Project No:</b> 7708 <b>Test No</b> 7186-6861
---	---

# Sieve Analysis Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	1.4	7.9	5.5	25.3	36.6	23.3	

Test Results (ASTM D6913 & ASTM D1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
3/4"	98.6		
1/2"	96.9		
3/8"	95.0		
#4	90.7		
#10	85.2		
#20	74.4		
#40	59.9		
#60	45.3		
#100	34.0		
#140	28.2		
#200	23.3		

**Material Description**

Brown clay

**Atterberg Limits (ASTM D 4318)**

PL= \_\_\_\_\_ LL= \_\_\_\_\_ PI= \_\_\_\_\_

**Classification**

USCS (D 2487)= \_\_\_\_\_ AASHTO (M 145)= \_\_\_\_\_

**Coefficients**

D<sub>90</sub>= 4.1716      D<sub>85</sub>= 1.9521      D<sub>60</sub>= 0.4269  
D<sub>50</sub>= 0.2976      D<sub>30</sub>= 0.1187      D<sub>15</sub>= \_\_\_\_\_  
D<sub>10</sub>= \_\_\_\_\_      C<sub>u</sub>= \_\_\_\_\_      C<sub>c</sub>= \_\_\_\_\_

Remarks

F.M.=1.98

Date Received: 4/18/23      Date Tested: 4/28/23

Tested By: Craig Englund \_\_\_\_\_

Checked By: Imtiaz Ahmed \_\_\_\_\_

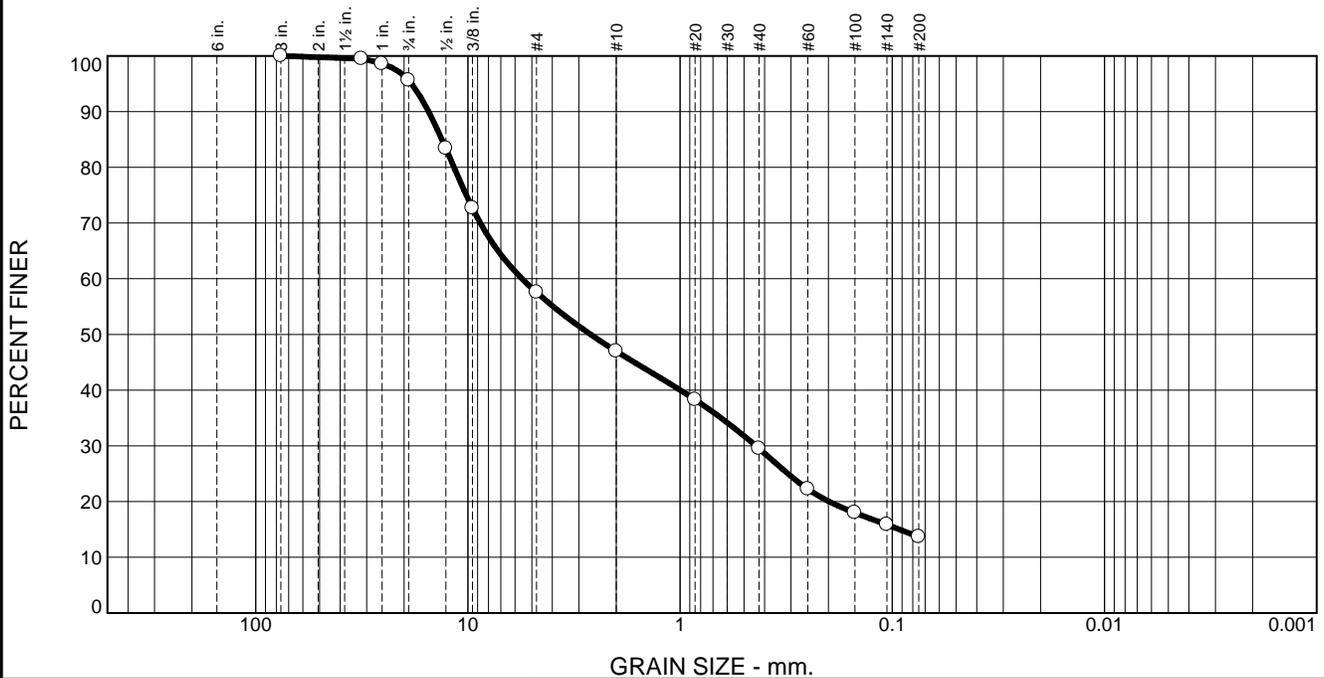
Title: Lab Manager \_\_\_\_\_

\* (no specification provided)

Source of Sample: Bluff      Depth: Onsite      Date Sampled: 4/18/23  
Sample Number: 17

<b>GeoTest, Inc.</b>  <b>West Allis, WI</b>	<b>Client:</b> Three Leaf Partners <b>Project:</b> Hatland Quarry Apartments  <b>Project No:</b> 7708 <b>Test No</b> 7187-6862
---	---

# Sieve Analysis Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.4	38.0	10.6	17.5	15.8	13.7	

Test Results (ASTM C136 & ASTM C117)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0		
1 1/4"	99.5		
1"	98.6		
3/4"	95.6		
1/2"	83.4		
3/8"	72.7		
#4	57.6		
#10	47.0		
#20	38.3		
#40	29.5		
#60	22.2		
#100	18.0		
#140	15.8		
#200	13.7		

\* (no specification provided)

**Material Description**

Brown sand and gravel

**Atterberg Limits (ASTM D 4318)**

PL= \_\_\_\_\_ LL= \_\_\_\_\_ PI= \_\_\_\_\_

**Classification**

USCS (D 2487)= \_\_\_\_\_ AASHTO (M 145)= \_\_\_\_\_

**Coefficients**

D<sub>90</sub>= 15.3163      D<sub>85</sub>= 13.2611      D<sub>60</sub>= 5.5607  
D<sub>50</sub>= 2.6404      D<sub>30</sub>= 0.4391      D<sub>15</sub>= 0.0926  
D<sub>10</sub>= \_\_\_\_\_      C<sub>u</sub>= \_\_\_\_\_      C<sub>c</sub>= \_\_\_\_\_

**Remarks**

F.M.=4.07

Date Received: 4/18/23      Date Tested: 4/28/23

Tested By: Craig Englund \_\_\_\_\_

Checked By: Imtiaz Ahmed \_\_\_\_\_

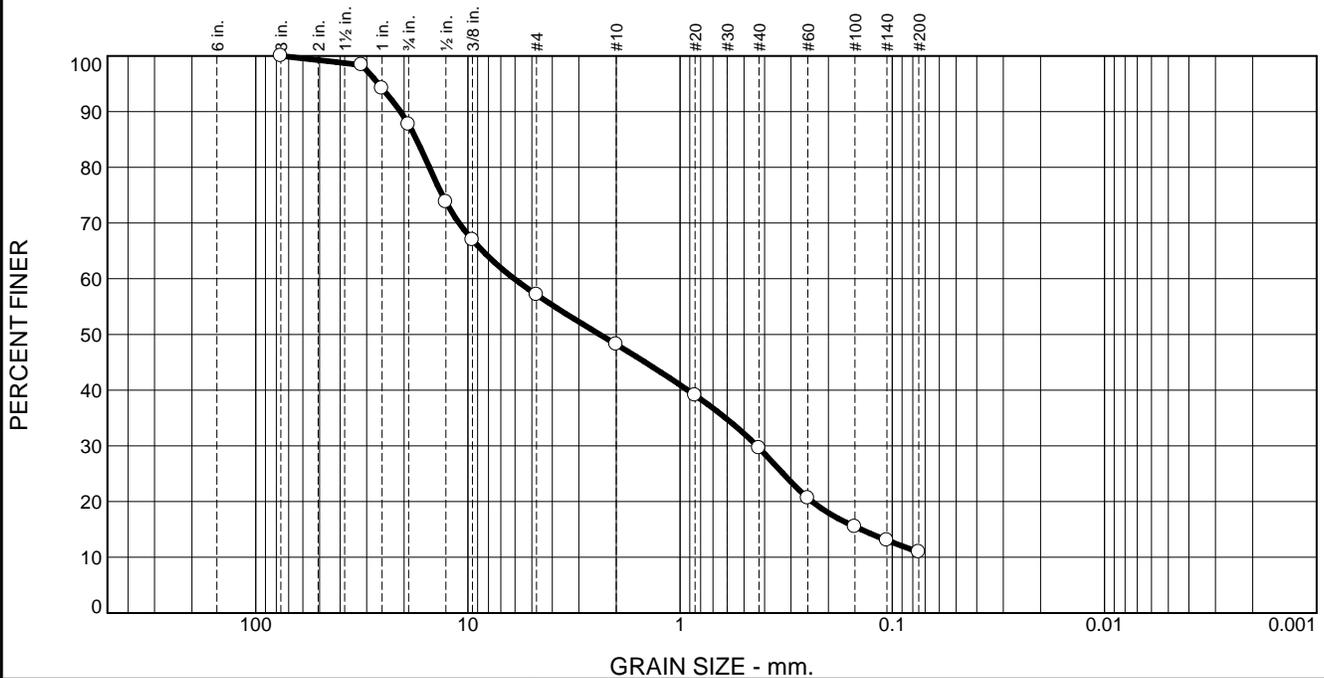
Title: Lab Manager \_\_\_\_\_

Source of Sample: Bluff      Depth: Onsite  
Sample Number: 18

Date Sampled: 4/18/23

<p><b>GeoTest, Inc.</b></p> <p><b>West Allis, WI</b></p>	<p><b>Client:</b> Three Leaf Partners</p> <p><b>Project:</b> Hatland Quarry Apartments</p> <p><b>Project No:</b> 7708</p>	<p><b>Test No</b> 7188-6863</p>
--	---	---------------------------------

# Sieve Analysis Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	12.3	30.6	8.9	18.6	18.7	10.9	

Test Results (ASTM C136 & ASTM C117)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3"	100.0		
1 1/4"	98.4		
1"	94.2		
3/4"	87.7		
1/2"	73.8		
3/8"	67.0		
#4	57.1		
#10	48.2		
#20	39.1		
#40	29.6		
#60	20.6		
#100	15.5		
#140	13.1		
#200	10.9		

\* (no specification provided)

**Material Description**

Brown sand and gravel with topsoil

**Atterberg Limits (ASTM D 4318)**

PL= \_\_\_\_\_ LL= \_\_\_\_\_ PI= \_\_\_\_\_

**Classification**

USCS (D 2487)= \_\_\_\_\_ AASHTO (M 145)= \_\_\_\_\_

**Coefficients**

D<sub>90</sub>= 20.7905      D<sub>85</sub>= 17.4838      D<sub>60</sub>= 6.0538  
D<sub>50</sub>= 2.3916      D<sub>30</sub>= 0.4347      D<sub>15</sub>= 0.1404  
D<sub>10</sub>= \_\_\_\_\_      C<sub>u</sub>= \_\_\_\_\_      C<sub>c</sub>= \_\_\_\_\_

**Remarks**

F.M.=4.23

Date Received: 4/18/23      Date Tested: 4/28/23

Tested By: Craig Englund \_\_\_\_\_

Checked By: Imtiaz Ahmed \_\_\_\_\_

Title: Lab Manager \_\_\_\_\_

Source of Sample: Bluff      Depth: Onsite      Date Sampled: 4/18/23  
Sample Number: 19

<b>GeoTest, Inc.</b>  <b>West Allis, WI</b>	<b>Client:</b> Three Leaf Partners <b>Project:</b> Hatland Quarry Apartments  <b>Project No:</b> 7708 <b>Test No</b> 7189-6864
---	---

September 8, 2023

John Ford  
President  
Three Leaf Partners  
504 W. Juneau Avenue  
Milwaukee WI, 53203



Subject: Geotechnical Slope Stability Analysis  
Hartland Quarry Apartments  
700 W. Capitol Drive, Hartland, Wisconsin

Dear Mr. Ford,

GeoTest, Inc. (GeoTest) has prepared this slope stability analysis for the west, north, and southeast bluffs around the perimeter of the above-referenced property. This report describes the subsurface exploration, laboratory testing, and computer analysis services, and presents our conclusions regarding the slope stability of the perimeter bluffs.

### **Project Description**

Three Leaf Partners is proposing to develop the property located at 700 W. Capitol Drive in the Village of Hartland, Wisconsin. The location of the project is illustrated in Figure 1 in Appendix A. The boundaries of the combined 45-acre property are illustrated in Figure 2 in Appendix A.

The proposed development consists of eighteen separate buildings, including a single-story club house, two-story apartment buildings, and single-story garage buildings. The development will also include parking and drive paved areas and multiple stormwater management devices. The proposed development is illustrated in Figure 3 in Appendix A.

The perimeter bluffs currently have slopes steeper than 1h:1v, with many sections close to 0.75h:1v. The proposed development plan assumes the final slopes will be designed for effectively 2h:1v, with toe buttresses ranging from 4h:1v to 10h:1v.

### **Geotechnical Services Background**

GeoTest completed an initial slope stability analysis for seven selected bluff sections. That analysis (report dated July 17, 2023) concluded that the seven sections will have Factors of Safety ranging from 1.3 to 4.3, based on the preliminary site grading plans. GeoTest also completed a geotechnical subsurface investigation (report dated May 4, 2023). That investigation provided geotechnical design parameters and recommendations related to the construction of buildings, pavements, and stormwater management systems.

## **Scope of Work**

### **Geotechnical Subsurface Exploration**

To advance the slope stability analysis for the most critical bluff sections (along Palmer Drive and Hill Street, and adjacent to the two cemeteries), we initiated a geotechnical exploration program. The locations of the four cross-sections are illustrated on Figure 4 in Appendix A. The drilling scope consisted of four borings (B-1 through B-4) drilled to depths of 60 to 70 feet below the existing ground surface. The boring locations are also identified on Figure 4 in Appendix A.

The borings were drilled using conventional hollow-stem augers to avoid the introduction of drilling fluids into the soil profile. Soil samples were obtained at 5-foot intervals in the borings using split-barrel sampling procedures in general accordance with ASTM D1586. Representative portions of the samples were sealed in glass jars and returned to GeoTest for laboratory testing and classification.

Descriptive logs for each boring, which describe the method of drilling, sample types, sample depths, and observations regarding soil and groundwater conditions, were prepared at the time of sampling. These logs were utilized by a GeoTest geotechnical engineer as an aid to prepare the final logs included in Appendix B.

The ground surface elevations at the boring locations were interpolated from a preliminary topographic map produced by Payne & Dolan. Water level observations, if encountered, were noted on the field logs.

All drilling and sampling procedures are described in Appendix C.

### **Laboratory Testing**

The laboratory testing program consisted of water content testing on all boring samples. In addition, a GeoTest geotechnical engineer examined and visually classified each sample, based on texture and plasticity, in accordance with the Unified Soil Classification System (USCS). The engineer grouped soil samples into strata that are illustrated on the logs.

The notes included on the logs and charts describing the system of classification are included in Appendix B. All laboratory testing procedures are described in Appendix C.

The recovered soil samples will be retained for 60 days after the date of this report. Unless other instructions as to their disposition are received, they will be discarded at that point.

### Soil and Groundwater Conditions

The following narrative is a generalization of the subsurface conditions encountered at the borings. Soil conditions can vary in areas between the sampling locations. For a more-detailed description of the subsurface conditions encountered at each sampling location, please refer to the attached logs in Appendix B.

#### Soil Conditions

The predominant soil profile encountered at the borings (beneath surface topsoil) consisted of stratified layers of native sand and gravel soils with varying clay, silt, cobble, and boulder content. They were classified as SC, SC-SM, SM, SW-SM, and GW-GM. No cohesive (clay or silt) layers were encountered or observed at the borings.

The soils recovered in the borings were similar to the soils (bluff samples) recovered during the May geotechnical investigation.

Buried concrete rubble fill was encountered at the initial location of B-1 (east of Palmer Drive) that caused auger refusal and prompted moving west of Palmer Drive.

The predominant native granular soils generally exhibited medium to very dense relative densities, with N-values ranging from 15 to sampler refusal (greater than 50 for 6 inches). The N-values were the lowest (medium dense) to depths of 3 to 15 feet.

Typically, moisture contents are considered high if they are above 15% in granular soils and above 20% in cohesive soils. The moisture contents in the native granular soils ranged from 1.6% to 12.6%, with an average of 5.5%.

Based on the field and laboratory data, four soil types were selected, with different physical characteristics used in the slope stability analysis. These were defined as follows:

<b>Name</b>	<b>Soil Density</b>	<b>Friction Angle</b>	<b>Description</b>
Soil 1	130 pcf	30 <sup>0</sup>	Medium Dense Sand with Fines
Soil 2	135 pcf	32 <sup>0</sup>	Very Dense Sand with Fines
Soil 3	140 pcf	33 <sup>0</sup>	Dense Sand and/or Gravel
Soil 4	145 pcf	35 <sup>0</sup>	Very Dense Sand and Gravel

The analyzed soil profiles consisting of these four generalized soil types are illustrated on the cross-sections included in Appendix D.

#### Groundwater Conditions

No free groundwater or perched water layers were encountered at the borings. These field observations were consistent with the laboratory testing.

### Analysis and Conclusions

Because of the relatively consistent nature of the soils observed during the May investigation and this additional analysis (granular soils), the additional slope stability analysis considered all field and laboratory data generated from both. The analysis was performed using STABLPRO 2015.4.5. The following table summarizes the results.

Section	Factor of Safety	Representative Boring
1	2.4	1
2	1.5	2
3	1.7	3
4	1.5	4

*Note - The complete output reports and cross-sections for each section analysis are included in Appendix D.*

The above Factor of Safety (FOS) results were assessed by referencing the following section in the USACOE Slope Stability Manual:

*EM 1110-2-1902 31 Oct 03 -*

*3-4. Other Slopes*

*a. Factors of safety. Factors of safety for slopes other than the slopes of dams should be selected consistent with the uncertainty involved in the parameters such as shear strength and pore water pressures that affect the calculated value of factor of safety and the consequences of failure. When the uncertainty and the consequences of failure are both small, it is acceptable to use small factors of safety, on the order of 1.3 or even smaller in some circumstances. When the uncertainties or the consequences of failure increase, larger factors of safety are necessary. Large uncertainties coupled with large consequences of failure represent an unacceptable condition, no matter what the calculated value of the factor of safety. The values of factor of safety listed in Table 3-1 provide guidance but are not prescribed for slopes other than the slopes of new embankment dams. Typical minimum acceptable values of factor of safety are about 1.3 for end of construction and multistage loading, 1.5 for normal long-term loading conditions, and 1.1 to 1.3 for rapid drawdown in cases where rapid drawdown represents an infrequent loading condition. In cases where rapid drawdown represents a frequent loading condition, as in pumped storage projects, the factor of safety should be higher.*

The goal for this project is to create and maintain a minimum FOS of 1.5. The sections analyzed meet these criteria.

The proposed civil design creates minimum slopes of 2H:1V (theoretical) from the tops of each slope to the toes. The design incorporates toe buttresses that will serve to resist slope failures and provide a mid-level horizontal bench top to collect material that may erode from

the upper slope section that will not be remodeled. The proposed slopes of the toe buttresses (minimum 4h:1v) will provide increased FOS.

There are three slope areas that have visual erosion and a lack of vegetation. A fourth area will be removed during site grading. These areas are illustrated on the Photograph Log in Appendix A. A mitigation plan for these three slopes will be addressed in a vegetation management plan prepared by others. These areas will also be specifically targeted to receive additional fills at their buttresses to further reduce the exposed height of the existing slopes.

The USACOE guide also considers Unsatisfactory Slope Performance (Section 1.7), which includes: shear failure, surface sloughing, excessive deformation, liquefaction, and piping. There are several small areas of visible surface sloughing between sections 2 and 6. These areas will be evaluated to determine the source of the sloughing, which appears to be stormwater runoff from adjacent lands.

### **General Qualifications**

The services provided by GeoTest on this project were performed with the degree of skill and care typically performed by other members of the geotechnical engineering profession, practicing in this locale, at this time. No other warranty, expressed or implied, is given.

We appreciate the opportunity to provide geotechnical engineering services for this project. If you have any questions, or require any further assistance, please feel free to contact us.

Sincerely,

*Michael D. Frede, P.E.*

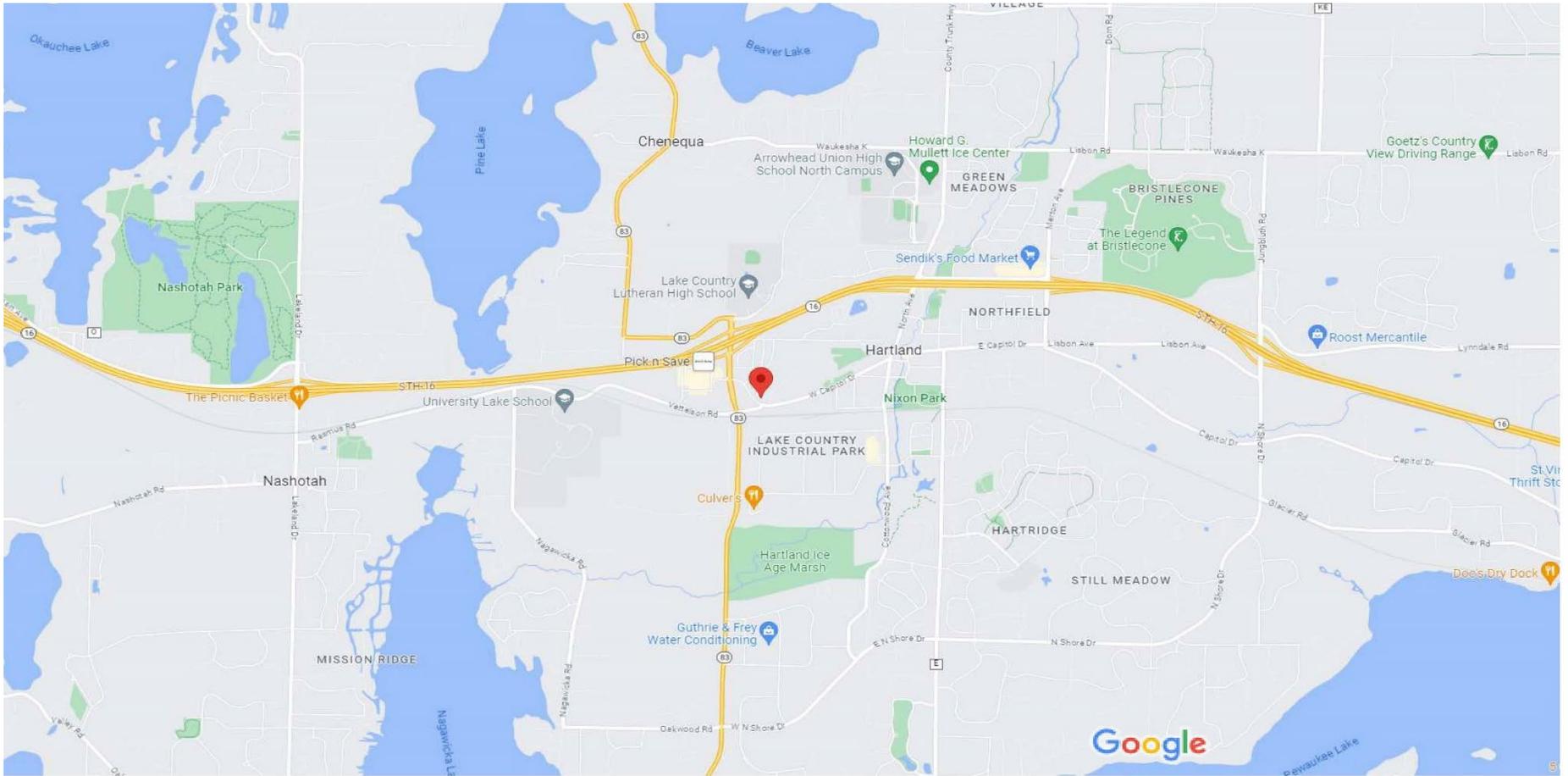
Michael D. Frede, P.E.  
Technical Director/Senior Engineer



## Appendix A

- Figure 1 – Site Location Diagram
- Figure 2 – Property Location Diagram
- Figure 3 – Proposed Development Diagram
- Figure 4 – Boring & Cross-Section Location Diagram
- Photographic Log





Map data ©2023 Google 2000 ft



**Project Name:** Hartland Quarry Apartments  
**Project Location:** 700 W. Capitol Drive  
Hartland, Wisconsin  
Waukesha County

**Project No.:** 7708  
**Date:** 4/29/23  
**Drawn By:** MDF  
**Scale:** NTS

**FIGURE 1**  
**Site Location**  
**Diagram**



**Project Name:** Hartland Quarry Apartments  
**Project Location:** 700 W. Capitol Drive  
 Hartland, Wisconsin  
 Waukesha County

**Project No.:** 7708  
**Date:** 9/5/23  
**Drawn By:** MDF  
**Scale:** NTS

**FIGURE 2**  
**Property Boundary**  
**Diagram**



JLA PROJECT NUMBER: W221013

**HARTLAND QUARRY DEVELOPMENT**  
Plan Commission Submittal

TOTAL LOT: 45.73 ACRES +/-  
DEVELOPABLE AREA: 27.2 ACRES +/-

SUMMARY	
STACKED FLATS (2-8 STORIES) =	240 UNITS
COVERED PARKING =	210 STALLS
DRIVEWAY PARKING =	210 STALLS
STREET PARKING =	48 STALLS
TOWNHOMES (2 STORIES) =	27 UNITS
COVERED PARKING =	54 STALLS
DRIVEWAY PARKING =	54 STALLS
SURFACE PARKING =	6 STALLS
CLUBHOUSE	19 STALLS
VISITATION PARKING =	19 STALLS
<b>TOTAL UNITS =</b>	<b>267 UNITS</b>

**PROGRESS DOCUMENTS**  
These documents reflect progress and are not and shall not be subject to the public records act. These documents are for informational purposes only and shall not be used for any other purpose without the consent of JLA Architects.

DATE OF RELEASE: 09/26/2023

REVISIONS ON SCHEDULE:

NO.	DATE	DESCRIPTION	BY

**ARCHITECTURAL SITE LAYOUT PLAN**

SHEET NUMBER:  
**ASP-100**



RENDERED ARCHITECTURAL SITE PLAN  
1" = 100' 0"



**Project Name:** Hartland Quarry Apartments  
**Project Location:** 700 W. Capitol Drive  
Hartland, Wisconsin  
Waukesha County

**Project No.:** 7708  
**Date:** 9/5/23  
**Drawn By:** MDF  
**Scale:** NTS

**FIGURE 3**  
**Proposed**  
**Development**  
**Diagram**



**Project Name:** Hartland Quarry Apartments  
**Project Location:** 700 W. Capitol Drive  
 Hartland, Wisconsin  
 Waukesha County

**Project No.:** 7708  
**Date:** 9/5/23  
**Drawn By:** MDF  
**Scale:** NTS

**FIGURE 4**  
**Boring & Cross-**  
**Section Location**  
**Diagram**

### Photographic Log

<b>Project:</b> Hartland Quarry Apartments		<b>Client:</b> Three Leaf Partners	<b>Project No.:</b> 7708
<b>Photo No.</b> 1	<b>Date</b> 9-7-23		
<b>Description:</b> Erosion area along Palmer Drive.			

<b>Photo No.</b> 2	<b>Date</b> 9-7-23		
<b>Description:</b> Erosion area near the neighboring barn.			

<b>Project:</b> Hartland Quarry Apartments	<b>Client:</b> Three Leaf Partners	<b>Project No.:</b> 7708
---	---------------------------------------	-----------------------------

<b>Photo No.</b> 3	<b>Date</b> 9-7-23	
<b>Description:</b> Erosion area near the North Point Church Cemetery.		

<b>Photo No.</b> 4	<b>Date</b> 9-7-23	
<b>Description:</b> Erosion area north of the industrial area.		



## Appendix B

- General Notes
- Boring Logs
  - B-1
  - B-2
  - B-3
  - B-4
- Legend
- Unified Soil Classification System (USCS)



## Drilling and Sampling Abbreviations:

<b>AD</b> Solid-Stem Auger	<b>OS</b> Osterberg Sampler, 3-inch-O.D. Shelby Tube
<b>AS</b> Auger Sample	<b>PMT</b> Pressuremeter Test (In Situ)
<b>BS</b> Bulk Sample	<b>RD</b> Rotary Drilling
<b>DD</b> Diamond Core Drilling	<b>SS</b> Split-Spoon Sampler, 1.375-inch-I.D., 2-inch-O.D. (Unless otherwise noted)
<b>FT</b> Fish Tail	<b>ST</b> Shelby Tube Sampler, 2-inch-O.D. (Unless otherwise noted)
<b>GP</b> Geoprobe	<b>VS</b> Vane Shear
<b>GS</b> Giddings Sampler	<b>WOH</b> Weight of Hammer
<b>HA</b> Hand-Auger Drilling	<b>WS</b> Wash Sample
<b>HS</b> Hollow-Stem Auger	

Standard Penetration (“N”): Blows per foot of a 140-pound hammer falling 30 inches on a 2-inch-O.D. split-spoon sampler, except where otherwise noted.

## Water Level Measurement Abbreviations:

<b>AAR</b> After Auger Removal	<b>BCR</b> Before Casing Removal	<b>WS</b> While Sampling
<b>AB</b> After Boring	<b>DCI</b> Dry Cave In	
<b>ACR</b> After Casing Removal	<b>WCI</b> Wet Cave In	
<b>BAR</b> Before Auger Removal	<b>WD</b> While Drilling	
<b>BCI</b> Before Casing Installation	<b>WL</b> Water Level	

Water levels indicated on the boring logs are the levels measured in the boring at the times indicated. In relatively pervious soils, the observed water levels are considered a reliable indicator of groundwater positions. In relatively impervious soils, the accurate determination of groundwater elevations may not be possible, even after several days of observations. In this case, other indicators of groundwater position, such as sealed observation wells or piezometers, may be required.

## Gradation Description and Terminology:

Coarse-grained granular soils have more than 50% of their dry weight retained on a #200 sieve (0.074 mm); they include boulders, cobbles, gravel, sand, and combinations thereof. Fine-grained soils have less than 50% of their dry weight retained on a #200 sieve. Fine-grained granular soils are non-cohesive, and include silt; fine-grained cohesive soils include silty clay, and clay.

Major Component of Sample	Size Range	Description of Components Present in Sample	Percent of Dry Weight
Boulders	Over 8" (200 mm)	Trace	<5
Cobbles	8" to 3" (200 to 75 mm)	Few	5 - 10
Gravel	3" to #4 sieve (75 to 4.76 mm)	Little	15 - 25
Sand	#4 to #200 sieve (4.76 to 0.074 mm)	Some	30 - 45
Silt	Passing #200 sieve (0.074 to 0.005 mm)		
Clay	Smaller than 0.005 mm		

### Consistency of Cohesive Soils

Unconfined Compressive Strength, $Q_u$ , tsf	Consistency
<0.25	Very Soft
0.25 - 0.49	Soft
0.50 - 0.99	Firm
1.00 - 1.99	Stiff
2.00 - 3.99	Very Stiff
>4.00	Hard

### Relative Density of Granular Soils

N, Blows per 12 inches	Relative Density
0 - 3	Very Loose
4 - 9	Loose
10 - 29	Medium Dense
30 - 49	Dense
50 - 80	Very Dense
>80	Extremely Dense



Client: Three Leaf Partners  
 Project: Hartland Quarry Apts, #7708  
 Address: 700 W. Capitol Drive, Hartland, WI

**BORING LOG**  
 Boring No. B-1  
 Page: 1 of 3

Drilling Start Date: 8/11/23  
 Drilling End Date: 8/11/23  
 Drilling Company: PTS  
 Drilling Method: Hollow Stem Auger  
 Drilling Equipment: CME55/Geoprobe 7822DT  
 Driller: Brian Szydzik/Jed Vela  
 Logged By: Michael Frede

Boring Depth (ft): 60  
 Boring Diameter (in): 6.0  
 Sampling Method(s): Split Spoon  
 DTW During Drilling (ft): N/A  
 DTW After Drilling (ft): N/A  
 Ground Surface Elev. (ft): 1007  
 Location (Lat, Long): 43.10481, -88.35907

DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%										
0																
0.00'						(0.00') Topsoil: 6 inches of Sandy Topsoil										
0.50'						(0.50') Clayey SAND (SC); mostly fine-coarse grained sand, few fine-coarse gravel, few silt, little clay, well-graded, medium dense, slightly moist, brown	6.4									1005
3.00'						(3.00') Silty, Clayey SAND and gravel (SC-SM); mostly fine-coarse grained sand, little fine-coarse gravel, little silt, little clay, well-graded, dense, slightly moist, brown, occasional cobbles	6									
9.50'							9.5									
14.00'							1.6									
22.00'						(22.00') Silty SAND with gravel (SM); mostly fine-coarse grained sand, little fine-coarse gravel, little silt, few clay, well-graded, very dense, slightly moist, brown, occasional cobbles	2.7									985

NOTES:



Client: Three Leaf Partners  
 Project: Hartland Quarry Apts, #7708  
 Address: 700 W. Capitol Drive, Hartland, WI

**BORING LOG**  
 Boring No. B-1  
 Page: 2 of 3

Drilling Start Date: 8/11/23	Boring Depth (ft): 60
Drilling End Date: 8/11/23	Boring Diameter (in): 6.0
Drilling Company: PTS	Sampling Method(s): Split Spoon
Drilling Method: Hollow Stem Auger	DTW During Drilling (ft): N/A
Drilling Equipment: CME55/Geoprobe 7822DT	DTW After Drilling (ft): N/A
Driller: Brian Szydzik/Jed Vela	Ground Surface Elev. (ft): 1007
Logged By: Michael Frede	Location (Lat, Long): 43.10481, -88.35907

DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%										
25						(22.00') Silty SAND with gravel (SM); mostly fine-coarse grained sand, little fine-coarse gravel, little silt, few clay, well-graded, very dense, slightly moist, brown, occasional cobbles										980
			SS	50		(26.00') Well-graded GRAVEL with silt and sand (GW-GM); mostly fine-coarse grained gravel, some fine-coarse sand, few silt, very dense, slightly moist, brown, occasional cobbles and boulders										
30																
			SS	17	0.30	50		3.9								
35																
			SS	8	0.30	69		2.3								
40																
			SS	19		50										
45																
			SS	33	0.50	69		2.3								
50																
			SS	19		50										
			SS	50												

NOTES:



Client: Three Leaf Partners  
 Project: Hartland Quarry Apts, #7708  
 Address: 700 W. Capitol Drive, Hartland, WI

**BORING LOG**  
 Boring No. B-1  
 Page: 3 of 3

Drilling Start Date: 8/11/23	Boring Depth (ft): 60
Drilling End Date: 8/11/23	Boring Diameter (in): 6.0
Drilling Company: PTS	Sampling Method(s): Split Spoon
Drilling Method: Hollow Stem Auger	DTW During Drilling (ft): N/A
Drilling Equipment: CME55/Geoprobe 7822DT	DTW After Drilling (ft): N/A
Driller: Brian Szydzik/Jed Vela	Ground Surface Elev. (ft): 1007
Logged By: Michael Frede	Location (Lat, Long): 43.10481, -88.35907

DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%										
50	Well-graded GRAVEL with silt and sand (GW-GM); mostly fine-coarse grained gravel, some fine-coarse sand, few silt, very dense, slightly moist, brown, occasional cobbles and boulders					(26.00') Well-graded GRAVEL with silt and sand (GW-GM); mostly fine-coarse grained gravel, some fine-coarse sand, few silt, very dense, slightly moist, brown, occasional cobbles and boulders	3.4								955	
55		SS	50													950
60			SS	50	0.10										945	
65						(60.00') Boring terminated									940	
70															935	
75																

NOTES:



Client: Three Leaf Partners  
 Project: Hartland Quarry Apts, #7708  
 Address: 700 W. Capitol Drive, Hartland, WI

**BORING LOG**  
 Boring No. B-2  
 Page: 1 of 3

Drilling Start Date: 8/8/23  
 Drilling End Date: 8/8/23  
 Drilling Company: PTS  
 Drilling Method: Hollow Stem Auger  
 Drilling Equipment: CME55/Geoprobe 7822DT  
 Driller: Brian Szydzik/Jed Vela  
 Logged By: Michael Frede

Boring Depth (ft): 70  
 Boring Diameter (in): 6.0  
 Sampling Method(s): Split Spoon  
 DTW During Drilling (ft): N/A  
 DTW After Drilling (ft): N/A  
 Ground Surface Elev. (ft): 1025  
 Location (Lat, Long): 43.10544, -88.35778

DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%										
0																1025
0.00'							(0.00') Topsoil: 4 inches of Sandy Topsoil									
0.50'							(0.50') Silty SAND with gravel (SM); mostly fine-coarse grained sand, little fine-coarse gravel, little silt, well-graded, medium dense, slightly moist, brown, occasional cobbles	6.3								
7	SS		7	0.80	15											
8																
5	SS		5	0.70	19			5.9								1020
9																
10																
10	SS		11	0.70	30			4.5								1015
13																
17																
15	SS		50				(13.00') Well-graded GRAVEL with silt and sand (GW-GM); mostly fine-coarse grained gravel, some fine-coarse sand, few silt, very dense, slightly moist, brown, occasional cobbles and boulders									1010
20																
20	SS		5	0.40	50			5.5								1005
50																
25	SS		50													

NOTES:



Client: Three Leaf Partners  
 Project: Hartland Quarry Apts, #7708  
 Address: 700 W. Capitol Drive, Hartland, WI

**BORING LOG**  
 Boring No. B-2  
 Page: 2 of 3

Drilling Start Date: 8/8/23	Boring Depth (ft): 70
Drilling End Date: 8/8/23	Boring Diameter (in): 6.0
Drilling Company: PTS	Sampling Method(s): Split Spoon
Drilling Method: Hollow Stem Auger	DTW During Drilling (ft): N/A
Drilling Equipment: CME55/Geoprobe 7822DT	DTW After Drilling (ft): N/A
Driller: Brian Szydzik/Jed Vela	Ground Surface Elev. (ft): 1025
Logged By: Michael Frede	Location (Lat, Long): 43.10544, -88.35778

DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%										
25						(13.00') Well-graded GRAVEL with silt and sand (GW-GM); mostly fine-coarse grained gravel, some fine-coarse sand, few silt, very dense, slightly moist, brown, occasional cobbles and boulders										1000
27			SS	19	0.20	59		8.6								995
30				27												
32				32												
35							(31.00') Silty SAND (SM); mostly fine-coarse grained sand, few fine-coarse gravel, little silt, well-graded, dense, slightly moist, brown									
35			SS	10	0.30	33		10.2								990
38				15												
40				18												
40			SS	16	1.00	44		4.4								985
42				21												
43				23												
45			SS	8	0.70	70	(42.00') Well-graded GRAVEL with silt and sand (GW-GM); mostly fine-coarse grained gravel, some fine-coarse sand, few silt, very dense, slightly moist, brown	4.9								980
48				20												
50				50												
50			SS	50												

NOTES:



Client: Three Leaf Partners  
 Project: Hartland Quarry Apts, #7708  
 Address: 700 W. Capitol Drive, Hartland, WI

**BORING LOG**  
 Boring No. B-2  
 Page: 3 of 3

Drilling Start Date: 8/8/23  
 Drilling End Date: 8/8/23  
 Drilling Company: PTS  
 Drilling Method: Hollow Stem Auger  
 Drilling Equipment: CME55/Geoprobe 7822DT  
 Driller: Brian Szydzik/Jed Vela  
 Logged By: Michael Frede

Boring Depth (ft): 70  
 Boring Diameter (in): 6.0  
 Sampling Method(s): Split Spoon  
 DTW During Drilling (ft): N/A  
 DTW After Drilling (ft): N/A  
 Ground Surface Elev. (ft): 1025  
 Location (Lat, Long): 43.10544, -88.35778

DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%										
50						(42.00') Well-graded GRAVEL with silt and sand (GW-GM); mostly fine-coarse grained gravel, some fine-coarse sand, few silt, very dense, slightly moist, brown										975
55			SS	11	0.80	37	(51.00') Well-graded SAND with silt and gravel (SW-SM); mostly fine-coarse grained sand, little fine-coarse gravel, few silt, dense, slightly moist, brown	9.6								970
60			SS	16	0.30	50	(57.00') Well-graded GRAVEL with silt and sand (GW-GM); mostly fine-coarse grained gravel, some fine-coarse sand, few silt, very dense, slightly moist, brown, occasional cobbles and boulders	8.9								965
65			SS	50	0.10			2.3								960
70			SS	22	0.30	50		5								955
75						(70.00') Boring terminated										

NOTES:



Client: Three Leaf Partners  
 Project: Hartland Quarry Apts, #7708  
 Address: 700 W. Capitol Drive, Hartland, WI

**BORING LOG**  
 Boring No. B-3  
 Page: 1 of 3

Drilling Start Date: 8/9/23  
 Drilling End Date: 8/9/23  
 Drilling Company: PTS  
 Drilling Method: Hollow Stem Auger  
 Drilling Equipment: CME55/Geoprobe 7822DT  
 Driller: Brian Szydzik/Jed Vela  
 Logged By: Michael Frede

Boring Depth (ft): 70  
 Boring Diameter (in): 6.0  
 Sampling Method(s): Split Spoon  
 DTW During Drilling (ft): N/A  
 DTW After Drilling (ft): N/A  
 Ground Surface Elev. (ft): 1022  
 Location (Lat, Long): 43.10538, -88.35464

DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT			SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)
			Sample Type	Blow Counts	Recovery (ft)										
0						(0.00') Topsoil: 5 inches of Sandy Topsoil									
0.50			SS	5	0.80	15	(0.50') Silty, Clayey SAND (SC-SM); mostly fine-coarse grained sand, few fine-coarse gravel, little silt, little clay, well-graded, medium dense, slightly moist, brown	4.6							1020
3.00			SS	5	1.20	33	(3.00') Silty SAND with gravel (SM); mostly fine-coarse grained sand, little fine-coarse gravel, little silt, well-graded, dense, slightly moist, brown, occasional cobbles and boulders	6							1015
15.00			SS	15		41									1010
18.00			SS	7	0.70	41		8.1							1005
20.00			SS	5	1.00	39	(20.00') Well-graded GRAVEL with silt and sand (GW-GM); mostly fine-coarse grained gravel, some fine-coarse sand, few silt, well-graded, very dense, slightly moist, brown, occasional cobbles and boulders	6.3							1000
25.00			SS	10	0.80	58		3.8							

NOTES:



Client: Three Leaf Partners  
 Project: Hartland Quarry Apts, #7708  
 Address: 700 W. Capitol Drive, Hartland, WI

**BORING LOG**  
 Boring No. B-3  
 Page: 2 of 3

Drilling Start Date: 8/9/23  
 Drilling End Date: 8/9/23  
 Drilling Company: PTS  
 Drilling Method: Hollow Stem Auger  
 Drilling Equipment: CME55/Geoprobe 7822DT  
 Driller: Brian Szydzik/Jed Vela  
 Logged By: Michael Frede

Boring Depth (ft): 70  
 Boring Diameter (in): 6.0  
 Sampling Method(s): Split Spoon  
 DTW During Drilling (ft): N/A  
 DTW After Drilling (ft): N/A  
 Ground Surface Elev. (ft): 1022  
 Location (Lat, Long): 43.10538, -88.35464

DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%										
25						(20.00') Well-graded GRAVEL with silt and sand (GW-GM); mostly fine-coarse grained gravel, some fine-coarse sand, few silt, well-graded, very dense, slightly moist, brown, occasional cobbles and boulders										995
			SS	50												
30						(30.00') Well-graded SAND with silt and gravel (SW-SM); mostly fine-coarse grained sand, little fine-coarse gravel, few silt, dense, slightly moist, brown										990
			SS	17	0.20	48		4.3								
				22												
				26												985
35																
			SS	18	0.50	43		3.1								
				20												
				23												980
40																
			SS	17	0.80	36	(41.00') Silty SAND with gravel (SM); mostly fine-coarse grained sand, little fine-coarse gravel, little silt, well-graded, dense, slightly moist, brown	3.4								
				15												
				21												975
45																
			SS	16	0.20	50		2.6								
				50												
50																

NOTES:



Client: Three Leaf Partners  
 Project: Hartland Quarry Apts, #7708  
 Address: 700 W. Capitol Drive, Hartland, WI

**BORING LOG**  
 Boring No. B-3  
 Page: 3 of 3

Drilling Start Date: 8/9/23	Boring Depth (ft): 70
Drilling End Date: 8/9/23	Boring Diameter (in): 6.0
Drilling Company: PTS	Sampling Method(s): Split Spoon
Drilling Method: Hollow Stem Auger	DTW During Drilling (ft): N/A
Drilling Equipment: CME55/Geoprobe 7822DT	DTW After Drilling (ft): N/A
Driller: Brian Szydzik/Jed Vela	Ground Surface Elev. (ft): 1022
Logged By: Michael Frede	Location (Lat, Long): 43.10538, -88.35464

DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%										
50	Well-graded GRAVEL with silt and sand (GW-GM); mostly fine-coarse grained gravel, some fine-coarse sand, few silt, well-graded, very dense, slightly moist, brown, occasional cobbles and boulders					(49.00') Well-graded GRAVEL with silt and sand (GW-GM); mostly fine-coarse grained gravel, some fine-coarse sand, few silt, well-graded, very dense, slightly moist, brown, occasional cobbles and boulders										970
55		SS	27	0.60	56		6.2									
			22													
			34													
60		SS	10	0.70	52		5.3									
		28														
		24														
65	SS	13	0.20	50	4.2											
		50														
70	SS	19	0.30	50	6											
		50														
						(70.00') Boring terminated										950
75																

NOTES:



Client: Three Leaf Partners  
 Project: Hartland Quarry Apts, #7708  
 Address: 700 W. Capitol Drive, Hartland, WI

**BORING LOG**  
 Boring No. B-4  
 Page: 1 of 3

Drilling Start Date: 8/10/23  
 Drilling End Date: 8/10/23  
 Drilling Company: PTS  
 Drilling Method: Hollow Stem Auger  
 Drilling Equipment: CME55/Geoprobe 7822DT  
 Driller: Brian Szydzik/Jed Vela  
 Logged By: Michael Frede

Boring Depth (ft): 70  
 Boring Diameter (in): 6.0  
 Sampling Method(s): Split Spoon  
 DTW During Drilling (ft): N/A  
 DTW After Drilling (ft): N/A  
 Ground Surface Elev. (ft): 1022  
 Location (Lat, Long): 43.10332, -88.35357

DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT			SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)
			Sample Type	Blow Counts	Recovery (ft)										
0															
8	SS		8	0.70	28	(0.50') Silty SAND (SM); mostly fine-coarse grained sand, few fine-coarse gravel, little silt, well-graded, medium dense, slightly moist, brown, occasional cobbles	12.6								1020
18			10												
5	SS		5	0.80	14		10.4								1015
6			8												
10	SS		4	0.60	15		8.9								1010
5			5												
15	SS		9	0.70	29		9.2								1005
14			15												
20	SS		13	0.40	28	(20.00') Well-graded SAND with silt and gravel (SW-SM); mostly fine-coarse grained sand, little fine-coarse gravel, few silt, dense, slightly moist, brown, occasional cobbles and boulders	8.7								1000
14			14												
25	SS		19	0.30	44		1.6								
21			21												
23			23												

NOTES:



Client: Three Leaf Partners  
 Project: Hartland Quarry Apts, #7708  
 Address: 700 W. Capitol Drive, Hartland, WI

**BORING LOG**  
 Boring No. B-4  
 Page: 2 of 3

Drilling Start Date: 8/10/23  
 Drilling End Date: 8/10/23  
 Drilling Company: PTS  
 Drilling Method: Hollow Stem Auger  
 Drilling Equipment: CME55/Geoprobe 7822DT  
 Driller: Brian Szydzik/Jed Vela  
 Logged By: Michael Frede

Boring Depth (ft): 70  
 Boring Diameter (in): 6.0  
 Sampling Method(s): Split Spoon  
 DTW During Drilling (ft): N/A  
 DTW After Drilling (ft): N/A  
 Ground Surface Elev. (ft): 1022  
 Location (Lat, Long): 43.10332, -88.35357

DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%										
25																995
						(20.00') Well-graded SAND with silt and gravel (SW-SM); mostly fine-coarse grained sand, little fine-coarse gravel, few silt, dense, slightly moist, brown, occasional cobbles and boulders										
			SS	12	0.30	50		4.7								
30				50												
						(32.00') Silty SAND (SM); mostly fine-coarse grained sand, few fine-coarse gravel, little silt, well-graded, dense, slightly moist, brown										990
			SS	15	0.40	43		2.7								
35				18												
				25												985
			SS	14	0.50	45		2.9								
40				15												
				30												980
			SS	9	0.80	47		3.5								
45				20												
				27												
						(46.00') Well-graded GRAVEL with silt and sand (GW-GM); mostly fine-coarse grained gravel, some fine-coarse sand, few silt, very dense, slightly moist, brown, occasional cobbles and boulders										975
			SS	15	0.30	50		7.2								
50				50												

NOTES:



Client: Three Leaf Partners  
 Project: Hartland Quarry Apts, #7708  
 Address: 700 W. Capitol Drive, Hartland, WI

**BORING LOG**  
 Boring No. B-4  
 Page: 3 of 3

Drilling Start Date: 8/10/23	Boring Depth (ft): 70
Drilling End Date: 8/10/23	Boring Diameter (in): 6.0
Drilling Company: PTS	Sampling Method(s): Split Spoon
Drilling Method: Hollow Stem Auger	DTW During Drilling (ft): N/A
Drilling Equipment: CME55/Geoprobe 7822DT	DTW After Drilling (ft): N/A
Driller: Brian Szydzik/Jed Vela	Ground Surface Elev. (ft): 1022
Logged By: Michael Frede	Location (Lat, Long): 43.10332, -88.35357

DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%										
50	Well-graded GRAVEL with silt and sand (GW-GM); mostly fine-coarse grained gravel, some fine-coarse sand, few silt, very dense, slightly moist, brown, occasional cobbles and boulders					(46.00') Well-graded GRAVEL with silt and sand (GW-GM); mostly fine-coarse grained gravel, some fine-coarse sand, few silt, very dense, slightly moist, brown, occasional cobbles and boulders										970
55		SS	12	0.50	67		5.2									
			17													
			50													
60		SS	20	0.50	52		5.3									
		19														
		33														
65																960
		SS	50													955
70																950
		SS	18	0.30	50	5										
		50														
						(70.00') Boring terminated										
75																

NOTES:



## BORING AND WELL LOG LEGEND

	<p><b>SURFACE</b>          ASPHALT          CONCRETE          FILL          TOPSOIL          AIR          ICE</p> <p><b>USCS</b>          Well-graded GRAVEL (GW)          Poorly graded GRAVEL (GP)          Silty GRAVEL (GM)          Clayey GRAVEL (GC)          Silty, Clayey GRAVEL (GC-GM)          Well-graded GRAVEL with silt (GW-GM)          Poorly graded GRAVEL with silt (GP-GM)          Well-graded GRAVEL with clay (GW-GC)          Poorly graded GRAVEL with clay (GP-GC)          Well-graded SAND (SW)          Poorly graded SAND (SP)          Silty SAND (SM)          Clayey SAND (SC)          Silty, Clayey SAND (SC-SM)          Well-graded SAND with silt (SW-SM)          Poorly graded SAND with silt (SP-SM)          Well-graded SAND with clay (SW-SC)          Poorly graded SAND with clay (SP-SC)          SILT (ML)          Lean CLAY (CL)          Silty CLAY (CL-ML)          Organic SOIL (OL)          Elastic SILT (MH)          Fat CLAY (CH)          Organic SOIL (OH)          Organic SOIL (OL/OH)          PEAT (PT)          BEDROCK          IGNEOUS Rock          METAMORPHIC Rock          SEDIMENTARY Rock          WATER</p> <p><b>Non-USCS</b>          Gravel          Sand          Silt          Clayey Silt          Silt &amp; Clay          Clay &amp; Silt          Silty Clay          Clay          Boulders          Cobbles          Peastone          Glacial Till          Iron Ore          Wood          Peat          Saprolite          Ash          Waste</p>		<p><b>Volume Descriptors</b>          Trace = &lt;5%          Few = 5-10%          Little = 15-25%          Some = 30-45%          Mostly = &gt;=50%</p> <p><b>Water Levels</b>   Water Level During Drilling   Water Level at End of Drilling/in Completed Well</p> <p><b>Well/Boring Completion</b>   Cap   Riser   Screen   End Plug   Annular Seal   Sanitary Seal (Bentonite Slurry/Chips/Pellets/Powder, Other)   Filter Pack (Sand, Gravel, Other)   Backfill</p> <p><b>Sample Type</b>   GR Grab   EN Encore   SS Split Spoon   SH Shelby Tube   CO Core Barrel   DP Direct Push   ID Lab Sample and ID</p> <p>NOTES:          - The boring was backfilled with soils cuttings and bentonite chips upon completion.          - The stratification lines represent approximate boundaries between soil types          - The elevations are considered accurate to 1/2 foot.</p>
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# Unified Soil Classification System (USCS)



Major Divisions		Group symbols	Typical Names	Laboratory classification criteria			
Coarse-grained soils (More than half of material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 percent . . . . . GW, GP, SW, SP More than 12 percent . . . . . GM, GC, SM, SC 5 to 12 percent . . . . . Borderline cases requiring dual symbols	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3		
		GP	Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW		
		GM u d	Silty gravels, gravel-sand-silt mixtures		Above "A" line with P.I. Between 4 and 7 are borderline cases requiring use of dual symbols		
						GC	Clayey gravels, gravel-sand-clay mixtures
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW		Well-graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			SP		Poorly graded sands, gravelly sands, little or no fines	Note meeting all gradation requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM u d		Silty sand, sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in hatched zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
		Fine-grained soils (More than half of material is smaller than No. 200 sieve size)	Silt and clays (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	
					CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays	
OL	Organic silts and organic silty clays of low plasticity						
Silt and clays (Liquid limit greater than 50)	MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soil, elastic silts				
	CH		Inorganic clays of high plasticity, fat clays				
	OH		Organic clays of medium to high plasticity, organic silts				
Highly organic soils	Pt		Peat and other highly organic soils				



## Appendix C

- Drilling Procedures
- Sampling Procedures
- Laboratory Procedures



## **Hand-Auger Drilling (HA)**

A sampling device is driven into the soil to the desired sample depth by a sledge hammer. After extracting the sample, the hole is advanced by a hand auger until the next sampling depth is reached. The manual driving of the sampler, especially into cohesive soils, may result in some sample disturbance. However, there are some situations where this method is the only viable option.

## **Solid-Stem Auger Drilling (AD)**

Continuous flight augers are turned and hydraulically advanced by a truck- or track-mounted unit to create a borehole. In solid-stem auger drilling, casing and drilling mud are not typically used to maintain an open borehole.

## **Hollow-Stem Auger Drilling (HS)**

Continuous flight augers having open stems are used to advance the borehole. The open stem allows the sampling tool to be used without removing the augers from the borehole. Hollow-stem augers maintain an open borehole during the sampling operations. This sampling method is not appropriate for geotechnical investigation beneath the water table, especially in granular soils.

## **Rotary Drilling (RD)**

Various cutting bits, in conjunction with circulating drilling fluid, are used to advance the borehole. Surface casing is used to maintain sidewall stability in the top several meters of the borehole, and to facilitate the circulation of the drilling fluid into the mud tank.

## **Diamond Core Drilling (DD)**

A double-tube or triple-tube core barrel with a diamond bit cuts an annular space around a cylinder of rock or cemented material. When the coring has proceeded to the desired core run length, the core is broken off and the sample is retained by a core catcher just above the diamond bit. Samples recovered by this procedure are placed in sturdy core boxes in sequential order.

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### **Auger Sampling (AS)**

Soil samples are obtained as cuttings from the auger flights as they are lifted from the borehole. Auger samples provide a general indication of subsurface conditions; however, they do not provide undisturbed samples, nor do they provide samples from specific depths. Due to the possible loss of soil components, or the mixing of soil components from various elevations, auger samples may not be representative of in-situ soil conditions.

### **Split-Barrel Sampling (SS) - ASTM Standard D-1586-84**

A 2-inch-O.D. split-barrel sampler is driven into the soil a distance of 18 inches by a 140-pound hammer free-falling 30 inches. The first 6 inches of penetration is usually considered a seating drive. The Standard Penetration Resistance value is the number of blows of the hammer over the final 12 inches of driving. This value provides an indication of the in-place relative density of granular soils. The indication should be considered qualitative, since many variables such as drill crews, drill rigs, drilling procedures, and hammer-rod-sampler assemblies can significantly affect the Standard Penetration Resistance value. A representative portion of the soil sample is recovered from the split-barrel sampler, placed in a sample jar, and delivered to our laboratory for further examination and possible testing.

### **Shelby Tube Sampling Procedure (ST) - ASTM Standard D-1587-83**

A 2- or 3-inch-diameter thin-walled seamless steel tube having a sharp cutting edge is hydraulically pushed into the soil to obtain a relatively undisturbed sample. This procedure is generally used for cohesive soils. The Shelby tubes are carefully handled to minimize sample disturbance, and delivered to a laboratory where the soil is extruded from the tube, examined, and tested.

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# Soil Sampling Methods

American Society for Testing and Materials

## ASTM 1586

### Standard Method for Penetration Test and Split-Barrel Sampling of Soils<sup>1</sup>

This standard is issued under the fixed designation D 1586; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of the last revision. A number in parentheses indicates the year of the last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

This method has been approved for use by agencies of the Department of Defense and for listing in the DOD Index of Specifications and Standards.

#### 1. Scope

1.1 This method describes the procedure, generally known as the Standard Penetration (SPT), for driving a split-barrel sampler to obtain a representative soil sample and a measure of the resistance of the soil to penetration of the sampler.

1.2 This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of whoever uses this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. For a specific precautionary statement, see 5.4.1.

1.3 The values stated in inch-pound units are to be regarded as the standard.

#### 2. Applicable Documents

##### 2.1 ASTM Standards:

D2487 Test Method for Classification of Soils for Engineering Purposes<sup>2</sup>

D2488 Practice for Description and Identification of Soils (Visual-Manual Procedure)<sup>2</sup>

D4220 Practice for Preserving and Transporting Soil Samples<sup>2</sup>

#### 3. Descriptions of Terms Specific to This Standard

3.1 anvil—that portion of the drive-weight assembly while the hammer strikes and through which the hammer energy passes into the drill rods.

3.2 cathead—the rotating drum or windlass in the rope-cathead lift system around which the operator wraps a rope to lift and drop the hammer by succes-

sively tightening and loosening the rope turns around the drum

3.3 drill rods—rods used to transmit downward force and torque to the drill bit while drilling a borehole.

3.4 drive-weight assembly—a device consisting of the hammer, hammer fall guide, the anvil, any hammer drop system.

3.5 hammer—that portion of the drive-weight assembly consisting of the  $140 \pm 2$  lb ( $63.5 \pm 1$  kg) impact weight which is successfully lifted and dropped to provide the energy that accomplishes the sampling and penetration.

3.6 hammer drop system—that portion of the drive-weight assembly by which the operator accomplishes the lifting and dropping of the hammer to produce the blow.

3.7 hammer fall guide—that part of the drive-weight assembly used to guide the fall of the hammer.

3.8 N-value—the blowcount representation of the penetration resistance of the soil. The N-value, reported in blows per foot, equals the sum of the number of blows required to drive the sampler over the depth interval of 6 to 18 in. (150 to 450 mm) (see 7.3).

3.9  $\Delta N$ —the number of blows obtained from each of the 6-in. (150-mm) intervals of sampler penetration (see 7.3).

3.10 number of rope turns—the total contact angle between the rope and the cathead at the beginning of the operator's rope slackening to drop the hammer; divided by  $360^\circ$  (see Fig. 1).

3.11 sampling rods—rods that connect the drive-weight assembly to the sampler. Drill rods are often used for this purpose.

3.12 SPT—abbreviation for Standard Penetration Test, a term by which engineers commonly refer to this method.

#### 4. Significance and Use

4.1 This method provides a soil sample for identification purposes and for laboratory tests appropriate for soil obtained from a sampler that may produce large shear strain disturbance in the sample.

4.2 This method is used extensively in a great variety of geotechnical exploration projects. Many local correlations and widely published correlations which relate SPT blowcount, or N-value, and the engineering behavior of earthworks and foundation are available.

#### 5. Apparatus

5.1 Drilling Equipment—Any drilling equipment that provides at the time of sampling a suitably clean open hole before insertion of the sampler and ensures that the penetration test is performed on undisturbed soil shall be acceptable. The following pieces of equipment have proven to be suitable for advancing a borehole in some subsurface conditions.

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<sup>1</sup>This method is under the jurisdiction of ASTM Committee D-18 on Soil and Rock and is the direct responsibility of subcommittee D18.02 on Sampling and Related Field Testing for Soil Investigations.

Current edition approved Sept. 11, 1984. Published November 1984. Originally published as D1586-58T. Last previous edition D1586-67 (1974).

<sup>2</sup>Annual Book of ASTM Standards, Vol 04.08.

5.1.1 Drag, Chopping and Fishtail Bits, less than 6.5 in. (162 mm) and greater than 2.2 in. (56 mm) in diameter may be used in conjunction with open-hole rotary drilling or casing-advance-ment drilling methods. To avoid disturbance of the underlying soil, bottom discharge bits are not permitted; only side discharging bits are permitted.

5.1.2 Roller-Cone Bits, less than 6.5 in. (162 mm) and greater than 2.2 in. (56 mm) in diameter may be used in conjunction with open-hole rotary drilling or casing-advance-ment drilling methods if the drilling fluid discharge is deflected.

5.1.3 Hollow-Stem Continuous Flight Augers, with or without a center bit assembly, may be used to drill the boring. The inside diameter of the hollow-stem augers shall be less than 6.5 in. (162 mm) and greater than 2.2 in. (56 mm).

5.1.4 Solid, Continuous Flight, Bucket and Hand Augers, less than 6.5 in. (162 mm) and greater than 2.2 in. (56 mm) in diameter may be used if the soil on the side of the boring does not cave into the sampler or sampling rods during the sampling.

5.2 Sampling Rods--Flush-joint steel drill rods shall be used to connect the split-barrel sampler to the drive-weight assembly. The sampling rod shall have a stiffness (moment of inertia) equal to or greater than that of a parallel wall "A" rod (a steel rod which has an outside diameter of 1 5/8 in. (41.2 mm) and an inside diameter of 1 1/8 in. (28.5 mm)).

NOTE 1--Recent research and comparative testing indicates the type rod used, with stiffness ranging from "A" size rod to "N" size rod, will usually have a negligible effect on the N-values to depths of at least 100 ft. (30 m).

5.3 Split-Barrel Sampler--The sampler shall be constructed with the dimensions indicated in Fig. 2. The driving shoe shall be hardened steel and shall be replaced or repaired when it becomes dented or distorted. The use of liners to produce a constant inside diameter of 1 3/8 in. (35 mm) is permitted, but shall be noted on the penetration record if used. The use of a sampler retainer basket is permitted, and should also be noted on the penetration record if used.

NOTE 2--Both theory and available test data suggest that N-values may increase 10 to 30% when liners are used.

#### 5.4 Drive-Weight Assembly:

5.4.1 Hammer and Anvil--The hammer shall weigh  $140 \pm 2$  lb ( $63.5 \pm 1$  kg) and shall be a solid rigid metallic mass. The hammer shall strike the anvil and make steel on steel contact when it is dropped. A hammer fall guide permitting a free fall shall be used. Hammers used with the cathead and rope method shall have an unimpeded overlift capacity of at least 4 in. (100 mm). For safety reasons, the use of hammer assembly with an internal anvil is encouraged.

NOTE 3--It is suggested that the hammer fall guide be permanently marked to enable the operator or inspector to judge the hammer drop height.

5.4.2 Hammer Drop System--Rope-cathead, trip, semi-automatic, or automatic hammer drop systems may be used, providing the lifting apparatus will not cause penetration of the sampler while re-engaging and lifting the hammer.

5.5 Accessory Equipment--Accessories such as labeled, sample containers, data sheets, and groundwater level measuring devices shall be provided in accordance with the requirements of the project and other ASTM standards.

### 6. Drilling Procedure

6.1 The boring shall be advanced incrementally to permit intermittent or continuous sampling. Test intervals and locations are normally stipulated by the project engineer or geologist. Typically, the intervals selected are 5 ft. (1.5 m) or less in homogeneous strata with test and sampling locations at every change of strata.

6.2 Any drilling procedure that provides a suitably clean and stable hole before insertion of the sampler and assures that the penetration test is performed on essentially undisturbed soil shall be acceptable. Each of the following procedures have proven to be acceptable for some subsurface conditions. The subsurface conditions anticipated should be considered when selecting the drilling method to be used.

6.2.1 Open-hole rotary drilling method.

6.2.2 Continuous flight hollow-stem auger method.

6.2.3 Wash boring method.

6.2.4 Continuous flight solid auger method.

6.3 Several drilling methods produce unacceptable borings. The process of jetting through an open tube sampler and then sampling when the desired depth is reached shall not be permitted. The continuous flight solid auger method shall not be used for advancing the boring below a water table or below the upper confining bed of a confined non-cohesive stratum that is under artesian pressure. Casing may not be advanced below the sampling elevation prior to sampling. Advancing a boring with bottom discharge bits is not permissible. It is not permissible to advance the boring for subsequent insertion of the sampler solely by means of previous sampling with the SPT sampler.

6.4 The drilling fluid within the boring or hollow-stem augers shall be maintained at or above the in situ groundwater level at all times during drilling, removal of drill rods, and sampling.

### 7. Sampling and Testing Procedure

7.1 After the boring has been advanced to the desired sampling elevation and excessive cuttings have been removed, prepare for the test with the following sequence of operations.

7.1.1 Attach the split-barrel sampler to the sampling rods and lower into borehole. Do not allow the sampler to drop onto the soil to be sampled.

7.1.2 Position the hammer above and attach the anvil to the top of the sampling rods. This may be done before the sampling rods and sampler are lowered into the borehole.

7.1.3 Rest the dead weight of the sampler, rods, anvil, and drive weight on the bottom of the boring and apply a seating blow. If excessive cuttings are encountered at the bottom of the boring, remove the sampler and sampling rods from the boring and remove the cuttings.

7.1.4 Mark the drill rods in three successive 6-in. (0.15-m) increments so that the advance of the sampler under the impact of the hammer can be easily observed for each 6-in. (0.15-m) increment.

7.2 Drive the sampler with blows from the 140-lb (63.5-kg) hammer and count the number of blows applied in

each 6-in. (0.15-m) increment until one of the following occurs:

7.2.1 A total of 50 blows have been applied during any one of the three 6-in. (0.15-m) increments described in 7.1.4.

7.2.2 A total of 100 blows have been applied.

7.2.3 There is no observed advance of the sampler during the application of 10 successive blows of the hammer.

7.2.4 The sampler is advanced the complete 18 in. (0.45 m) without the limiting blow counts occurring as described in 7.2.1, 7.2.2, or 7.2.3.

7.3 Record the number of blows required to effect each 6 in. (0.15 m) of penetration or fraction thereof. The first 6 in. is considered to be a seating drive. The sum of the number of blows required for the second and third 6 in. of penetration is termed the "standard penetration resistance", or the "N-value". If the sampler is driven less than 18 in. (0.45 m), as permitted in 7.2.1, 7.2.2, or 7.2.3, the number of blows per each complete 6 in. (0.15-m) increment and per each partial increment shall be recorded on the boring log. For partial increments, the depth of penetration shall be reported to the nearest 1 in. (25 mm), in addition to the number of blows. If the sampler advances below the bottom of the boring under the static weight of the hammer, this information should be noted on the boring log.

7.4 The raising and dropping of the 140-lb (63.5-kg) hammer shall be accomplished using either the following two methods:

7.4.1 By using a trip, automatic, or semi-automatic hammer drop system which lifts the 140-lb (63.5 kg) hammer and allows it to drop  $30 \pm 1.0$  in. (0.76 m  $\pm$  25 mm) unimpeded.

7.4.2 By using a cathead to pull a rope attached to the hammer. When the cathead and rope method is used the system and operation shall conform to the following:

7.4.2.1 The cathead shall be essentially free of rust, oil, or grease and have a diameter in the range of 6 to 10 in. (150 to 250 mm).

7.4.2.2 The cathead should be operated at a minimum speed of rotation of 100 RPM, or the approximate speed of rotation shall be reported on the boring log.

7.4.2.3 No more than 2 1/4 rope turns on the cathead may be used during the performance of the penetration test,

as shown in Fig. 1.

NOTE 4—The operator should generally use either 1 3/4 of 2 1/4 rope turns, depending upon whether or not the rope comes off the top (1 3/4 turns) or the bottom (2 1/4 turns) of the cathead. It is generally known and accepted that 2 3/4 or more rope turns considerably impedes the fall of the hammer and should not be used to perform the test. The cathead rope should be maintained in a relatively dry, clean, and unfrayed condition.

7.4.2.4 For each hammer blow, a 30-in. (0.76 m) lift and drop shall be employed by the operator. The operation of pulling and throwing the rope shall be performed rhythmically without holding the rope at the top of the stroke.

7.5 Bring the sampler to the surface and open. Record the percent recovery or length of sample recovered. Describe the soil samples recovered as to composition, color, stratification, and condition, then place one or more representative portions of the sample into sealable moisture-proof containers (jars) without ramming or distorting any apparent stratification. Seal each container to prevent evaporation of soil moisture. Affix labels to the containers bearing job designation, boring number, sample depth, and the blow count per 6-in. (0.15 m) increment. Protect the samples against extreme temperature changes. If there is a soil change within the jar for each stratum and note its location in the sampler barrel.

## 8. Report

8.1 Drilling information shall be recorded in the filed and shall include the following:

- 8.1.1 Name and location of job,
- 8.1.2 Names of crew,
- 8.1.3 Type and make of drilling machine,
- 8.1.4 Weather conditions,
- 8.1.5 Date and time of start and finish of boring,
- 8.1.6 Boring number and location (station and coordinates, if available and applicable),
- 8.1.7 Surface evaluation, if applicable
- 8.1.8 Method of advancing and cleaning the boring,
- 8.1.9 Method of keeping boring open,
- 8.1.10 Depth of water surface and

drilling depth at time of a noted loss of drilling fluid, and time and date when reading or notation was made,

- 8.1.11 Location of strata changes,
  - 8.1.12 Size of casing, depth of cased portion of boring,
  - 8.1.13 Equipment and method of driving sampler,
  - 8.1.14 Type of sampler and length and inside diameter of barrel (note use of liners),
  - 8.1.15 Size, type and section length of the sampling rods, and
  - 8.1.16 Remarks.
- 8.2 Data obtained for each sample shall be recorded in the field and shall include the following:
- 8.2.1 Sample depth and, if utilized, the sample number,
  - 8.2.2 Description of soil,
  - 8.2.3 Strata changes within sample,
  - 8.2.4 Sampler penetration and recovery lengths, and
  - 8.2.5 Number of blows per 6-in. (0.15 m) or partial increment.

## 9. Precision and Bias

9.1 Variations in N-values of 100% or more have been observed when using different standard penetration test apparatus and drillers for adjacent borings in the same soil formation. Current opinion, based on field experience, indicates that when using the same apparatus and driller N-values in the same soil can be reproduced with coefficient or variation of about 10%.

9.2 The use of faulty equipment, such as extremely massive or damaged anvil, a rusty cathead, a low speed cathead, an old, oily rope, or massive or poorly lubricated rope sheaves can significantly contribute to differences in N-values obtained between operator-drill rig systems.

9.3 The variability in N-values produced by different drill rigs and operators may be reduced by measuring the part of the hammer energy delivered into the drilling rods from the sampler and adjusting N on the basis of comparative energies. A method for energy measurement and N-value adjustment is currently under development.

ASTM Designation: D 1595

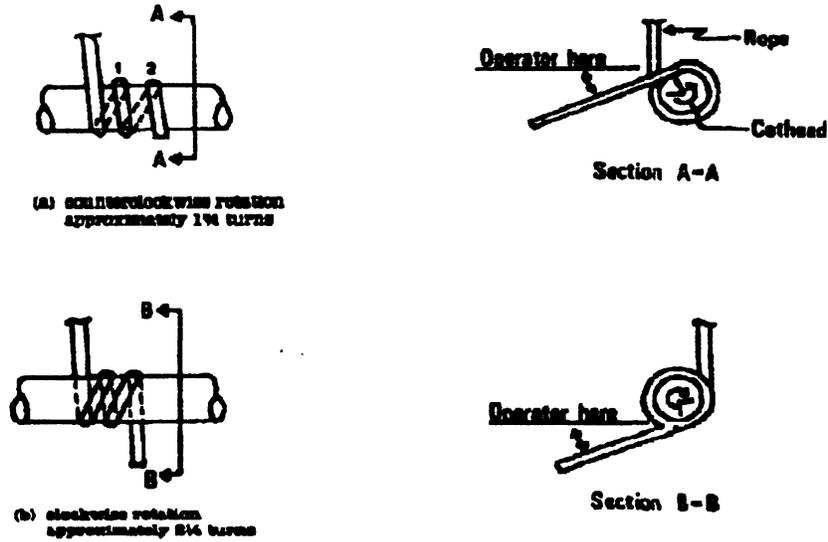
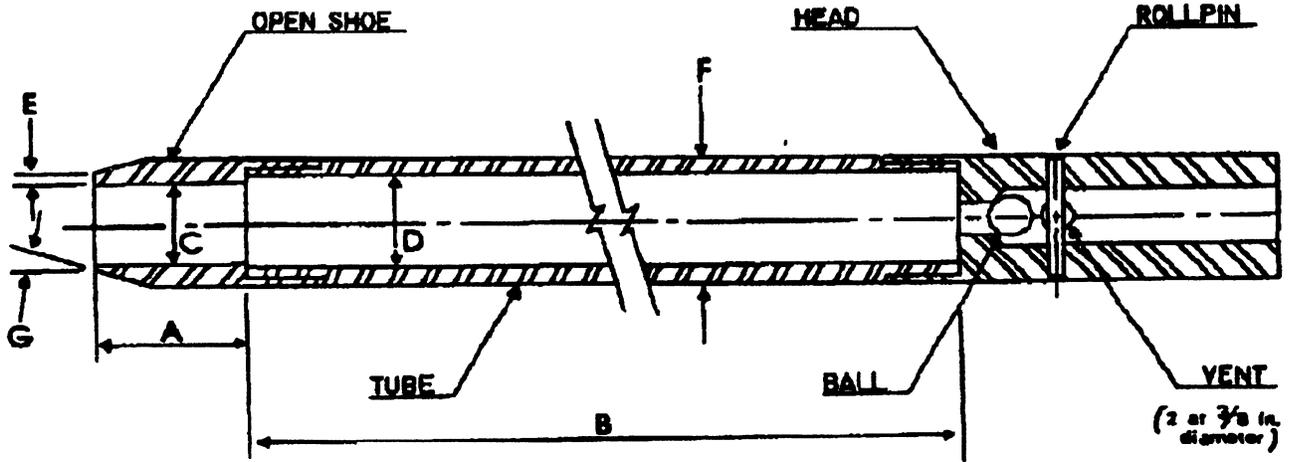


FIG. 1 Definitions of the number of rope turns and the angle for (a) counterclockwise rotation and (b) clockwise rotation of the cathead



- |  |  |
|--|--|
| A = 1.0 to 2.0 in. (25 to 50 mm)                 | E = 0.10 ± 0.02 in. (2.54 ± 0.25 mm)             |
| B = 18.0 to 30.0 in. (0.457 to 0.762 m)          | F = 2.00 ± 0.05 - 0.00 in. (50.8 ± 1.3 - 0.0 mm) |
| C = 1.375 ± 0.005 in. (34.93 ± 0.13 mm)          | G = 16.0° to 23.0°                               |
| D = 1.50 ± 0.05 - 0.00 in. (38.1 ± 1.3 - 0.0 mm) |  |

The 1 1/2 in. (38 mm) inside diameter split barrel may be used with a 16-gage wall thickness split liner. The penetrating end of the drive shoe may be slightly rounded. Metal or plastic retainers may be used to retain soil samples.

FIG. 2 Split-Barrel Sampler

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This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 1916 Race St., Philadelphia, PA 19103.

### **Water Content ( $W_c$ )**

The water content of a soil is determined by weighing a moist soil sample, drying it in an oven for approximately 24 hours, and reweighing the sample to determine the moisture loss. The water content is the ratio of the weight of water in the soil to the weight of the dry soil. Water content is typically expressed as a percentage.

### **Calibrated Hand Penetrometer ( $Q_p$ )**

In the calibrated hand penetrometer test, the unconfined compressive strength of a soil is estimated to a maximum value of 4.5 tons per square foot (tsf) by measuring the resistance of the soil sample to penetration by a spring-calibrated plunger. The hand penetrometer test device has been carefully calibrated by its manufacturer with the results of numerous unconfined compressive strength tests. This test provides a quick, simple, and low-cost testing procedure from which soil strength can be estimated.

### **Unconfined Compression Test ( $Q_u$ )**

In the unconfined compression strength test, an undisturbed cylinder of soil is loaded axially until the soil fails to carry additional load, or until 20% strain has been reached, whichever occurs first. The undrained shear strength of a cohesive soil is usually considered to equal half of the unconfined compressive strength.

### **Dry Density ( $\gamma_d$ )**

The dry density of a soil is the weight of dry soil in a unit volume. The soil's total unit weight is typically calculated by weighing a cylinder of soil, and dividing the weight by the cylinder's volume as calculated by measuring the cylinder's height and diameter at several locations. The soil's dry density is then determined by correcting the cylinder's weight to account for its water content measured as described above. Use of this value is often made when estimating the degree of compaction of a soil.

### **Classification of Samples**

Soil samples are classified on the basis of their texture and plasticity in accordance with the Unified Soil Classification System (USCS). The two-letter designator in parentheses following each soil description on the boring logs represents the applicable unified classification. If the designator is capitalized, the classification has been confirmed by the appropriate index testing. If the designator is lower-case, the classification has been visually estimated.

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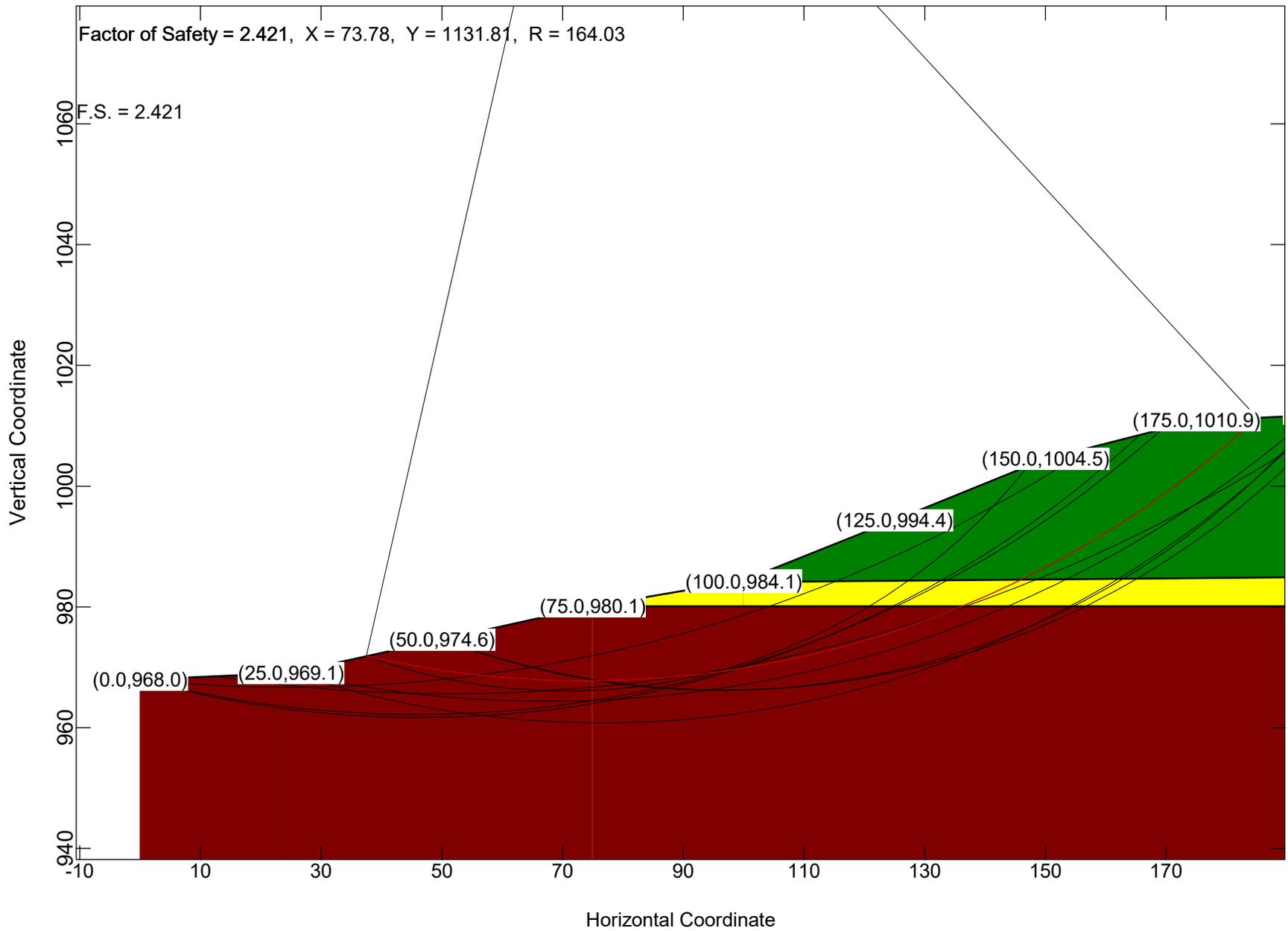


## Appendix D

- Slope Stability Analyses
  - Section 1 (B-1)
  - Section 2 (B-2)
  - Section 3 (B-3)
  - Section 4 (B-4)



# SECTION 1



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STABLPro for Windows, Version 2015.4.5

Upgraded from:  
FHWA-PCSTABLE

Serial Number : 179981068

--Slope Stability Analysis--  
Simplified Janbu, Simplified Bishop  
or Spencer Method of Slices

=====

This program is licensed to :

GeoTest, Inc.  
West Allis, WI, USA

Path to file locations : C:\Ensoft\Hartland Quarry\  
Name of input data file : Hartland Quarry - Section 1c.sl4d  
Name of output file : Hartland Quarry - Section 1c.sl4o  
Name of plot output file : Hartland Quarry - Section 1c.sl4p

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Time and Date of Analysis  
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Date: September 05, 2023 Time: 18:05:02

1

PROBLEM DESCRIPTION Section 1c - After Grading

BOUNDARY COORDINATES

8 Top Boundaries  
10 Total Boundaries

Boundary No.	X-Left ft.	Y-Left ft.	X-Right ft.	Y-Right ft.	Soil Type Below Bnd
-----------------	---------------	---------------	----------------	----------------	------------------------

1	0.00	967.98	25.00	969.08	4
2	25.00	969.08	50.00	974.60	4
3	50.00	974.60	75.00	980.12	4
4	75.00	980.12	100.00	984.41	2
5	100.00	984.41	125.00	994.36	1
6	125.00	994.36	150.00	1004.49	1
7	150.00	1004.49	175.00	1010.86	1
8	175.00	1010.86	200.00	1012.00	1
9	100.00	984.12	200.00	985.00	2
10	75.00	980.12	200.00	980.12	4

1

#### ISOTROPIC SOIL PARAMETERS

##### 4 Type(s) of Soil

Soil Type No.	Total Unit Wt. pcf	Saturated Unit Wt. pcf	Cohesion Intercept psf	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant psf	Piez. Surface No.
1	130.0	0.0	0.0	30.0	0.00	0.0	0
2	135.0	0.0	0.0	32.0	0.00	0.0	0
3	140.0	0.0	0.0	33.0	0.00	0.0	0
4	145.0	0.0	0.0	35.0	0.00	0.0	0

1

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

50 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 5 Points Equally Spaced Along The Ground Surface Between X = 0.00 ft.  
and X = 50.00 ft.

Each Surface Terminates Between X = 125.00 ft.  
and X = 200.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 900.00 ft.

5.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation.  
The Angle Has Been Restricted Between The Angles Of -45.0  
And 0.0 deg.

1

Following Are Displayed The Ten Most Critical Of The Trial  
Failure Surfaces Examined. They Are Ordered - Most Critical  
First.

\* \* Safety Factors Are Calculated By The Modified Janbu Method \* \*

Failure Surface Specified By 33 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	37.50	971.84
2	42.39	970.81
3	47.31	969.93
4	52.26	969.20
5	57.23	968.62
6	62.21	968.19
7	67.20	967.91
8	72.20	967.79
9	77.20	967.81
10	82.20	967.99
11	87.19	968.33
12	92.16	968.81
13	97.12	969.45
14	102.06	970.23
15	106.97	971.17
16	111.85	972.26
17	116.70	973.49
18	121.50	974.87
19	126.26	976.40
20	130.97	978.07
21	135.63	979.89
22	140.24	981.84
23	144.78	983.94
24	149.25	986.17
25	153.65	988.54



26	4.1	0.99E+04	0.00E+00							
27	4.5	0.11E+05	0.00E+00							
28	1.2	0.28E+04	0.00E+00							
29	3.3	0.78E+04	0.00E+00							
30	0.8	0.18E+04	0.00E+00							
31	3.7	0.83E+04	0.00E+00							
32	4.3	0.91E+04	0.00E+00							
33	4.3	0.81E+04	0.00E+00							
34	4.2	0.71E+04	0.00E+00							
35	4.1	0.60E+04	0.00E+00							
36	4.0	0.49E+04	0.00E+00							
37	0.5	0.56E+03	0.00E+00							
38	3.4	0.30E+04	0.00E+00							
39	3.8	0.20E+04	0.00E+00							
40	2.9	0.47E+03	0.00E+00							

-----

Failure Surface Specified By 41 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	12.50	968.53
2	17.45	967.83
3	22.42	967.23
4	27.39	966.72
5	32.37	966.31
6	37.36	966.00
7	42.36	965.78
8	47.36	965.65
9	52.36	965.63
10	57.36	965.70
11	62.35	965.86
12	67.35	966.12
13	72.33	966.48
14	77.31	966.93
15	82.28	967.48
16	87.24	968.13
17	92.19	968.87
18	97.11	969.71
19	102.03	970.64
20	106.92	971.66
21	111.79	972.78
22	116.65	973.99
23	121.47	975.30
24	126.27	976.69
25	131.05	978.18
26	135.79	979.77
27	140.50	981.44

28	145.18	983.20
29	149.82	985.05
30	154.43	987.00
31	159.00	989.03
32	163.53	991.14
33	168.02	993.35
34	172.46	995.64
35	176.86	998.01
36	181.21	1000.47
37	185.52	1003.02
38	189.77	1005.64
39	193.98	1008.35
40	198.13	1011.14
41	199.32	1011.97

Circle Center At X = 51.3 ; Y = 1225.5 and Radius, 259.8

\*\*\* 2.549 \*\*\*

1

Failure Surface Specified By 38 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	25.00	969.08
2	29.89	968.05
3	34.81	967.14
4	39.75	966.36
5	44.71	965.71
6	49.68	965.18
7	54.66	964.79
8	59.66	964.52
9	64.65	964.38
10	69.65	964.38
11	74.65	964.50
12	79.65	964.75
13	84.63	965.13
14	89.60	965.64
15	94.56	966.28
16	99.51	967.04
17	104.42	967.94
18	109.32	968.96
19	114.19	970.11
20	119.02	971.38
21	123.82	972.77

22	128.59	974.29
23	133.31	975.94
24	137.99	977.70
25	142.62	979.59
26	147.20	981.59
27	151.73	983.71
28	156.20	985.95
29	160.61	988.31
30	164.96	990.77
31	169.24	993.35
32	173.46	996.04
33	177.60	998.84
34	181.67	1001.74
35	185.67	1004.75
36	189.58	1007.86
37	193.42	1011.07
38	194.17	1011.73

Circle Center At X = 67.4 ; Y = 1157.6 and Radius, 193.3

\*\*\* 2.564 \*\*\*

Failure Surface Specified By 33 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	50.00	974.60
2	54.71	972.92
3	59.48	971.42
4	64.30	970.11
5	69.18	968.98
6	74.09	968.04
7	79.03	967.29
8	84.00	966.73
9	88.98	966.36
10	93.98	966.19
11	98.98	966.21
12	103.98	966.41
13	108.96	966.81
14	113.93	967.41
15	118.86	968.19
16	123.77	969.16
17	128.63	970.32
18	133.45	971.67
19	138.21	973.20

20	142.91	974.91
21	147.53	976.80
22	152.09	978.87
23	156.56	981.11
24	160.94	983.52
25	165.22	986.10
26	169.40	988.84
27	173.47	991.74
28	177.43	994.80
29	181.27	998.00
30	184.98	1001.35
31	188.56	1004.84
32	192.01	1008.46
33	194.91	1011.77

Circle Center At X = 96.0 ; Y = 1096.2 and Radius, 130.0

\*\*\* 2.585 \*\*\*

1

Failure Surface Specified By 34 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	50.00	974.60
2	54.72	972.95
3	59.50	971.48
4	64.33	970.19
5	69.21	969.08
6	74.12	968.15
7	79.06	967.40
8	84.03	966.83
9	89.01	966.44
10	94.01	966.24
11	99.01	966.23
12	104.01	966.40
13	108.99	966.75
14	113.97	967.29
15	118.91	968.01
16	123.83	968.91
17	128.71	970.00
18	133.55	971.26
19	138.34	972.70
20	143.07	974.32
21	147.74	976.11

22	152.34	978.07
23	156.86	980.20
24	161.30	982.49
25	165.66	984.95
26	169.92	987.56
27	174.08	990.34
28	178.14	993.26
29	182.08	996.33
30	185.91	999.55
31	189.62	1002.90
32	193.20	1006.39
33	196.65	1010.01
34	198.35	1011.92

Circle Center At X = 96.9 ; Y = 1101.7 and Radius, 135.5

\*\*\* 2.618 \*\*\*

Failure Surface Specified By 35 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	0.00	967.98
2	4.98	967.51
3	9.97	967.15
4	14.96	966.89
5	19.96	966.74
6	24.96	966.68
7	29.96	966.74
8	34.95	966.89
9	39.95	967.15
10	44.93	967.51
11	49.91	967.98
12	54.88	968.55
13	59.83	969.22
14	64.77	969.99
15	69.70	970.87
16	74.60	971.85
17	79.48	972.93
18	84.34	974.11
19	89.17	975.40
20	93.98	976.78
21	98.75	978.26
22	103.50	979.84
23	108.21	981.52

24	112.88	983.29
25	117.52	985.17
26	122.11	987.13
27	126.67	989.20
28	131.18	991.35
29	135.64	993.61
30	140.06	995.95
31	144.43	998.38
32	148.74	1000.90
33	153.01	1003.52
34	157.22	1006.22
35	157.48	1006.40

Circle Center At X = 25.0 ; Y = 1207.6 and Radius, 241.0

\*\*\* 2.672 \*\*\*

1

Failure Surface Specified By 39 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	25.00	969.08
2	29.77	967.59
3	34.59	966.24
4	39.44	965.04
5	44.33	963.99
6	49.25	963.09
7	54.19	962.34
8	59.15	961.73
9	64.13	961.28
10	69.12	960.98
11	74.12	960.83
12	79.12	960.83
13	84.12	960.98
14	89.11	961.28
15	94.09	961.74
16	99.05	962.34
17	104.00	963.10
18	108.91	964.00
19	113.80	965.05
20	118.66	966.25
21	123.47	967.60
22	128.24	969.09
23	132.97	970.73

24	137.64	972.51
25	142.26	974.43
26	146.81	976.48
27	151.31	978.68
28	155.73	981.01
29	160.08	983.47
30	164.36	986.06
31	168.55	988.79
32	172.66	991.63
33	176.68	994.61
34	180.61	997.70
35	184.45	1000.91
36	188.18	1004.23
37	191.82	1007.66
38	195.34	1011.21
39	195.91	1011.81

Circle Center At X = 76.6 ; Y = 1125.9 and Radius, 165.1

\*\*\* 2.684 \*\*\*

Failure Surface Specified By 38 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	0.00	967.98
2	4.86	966.80
3	9.75	965.76
4	14.67	964.85
5	19.60	964.07
6	24.56	963.42
7	29.54	962.91
8	34.52	962.54
9	39.52	962.29
10	44.52	962.19
11	49.52	962.22
12	54.51	962.38
13	59.50	962.68
14	64.48	963.12
15	69.45	963.69
16	74.40	964.39
17	79.33	965.23
18	84.24	966.20
19	89.11	967.31
20	93.96	968.54

21	98.77	969.91
22	103.54	971.40
23	108.27	973.02
24	112.95	974.78
25	117.59	976.65
26	122.17	978.65
27	126.69	980.78
28	131.16	983.03
29	135.57	985.39
30	139.90	987.88
31	144.17	990.48
32	148.37	993.20
33	152.49	996.03
34	156.54	998.96
35	160.50	1002.01
36	164.38	1005.17
37	168.18	1008.42
38	169.24	1009.39

Circle Center At X = 45.9 ; Y = 1147.0 and Radius, 184.8

\*\*\* 2.714 \*\*\*

1

Failure Surface Specified By 37 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	0.00	967.98
2	4.84	966.72
3	9.71	965.60
4	14.61	964.62
5	19.54	963.78
6	24.49	963.08
7	29.46	962.52
8	34.45	962.10
9	39.44	961.83
10	44.44	961.70
11	49.44	961.71
12	54.43	961.86
13	59.42	962.16
14	64.41	962.60
15	69.37	963.18
16	74.32	963.90
17	79.24	964.77

18	84.14	965.77
19	89.01	966.92
20	93.84	968.20
21	98.64	969.62
22	103.39	971.18
23	108.09	972.87
24	112.75	974.69
25	117.35	976.65
26	121.89	978.74
27	126.37	980.96
28	130.79	983.30
29	135.14	985.77
30	139.41	988.36
31	143.61	991.08
32	147.73	993.91
33	151.77	996.86
34	155.72	999.92
35	159.58	1003.10
36	163.35	1006.38
37	165.62	1008.47

Circle Center At X = 46.5 ; Y = 1136.7 and Radius, 175.0

\*\*\* 2.764 \*\*\*

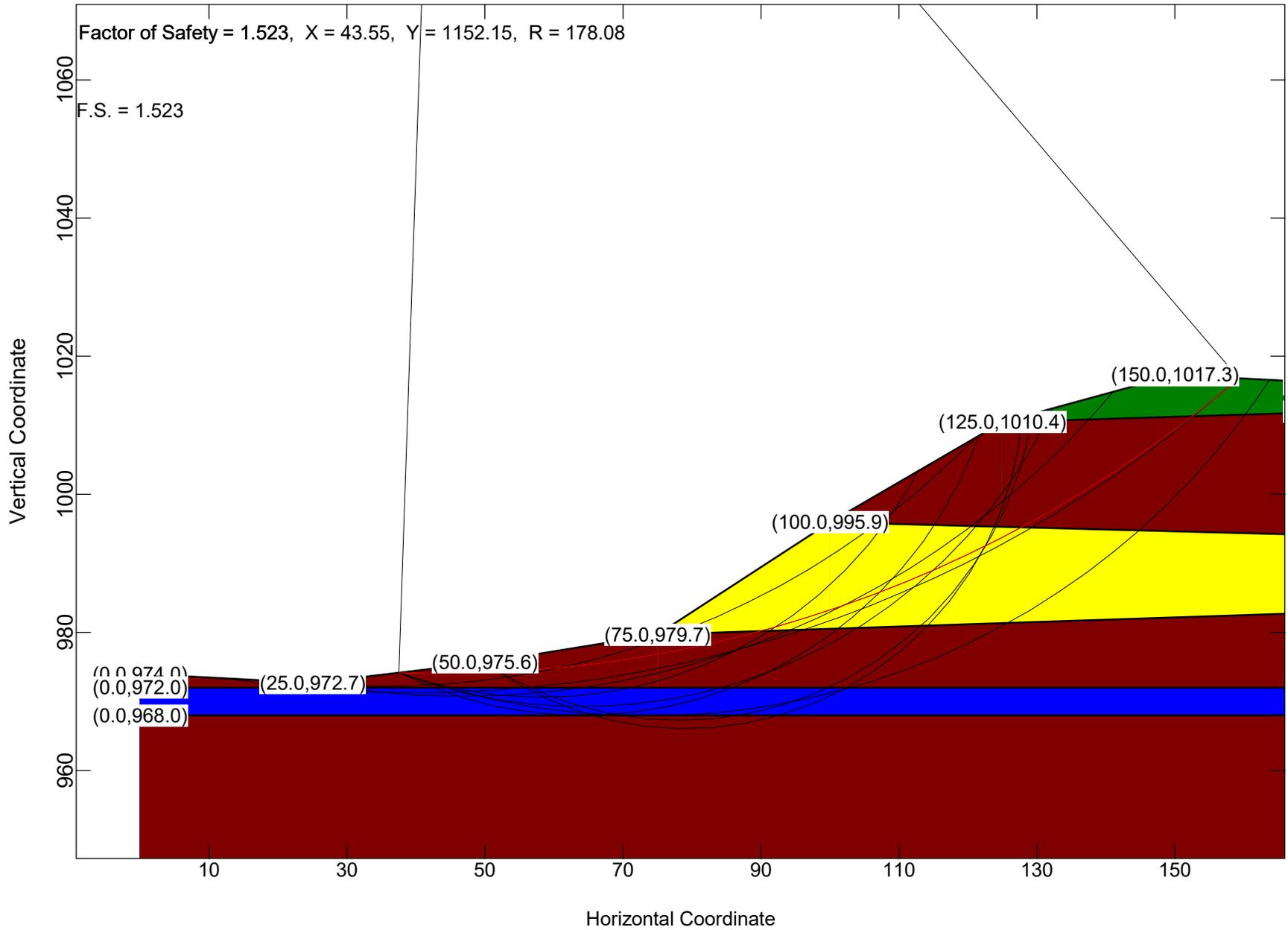
Failure Surface Specified By 26 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	37.50	971.84
2	42.25	970.26
3	47.07	968.93
4	51.95	967.85
5	56.88	967.02
6	61.84	966.45
7	66.83	966.13
8	71.83	966.07
9	76.83	966.27
10	81.81	966.72
11	86.76	967.42
12	91.67	968.38
13	96.52	969.60
14	101.30	971.05
15	106.00	972.76
16	110.61	974.70



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F 1558.48 +  
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T 1781.12 +

# SECTION 2



=====

STABLPro for Windows, Version 2015.4.5

Upgraded from:  
FHWA-PCSTABLE

Serial Number : 179981068

--Slope Stability Analysis--  
Simplified Janbu, Simplified Bishop  
or Spencer Method of Slices

=====

This program is licensed to :

GeoTest, Inc.  
West Allis, WI, USA

Path to file locations : C:\Ensoft\Hartland Quarry\  
Name of input data file : Hartland Quarry - Section 2c.sl4d  
Name of output file : Hartland Quarry - Section 2c.sl4o  
Name of plot output file : Hartland Quarry - Section 2c.sl4p

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Time and Date of Analysis

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Date: September 05, 2023 Time: 17:16:57

1

PROBLEM DESCRIPTION Section 2c- After Grading

BOUNDARY COORDINATES

7 Top Boundaries  
12 Total Boundaries

Boundary No.	X-Left ft.	Y-Left ft.	X-Right ft.	Y-Right ft.	Soil Type Below Bnd
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1	0.00	974.00	25.00	972.70	4
2	25.00	972.70	50.00	975.63	4
3	50.00	975.63	75.00	979.70	4
4	75.00	979.70	100.00	995.94	2
5	100.00	995.94	125.00	1010.44	4
6	125.00	1010.44	150.00	1017.28	1
7	150.00	1017.28	175.00	1016.00	1
8	125.00	1010.44	175.00	1012.00	4
9	100.00	995.94	175.00	994.00	2
10	75.00	979.70	175.00	983.00	4
11	0.00	972.00	175.00	972.00	3
12	0.00	968.00	175.00	968.00	4

1

#### ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. pcf	Saturated Unit Wt. pcf	Cohesion Intercept psf	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant psf	Piez. Surface No.
1	130.0	0.0	0.0	30.0	0.00	0.0	0
2	135.0	0.0	0.0	32.0	0.00	0.0	0
3	140.0	0.0	0.0	33.0	0.00	0.0	0
4	145.0	0.0	0.0	35.0	0.00	0.0	0

1

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

50 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 5 Points Equally Spaced Along The Ground Surface Between X = 0.00 ft.  
and X = 50.00 ft.

Each Surface Terminates Between X = 100.00 ft.  
and X = 175.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation

At Which A Surface Extends Is Y =900.00 ft.

5.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation.  
The Angle Has Been Restricted Between The Angles Of -45.0  
And 0.0 deg.

1

Following Are Displayed The Ten Most Critical Of The Trial  
Failure Surfaces Examined. They Are Ordered - Most Critical  
First.

\* \* Safety Factors Are Calculated By The Modified Janbu Method \* \*

Failure Surface Specified By 28 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	37.50	974.17
2	42.50	974.07
3	47.50	974.11
4	52.50	974.29
5	57.49	974.61
6	62.46	975.07
7	67.43	975.67
8	72.37	976.41
9	77.30	977.29
10	82.19	978.31
11	87.06	979.46
12	91.89	980.75
13	96.68	982.17
14	101.43	983.73
15	106.14	985.42
16	110.79	987.24
17	115.40	989.20
18	119.94	991.28
19	124.43	993.49
20	128.85	995.82
21	133.21	998.27
22	137.49	1000.85
23	141.70	1003.55



0.00E+00									
15	4.8	0.70E+04	0.00E+00						
0.00E+00									
16	3.3	0.54E+04	0.00E+00						
0.00E+00									
17	1.4	0.25E+04	0.00E+00						
0.00E+00									
18	4.7	0.87E+04	0.00E+00						
0.00E+00									
19	4.7	0.94E+04	0.00E+00						
0.00E+00									
20	4.6	0.99E+04	0.00E+00						
0.00E+00									
21	4.5	0.10E+05	0.00E+00						
0.00E+00									
22	4.5	0.11E+05	0.00E+00						
0.00E+00									
23	0.6	0.14E+04	0.00E+00						
0.00E+00									
24	2.7	0.64E+04	0.00E+00						
0.00E+00									
25	1.1	0.26E+04	0.00E+00						
0.00E+00									
26	4.4	0.94E+04	0.00E+00						
0.00E+00									
27	4.3	0.84E+04	0.00E+00						
0.00E+00									
28	4.2	0.72E+04	0.00E+00						
0.00E+00									
29	4.1	0.61E+04	0.00E+00						
0.00E+00									
30	4.1	0.49E+04	0.00E+00						
0.00E+00									
31	0.1	0.12E+03	0.00E+00						
0.00E+00									
32	2.5	0.23E+04	0.00E+00						
0.00E+00									
33	1.3	0.93E+03	0.00E+00						
0.00E+00									
34	3.9	0.16E+04	0.00E+00						
0.00E+00									
35	1.5	0.14E+03	0.00E+00						
0.00E+00									

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Failure Surface Specified By 27 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
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1	25.00	972.70
2	29.94	971.92
3	34.91	971.34
4	39.89	970.97
5	44.89	970.80
6	49.89	970.83
7	54.88	971.06
8	59.86	971.49
9	64.82	972.13
10	69.75	972.97
11	74.64	974.01
12	79.49	975.24
13	84.28	976.67
14	89.01	978.30
15	93.67	980.11
16	98.25	982.11
17	102.75	984.30
18	107.15	986.67
19	111.46	989.21
20	115.65	991.93
21	119.74	994.81
22	123.70	997.86
23	127.54	1001.06
24	131.24	1004.42
25	134.81	1007.93
26	138.23	1011.58
27	141.03	1014.83

Circle Center At X = 46.6 ; Y = 1093.9 and Radius, 123.2

\*\*\* 1.544 \*\*\*

1

Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	37.50	974.17
2	42.23	972.55
3	47.06	971.25
4	51.96	970.27
5	56.92	969.63
6	61.91	969.31
7	66.91	969.33

8	71.90	969.67
9	76.85	970.35
10	81.75	971.35
11	86.57	972.68
12	91.29	974.33
13	95.90	976.28
14	100.36	978.54
15	104.66	981.08
16	108.79	983.91
17	112.71	987.00
18	116.43	990.35
19	119.91	993.94
20	123.15	997.75
21	126.12	1001.77
22	128.83	1005.97
23	131.24	1010.35
24	132.21	1012.41

Circle Center At X = 64.2 ; Y = 1044.5 and Radius, 75.3

\*\*\* 1.547 \*\*\*

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	50.00	975.63
2	54.32	973.11
3	58.86	971.02
4	63.59	969.38
5	68.45	968.21
6	73.40	967.50
7	78.39	967.28
8	83.38	967.55
9	88.33	968.29
10	93.18	969.51
11	97.89	971.19
12	102.41	973.32
13	106.71	975.87
14	110.74	978.83
15	114.47	982.16
16	117.85	985.84
17	120.87	989.83
18	123.49	994.09
19	125.68	998.58

20	127.43	1003.27
21	128.72	1008.10
22	129.30	1011.62

Circle Center At X = 78.2 ; Y = 1019.0 and Radius, 51.7

\*\*\* 1.629 \*\*\*

1

Failure Surface Specified By 33 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	12.50	973.35
2	17.45	972.66
3	22.42	972.11
4	27.41	971.70
5	32.40	971.42
6	37.40	971.29
7	42.40	971.29
8	47.39	971.44
9	52.39	971.72
10	57.37	972.14
11	62.34	972.70
12	67.29	973.40
13	72.22	974.24
14	77.12	975.21
15	82.00	976.32
16	86.84	977.56
17	91.65	978.94
18	96.41	980.46
19	101.13	982.10
20	105.81	983.88
21	110.43	985.78
22	115.00	987.81
23	119.51	989.97
24	123.96	992.26
25	128.34	994.66
26	132.65	997.19
27	136.89	999.84
28	141.06	1002.60
29	145.15	1005.48
30	149.15	1008.48
31	153.07	1011.58
32	156.91	1014.79

33            159.19        1016.81

Circle Center At X = 39.7 ; Y = 1150.8 and Radius, 179.5

\*\*\*        1.639        \*\*\*

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	25.00	972.70
2	29.99	972.36
3	34.99	972.23
4	39.99	972.30
5	44.98	972.59
6	49.95	973.08
7	54.90	973.79
8	59.82	974.69
9	64.70	975.81
10	69.52	977.13
11	74.28	978.64
12	78.98	980.36
13	83.60	982.27
14	88.14	984.37
15	92.58	986.66
16	96.93	989.13
17	101.16	991.79
18	105.29	994.62
19	109.29	997.62
20	113.16	1000.78
21	116.90	1004.10
22	120.49	1007.58
23	121.01	1008.13

Circle Center At X = 35.7 ; Y = 1091.7 and Radius, 119.5

\*\*\*        1.644        \*\*\*

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	37.50	974.17
2	42.08	972.16
3	46.81	970.54
4	51.66	969.31
5	56.59	968.49
6	61.57	968.07
7	66.57	968.06
8	71.56	968.46
9	76.49	969.27
10	81.34	970.48
11	86.08	972.08
12	90.67	974.07
13	95.08	976.43
14	99.28	979.14
15	103.24	982.18
16	106.95	985.54
17	110.36	989.19
18	113.47	993.11
19	116.24	997.28
20	118.66	1001.65
21	120.71	1006.21
22	121.50	1008.41

Circle Center At X = 64.2 ; Y = 1029.0 and Radius, 60.9

\*\*\* 1.671 \*\*\*

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	50.00	975.63
2	54.17	972.87
3	58.60	970.56
4	63.25	968.70
5	68.05	967.33
6	72.98	966.46
7	77.96	966.09
8	82.96	966.24
9	87.92	966.89
10	92.78	968.05
11	97.51	969.69

12	102.03	971.81
13	106.32	974.38
14	110.33	977.37
15	114.01	980.76
16	117.32	984.51
17	120.24	988.57
18	122.72	992.91
19	124.75	997.48
20	126.30	1002.23
21	127.36	1007.11
22	127.82	1011.21

Circle Center At X = 79.1 ; Y = 1015.0 and Radius, 49.0

\*\*\* 1.705 \*\*\*

1

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	37.50	974.17
2	42.28	972.69
3	47.16	971.60
4	52.11	970.91
5	57.10	970.62
6	62.10	970.74
7	67.07	971.25
8	71.99	972.17
9	76.81	973.48
10	81.52	975.18
11	86.07	977.25
12	90.44	979.68
13	94.59	982.46
14	98.52	985.56
15	102.17	988.97
16	105.54	992.66
17	108.61	996.62
18	111.34	1000.80
19	112.69	1003.30

Circle Center At X = 58.2 ; Y = 1032.5 and Radius, 61.9

\*\*\* 1.723 \*\*\*

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	37.50	974.17
2	42.25	972.60
3	47.06	971.25
4	51.94	970.13
5	56.86	969.24
6	61.81	968.58
7	66.79	968.15
8	71.79	967.94
9	76.79	967.97
10	81.78	968.24
11	86.76	968.73
12	91.71	969.45
13	96.61	970.41
14	101.47	971.58
15	106.27	972.99
16	111.00	974.61
17	115.65	976.45
18	120.21	978.51
19	124.67	980.77
20	129.02	983.24
21	133.25	985.91
22	137.35	988.77
23	141.31	991.81
24	145.13	995.04
25	148.79	998.44
26	152.30	1002.01
27	155.63	1005.74
28	158.79	1009.61
29	161.76	1013.63
30	163.74	1016.58

Circle Center At X = 73.6 ; Y = 1075.7 and Radius, 107.8

\*\*\* 1.752 \*\*\*

0.00      223.80      447.60      671.41      895.21      1119.01

X	0.00	+	-----+	-----+	-----+	-----+	**-----+
		-					.**
		-					.2*
		-					.41*
		-					.0*
		-					***
	223.80	+					
		-					
		-					
		-					
		-					
A	447.60	+					
		-					
		-					
		-					
		-					
X	671.41	+					
		-					
		-					
		-					
		-					
I	895.21	+					
		-					
		-					
		-					
		-					
S	1119.01	+					
		-					
		-					
		-					
		-					
	1342.81	+					
		-					
		-					
		-					
		-					
F	1566.61	+					
		-					
		-					
		-					

T 1790.41 +

=====

STABLPro for Windows, Version 2015.4.5

Upgraded from:  
FHWA-PCSTABLE

Serial Number : 179981068

--Slope Stability Analysis--  
Simplified Janbu, Simplified Bishop  
or Spencer Method of Slices

=====

This program is licensed to :

GeoTest, Inc.  
West Allis, WI, USA

Path to file locations : C:\Ensoft\Hartland Quarry\  
Name of input data file : Hartland Quarry - Section 2c.sl4d  
Name of output file : Hartland Quarry - Section 2c.sl4o  
Name of plot output file : Hartland Quarry - Section 2c.sl4p

-----

Time and Date of Analysis

-----

Date: September 05, 2023 Time: 17:16:57

1

PROBLEM DESCRIPTION Section 2c- After Grading

BOUNDARY COORDINATES

7 Top Boundaries  
12 Total Boundaries

Boundary No.	X-Left ft.	Y-Left ft.	X-Right ft.	Y-Right ft.	Soil Type Below Bnd
--------------	------------	------------	-------------	-------------	---------------------

1	0.00	974.00	25.00	972.70	4
2	25.00	972.70	50.00	975.63	4
3	50.00	975.63	75.00	979.70	4
4	75.00	979.70	100.00	995.94	2
5	100.00	995.94	125.00	1010.44	4
6	125.00	1010.44	150.00	1017.28	1
7	150.00	1017.28	175.00	1016.00	1
8	125.00	1010.44	175.00	1012.00	4
9	100.00	995.94	175.00	994.00	2
10	75.00	979.70	175.00	983.00	4
11	0.00	972.00	175.00	972.00	3
12	0.00	968.00	175.00	968.00	4

1

#### ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. pcf	Saturated Unit Wt. pcf	Cohesion Intercept psf	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant psf	Piez. Surface No.
1	130.0	0.0	0.0	30.0	0.00	0.0	0
2	135.0	0.0	0.0	32.0	0.00	0.0	0
3	140.0	0.0	0.0	33.0	0.00	0.0	0
4	145.0	0.0	0.0	35.0	0.00	0.0	0

1

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

50 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 5 Points Equally Spaced Along The Ground Surface Between X = 0.00 ft.  
and X = 50.00 ft.

Each Surface Terminates Between X = 100.00 ft.  
and X = 175.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation

At Which A Surface Extends Is Y =900.00 ft.

5.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation.  
The Angle Has Been Restricted Between The Angles Of -45.0  
And 0.0 deg.

1

Following Are Displayed The Ten Most Critical Of The Trial  
Failure Surfaces Examined. They Are Ordered - Most Critical  
First.

\* \* Safety Factors Are Calculated By The Modified Janbu Method \* \*

Failure Surface Specified By 28 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	37.50	974.17
2	42.50	974.07
3	47.50	974.11
4	52.50	974.29
5	57.49	974.61
6	62.46	975.07
7	67.43	975.67
8	72.37	976.41
9	77.30	977.29
10	82.19	978.31
11	87.06	979.46
12	91.89	980.75
13	96.68	982.17
14	101.43	983.73
15	106.14	985.42
16	110.79	987.24
17	115.40	989.20
18	119.94	991.28
19	124.43	993.49
20	128.85	995.82
21	133.21	998.27
22	137.49	1000.85
23	141.70	1003.55



0.00E+00									
15	4.8	0.70E+04	0.00E+00						
0.00E+00									
16	3.3	0.54E+04	0.00E+00						
0.00E+00									
17	1.4	0.25E+04	0.00E+00						
0.00E+00									
18	4.7	0.87E+04	0.00E+00						
0.00E+00									
19	4.7	0.94E+04	0.00E+00						
0.00E+00									
20	4.6	0.99E+04	0.00E+00						
0.00E+00									
21	4.5	0.10E+05	0.00E+00						
0.00E+00									
22	4.5	0.11E+05	0.00E+00						
0.00E+00									
23	0.6	0.14E+04	0.00E+00						
0.00E+00									
24	2.7	0.64E+04	0.00E+00						
0.00E+00									
25	1.1	0.26E+04	0.00E+00						
0.00E+00									
26	4.4	0.94E+04	0.00E+00						
0.00E+00									
27	4.3	0.84E+04	0.00E+00						
0.00E+00									
28	4.2	0.72E+04	0.00E+00						
0.00E+00									
29	4.1	0.61E+04	0.00E+00						
0.00E+00									
30	4.1	0.49E+04	0.00E+00						
0.00E+00									
31	0.1	0.12E+03	0.00E+00						
0.00E+00									
32	2.5	0.23E+04	0.00E+00						
0.00E+00									
33	1.3	0.93E+03	0.00E+00						
0.00E+00									
34	3.9	0.16E+04	0.00E+00						
0.00E+00									
35	1.5	0.14E+03	0.00E+00						
0.00E+00									

-----

Failure Surface Specified By 27 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
-----------	------------	------------

1	25.00	972.70
2	29.94	971.92
3	34.91	971.34
4	39.89	970.97
5	44.89	970.80
6	49.89	970.83
7	54.88	971.06
8	59.86	971.49
9	64.82	972.13
10	69.75	972.97
11	74.64	974.01
12	79.49	975.24
13	84.28	976.67
14	89.01	978.30
15	93.67	980.11
16	98.25	982.11
17	102.75	984.30
18	107.15	986.67
19	111.46	989.21
20	115.65	991.93
21	119.74	994.81
22	123.70	997.86
23	127.54	1001.06
24	131.24	1004.42
25	134.81	1007.93
26	138.23	1011.58
27	141.03	1014.83

Circle Center At X = 46.6 ; Y = 1093.9 and Radius, 123.2

\*\*\* 1.544 \*\*\*

1

Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	37.50	974.17
2	42.23	972.55
3	47.06	971.25
4	51.96	970.27
5	56.92	969.63
6	61.91	969.31
7	66.91	969.33

8	71.90	969.67
9	76.85	970.35
10	81.75	971.35
11	86.57	972.68
12	91.29	974.33
13	95.90	976.28
14	100.36	978.54
15	104.66	981.08
16	108.79	983.91
17	112.71	987.00
18	116.43	990.35
19	119.91	993.94
20	123.15	997.75
21	126.12	1001.77
22	128.83	1005.97
23	131.24	1010.35
24	132.21	1012.41

Circle Center At X = 64.2 ; Y = 1044.5 and Radius, 75.3

\*\*\* 1.547 \*\*\*

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	50.00	975.63
2	54.32	973.11
3	58.86	971.02
4	63.59	969.38
5	68.45	968.21
6	73.40	967.50
7	78.39	967.28
8	83.38	967.55
9	88.33	968.29
10	93.18	969.51
11	97.89	971.19
12	102.41	973.32
13	106.71	975.87
14	110.74	978.83
15	114.47	982.16
16	117.85	985.84
17	120.87	989.83
18	123.49	994.09
19	125.68	998.58

20	127.43	1003.27
21	128.72	1008.10
22	129.30	1011.62

Circle Center At X = 78.2 ; Y = 1019.0 and Radius, 51.7

\*\*\* 1.629 \*\*\*

1

Failure Surface Specified By 33 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	12.50	973.35
2	17.45	972.66
3	22.42	972.11
4	27.41	971.70
5	32.40	971.42
6	37.40	971.29
7	42.40	971.29
8	47.39	971.44
9	52.39	971.72
10	57.37	972.14
11	62.34	972.70
12	67.29	973.40
13	72.22	974.24
14	77.12	975.21
15	82.00	976.32
16	86.84	977.56
17	91.65	978.94
18	96.41	980.46
19	101.13	982.10
20	105.81	983.88
21	110.43	985.78
22	115.00	987.81
23	119.51	989.97
24	123.96	992.26
25	128.34	994.66
26	132.65	997.19
27	136.89	999.84
28	141.06	1002.60
29	145.15	1005.48
30	149.15	1008.48
31	153.07	1011.58
32	156.91	1014.79

33            159.19        1016.81

Circle Center At X = 39.7 ; Y = 1150.8 and Radius, 179.5

\*\*\*        1.639        \*\*\*

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	25.00	972.70
2	29.99	972.36
3	34.99	972.23
4	39.99	972.30
5	44.98	972.59
6	49.95	973.08
7	54.90	973.79
8	59.82	974.69
9	64.70	975.81
10	69.52	977.13
11	74.28	978.64
12	78.98	980.36
13	83.60	982.27
14	88.14	984.37
15	92.58	986.66
16	96.93	989.13
17	101.16	991.79
18	105.29	994.62
19	109.29	997.62
20	113.16	1000.78
21	116.90	1004.10
22	120.49	1007.58
23	121.01	1008.13

Circle Center At X = 35.7 ; Y = 1091.7 and Radius, 119.5

\*\*\*        1.644        \*\*\*

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	37.50	974.17
2	42.08	972.16
3	46.81	970.54
4	51.66	969.31
5	56.59	968.49
6	61.57	968.07
7	66.57	968.06
8	71.56	968.46
9	76.49	969.27
10	81.34	970.48
11	86.08	972.08
12	90.67	974.07
13	95.08	976.43
14	99.28	979.14
15	103.24	982.18
16	106.95	985.54
17	110.36	989.19
18	113.47	993.11
19	116.24	997.28
20	118.66	1001.65
21	120.71	1006.21
22	121.50	1008.41

Circle Center At X = 64.2 ; Y = 1029.0 and Radius, 60.9

\*\*\* 1.671 \*\*\*

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	50.00	975.63
2	54.17	972.87
3	58.60	970.56
4	63.25	968.70
5	68.05	967.33
6	72.98	966.46
7	77.96	966.09
8	82.96	966.24
9	87.92	966.89
10	92.78	968.05
11	97.51	969.69

12	102.03	971.81
13	106.32	974.38
14	110.33	977.37
15	114.01	980.76
16	117.32	984.51
17	120.24	988.57
18	122.72	992.91
19	124.75	997.48
20	126.30	1002.23
21	127.36	1007.11
22	127.82	1011.21

Circle Center At X = 79.1 ; Y = 1015.0 and Radius, 49.0

\*\*\* 1.705 \*\*\*

1

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	37.50	974.17
2	42.28	972.69
3	47.16	971.60
4	52.11	970.91
5	57.10	970.62
6	62.10	970.74
7	67.07	971.25
8	71.99	972.17
9	76.81	973.48
10	81.52	975.18
11	86.07	977.25
12	90.44	979.68
13	94.59	982.46
14	98.52	985.56
15	102.17	988.97
16	105.54	992.66
17	108.61	996.62
18	111.34	1000.80
19	112.69	1003.30

Circle Center At X = 58.2 ; Y = 1032.5 and Radius, 61.9

\*\*\* 1.723 \*\*\*

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	37.50	974.17
2	42.25	972.60
3	47.06	971.25
4	51.94	970.13
5	56.86	969.24
6	61.81	968.58
7	66.79	968.15
8	71.79	967.94
9	76.79	967.97
10	81.78	968.24
11	86.76	968.73
12	91.71	969.45
13	96.61	970.41
14	101.47	971.58
15	106.27	972.99
16	111.00	974.61
17	115.65	976.45
18	120.21	978.51
19	124.67	980.77
20	129.02	983.24
21	133.25	985.91
22	137.35	988.77
23	141.31	991.81
24	145.13	995.04
25	148.79	998.44
26	152.30	1002.01
27	155.63	1005.74
28	158.79	1009.61
29	161.76	1013.63
30	163.74	1016.58

Circle Center At X = 73.6 ; Y = 1075.7 and Radius, 107.8

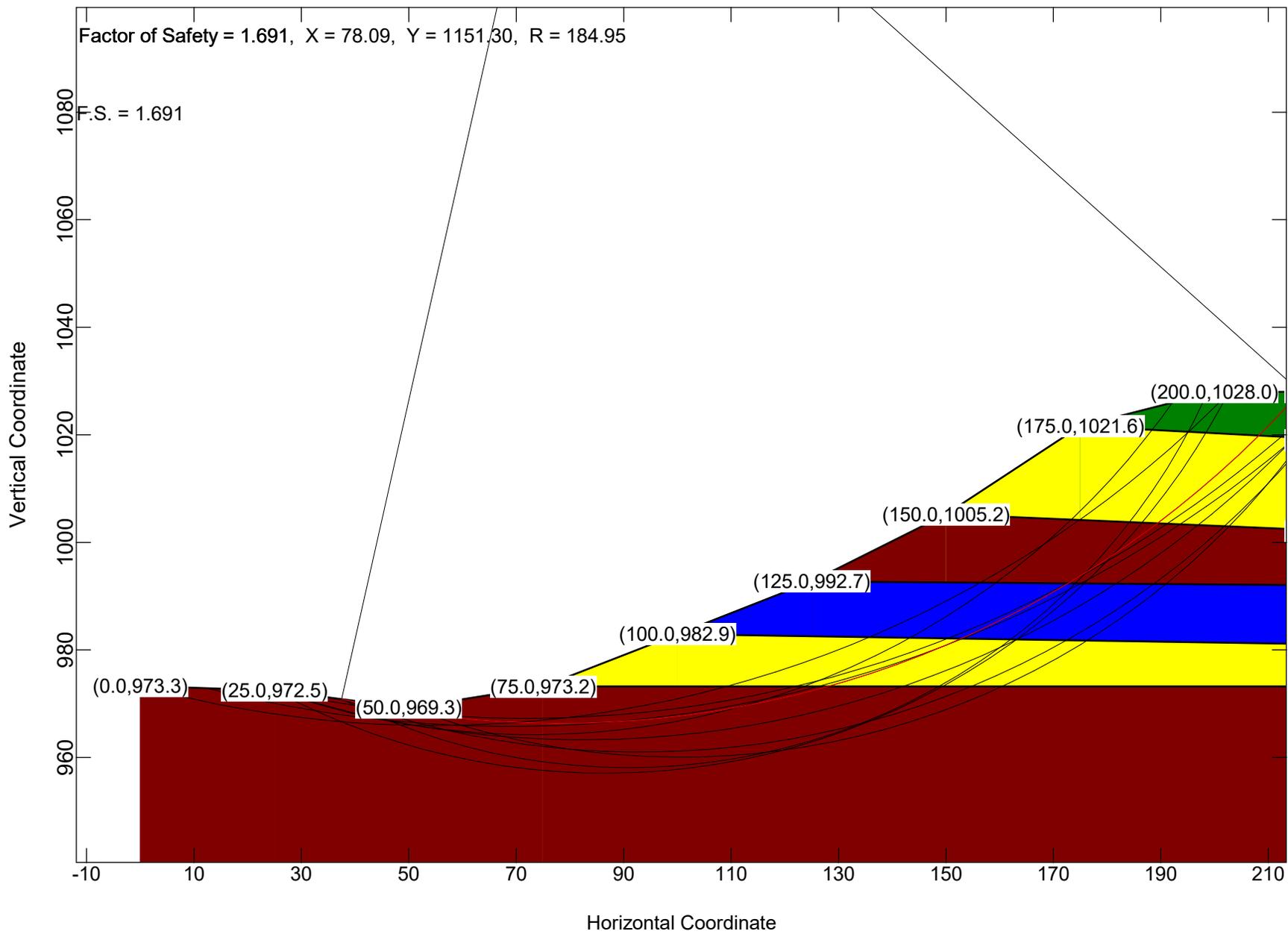
\*\*\* 1.752 \*\*\*

0.00      223.80      447.60      671.41      895.21      1119.01

X	0.00	+	-----+	-----+	-----+	-----+	**-----+
		-					.**
		-					.2*
		-					.41*
		-					.0*
		-					***
	223.80	+					
		-					
		-					
		-					
		-					
A	447.60	+					
		-					
		-					
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X	671.41	+					
		-					
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		-					
		-					
I	895.21	+					
		-					
		-					
		-					
		-					
S	1119.01	+					
		-					
		-					
		-					
		-					
	1342.81	+					
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		-					
F	1566.61	+					
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T 1790.41 +

# SECTION 3



=====

STABLPro for Windows, Version 2015.4.5

Upgraded from:  
FHWA-PCSTABLE

Serial Number : 179981068

--Slope Stability Analysis--  
Simplified Janbu, Simplified Bishop  
or Spencer Method of Slices

=====

This program is licensed to :

GeoTest, Inc.  
West Allis, WI, USA

Path to file locations : C:\Ensoft\Hartland Quarry\  
Name of input data file : Hartland Quarry - Section 3c.sl4d  
Name of output file : Hartland Quarry - Section 3c.sl4o  
Name of plot output file : Hartland Quarry - Section 3c.sl4p

-----  
Time and Date of Analysis  
-----

Date: September 05, 2023 Time: 18:33:43

1

PROBLEM DESCRIPTION Section 3c - After Grading

BOUNDARY COORDINATES

9 Top Boundaries  
14 Total Boundaries

Boundary No.	X-Left ft.	Y-Left ft.	X-Right ft.	Y-Right ft.	Soil Type Below Bnd
-----------------	---------------	---------------	----------------	----------------	------------------------

1	0.00	973.30	25.00	972.46	4
2	25.00	972.46	50.00	969.25	4
3	50.00	969.25	75.00	973.21	4
4	75.00	973.21	100.00	982.92	2
5	100.00	982.92	125.00	992.74	3
6	125.00	992.74	150.00	1005.22	4
7	150.00	1005.22	175.00	1021.61	2
8	175.00	1021.61	200.00	1028.00	1
9	200.00	1028.00	225.00	1028.00	1
10	175.00	1021.61	225.00	1019.00	2
11	150.00	1005.22	225.00	1002.00	4
12	125.00	992.74	225.00	992.00	3
13	100.00	982.92	225.00	981.00	2
14	75.00	973.21	225.00	973.21	4

1

#### ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. pcf	Saturated Unit Wt. pcf	Cohesion Intercept psf	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant psf	Piez. Surface No.
1	130.0	0.0	0.0	30.0	0.00	0.0	0
2	135.0	0.0	0.0	32.0	0.00	0.0	0
3	140.0	0.0	0.0	33.0	0.00	0.0	0
4	145.0	0.0	0.0	35.0	0.00	0.0	0

1

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

50 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 5 Points Equally Spaced Along The Ground Surface Between X = 0.00 ft.  
and X = 50.00 ft.

Each Surface Terminates Between X = 175.00 ft.  
and X = 225.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =900.00 ft.

5.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation. The Angle Has Been Restricted Between The Angles Of -45.0 And 0.0 deg.

1

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

\* \* Safety Factors Are Calculated By The Modified Janbu Method \* \*

Failure Surface Specified By 41 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	37.50	970.85
2	42.39	969.82
3	47.31	968.92
4	52.25	968.16
5	57.21	967.53
6	62.19	967.03
7	67.17	966.67
8	72.17	966.44
9	77.17	966.35
10	82.17	966.39
11	87.17	966.57
12	92.16	966.88
13	97.14	967.33
14	102.10	967.91
15	107.05	968.62
16	111.98	969.47
17	116.88	970.46
18	121.75	971.57
19	126.60	972.82
20	131.40	974.19
21	136.17	975.70



14	5.0	0.95E+04	0.00E+00							
15	2.9	0.59E+04	0.00E+00							
16	2.1	0.45E+04	0.00E+00							
17	4.9	0.11E+05	0.00E+00							
18	4.9	0.12E+05	0.00E+00							
19	4.9	0.13E+05	0.00E+00							
20	4.9	0.13E+05	0.00E+00							
21	3.2	0.90E+04	0.00E+00							
22	1.6	0.45E+04	0.00E+00							
23	1.4	0.40E+04	0.00E+00							
24	3.4	0.10E+05	0.00E+00							
25	4.8	0.15E+05	0.00E+00							
26	4.7	0.15E+05	0.00E+00							
27	4.7	0.16E+05	0.00E+00							
28	4.4	0.15E+05	0.00E+00							
29	0.2	0.72E+03	0.00E+00							
30	2.6	0.90E+04	0.00E+00							
31	2.0	0.72E+04	0.00E+00							
32	4.5	0.16E+05	0.00E+00							
33	4.5	0.17E+05	0.00E+00							
34	4.4	0.17E+05	0.00E+00							
35	4.3	0.17E+05	0.00E+00							
36	0.2	0.88E+03	0.00E+00							
37	2.3	0.88E+04	0.00E+00							
38	1.8	0.67E+04	0.00E+00							
39	4.2	0.15E+05	0.00E+00							
40	4.1	0.14E+05	0.00E+00							
41	4.0	0.12E+05	0.00E+00							
42	0.2	0.64E+03	0.00E+00							
43	3.7	0.10E+05	0.00E+00							
44	3.9	0.97E+04	0.00E+00							
45	3.0	0.68E+04	0.00E+00							
46	0.7	0.15E+04	0.00E+00							
47	3.7	0.66E+04	0.00E+00							
48	3.6	0.48E+04	0.00E+00							
49	0.2	0.22E+03	0.00E+00							
50	3.3	0.28E+04	0.00E+00							
51	3.4	0.13E+04	0.00E+00							
52	1.0	0.72E+02	0.00E+00							

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Failure Surface Specified By 39 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	25.00	972.46
2	29.75	970.88
3	34.54	969.47

4	39.38	968.23
5	44.27	967.15
6	49.18	966.24
7	54.13	965.50
8	59.10	964.93
9	64.08	964.53
10	69.07	964.30
11	74.07	964.24
12	79.07	964.36
13	84.06	964.65
14	89.04	965.11
15	94.00	965.74
16	98.94	966.54
17	103.84	967.51
18	108.71	968.64
19	113.54	969.95
20	118.32	971.42
21	123.04	973.05
22	127.71	974.85
23	132.31	976.80
24	136.85	978.91
25	141.30	981.18
26	145.68	983.60
27	149.97	986.16
28	154.17	988.87
29	158.27	991.73
30	162.28	994.73
31	166.18	997.86
32	169.97	1001.12
33	173.64	1004.51
34	177.19	1008.03
35	180.63	1011.66
36	183.93	1015.41
37	187.11	1019.28
38	190.15	1023.25
39	192.09	1025.98

Circle Center At X = 73.2 ; Y = 1109.7 and Radius, 145.4

\*\*\* 1.714 \*\*\*

1

Failure Surface Specified By 44 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
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1	25.00	972.46
2	29.89	971.43
3	34.81	970.51
4	39.74	969.70
5	44.69	969.01
6	49.66	968.43
7	54.64	967.97
8	59.63	967.63
9	64.62	967.40
10	69.62	967.29
11	74.62	967.30
12	79.62	967.42
13	84.61	967.66
14	89.60	968.01
15	94.58	968.49
16	99.54	969.07
17	104.50	969.77
18	109.43	970.59
19	114.34	971.52
20	119.23	972.57
21	124.09	973.73
22	128.93	975.00
23	133.73	976.38
24	138.50	977.88
25	143.24	979.49
26	147.94	981.20
27	152.59	983.03
28	157.20	984.96
29	161.77	987.00
30	166.28	989.15
31	170.75	991.40
32	175.16	993.75
33	179.51	996.21
34	183.81	998.76
35	188.05	1001.42
36	192.22	1004.17
37	196.33	1007.02
38	200.37	1009.97
39	204.34	1013.01
40	208.24	1016.14
41	212.07	1019.36
42	215.82	1022.66
43	219.49	1026.06
44	221.49	1028.00

Circle Center At X = 71.9 ; Y = 1182.1 and Radius, 214.8

\*\*\* 1.723 \*\*\*

Failure Surface Specified By 46 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	0.00	973.30
2	4.84	972.04
3	9.71	970.90
4	14.60	969.87
5	19.52	968.96
6	24.45	968.17
7	29.41	967.50
8	34.38	966.95
9	39.36	966.52
10	44.35	966.21
11	49.35	966.02
12	54.35	965.95
13	59.35	966.00
14	64.34	966.17
15	69.33	966.46
16	74.32	966.87
17	79.29	967.40
18	84.25	968.05
19	89.19	968.82
20	94.11	969.71
21	99.01	970.71
22	103.88	971.83
23	108.72	973.07
24	113.54	974.43
25	118.31	975.90
26	123.06	977.49
27	127.76	979.19
28	132.42	981.00
29	137.03	982.92
30	141.60	984.96
31	146.12	987.10
32	150.58	989.35
33	154.99	991.71
34	159.34	994.18
35	163.63	996.75
36	167.86	999.42
37	172.02	1002.19
38	176.11	1005.06
39	180.14	1008.03
40	184.09	1011.09
41	187.96	1014.25

42	191.76	1017.50
43	195.48	1020.84
44	199.12	1024.27
45	202.67	1027.79
46	202.88	1028.00

Circle Center At X = 54.8 ; Y = 1173.7 and Radius, 207.7

\*\*\* 1.816 \*\*\*

1

Failure Surface Specified By 40 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	37.50	970.85
2	42.01	968.69
3	46.60	966.72
4	51.28	964.95
5	56.02	963.37
6	60.83	962.00
7	65.69	960.83
8	70.60	959.87
9	75.54	959.11
10	80.51	958.57
11	85.50	958.24
12	90.50	958.11
13	95.50	958.20
14	100.49	958.50
15	105.46	959.02
16	110.41	959.74
17	115.32	960.67
18	120.19	961.80
19	125.01	963.15
20	129.76	964.69
21	134.45	966.44
22	139.06	968.38
23	143.58	970.51
24	148.01	972.83
25	152.33	975.34
26	156.55	978.03
27	160.65	980.90
28	164.62	983.93
29	168.46	987.14
30	172.16	990.50

31	175.72	994.01
32	179.12	997.67
33	182.37	1001.47
34	185.45	1005.41
35	188.37	1009.47
36	191.10	1013.66
37	193.66	1017.95
38	196.04	1022.35
39	198.23	1026.85
40	198.57	1027.63

Circle Center At X = 90.9 ; Y = 1076.3 and Radius, 118.2

\*\*\* 1.826 \*\*\*

Failure Surface Specified By 47 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	12.50	972.88
2	17.36	971.69
3	22.24	970.61
4	27.14	969.63
5	32.07	968.77
6	37.01	968.01
7	41.97	967.37
8	46.94	966.83
9	51.92	966.40
10	56.91	966.08
11	61.91	965.88
12	66.91	965.78
13	71.91	965.80
14	76.90	965.92
15	81.90	966.16
16	86.89	966.50
17	91.87	966.96
18	96.83	967.53
19	101.79	968.20
20	106.73	968.99
21	111.64	969.88
22	116.54	970.88
23	121.42	971.99
24	126.27	973.21
25	131.09	974.54
26	135.88	975.97

27	140.64	977.50
28	145.36	979.15
29	150.05	980.89
30	154.69	982.74
31	159.30	984.69
32	163.86	986.74
33	168.37	988.89
34	172.83	991.15
35	177.25	993.50
36	181.61	995.94
37	185.91	998.48
38	190.16	1001.12
39	194.35	1003.85
40	198.48	1006.67
41	202.54	1009.59
42	206.54	1012.59
43	210.47	1015.68
44	214.33	1018.85
45	218.12	1022.11
46	221.84	1025.46
47	224.54	1028.00

Circle Center At X = 68.7 ; Y = 1191.9 and Radius, 226.1

\*\*\* 1.838 \*\*\*

1

Failure Surface Specified By 45 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	25.00	972.46
2	29.77	970.97
3	34.58	969.61
4	39.43	968.38
5	44.31	967.28
6	49.21	966.31
7	54.14	965.48
8	59.10	964.78
9	64.06	964.22
10	69.05	963.79
11	74.04	963.50
12	79.03	963.34
13	84.03	963.31
14	89.03	963.43

15	94.03	963.68
16	99.01	964.06
17	103.98	964.58
18	108.94	965.23
19	113.88	966.02
20	118.79	966.94
21	123.68	967.99
22	128.54	969.18
23	133.36	970.49
24	138.15	971.94
25	142.89	973.52
26	147.59	975.22
27	152.25	977.05
28	156.85	979.01
29	161.39	981.09
30	165.88	983.29
31	170.31	985.62
32	174.67	988.06
33	178.97	990.62
34	183.19	993.30
35	187.34	996.09
36	191.41	998.99
37	195.40	1002.00
38	199.31	1005.12
39	203.14	1008.34
40	206.87	1011.66
41	210.51	1015.09
42	214.06	1018.61
43	217.52	1022.23
44	220.87	1025.94
45	222.63	1028.00

Circle Center At X = 82.4 ; Y = 1147.8 and Radius, 184.5

\*\*\* 1.839 \*\*\*

Failure Surface Specified By 43 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	37.50	970.85
2	42.22	969.21
3	46.99	967.71
4	51.81	966.36
5	56.66	965.16

6	61.55	964.11
7	66.47	963.21
8	71.41	962.46
9	76.38	961.87
10	81.36	961.43
11	86.35	961.15
12	91.35	961.01
13	96.35	961.04
14	101.34	961.22
15	106.33	961.55
16	111.31	962.03
17	116.27	962.67
18	121.20	963.47
19	126.11	964.41
20	130.99	965.51
21	135.83	966.76
22	140.64	968.15
23	145.39	969.69
24	150.10	971.38
25	154.75	973.22
26	159.34	975.19
27	163.87	977.31
28	168.33	979.57
29	172.72	981.96
30	177.04	984.49
31	181.27	987.15
32	185.42	989.94
33	189.48	992.86
34	193.45	995.90
35	197.32	999.06
36	201.09	1002.34
37	204.77	1005.74
38	208.33	1009.25
39	211.78	1012.86
40	215.12	1016.58
41	218.35	1020.40
42	221.45	1024.32
43	224.18	1028.00

Circle Center At X = 93.1 ; Y = 1122.8 and Radius, 161.8

\*\*\* 1.880 \*\*\*

Point No.	X-Surf ft.	Y-Surf ft.
1	50.00	969.25
2	54.71	967.57
3	59.47	966.05
4	64.29	964.71
5	69.15	963.53
6	74.05	962.52
7	78.97	961.68
8	83.93	961.02
9	88.91	960.52
10	93.90	960.21
11	98.89	960.06
12	103.89	960.10
13	108.89	960.30
14	113.88	960.68
15	118.84	961.24
16	123.79	961.96
17	128.71	962.86
18	133.59	963.93
19	138.44	965.18
20	143.23	966.58
21	147.98	968.16
22	152.67	969.90
23	157.29	971.80
24	161.85	973.87
25	166.33	976.09
26	170.73	978.46
27	175.04	980.99
28	179.26	983.67
29	183.39	986.49
30	187.41	989.45
31	191.33	992.56
32	195.14	995.80
33	198.84	999.17
34	202.41	1002.66
35	205.86	1006.28
36	209.18	1010.02
37	212.37	1013.87
38	215.42	1017.83
39	218.34	1021.90
40	221.11	1026.06
41	222.30	1028.00

Circle Center At X = 100.5 ; Y = 1103.3 and Radius, 143.2

\*\*\* 1.885 \*\*\*

Failure Surface Specified By 43 Coordinate Points

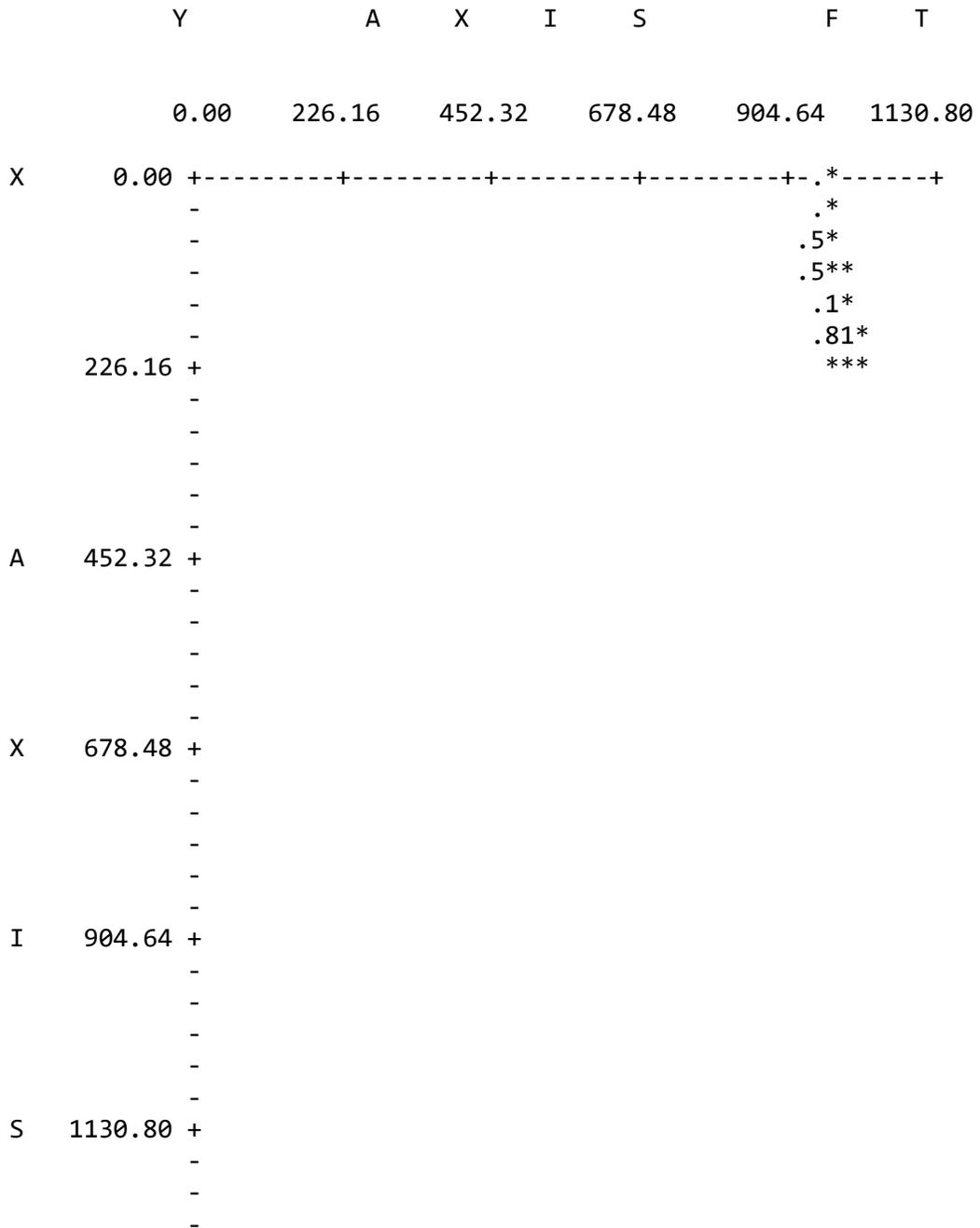
Point No.	X-Surf ft.	Y-Surf ft.
1	25.00	972.46
2	29.46	970.19
3	33.99	968.09
4	38.61	966.17
5	43.30	964.43
6	48.05	962.86
7	52.85	961.48
8	57.71	960.29
9	62.60	959.28
10	67.54	958.46
11	72.50	957.83
12	77.48	957.39
13	82.47	957.14
14	87.47	957.08
15	92.47	957.21
16	97.46	957.54
17	102.43	958.05
18	107.38	958.76
19	112.30	959.65
20	117.18	960.73
21	122.02	962.00
22	126.80	963.45
23	131.53	965.09
24	136.19	966.90
25	140.77	968.89
26	145.28	971.06
27	149.70	973.39
28	154.03	975.89
29	158.26	978.56
30	162.38	981.39
31	166.40	984.37
32	170.29	987.51
33	174.06	990.79
34	177.71	994.21
35	181.22	997.77
36	184.59	1001.46
37	187.82	1005.28
38	190.90	1009.22
39	193.82	1013.28
40	196.59	1017.44
41	199.20	1021.71
42	201.64	1026.07

43            202.63        1028.00

Circle Center At X = 86.5 ; Y = 1087.6 and Radius, 130.6

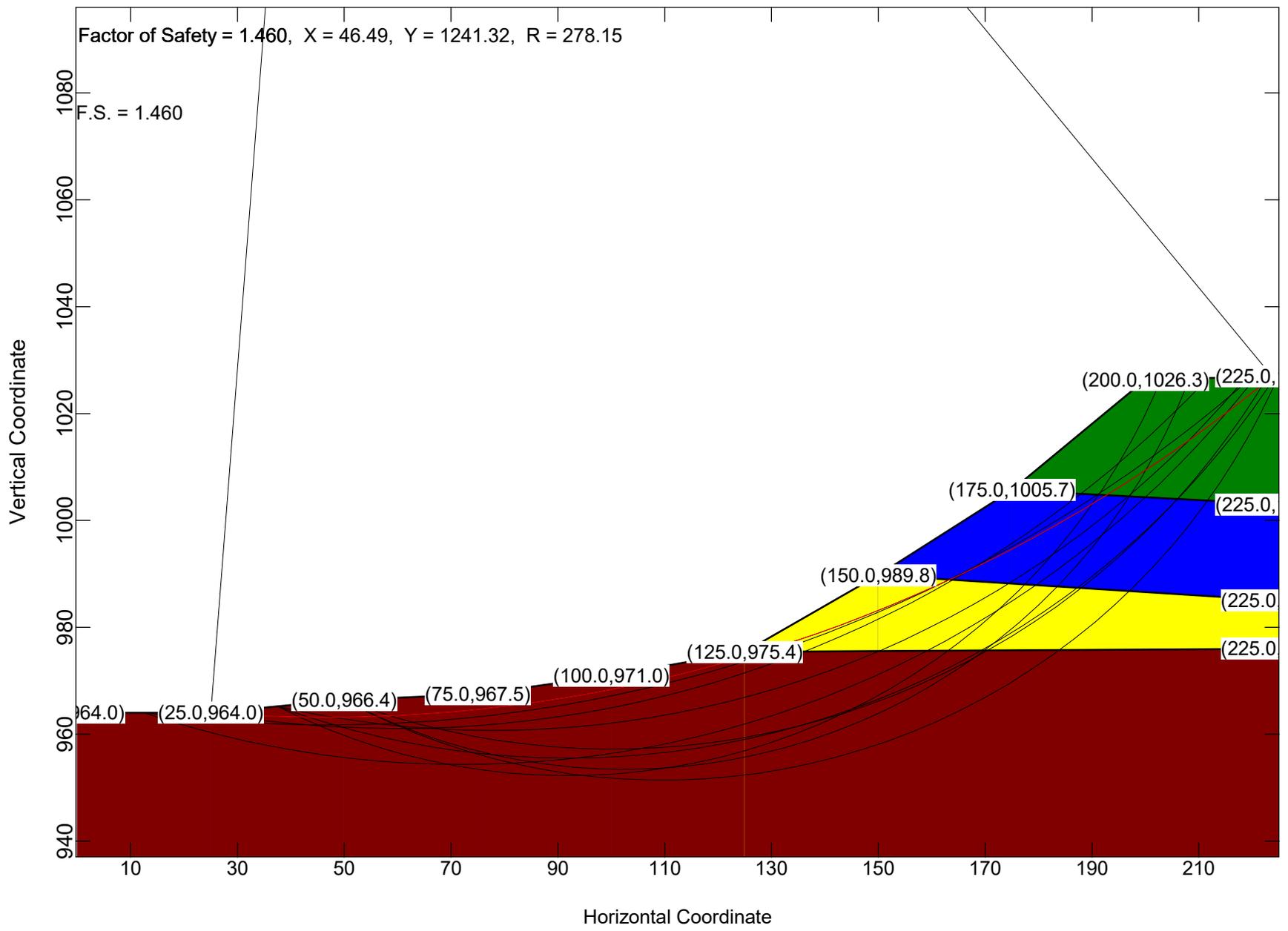
\*\*\*        1.904        \*\*\*

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# SECTION 4



=====

STABLPro for Windows, Version 2015.4.5

Upgraded from:  
FHWA-PCSTABLE

Serial Number : 179981068

--Slope Stability Analysis--  
Simplified Janbu, Simplified Bishop  
or Spencer Method of Slices

=====

This program is licensed to :

GeoTest, Inc.  
West Allis, WI, USA

Path to file locations : C:\Ensoft\Hartland Quarry\  
Name of input data file : Hartland Quarry - Section 4c.sl4d  
Name of output file : Hartland Quarry - Section 4c.sl4o  
Name of plot output file : Hartland Quarry - Section 4c.sl4p

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Time and Date of Analysis

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Date: September 05, 2023 Time: 14:07:39

1

PROBLEM DESCRIPTION Section 4c - After Grading

BOUNDARY COORDINATES

9 Top Boundaries  
12 Total Boundaries

Boundary No.	X-Left ft.	Y-Left ft.	X-Right ft.	Y-Right ft.	Soil Type Below Bnd
--------------	------------	------------	-------------	-------------	---------------------

1	0.00	964.00	25.00	964.00	4
2	25.00	964.00	50.00	966.38	4
3	50.00	966.38	75.00	967.48	4
4	75.00	967.48	100.00	970.99	4
5	100.00	970.99	125.00	975.42	4
6	125.00	975.42	150.00	989.75	2
7	150.00	989.75	175.00	1005.66	3
8	175.00	1005.66	200.00	1026.34	1
9	200.00	1026.34	225.00	1027.00	1
10	175.00	1005.66	225.00	1011.00	3
11	150.00	989.75	225.00	985.00	2
12	125.00	975.42	225.00	976.00	4

1

#### ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. pcf	Saturated Unit Wt. pcf	Cohesion Intercept psf	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant psf	Piez. Surface No.
1	130.0	0.0	0.0	30.0	0.00	0.0	0
2	135.0	0.0	0.0	32.0	0.00	0.0	0
3	140.0	0.0	0.0	33.0	0.00	0.0	0
4	145.0	0.0	0.0	35.0	0.00	0.0	0

1

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

50 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 5 Points Equally Spaced Along The Ground Surface Between X = 0.00 ft. and X = 50.00 ft.

Each Surface Terminates Between X = 175.00 ft. and X = 225.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation

At Which A Surface Extends Is Y =900.00 ft.

5.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation.  
The Angle Has Been Restricted Between The Angles Of -45.0  
And 0.0 deg.

1

Following Are Displayed The Ten Most Critical Of The Trial  
Failure Surfaces Examined. They Are Ordered - Most Critical  
First.

\* \* Safety Factors Are Calculated By The Modified Janbu Method \* \*

Failure Surface Specified By 44 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	25.00	964.00
2	29.99	963.66
3	34.98	963.41
4	39.98	963.25
5	44.98	963.17
6	49.98	963.19
7	54.98	963.30
8	59.97	963.50
9	64.97	963.78
10	69.95	964.16
11	74.93	964.63
12	79.90	965.18
13	84.86	965.83
14	89.80	966.56
15	94.73	967.39
16	99.65	968.30
17	104.55	969.30
18	109.43	970.39
19	114.29	971.56
20	119.13	972.82
21	123.94	974.17
22	128.73	975.61
23	133.49	977.13





0.00E+00									
32	2.2	0.21E+04	0.00E+00						
0.00E+00									
33	4.6	0.48E+04	0.00E+00						
0.00E+00									
34	4.6	0.54E+04	0.00E+00						
0.00E+00									
35	1.9	0.24E+04	0.00E+00						
0.00E+00									
36	2.7	0.35E+04	0.00E+00						
0.00E+00									
37	4.5	0.64E+04	0.00E+00						
0.00E+00									
38	4.5	0.67E+04	0.00E+00						
0.00E+00									
39	0.1	0.13E+03	0.00E+00						
0.00E+00									
40	4.3	0.70E+04	0.00E+00						
0.00E+00									
41	4.4	0.77E+04	0.00E+00						
0.00E+00									
42	4.3	0.82E+04	0.00E+00						
0.00E+00									
43	4.3	0.85E+04	0.00E+00						
0.00E+00									
44	4.2	0.89E+04	0.00E+00						
0.00E+00									
45	1.5	0.33E+04	0.00E+00						
0.00E+00									
46	1.9	0.42E+04	0.00E+00						
0.00E+00									
47	0.7	0.16E+04	0.00E+00						
0.00E+00									
48	4.1	0.81E+04	0.00E+00						
0.00E+00									
49	4.1	0.66E+04	0.00E+00						
0.00E+00									
50	4.0	0.50E+04	0.00E+00						
0.00E+00									
51	4.0	0.35E+04	0.00E+00						
0.00E+00									
52	3.9	0.19E+04	0.00E+00						
0.00E+00									
53	2.8	0.42E+03	0.00E+00						
0.00E+00									

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Failure Surface Specified By 42 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	37.50	965.19
2	42.39	964.16
3	47.31	963.26
4	52.25	962.50
5	57.21	961.87
6	62.19	961.38
7	67.18	961.02
8	72.17	960.80
9	77.17	960.71
10	82.17	960.76
11	87.17	960.95
12	92.16	961.27
13	97.14	961.73
14	102.10	962.32
15	107.05	963.05
16	111.97	963.92
17	116.87	964.91
18	121.74	966.04
19	126.58	967.31
20	131.38	968.70
21	136.14	970.23
22	140.86	971.88
23	145.53	973.66
24	150.16	975.57
25	154.72	977.60
26	159.24	979.76
27	163.69	982.03
28	168.07	984.43
29	172.39	986.95
30	176.64	989.59
31	180.82	992.33
32	184.92	995.20
33	188.94	998.17
34	192.88	1001.25
35	196.73	1004.44
36	200.50	1007.73
37	204.17	1011.12
38	207.75	1014.61
39	211.23	1018.20
40	214.62	1021.88
41	217.90	1025.65
42	218.88	1026.84

Circle Center At X = 77.8 ; Y = 1144.2 and Radius, 183.5

\*\*\* 1.606 \*\*\*

## Failure Surface Specified By 46 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	12.50	964.00
2	17.46	963.39
3	22.44	962.88
4	27.42	962.46
5	32.41	962.14
6	37.40	961.91
7	42.40	961.77
8	47.40	961.74
9	52.40	961.79
10	57.40	961.95
11	62.39	962.19
12	67.38	962.53
13	72.36	962.97
14	77.33	963.50
15	82.29	964.13
16	87.24	964.85
17	92.18	965.67
18	97.09	966.58
19	101.99	967.58
20	106.87	968.67
21	111.73	969.86
22	116.56	971.14
23	121.37	972.51
24	126.15	973.98
25	130.90	975.53
26	135.62	977.17
27	140.31	978.91
28	144.97	980.73
29	149.59	982.64
30	154.17	984.64
31	158.72	986.73
32	163.22	988.90
33	167.68	991.16
34	172.10	993.50
35	176.47	995.92
36	180.80	998.43
37	185.07	1001.02
38	189.30	1003.69
39	193.47	1006.44
40	197.60	1009.27

41	201.66	1012.18
42	205.68	1015.17
43	209.63	1018.23
44	213.52	1021.36
45	217.36	1024.57
46	220.00	1026.87

Circle Center At X = 46.9 ; Y = 1224.3 and Radius, 262.6

\*\*\* 1.621 \*\*\*

Failure Surface Specified By 41 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	50.00	966.38
2	54.71	964.70
3	59.47	963.18
4	64.29	961.84
5	69.15	960.66
6	74.05	959.65
7	78.98	958.82
8	83.93	958.16
9	88.91	957.67
10	93.90	957.36
11	98.90	957.22
12	103.90	957.26
13	108.89	957.48
14	113.88	957.86
15	118.85	958.43
16	123.79	959.16
17	128.71	960.07
18	133.59	961.15
19	138.43	962.41
20	143.22	963.83
21	147.97	965.41
22	152.65	967.17
23	157.27	969.08
24	161.82	971.16
25	166.29	973.39
26	170.68	975.78
27	174.99	978.32
28	179.20	981.02
29	183.32	983.85
30	187.33	986.83

31	191.24	989.95
32	195.04	993.21
33	198.72	996.59
34	202.28	1000.10
35	205.71	1003.74
36	209.01	1007.49
37	212.18	1011.35
38	215.22	1015.33
39	218.11	1019.41
40	220.86	1023.59
41	222.90	1026.94

Circle Center At X = 100.3 ; Y = 1099.9 and Radius, 142.7

\*\*\* 1.657 \*\*\*

1

Failure Surface Specified By 43 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	25.00	964.00
2	29.94	963.22
3	34.90	962.56
4	39.87	962.02
5	44.85	961.60
6	49.84	961.30
7	54.84	961.12
8	59.84	961.05
9	64.84	961.11
10	69.83	961.29
11	74.82	961.59
12	79.81	962.00
13	84.78	962.54
14	89.73	963.20
15	94.67	963.97
16	99.59	964.86
17	104.49	965.87
18	109.36	967.00
19	114.20	968.24
20	119.02	969.60
21	123.79	971.08
22	128.53	972.67
23	133.24	974.37
24	137.89	976.18

25	142.51	978.11
26	147.08	980.15
27	151.59	982.29
28	156.06	984.54
29	160.47	986.90
30	164.82	989.37
31	169.11	991.93
32	173.33	994.60
33	177.50	997.37
34	181.59	1000.24
35	185.62	1003.21
36	189.57	1006.27
37	193.45	1009.43
38	197.25	1012.68
39	200.97	1016.01
40	204.61	1019.44
41	208.17	1022.95
42	211.64	1026.55
43	211.73	1026.65

Circle Center At X = 59.9 ; Y = 1169.5 and Radius, 208.4

\*\*\* 1.713 \*\*\*

Failure Surface Specified By 44 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	37.50	965.19
2	42.22	963.54
3	46.99	962.05
4	51.81	960.71
5	56.67	959.51
6	61.56	958.48
7	66.48	957.59
8	71.42	956.87
9	76.39	956.30
10	81.37	955.88
11	86.37	955.63
12	91.37	955.53
13	96.37	955.59
14	101.36	955.81
15	106.35	956.18
16	111.32	956.71
17	116.27	957.40

18	121.20	958.25
19	126.10	959.25
20	130.96	960.40
21	135.79	961.71
22	140.57	963.16
23	145.31	964.77
24	149.99	966.53
25	154.61	968.44
26	159.17	970.48
27	163.67	972.68
28	168.09	975.01
29	172.43	977.48
30	176.70	980.09
31	180.88	982.83
32	184.98	985.70
33	188.98	988.70
34	192.88	991.82
35	196.69	995.07
36	200.38	998.43
37	203.98	1001.91
38	207.46	1005.50
39	210.82	1009.20
40	214.07	1013.00
41	217.19	1016.91
42	220.19	1020.91
43	223.06	1025.00
44	224.36	1026.98

Circle Center At X = 92.0 ; Y = 1113.9 and Radius, 158.4

\*\*\* 1.763 \*\*\*

1

Failure Surface Specified By 40 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	50.00	966.38
2	54.48	964.15
3	59.05	962.13
4	63.71	960.31
5	68.44	958.69
6	73.24	957.29
7	78.09	956.10
8	83.00	955.13

9	87.94	954.37
10	92.91	953.84
11	97.90	953.52
12	102.90	953.43
13	107.90	953.56
14	112.89	953.90
15	117.85	954.47
16	122.79	955.26
17	127.69	956.27
18	132.54	957.49
19	137.33	958.92
20	142.05	960.57
21	146.69	962.42
22	151.25	964.47
23	155.71	966.73
24	160.07	969.18
25	164.32	971.82
26	168.44	974.65
27	172.44	977.65
28	176.30	980.83
29	180.01	984.18
30	183.57	987.69
31	186.98	991.35
32	190.21	995.16
33	193.28	999.11
34	196.17	1003.19
35	198.87	1007.40
36	201.39	1011.72
37	203.71	1016.15
38	205.84	1020.67
39	207.76	1025.29
40	208.22	1026.56

Circle Center At X = 102.5 ; Y = 1066.4 and Radius, 113.0

\*\*\* 1.784 \*\*\*

Failure Surface Specified By 43 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	50.00	966.38
2	54.45	964.10
3	58.99	962.00
4	63.61	960.08

5	68.30	958.35
6	73.05	956.81
7	77.87	955.45
8	82.73	954.29
9	87.63	953.32
10	92.57	952.55
11	97.54	951.97
12	102.53	951.60
13	107.52	951.42
14	112.52	951.44
15	117.52	951.65
16	122.50	952.07
17	127.46	952.68
18	132.40	953.50
19	137.29	954.50
20	142.15	955.70
21	146.95	957.09
22	151.69	958.68
23	156.37	960.45
24	160.97	962.40
25	165.49	964.53
26	169.93	966.85
27	174.26	969.33
28	178.50	971.99
29	182.63	974.82
30	186.64	977.80
31	190.53	980.94
32	194.29	984.24
33	197.91	987.68
34	201.40	991.26
35	204.74	994.98
36	207.93	998.83
37	210.97	1002.80
38	213.85	1006.89
39	216.56	1011.09
40	219.10	1015.40
41	221.47	1019.80
42	223.66	1024.30
43	224.85	1027.00

Circle Center At X = 109.5 ; Y = 1077.2 and Radius, 125.8

\*\*\* 1.806 \*\*\*

Point No.	X-Surf ft.	Y-Surf ft.
1	12.50	964.00
2	17.26	962.48
3	22.07	961.09
4	26.90	959.83
5	31.77	958.69
6	36.67	957.68
7	41.59	956.81
8	46.54	956.06
9	51.50	955.45
10	56.48	954.97
11	61.47	954.62
12	66.46	954.41
13	71.46	954.32
14	76.46	954.37
15	81.46	954.55
16	86.45	954.87
17	91.43	955.31
18	96.39	955.89
19	101.34	956.60
20	106.27	957.44
21	111.18	958.41
22	116.05	959.52
23	120.90	960.75
24	125.71	962.10
25	130.49	963.59
26	135.22	965.20
27	139.91	966.94
28	144.55	968.80
29	149.14	970.78
30	153.67	972.89
31	158.15	975.11
32	162.57	977.45
33	166.92	979.91
34	171.21	982.48
35	175.43	985.17
36	179.57	987.96
37	183.64	990.87
38	187.63	993.88
39	191.54	997.00
40	195.37	1000.22
41	199.11	1003.54
42	202.75	1006.96
43	206.31	1010.47
44	209.77	1014.08
45	213.14	1017.78
46	216.41	1021.56

47	219.57	1025.44
48	220.69	1026.89

Circle Center At X = 72.1 ; Y = 1142.7 and Radius, 188.4

\*\*\* 1.951 \*\*\*

Failure Surface Specified By 41 Coordinate Points

Point No.	X-Surf ft.	Y-Surf ft.
1	37.50	965.19
2	42.01	963.03
3	46.60	961.05
4	51.27	959.27
5	56.02	957.68
6	60.82	956.30
7	65.68	955.11
8	70.58	954.13
9	75.52	953.35
10	80.48	952.77
11	85.47	952.40
12	90.47	952.25
13	95.47	952.29
14	100.46	952.55
15	105.44	953.01
16	110.39	953.68
17	115.32	954.56
18	120.20	955.64
19	125.03	956.92
20	129.81	958.40
21	134.52	960.07
22	139.16	961.94
23	143.71	964.01
24	148.18	966.26
25	152.54	968.69
26	156.81	971.30
27	160.96	974.09
28	164.99	977.05
29	168.89	980.17
30	172.67	983.45
31	176.30	986.89
32	179.78	990.47
33	183.12	994.20
34	186.30	998.06

35	189.31	1002.05
36	192.16	1006.16
37	194.83	1010.39
38	197.32	1014.72
39	199.63	1019.15
40	201.76	1023.68
41	202.91	1026.42

Circle Center At X = 91.8 ; Y = 1072.6 and Radius, 120.3

\*\*\* 2.004 \*\*\*

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