GEOTECHNICAL ENGINEERING REPORT
PROPOSED VILLAGE GREEN CENTER
OFFICE BUILDINGS
SHERMER ROAD & MEADOW ROAD
NORTHBROOK, ILLINOIS

Terra Group No. 12025041
October 7, 2002

Prepared for:

Village Green Center, Inc.
Northbrook, Illinois

Prepared by:

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October 7, 2002

Village Green Center, Inc.
2225 Greenview Road
Northbrook, Illinois 60062

Attn: Mr. Selwyn Marcus

RE: Geotechnical Engineering Report
Proposed Village Green Center Office Buildings
Shermer Road & Meadow Road
Northbrook, Illinois
Terra Group No. 12025041

Dear Mr. Marcus:

We are submitting, herewith, the results of the subsurface exploration completed for the referenced project. The purpose of this exploration was to obtain information on subsurface conditions at the proposed project site and, based on this information, to provide recommendations regarding the design and construction of foundations, floor slabs and site development for the new office buildings.

About 8 to 9 feet of predominantly clay fill materials was encountered at the boring locations. Mostly stiff to very stiff consistency lean clay, lean to fat clay and silty clay was encountered beneath the fill. Footing foundations bearing on suitable native soils or on new engineered fill extending down to suitable native soils are considered feasible for support of the new buildings. Excavations for basements are anticipated to extend below existing fill materials. An overexcavation and backfill procedure will likely be needed to extend footing foundations to suitable native soils for slab-on-grade structures. In addition, some corrective action will be needed to support floor slabs over existing fill soils. The geotechnical engineering aspects of the site are discussed in further detail in the text of the report.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, please contact us.

Sincerely,
THE TERRA GROUP OF CHICAGO, INC.

Nicholas P. Wolff, E.I.
Project Engineer

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Illinois No. 062-052191

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INTRODUCTION

Subsurface exploration for the proposed Village Green Center office buildings to be located northwest of the intersection of Shermer Road and Meadow Road in Northbrook, Illinois has been completed. Three (3) soil borings extending to depths of approximately 15 to 20 feet below the existing ground surface were performed on the proposed project site. Individual boring logs and a location diagram are included with this report. The purposes of this report are to describe the subsurface conditions encountered in the borings, present the test data, and provide recommendations regarding the design and construction of foundations, floor slabs, pavements, and earthwork for the new apartment buildings.

PROJECT DESCRIPTION

The proposed buildings will occupy vacant lot and pavement spaces between existing one and two-story buildings at the development. The plan dimensions of the buildings are not known. We estimate the new buildings will be a maximum of two stories. The building northwest of 1320-26 Shermer Road will have a basement, while the other building to be located between 1332 and 1338 Shermer Road is planned to be slab-on-grade. Details of the planned construction has not been provided, but we anticipate the structures will consist of a combination of masonry walls and steel framing, although wood framing might also be used. We estimate maximum column loads 75 kips and maximum wall loads of 4 kips per lineal foot.

For the purpose of developing recommendations for this report, we estimate cuts and fills in the slab-on-grade building area will be less than about 2 to 3 feet and the basement excavation will extend to depths of about 10 to 12 feet below current grade. Deeper excavations may be needed in slab on grade areas to extend foundations to suitable native soils.

SITE EXPLORATION PROCEDURES

Field Exploration

The boring locations shown on the attached Soil Boring Location Diagram were laid out on the site by Terra Group personnel. Horizontal distances from reference features to the proposed boring locations were measured with a rolling wheel measuring device. Right angles for the boring location measurements were estimated. Ground surface elevations (rounded to the nearest 1 foot) indicated on the boring logs are approximate and were estimated. The elevations were referenced to the existing sidewalk at the front entrance of 1330 - 32 Shermer Road. An arbitrary elevation of 100 feet was assigned to this location. The locations and elevations of the borings should be considered accurate only to the degree implied by the means and methods used to define them.

The borings were drilled with a truck mounted drilling rig, using continuous flight augers to advance the boreholes. Boring 2 encountered practical auger refusal at a depth of 2 feet. Boring 2A was performed a few feet offset from Boring 2 to reach the planned Boring depth. Representative samples were obtained using thin-walled tube and split-barrel sampling procedures. In the split-barrel sampling procedure, a standard 2-inch O.D. split-barrel sampling spoon is driven into the ground with a 140-pound hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the standard penetration resistance "N" value. These values are indicated on the boring logs at the depths of occurrence. The samples were sealed and returned to the laboratory for testing and classification.

Field logs of each boring were prepared by the drill crew. These logs included visual classifications of the materials encountered during drilling as well as the driller's interpretation of the subsurface conditions between samples. Final boring logs included with this report represent an interpretation of the field logs and include modifications based on laboratory observation and tests of the samples.

Laboratory Testing

Soil samples were tested in the laboratory to measure their natural water contents. A calibrated hand penetrometer was used to estimate the approximate unconfined compressive strength of all cohesive native soil samples. The test results are provided on the boring logs.

As part of the testing program, the samples were examined in the laboratory and classified in accordance with the attached General Notes and the Unified Soil Classification System based on the material's texture and plasticity. The estimated group symbols for the Unified Soil Classification System are shown on the boring logs, and a brief description of the Unified System is included with this report.

SITE AND SUBSURFACE CONDITIONS

Site Description

The proposed buildings are located on two (2) lots located at 1334-36 Shermer Road and northwest of 1320 - 26 Shermer Road in Northbrook, Illinois. We understand that buildings had previously occupied these sites and have been subsequently demolished. The 1334-36 Shermer Road site was a graded vacant lot that sloped down gently away from Shermer Road. About 3 feet of vertical change is estimated across the lot. The other lot, located northwest of 1320 – 26 Shermer Road is currently occupied by an asphalt drive, and parking area that surrounds a former building area. The former building area was rough and the previous building was demolished just prior to the exploration. The site topography in this area was, generally, relatively flat, but could not be accessed by the drill rig due to rough surface features.

We understand that during previous construction of neighboring buildings in the development, that basement fill from an older, relatively large facility was encountered. The basement fill appeared to be uncontrolled and rubble and debris were also common in the fill.

Soil Conditions

Conditions encountered at each boring location are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in-situ, the transition between materials may be gradual. Based on the results of the borings, subsurface conditions on the project site can be generalized as follows.

Boring 1 was performed in the planned location of 1334-36 Shermer Road. Lean clay and lean to fat clay fill soils were encountered in Boring 1 to a depth of about 8 feet. The fill was brown and dark brown to depths of about 5 feet where the fill soils became dark gray. Native, brown and gray, stiff consistency lean to fat clay soils were encountered beneath the fill and extended to a depth of about 9 feet, where stiff consistency lean clay soils were encountered to the termination depth of about 15 feet. Sand and silt seams were encountered throughout the native and fill clay soils.

Borings 2, 2A and 3 were performed in the area for the planned office building to be located northwest of 1320 - 26 Shermer Road. Boring 2 lean clay fill soils to a depth of about 2 feet, where the boring encountered practical auger refusal in apparent concrete rubble. Boring 2A encountered sandy gravel fill to a depth of about 5 feet. The sandy gravel included clay chunks, rubble and brick fragments. Below the sandy gravel, sand fill soils were encountered and continued to a depth of about 8 feet. About 3 inches of asphalt pavement, underlain by about 4 inches of crushed stone base course was encountered at Boring 3. Boring 3 encountered lean clay fill soils beneath the pavement materials and continued to a depth of about 5 feet, where a layer of cinders with trace amounts of slag was encountered. Layers of lean clay, sand and gravel and lean to fat clay fill soils were encountered beneath cinders and continued to depths of about 9 feet. The fill soils in Borings 2A and 3 were underlain by medium to stiff consistency lean to fat clay soils that extended to depths of about 13 feet.

Very stiff consistency lean clay and silty clay soils were encountered beneath the lean to fat clay and extended to depths of about 20 feet. The native clay soils were generally brown and gray.

Please refer to the attached boring logs for the laboratory data and a more detailed description of the subsurface conditions encountered at the individual boring locations.

Water Level Observations

The borings were monitored while drilling and after completion for the presence and level of groundwater. During drilling, groundwater was encountered in Borings 2A and 3 at depths of about 8 to 11.5 feet. After boring completion, groundwater was encountered in Borings 2A and 3 at depths of about 18 to 18.5 feet. Groundwater was not observed in Borings 1 and 2 at these times. These water level observations provide an approximate indication of the groundwater conditions existing on the site at the time the borings were performed. A relatively long time is often required for a water level to develop and stabilize in an open borehole in low permeability cohesive soils. Long term monitoring in cased holes or piezometers sealed from the influence of surface water are often required to evaluate groundwater conditions in these types of soils.

It should be recognized that fluctuations of the groundwater table might occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Due to these factors, groundwater levels could be higher or lower than those indicated on the boring logs at the time of construction. In addition, water seepage could occur from several sources, including existing fill, lean to fat clay, silty clay or sand and silt seams that were encountered in the clay soils. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

ENGINEERING ANALYSIS AND RECOMMENDATIONS

Geotechnical Considerations

The soil boring and laboratory test results were evaluated to develop recommendations for the site preparation, foundation and floor slab design and construction for the proposed buildings. Based on the results of the soil borings and our understanding of the project, support of the proposed structures on footing foundations is considered feasible and is recommended. Footing foundations are expected to bear on stiff to very stiff consistency, native cohesive soils, below any existing fill.

Existing fill was encountered in the borings to depths of about 8 to 9 feet. Although we anticipate the fill soils in one of the structures will be removed during basement excavation, deepened footing excavations will be needed in the vicinity of Boring 1 due to the presence of old fill. The fills encountered in the borings probably consist of backfill of former demolished basement structures. **The existing fill soils are not considered suitable for support of perimeter or interior foundations.**

In addition, the uppermost several feet of native lean to fat clay soils exhibited relatively high moisture contents. These soils could be subject to strength loss and disturbance during construction. Due to the presence of these high moisture soils, some footing excavations may also need to be deepened to encounter suitable bearing soils. The footings could bear on the native soils at the deeper level or on new compacted fill.

We are unaware if the buildings adjacent to the proposed buildings have basements. If adjacent footings are located at shallow depths, underpinning and shoring of excavations will be needed. Foundations for the new and existing structures should bear at the same elevation where they abut on another.

Based on the results of the borings and our understanding of the project, the first floor slab for the 1334-36 Shermer Road building would be supported over some thickness of existing fill. The owner should be aware of risks associated with support of slabs over existing fills. As is the case with any fill placed without technical observations, the possibility exists that the fill may contain concentrated amounts of deleterious material, or soft, compressible zones beneath the fill not disclosed by our borings. Accordingly, there are certain risks associated with construction on these types of fill. The risk primarily consists of non-uniform settlement caused by zones or pockets of soft, loose, or uncompacted material. Additional construction costs can also be incurred when unsuitable fill deposits are encountered during construction.

Corrective actions to reduce the risk for settlement of floor slabs supported above unsuitable fill will probably be needed. The actions could include:

- complete removal and replacement with controlled fill
- partial removal and replacement
- incorporation of a structural slab over the thick fill deposits
- including a basement in the design for the current slab-on-grade building

More thorough evaluation of the existing fill soils should be performed prior to construction and should include test pits. Hand auger borings and moisture/density tests on the fill, would be necessary during the construction phase of the project. These operations would be useful to determine the depth and lateral extent of necessary existing fill removal.

Our recommendations for site preparation, foundation and floor slab design and construction are presented in the following sections.

Basement Excavation

The building to be located northwest of 1320 – 26 Shermer Road will include a basement. The sides of the excavations should be sloped or braced for stability. Information about the bearing elevation of foundations of adjacent structures had not been provided at the time this report was written. Care should be taken to not undermine the foundations of the existing buildings during excavation. Shoring, sheeting, or bracing of the sides of the excavations may also be required to avoid undermining the existing foundations. Underpinning the existing foundations will be needed if the existing foundations bear at shallow depths. Test pits could be performed to evaluate the elevations and types of existing footings.

Excavations should comply with the requirements of OSHA 29CFR, Part 1926, Subpart P, "Excavations" and its appendices, as well as other applicable codes. This document states that the excavation safety is the responsibility of the contractor. Reference to this OSHA requirement should be included in the job specifications.

Underpinning of existing foundations will be required where if new foundations will extend below existing foundations. Underpinning of the continuous wall foundations will probably require excavation and replacement with concrete in short segments. The underpinning concrete should only extend to within a few inches from the bottom of the existing foundation, then shims and non-shrink grout should be pressure injected into the cavity to provide positive contact between the foundation and underpinning elements. The existing foundations should be monitored for settlement during the excavation and underpinning work.

Grades adjacent to basement and footing excavations should be sloped to divert surface water away from the excavations. Some water may accumulate in the excavations as a result of precipitation, runoff and subsurface seepage. Should a relatively high groundwater table occur during construction, some water seepage into excavations could occur. Removal of a limited volume of water could probably be achieved by using an appropriate number of sump pits and pumps in the excavations.

Site Preparation

We recommend that asphalt pavement, crushed stone, loose fill, topsoil (if any), vegetation, roots and any soft or otherwise unsuitable soils be removed from planned building areas at the onset of construction. Depths of these surface materials encountered in our borings typically ranged from the uppermost few inches to about 7 inches. Since the near surface soils could be subject to moisture accumulation and strength loss, actual stripping depths at the time of construction will likely vary and we recommend that a Terra Group representative assist in evaluating that unsuitable materials are removed.

Although demolition of the previous buildings has already been performed, it is possible that existing utilities and building/foundation elements are still present in the previous building areas. These materials are anticipated to be removed during basement excavations, but could still be present within the slab-on-grade building area. Test pits should be performed to determine the presence of existing structures in former building areas. If present, utility conduits and associated backfill materials should also be removed from proposed building areas, unless the utilities are planned to remain in service for the new buildings. Any storm water, sanitary sewer or water utilities present in planned building areas should be abandoned or rerouted and their elements removed and replaced with controlled fill. Floor slabs and below grade foundation elements of the existing buildings should be completely removed where they will conflict with new construction. The tops of foundation walls should be removed to depths of at least 2 feet below the base of new floor slabs, but existing wall backfill materials, if encountered, should be completely removed and replaced with controlled compacted fill. Soils exposed in the excavations created by the demolition should be observed and evaluated by representatives of Terra Group. The completed excavations should be backfilled with properly placed and compacted fill as recommended in this report.

Some form of corrective measure is anticipated for the planned slab-on-grade structure located at 1334 – 36 Shermer Road, as previously discussed. Clay fill was encountered in Boring 1 to a depth of about 8 feet. The standard penetration test blowcount values and moisture contents of the clay fill at Boring 1 ranged from 8 to 9 and from 18 to 28 percent, respectively. Based upon the results of our borings, it is our opinion that the potential for additional settlement of the clay fill could be significant (in excess of 1 to 2 inches). As such, remedial actions should be taken to reduce the potential for excessive total and differential settlement of floor slabs. Complete removal and replacement with controlled fill, although the most costly, would provide the most positive support of the slabs. Alternately, a portion of the existing fill could be removed (about 3 feet) and replaced with controlled compacted fill. The exposed soils should be evaluated with density testing and shallow probe holes. Additional removal, or compaction/densification of the exposed soils may be needed. By leaving some thickness of uncontrolled fill in-place, some risk of total and differential settlement would remain. Test pits should be performed prior to construction to better evaluate the density and consistency of the fill materials.

If complete or partial removal of the soils is considered cost prohibitive, consideration could be given to installing a structural slab over the thick deposits of existing fill. Also, a basement could be included in the design of this building as well. With this option, basement slabs would be located over native soils.

Following stripping, removal of clay fill and prior to placement of site fill in areas below design grade and after rough grading is completed in other areas, the exposed slab-on-grade subgrades should be proofrolled. Proofrolling aids in providing a firm base for compaction of new fill by delineating soft or disturbed areas that may exist at or near the exposed subgrade level. **Proofrolling is extremely important to help evaluate the surficial stability of the existing near surface fill materials that might be left in-place below floor slabs.** Unstable areas observed at this time should be improved by scarification and recompaction or by undercutting and replacement with suitable compacted fill. Proofrolling may be accomplished with a fully loaded, tandem-axle dump truck or other equipment providing an equivalent subgrade loading. A minimum gross weight of 25 tons is recommended for the proofrolling equipment. Proofrolling should be performed in the presence of a Terra Group representative to aid in evaluating corrective action for unstable subgrade areas.

Proofrolling will probably not be possible in the basement excavations due to inaccessibility of the excavation to truck traffic. As such, the basement subgrade should be evaluated with shallow probe holes, nuclear density tests and calibrated hand penetrometer tests.

The near surface fill soils at Boring 1, as well as the native lean clay and lean to fat clay soils that were encountered at the anticipated basement depth encountered in Borings 2A and 3, exhibited relatively high moisture contents. These soils could be susceptible to strength loss from construction disturbance. Sand and silt lenses or seams were also common in the clay profile in the borings. The soils could be sensitive to disturbance from construction activity, particularly if wetted further by rainfall or seepage, and if a shallow groundwater level is present. These soils could exhibit a relatively firm/stable condition upon initial exposure at the subgrade level. However, repetitive construction traffic and/or wetting of the soils will deteriorate the soil strength and likely result in rutting and instability. Construction traffic over unstable areas should be avoided.

Compacted Fill

New fill placed in building areas should be low plasticity cohesive soil or granular soil, and be free of organic matter and debris. Low plasticity cohesive soil would have a liquid limit less than about 45 and a plasticity index less than about 20. The on-site, inorganic brown and dark brown lean clay existing fill soils generally are considered suitable for use as site fill provided they are free of rubble and debris. The dark gray clay fills or fill containing cinders and other debris should not be used. Drying of on-site clay soils may be needed to achieve proper compaction. Atterberg limits tests and laboratory moisture-density tests should be performed on potential fill materials prior to their use on site. Further evaluation of any on-site soils or off-site fill materials should be provided at the time of construction.

The moisture content of cohesive fill should be within the range of 1 percent below to 3 percent above the optimum moisture content value determined by the standard Proctor method (ASTM D-698). Granular fill should be placed at moisture contents within about 3 percent above or below the material's optimum moisture content.

New fill should be placed and compacted in lifts of 9 inches or less in loose thickness. Fill placed below footing base elevations should be compacted to at least 98% of the material's standard Proctor maximum dry density (ASTM D-698). The higher degree of new fill compaction below footings in the building areas should extend laterally beyond the exterior edges of perimeter footings at least 8 inches per foot of fill thickness below footing base elevation. Fill placed above footing base elevation for support of lightly loaded floor slabs, for uplift or passive soil resistance should be compacted to at least 95% of the material's standard Proctor maximum dry density (ASTM D-698). All new fill placement and compaction should be observed and tested by Terra Group personnel.

Upon completion of the filling operation, care should be taken to maintain the subgrade moisture content prior to construction of floor slabs. If the subgrade should become frozen, desiccated, saturated, or disturbed, the affected material should be removed or these materials should be scarified, moisture conditioned, and recompacted prior to new floor slab construction.

Representatives of Terra Group should be present on an on-going basis to perform observations and testing during the preparation of the building site and pavement areas.

Footing Foundations

Design Criteria:

We recommend foundation excavations extend to suitable native soils. Existing fill was encountered in the borings to depths of about 8 to 9 feet. **Existing fill is not considered suitable for support of foundations.** It is anticipated that the existing fill will be removed during excavation of the basement in the vicinity of Borings 2, 2A and 3; however, in the vicinity of Boring 1, where a planned slab-on-grade structure is located, footings will need to be deepened to reach suitable native soils. If the existing fill is removed and replaced at the onset of construction, the foundations could bear at shallow depths on properly compacted and tested fill. Footing foundations are anticipated to be supported on stiff to very stiff consistency lean clay, lean to fat clay and silty clay that could be designed using a maximum net allowable soil bearing pressure of 3000 pounds per square foot (psf). The net allowable soil bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at footing base elevation.

Regardless of contact pressure, isolated footings should have a minimum width of 30 inches, and continuous wall footings should have a minimum width of 18 inches. Perimeter footings and footings in unheated areas should extend at least 3.5 feet below the lowest adjacent finished grade for frost protection. Interior footings, at least 5 feet from outside temperature fluctuations, should bear on approved soils at least 2 feet below the top of floor slab, provided the subgrade is not wet, frozen or otherwise unsuitable at the time of construction.

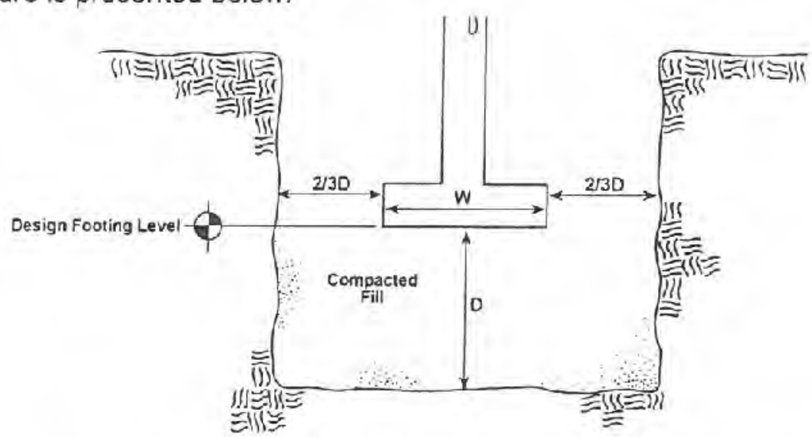
The base of new footings adjacent to the existing building should bear at the same elevation as existing footings. The bottom of existing footings should not be undermined. Where possible, the sides of footings adjacent to the existing building should be separated by at least one footing width to reduce overlapping pressure distributions.

Based on the subsurface conditions and structural information described herein, we estimate that post-construction settlements of the footing foundations designed and constructed in accordance with the recommendations in this report should be less than about 1 inch. Differential settlements can typically be on the order of 1/2 to 2/3 of the total settlement.

<u>Footing Excavations and Backfilling:</u>
Due to the potential for subsurface variations across the site, it is recommended that Terra Group personnel evaluate the soil conditions at and below footing grade at the time the excavations are performed. Hand auger probes below footing level should be performed at individual column locations and at intervals along wall footings to evaluate that the bearing soil properties are consistent with the recommended design parameters.

If soft, loose, or otherwise unsuitable soils are encountered below the design bottom of footing elevations, the footing excavations should be extended deeper to reach adequate bearing soils. Beneath the fill soils, a layer of higher moisture lean clay and lean to fat clay soils, some of which exhibited medium consistency was encountered in the borings and may not be suitable for foundation support. Where deepened excavations are needed, the footings could bear directly on the suitable soils at the lower level, or lean concrete could be placed from the suitable soils back to the design bearing level. If lean concrete (minimum f'c = 1500 psi) is used, the excavation should be widened at least 6 inches from all edges of the design footing width. The lean concrete may be advantageous since it should reduce the amount of excavation and time required to replace the unsuitable soils. Additionally, the lean concrete serves as a "mud mat" to protect the underlying foundation bearing materials.

The footings could also bear on properly compacted granular backfill placed in widened excavations extending down to suitable soil. For the granular fill alternative, we recommend the excavation extend laterally at least 8 inches beyond all footing edges for each 12 inches of additional excavation depth required below the bottom of foundation design elevation. The overexcavation should then be backfilled to design elevation with new engineered granular fill that is approved by the geotechnical engineer. Granular fill placed below footing base elevation should be placed in loose lifts not exceeding 9 inches in thickness and compacted to at least 98 percent of the material's standard Proctor maximum dry density (ASTM D-698). Footings bearing on new engineered fill would be considered suitable for the net maximum allowable soil bearing pressure of 3000 psf. A diagram illustrating the overexcavation and backfill procedure is presented below.

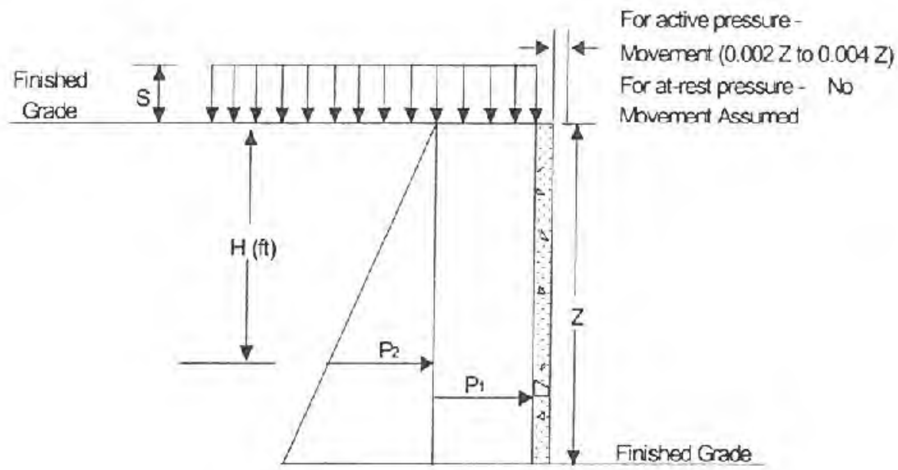


Note: Excavation sides are shown vertical for reference only; slopes should conform to OSHA requirements.

The base of the foundation excavations should be free of water and loose soil prior to placing concrete. Concrete should be placed as soon as possible after excavation to reduce bearing soil disturbance. Soils at bearing level that become frozen, disturbed or saturated should be removed prior to placing concrete.

Lateral Earth Pressures

Walls with unbalanced backfill levels on opposite sides, such as basement walls, should be designed for earth pressures at least equal to those indicated in the following table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction and/or compaction and the strength of the materials being restrained. The "at-rest" condition assumes no wall rotation and would be appropriate for basement walls. The recommended design lateral earth pressures do not include a factor of safety, do not provide for possible hydrostatic pressure on the walls and are valid for cast-in-place concrete walls only.



EARTH PRESSURE COEFFICIENTS

EARTH PRESSURE CONDITIONS	COEFFICIENT FOR BACKFILL TYPE	EQUIVALENT FLUID WEIGHT (pcf)	SURCHARGE PRESSURE, P_1 (psf)	EARTH PRESSURE, P_2 (psf)
At-Rest (Ko)	Granular – 0.46	55	(0.46)S	(55)H
	Lean Clay - 0.58	70	(0.58)S	(70)H
Passive (Kp)	Granular – 3.0	360	---	---
	Lean Clay - 2.4	290	---	---

Conditions applicable to the above conditions include:

- For active earth pressure, wall must rotate about base, with top lateral movements 0.002 Z to 0.004 Z, where Z is wall height
- For passive earth pressure, wall must move horizontally to mobilize resistance.
- Uniform surcharge, where S is surcharge pressure
- In-situ soil backfill weight a maximum of 120 pcf

- Horizontal backfill, compacted to at least 95% of standard Proctor maximum dry density
- Loading from heavy compaction equipment not included
- No groundwater acting on wall
- No safety factor included
- Ignore passive pressure in frost zone

These pressures do not include the influence of surcharge, equipment or floor loading, which should be added. Heavy equipment should not operate within a distance closer than the exposed height of retaining walls to prevent lateral pressures more than those provided.

Backfill placed against structures should consist of granular soils or low plasticity cohesive soils. For the granular values to be valid, the granular backfill must extend out from the base of the wall at an angle of at least 45 and 60 degrees from vertical for the active and passive cases, respectively. To calculate the resistance to sliding, a value of 0.3 could be used as the allowable coefficient of friction between the footing and the underlying soil.

Perforated, rigid plastic or metal drain lines should be installed on the exterior side and at the base of below grade walls to reduce hydrostatic loading. The invert of drain lines around the perimeter of below grade structures should be at least 12 inches below the finished subgrade elevation of the interior slab or at least at the footing base level for exterior retaining walls. The drain line should be sloped to provide positive gravity drainage and should be surrounded by clean, free-draining granular material that is graded to prevent the intrusion of fines, or an alternate non-graded free-draining granular material encapsulated with a suitable filter fabric. At least a 2-foot wide section of free-draining granular fill should be used for backfill above the drain line and adjacent to the wall. The granular fill should extend to within 2 feet of final grade, where it should be capped with compacted cohesive fill to reduce infiltration of surface water into the drain system.

Underslab Drainage

It would be prudent to install an underslab drain system beneath basement floor slabs to collect water that infiltrates from the soils adjacent to basement walls as well as from the ground surface. The drain system could consist of a 6-inch thick layer of open-graded, free draining base underlain by drains composed of perforated pipe placed in a trench that is backfilled with free-draining granular material. The trenches should extend 12 inches below the floor slab subgrade and should be spaced at 50 feet center-to-center.

The drain systems should be sloped to provide positive gravity drainage to a frost-free outlet or sump equipped for automated pumping. Pumps should be sized and selected to adequately handle potential flows that may be encountered at the desired basement depths.

Redundant pumps with battery backup power should be considered, to reduce the risk of basement seepage in the event of pump and/or power failure. Periodic maintenance of the drainage systems are necessary so that they do not become plugged and inoperative.

Floor Slab Support

Floor slab subgrades should be prepared in accordance with the procedures outlined in the **Site Preparation** subsection. In slab-on-grade areas, a minimum 6-inch thickness of compacted, well-graded crushed stone, such as IDOT Type CA-6 aggregate, should be placed immediately below the floor slab in the building areas to facilitate fine grading and to serve as a capillary moisture break. In the basement areas, the base course should consist of open-graded granular material, such as IDOT Type CA-7 aggregate, as prescribed in the previous **Underslab Drainage** subsection.

For a slab supported on a minimum 6-inch granular base recommended above, the floor slab thickness and reinforcement could be designed using a modulus of subgrade reaction of 150 pounds per cubic inch. The floor slab should also incorporate control joints in accordance with ACI recommendations. Floor slabs should be isolated from the foundation walls and columns and should also have adequate reinforcement and proper jointing to reduce possible distress due to slight differential movements.

Construction Considerations

Impervious surfaces or finished grading slopes of at least 2% should be maintained for a distance of 5 feet or more outside the building perimeters to direct surface water away from the structure. Roof drains should extend so as not to discharge in lawn areas within 10 feet of the buildings or pavements. Any watered planters adjacent to the buildings should be lined with a plastic barrier and sloped to drain to an appropriate discharge point.

GENERAL COMMENTS

The Terra Group of Chicago should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terra Group also should be retained to provide testing and observation during excavation, grading, foundation and construction phases of the project.

Support of floor slabs over some thickness of existing fill is discussed in this report. However, even with the recommended construction testing, there is a risk that unsuitable material within or buried by the fill will not be discovered. This risk cannot be eliminated without removing the fill, but in our opinion, can be reduced to a reasonable level by thorough exploration and testing.

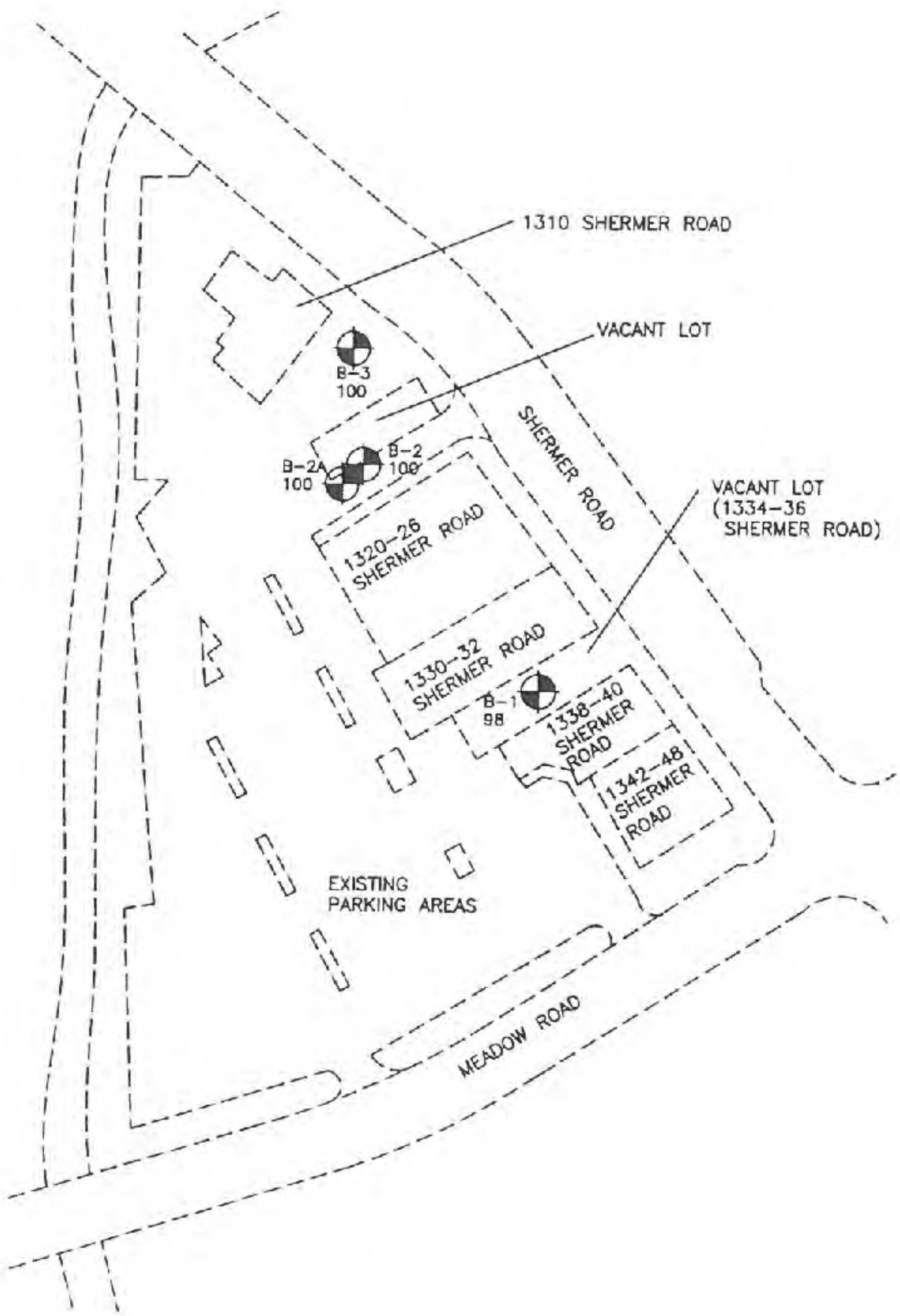
The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

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

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terra Group reviews the changes and either verifies or modifies the conclusions of this report in writing.

APPENDIX A

SOIL BORING LOCATION DIAGRAM
SOIL BORING LOGS



LEGEND

⊕ – Approximate Location and Elevation of Boring

TerraGroup of Chicago, Inc.

SOIL BORING LOCATION DIAGRAM

PROPOSED VILLAGE GREEN
OFFICE BUILDINGS
SHERMER ROAD & MEADOW ROAD
NORTHBROOK, ILLINOIS

DRAWING NOT TO SCALE

PROJECT #	FILE NAME	DATE	BY
12025041	5041SBLD	10/03/02	HPW

LOG OF BORING NO. 1

CLIENT Village Green Center, Inc.	ARCHITECT Myefski Cook Architects, Inc.
SITE Shermer Road & Meadow Road, Northbrook, Illinois	PROJECT Village Green Center

Approx. Surface Elev.: 98 ft

Graphic log depth	DESCRIPTION	Elev.	DEPTH, ft.	USCS SYMBOL	SAMPLES: NUMBER	TYPE	RECOVERY, in.	SPT - N ** BLOWS / ft.	TESTS: WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED STRENGTH, psf
	FILL: LEAN CLAY, WITH SAND, TRACE GRAVEL, brown and dark brown					PA					
					1	SS	15	9	18		
3		95				PA					
	FILL: LEAN CLAY, TRACE SAND AND GRAVEL, OCCASIONAL SILT SEAMS, brown				2	SS	11	8	18		
5		93	5			PA					
	FILL: LEAN TO FAT CLAY, TRACE SAND AND GRAVEL, dark gray				3	AS	NR	9	28		
						PA					
8		90									
9	**LEAN TO FAT CLAY, TRACE SAND AND GRAVEL, OCCASIONAL SAND SEAMS**, blue gray, stiff	89		CL/CH CL	4	SS	18	8	32		4000*
	LEAN CLAY, TRACE SAND AND GRAVEL, OCCASIONAL SAND SEAMS, brown and gray, stiff		10			PA					
13		85									
	LEAN CLAY, TRACE SAND AND GRAVEL, brownish gray, stiff			CL	5	SS	18	12	20		4000*
15		83	15								
	BOTTOM OF BORING										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

**140 Lbs Automatic SPT Hammer
*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft				BORING STARTED		9-19-02
WL	∇ NONE	WD ▼ NONE	AB	BORING COMPLETED		9-19-02
WL	∇	▼		RIG 74	FOREMAN	JM
WL				APPROVED NW	JOB #	12025041

TerraGroup of Chicago, Inc.

EVERGREEN 12025041.GPJ TERRACON.GDT 10/7/02

LOG OF BORING NO. 2

CLIENT Village Green Center, Inc.	ARCHITECT Myefski Cook Architects, Inc.
SITE Shermer Road & Meadow Road, Northbrook, Illinois	PROJECT Village Green Center

GRAPHIC LOG	DESCRIPTION Approx. Surface Elev.: 100 ft		DEPTH, ft.	USCS SYMBOL	SAMPLES: NUMBER	TYPE	RECOVERY, in.	SPT - N ** BLOWS / ft.	TESTS: WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED STRENGTH, psf	
	FILL: LEAN CLAY, WITH SAND, GRAVEL AND CONCRETE RUBBLE, dark brown and gray					PA						
					1	SS	1	45/6" 20/6	21			
2		98										
	PRACTICAL AUGER REFUSAL IN APPARENT CONCRETE RUBBLE @ 2'											
	BOTTOM OF BORING											

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

**140 Lbs Automatic SPT Hammer
*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft			
WL	∇ NONE	WD ▼ NONE	AB
WL	∇	▼	
WL			

TerraGroup of Chicago, Inc.

BORING STARTED			9-19-02
BORING COMPLETED			9-19-02
RIG	74	FOREMAN	JM
APPROVED	NW	JOB #	12025041

LOG OF BORING NO. 2A

CLIENT: Village Green Center, Inc.	ARCHITECT: Myefski Cook Architects, Inc.
SITE: Shermer Road & Meadow Road, Northbrook, Illinois	PROJECT: Village Green Center

Approx. Surface Elev.: 100 ft

Depth (ft) / Elev.	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	NUMBER	TYPE	RECOVERY, in.	SPT - N ** BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED STRENGTH, psf
	FILL: SANDY GRAVEL, WITH CLAY CHUNKS, BRICK AND RUBBLE, brown and dark brown				PA					
				1	SS	13	57	10		
					PA					
				2	SS	6	39	8		
5 / 95		5								
	FILL: SAND, WITH CLAY CHUNKS, TRACE GRAVEL, brown and dark brown				PA					
				3	SS	12	24	15		
					PA					
8 / 92										
	LEAN TO FAT CLAY, TRACE SAND AND GRAVEL, gray and brown, stiff		CL/CH	4	SS	18	7	25		4000*
		10			PA					
13 / 87										
	SILTY CLAY, TRACE SAND AND GRAVEL, gray, very stiff		CL/ML	5	SS	15	18	14		6500*
		15			PA					
18 / 82										
	LEAN CLAY, TRACE SAND AND GRAVEL, brownish gray, very stiff		CL	6	SS	18	15	20		5500*
20 / 80		20								
	BOTTOM OF BORING									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

**140 Lbs Automatic SPT Hammer
*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft			
WL	∇ 11.5	WD ▼ 18	AB
WL	∇	▼	
WL			

TerraGroup of Chicago, Inc.

BORING STARTED	9-24-02
BORING COMPLETED	9-24-02
RIG 74	FOREMAN JM
APPROVED NW	JOB # 12025041

LOG OF BORING NO. 3

CLIENT Village Green Center, Inc.	ARCHITECT Myefski Cook Architects, Inc.
SITE Shermer Road & Meadow Road, Northbrook, Illinois	PROJECT Village Green Center

Approx. Surface Elev.: 100 ft

Depth (graphic log)	DESCRIPTION	Elev.	DEPTH, ft.	USCS SYMBOL	SAMPLES: NUMBER	TYPE	RECOVERY, in.	SPT - N **, BLOWS / ft.	TESTS: WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED STRENGTH, psf
0.3	**3" Asphalt Pavement**	99.5				PA					
0.6	**4" Crushed Stone Base Course**	99.5			1	SS	13	9	18		
	<u>**FILL: LEAN CLAY, TRACE SAND AND GRAVEL**</u>, brown and gray brown					PA					
					2	SS	16	10	19		
5		95	5			PA					
6	<u>**FILL: CINDERS, WITH CLAY CHUNKS, TRACE SLAG**</u>, black	94			3	SS	18	8	22		
7	<u>**FILL: LEAN CLAY, TRACE SAND AND GRAVEL**</u>, gray and brown, with dark gray	93							17		
8	<u>**FILL: SAND AND GRAVEL**</u>, dark gray ▽	92				PA					
9	<u>**FILL: LEAN TO FAT CLAY, TRACE SAND**</u>, dark gray	91		CL	4	SS	18	5	30 36		2000*
13	<u>**LEAN TO FAT CLAY, TRACE SAND AND GRAVEL, OCCASIONAL SAND AND SILT SEAMS**</u>, brown and gray, medium	87	10			PA					
15	<u>**LEAN CLAY, WITH SILT SEAMS, TRACE SAND AND GRAVEL**</u>, brown, very stiff	85		CL	5	SS	18	14	16		4500*
20	<u>**LEAN CLAY, TRACE SAND AND GRAVEL**</u>, brownish gray, very stiff ▼	80	15			PA					
				CL	6	SS	18	17	18		8000*
	BOTTOM OF BORING		20								

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

**140 Lbs Automatic SPT Hammer
*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft			
WL ▽ 8	WD ▼ 18.5	AB	
WL ▽	▼		
WL			

TerraGroup of Chicago, Inc.

BORING STARTED			9-24-02
BORING COMPLETED			9-24-02
RIG	74	FOREMAN	JM
APPROVED	NW	JOB #	12025041

APPENDIX B

GENERAL NOTES
UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION SYSTEM

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

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

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

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

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

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

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

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

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

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

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

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

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

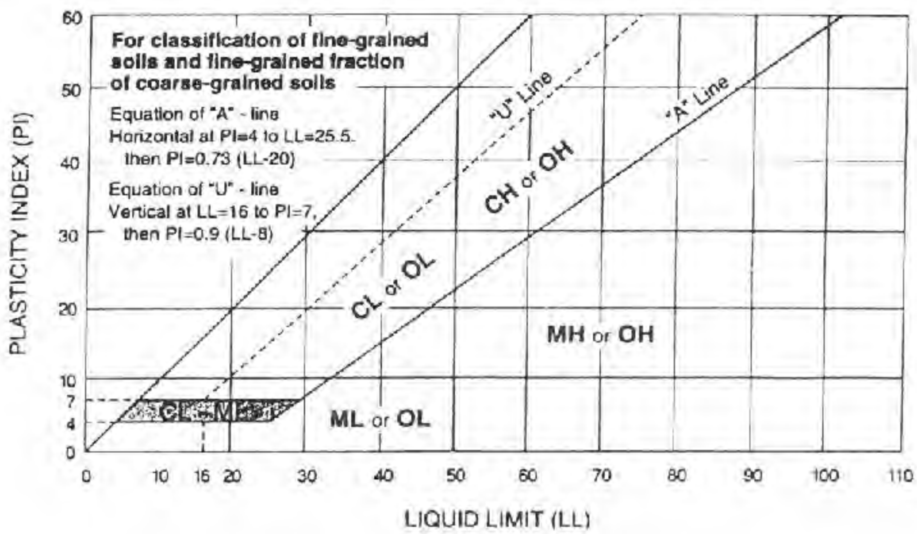
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



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GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon - 1-3/8" I.D., 2" O.D., unless otherwise noted	HS:	Hollow Stem Auger
ST:	Thin-Walled Tube - 2" O.D., unless otherwise noted	PA:	Power Auger
RS:	Ring Sampler - 2.42" I.D., 3" O.D., unless otherwise noted	HA:	Hand Auger
DB:	Diamond Bit Coring - 4", N, B	RB:	Rock Bit
BS:	Bulk Sample or Auger Sample	WB:	Wash Boring or Mud Rotary

The number of blows required to advance a standard 2-inch O.D. split-spoon sampler (SS) the last 12 inches of the total 18-inch penetration with a 140-pound hammer falling 30 inches is considered the "Standard Penetration" or "N-value".

WATER LEVEL MEASUREMENT SYMBOLS:

WL:	Water Level	WS:	While Sampling
WCI:	Wet Cave in	WD:	While Drilling
DCI:	Dry Cave in	BCR:	Before Casing Removal
AB:	After Boring	ACR:	After Casing Removal

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. Groundwater levels at other times and other locations across the site could vary. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels may not be possible with only short-term observations.

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

CONSISTENCY OF FINE-GRAINED SOILS

Unconfined Compressive Strength, Qu, psf	Standard Penetration or N-value (SS) Blows/Ft.	Consistency
< 500	<2	Very Soft
500 – 1,000	2-3	Soft
1,001 – 2,000	4-6	Medium Stiff
2,001 – 4,000	7-12	Stiff
4,001 – 8,000	13-26	Very Stiff
8,000+	26+	Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Standard Penetration or N-value (SS) Blows/Ft.	Relative Density
0 – 3	Very Loose
4 – 9	Loose
10 – 29	Medium Dense
30 – 49	Dense
50+	Very Dense

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 – 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75 mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm)
Silt or Clay	Passing #200 Sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 – 12
Modifiers	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1-10
Medium	11-30
High	30+

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