# Reference-4: Geotechnical Exploration Report

CGC, Inc.
Construction • Geotechnical
Consulting Engineering/Testing

July 11, 2019
C19051-10

Mr. Brent Pauba
Department of Public Works – Engineering Division
City County Building, Room 115
210 Martin Luther King, Jr. Blvd.
Madison WI 53703-3342

Re: Geotechnical Exploration Report
Proposed Redevelopment
200 North First Street
City of Madison, Dane County, Wisconsin

Dear Mr. Pauba:

Construction • Geotechnical Consultants, Inc. (CGC) has completed the subsurface exploration program for the above-referenced project. The purpose of this program was to evaluate the subsurface conditions within the proposed construction area and to provide geotechnical recommendations regarding site preparation, foundation, floor slab, below-grade wall and pavement design/construction. A determination of the site class for seismic design and a preliminary discussion of the stormwater infiltration potential are also included. We are sending you an electronic copy of this report, and we can provide a paper copy upon request.

## SITE AND PROJECT DESCRIPTION

We understand the City of Madison Fleet Services site at 200 North First Street is planned to be redeveloped. While the existing garage is envisioned to house the future public market, which will require some remodeling, we understand that outdoor market spaces, landscaping features, stormwater management areas and a parking lot are planned to be added in the surrounding areas. The existing buildings in southern parts of the site are proposed to be preserved.

Based on a provided topographic site plan (Burse Surveying & Engineering; 1-ft contour lines), site grades surrounding the existing buildings are fairly flat, with current ground surface elevations ranging between about EL 851 and 853 ft. The majority of the site is paved with asphalt and used for vehicle parking. Gas pumps exist in northwestern portions of the site.

We understand improvements to the existing garage/future public market building are envisioned to include an elevator and recessed pit for a loading dock lift. The elevator pit is proposed to be about 4.0 ft deep. We understand the footings of the existing building extend approximately 13.5 ft below the ground surface and were designed for an allowable bearing pressure of 4,000 psf. Canopies are to be added adjacent to the building on the southwest, northwest and northeast sides, and we understand canopy footing grades are envisioned to match footing grades of the existing building. In addition, an 80- to 120-ft tall landmark steel structure is proposed near the planned main entrance on the northwest side of the building. Besides these improvements, the redevelopment of the side is planned to involve a reconfiguration of the pavement areas to facilitate truck access as well as car and bike parking, and a raised patio is also planned on the northeast side of the building.

## SUBSURFACE CONDITIONS

Subsurface conditions for this study were explored by drilling 14 Standard Penetration Test (SPT) soil borings to planned depths between 10 and 75 ft below current site grades at locations selected by the planning team and located in the field by CGC in conjunction with City personnel. The borings were conducted by Badger State Drilling (under subcontract to CGC) on June 10 through 12 and 17, 2019 using a truck-mounted CME-55 and a track-mounted D-50 rotary drill rig equipped with hollow stem augers, mud rotary tooling and automatic SPT hammers. Note that auger and split-spoon refusal occurred in Borings 9 and 11, which were planned to be extended to 75 ft, at depths of about 63.5 ft on apparent sandstone bedrock and about 53 ft on a cobble/boulder or bedrock, respectively. During drilling, soil samples from certain borings located near known contaminated areas were screened for potential environmental contamination by a City of Madison hydrogeologist. (Specific results of the field screening are not included in this report.) The specific procedures used for drilling and sampling are described in Appendix A, and the boring locations are shown in plan on the Soil Boring Location Exhibit presented in Appendix B. Ground surface elevations at the boring locations were estimated by CGC based on the provided topographic site plan (Burse Surveying & Engineering; 1-ft contour lines), and elevations should therefore be considered approximate.

The subsurface profiles at the boring locations were fairly consistent, and the following strata were typically encountered (in descending order):

- About 4 to 10 in. of ***asphalt pavement*** over about 4 to 10 in. of ***base course***; or
- About 4 to 8 in. of ***topsoil fill***; followed by
- About 1 to 6.5 ft of ***variable fill*** soils, containing miscellaneous debris/rubble and/or organics in some location; over
- About 1.5 to 4.5 ft of very loose to loose ***sedimentary to fibrous peat and organic soils***, as well as isolated medium stiff to stiff clay layers; underlain by
- About 2 to 15.5 ft of very loose to medium dense ***sand strata*** *(possible sandy marl)*, generally containing fairly low amounts of silt and gravel, with occasional peat/organic seams and pockets and shells; over
- About 8+ to 40+ ft of ***cohesive and fine-grained soils***, including medium stiff to very stiff lean to silty clay and medium dense to dense clayey silt, silt and sandy silt soils, interspersed with occasional sand seams/layers; followed by
- About 10 ft of ***sand soils*** with variable silt and gravel contents, as well as scattered cobbles/boulders (apparent glacial till in lower portions), in Boring 9; and

- ***Very dense probable weathered sandstone bedrock*** to the level of auger and split-spoon refusal in Boring 9.

As noted above, some of the existing fill soils were intermixed with debris, such as concrete, ceramic and glass fragments, as well as possible cinders and possible coal residue, or comprised of possible foundry sand, and also included coarser concrete and/or asphalt rubble in some locations. In addition, possible petroleum/chemical odors were noted in samples from the existing fill and/or some of the natural soils underlying the fill in Borings 2, 3, 5, 8 and 11. Fill soils containing cinders and other debris, as well as natural soils containing odors may be environmentally impacted and could potentially require landfill disposal if excavated and removed from the site. We recommend further guidance regarding these issues be provided by the City's hydrogeologist or an environmental consultant.

The existing fill was generally underlain by peat and organic soils. Natural moisture contents determined on representative samples obtained from these strata ranged from 24.2% to 173.5%. In addition to natural moisture contents, a few of these samples were analyzed for their organic contents by means of loss-on-ignition (LOI). The tested specimens had organic contents between 8.3% and 38.2%, with soils having organic contents between 4% and 12% being considered organic, and soils with organic contents greater than 12% considered to be peat (fibrous peat above 50%). The organic soil and peat layers (and, to a slightly lesser extent, sandy marl soils containing peat seams) are moderately to highly compressible in the short term, and are subject to decomposition causing further (secondary) settlement in the long term.

Furthermore, representative sand samples obtained from Borings 7 and 13 were analyzed with regard to their particle size distribution (gradation). The samples were determined to have P200 ("fines") contents of 4.1% and 14.8%, corresponding to USCS classifications of poorly graded sand (SP) to silty sand (SM) and USDA classification of fine sand (FS), respectively.

Natural moisture contents were also determined on samples obtained from the deeper clay layers encountered in Borings 3, 4, 8, 9 and 11, as well as the shallow *possible fill* clay soils encountered in Boring 5. The clay samples were found to have natural moisture contents between 18.2% and 25.3%. Atterberg limits determined on a few clay samples showed liquid and plastic limits of 25% to 30% and 14% to 16%, respectively. Based on natural moisture contents, Atterberg limits, pocket penetrometer readings ($q_p$; an estimate of the unconfined compressive strength of cohesive soils) and SPT blow counts (N-values), the on-site clays should generally be considered slightly compressible.

As mentioned above, auger and split-spoon refusal occurred in Borings 9 and 11, which were planned to be extended to 75 ft, at depths of about 63.5 ft on apparent sandstone bedrock and about 53 ft on a cobble/boulder or bedrock, respectively. Apparent bedrock (or auger/split-spoon refusal) was not encountered in the other borings performed on this site.

Groundwater was encountered in the borings during drilling at depths between about 5.5 and 8.5 ft, corresponding to approximately EL 842.5 to 846.5 ft. In Boring 2, apparent perched water was encountered at about 3.0 ft below the ground surface during drilling (corresponding to approximately EL 848.0 ft). About 20 to 30 minutes after the completion of drilling, groundwater levels in the boreholes were read at depths of about 5.0 to 8.0 ft below current site grades, corresponding to approximately EL 843.7 to 846.6 ft. Note, however, that some of the on-site soils are fairly fine-grained (typically associated with a fairly low hydraulic conductivity), which may delay infiltration of groundwater into the boreholes. Groundwater readings during the fairly short period of drilling (and shortly thereafter) should therefore be considered approximate.

The site is located about 2,200 ft southeast of Lake Mendota and 3,500 ft northwest of Lake Monona, as well as about 700 ft northeast of the Yahara River connecting the two lakes. Therefore, groundwater levels on the site are generally expected to be between the water levels in the two lakes. For reference, during the time of our subsurface investigation from June 10 to 17, 2019, the water levels in Lakes Mendota and Monona were recorded at about EL 850.3 and 845.9 ft, respectively, according to the Dane County Land & Water Resources Department *Lake Levels & Information* online platform. Typical water levels in Lakes Mendota and Monona are EL 850.1 and 845.2 ft (typical summer maximum), and 100-year water level are set at EL 852.8 and 847.7 ft, respectively, Note, however, that Lake Monona experienced unusually high water levels due to heavy rainfalls and subsequent flooding in August and September of 2018, with the maximum lake level recorded at EL 848.52 ft on September 6, 2018 (exceeding the 100-year level by about 0.8 ft). Lake Mendota reached a maximum water level of EL 852.30 ft on August 23, 2018, which did not exceed the 100-year level.

In order to obtain longer-term groundwater data, a temporary groundwater monitoring well was installed in the borehole of Boring 13. Water level observations in the well, the soil borings and lake levels are summarized in the following Table 1:

**TABLE 1 – Summary of Water Levels**

| **Date** | **June 10, 2019** | **June 11, 2019** | **June 12, 2019** | **June 17, 2019** | **July 3, 2019** |
|---|---|---|---|---|---|
| Lake Mendota | 850.4 | 850.4 | 850.3 | 850.3 | 850.7 |
| B-13/MW | N/A | 844.0± (1) | N/A | N/A | 846.0± |
| Average in Borings | 846.2± (2) | 844.7± (3) | 845.4± (4) | 844.8± (5) | N/A |
| Lake Monona | 845.9 | 845.9 | 845.9 | 845.9 | 846.4 |

Notes: (1) Approximate groundwater level in Boring 13 during drilling.
(2) Average groundwater level in Borings 1, 2 and 6 about 20 minutes after completion of drilling.

(3) Average groundwater level in Borings 3, 5, 7 and 8 about 20 to 30 minutes after completion of drilling.
(4) Average groundwater level in Borings 4, 10 and 12 about 20 minutes after completion of drilling.
(5) Approximate groundwater level in Boring 14 about 30 minutes after completion of drilling.

Based on the available groundwater data summarized in Table 1, groundwater levels on this site generally appear to be closer to water levels in Lake Monona. In addition to the influence from the water levels in Lakes Mendota and Monona (and Yahara River), groundwater levels are expected to fluctuate with pumping rates in nearby wells and seasonal variations in precipitation, infiltration, evapotranspiration, as well as other factors. A more detailed description of the site soil and groundwater conditions is presented on the soil boring logs attached in Appendix B, which also contain the laboratory test results including Particle Size Distribution Test Reports.

## DISCUSSION AND RECOMMENDATIONS

### 1. Overview

In our opinion, the lower-strength shallow subsurface conditions, including variable fill, peat/organic soils and loose sand/marl, are not favorable for the support of conventional shallow spread footing foundations. The fairly shallow groundwater table on this site is anticipated to further complicate construction. Our recommendations, further elaborated in the subsequent sections of this report, can be outlined as follows:

- We understand the new canopy footings are planned to be extended about 13.5 ft below current site grades to match footing grades of the existing building. At that depth, natural soils suitable to support footings designed for a moderate allowable bearing pressure should generally be encountered, with the understanding that undercutting of looser sands could potentially be required below the bottom of footings in isolated areas. However, footing excavations to match existing footing grades (as well as potential undercutting) are expected to require a significant dewatering effort during construction in order to develop firm and stable foundation subgrades. In addition, underpinning of existing footings could be required if unsuitable soils will need to be undercut below existing foundation grades.

- In order to somewhat reduce the dewatering effort and excavation volume, it is our opinion that canopy footings further away from the existing building could potentially be supported at shallower depths if a lower allowable bearing pressure is used for foundation design. One option would be to undercut the existing fill and peat to expose the natural sands and support the canopy footings at frost depth on engineered backfill. Alternatively, the footings, designed for a fairly low allowable bearing pressure, could be supported directly on the top of the native sand/marl layers, about 5 to 10 ft below current site grades.

- A third option for canopy support would be a deep foundation system, such as helical piers. The advantage with using helical piers (or other deep foundations) would be to practically eliminate the need for undercutting below pile caps/grade beams (bottom at frost depth at least 4 ft below finish site grades), and significantly reduce the need for dewatering during construction.

- The potential landfill disposal costs of impacted soils should also be considered when deciding on the foundation alternative. The additional disposal costs from deep undercutting/replacement may render a deep foundation alternative more favorable.

- As noted above, temporary dewatering during construction is generally expected, which could be fairly significant if conventional spread footings at existing footing grades or intermediate depths should be pursued. Environmentally impacted water (dewatering system effluent) may have special treatment or disposal requirements.

- Based on Boring 14, we expect the 4-ft deep elevator pit base slab to be supported on existing fill over possible fill clay and native sand soils, and we assume similar conditions for the loading dock lift pit. Compared to fill soils encountered in other portions of the site, the fill soils below the existing building appear to have been placed in a somewhat engineered manner, and the peat layer appears to have been removed prior to fill placement within the building pad. Provided the organic soils have been removed and the contact pressure at the bottom of the elevator pit base slab and loading dock lift pit base slab is fairly low, the elevator pit and loading dock lift pit can potentially be supported on the existing fill if found to be stable during construction. If the existing fill soils are found to be unsuitable for base slab support at the time of construction, or peat/organic soils are encountered at or slightly below base slab grades, we recommend the elevator pit and loading dock lift pit be supported on helical piers, as undercutting of unsuitable soils will likely be extremely difficult within the existing building.

- We recommend the raised patio which is planned near the north building corner either be supported on columns, with footings similar to the canopies or helical pier support. If the patio will be supported on structural fill placed to raise grades instead, we recommend that the marginal to lower-strength existing fill and highly-compressible peat soils be undercut prior to new fill placement, as we expect that new fill placement with the peat remaining in-place would result in significant settlement. Alternatively, surcharging the patio area could also be considered.

- New pavement construction on this site will likely require widespread subgrade improvement, such as an additional layer of stone over a reinforcing geogrid below the new pavement base course.

- Based on the borings, it is our *preliminary* opinion that the site is not suitable to infiltrate significant amounts of stormwater due to the presence of variable fill and lower-permeability peat and the fairly shallow groundwater table.

Subject to the limitations discussed below, our recommendations for site preparation, foundation, floor slab, below-grade wall and pavement design/construction, along with our assessment of the site class for seismic design and a preliminary discussion of the stormwater infiltration potential, are presented in the following subsections. Additional information regarding the conclusions and recommendations presented in this report is discussed in Appendix C.

## 2. Site Preparation

We recommend that the existing pavement and base course be removed to evaluate the underlying subgrade soils with regard to new pavement support. Consideration could be given to milling the existing asphalt for reuse as fill. Existing topsoil should also be stripped at least 10 ft beyond the proposed construction areas, and trees and root zones should be removed from construction areas prior to or in conjunction with topsoil stripping. The topsoil can be stockpiled on-site and later re-used as fill in landscaped areas. Topsoil was about 4 to 8 in. thick in Borings 1, 4 and 9, but variable topsoil thicknesses should be expected between and beyond boring locations due to previous grading activities.

After pavement removal and topsoil stripping, exposed soils are generally expected to consist of existing variable fill soils. In areas remaining at-grade or requiring additional fill, we recommend the exposed granular soils be thoroughly recompacted with a vibratory smooth-drum roller. Zones that remain loose after recompaction should be undercut and replaced with granular backfill compacted to at least 95% compaction based on modified Proctor methods (ASTM D1557) in accordance with our Recommended Compacted Fill Specifications presented in Appendix D. Alternatively, 3-in. dense graded base (DGB) that is placed in loose 10-in. lifts and compacted until deflection ceases can also be used to restore grades in undercut areas. Note that cohesive and fine-grained subgrades should be statically recompacted (i.e., without vibration) and subsequently proof-rolled with a piece of heavy rubber-tire construction equipment, such as a loaded tri-axle dump truck, to check for soft/yielding areas. If soft/yielding areas are observed, these soils should be undercut and replaced or stabilized as described above. Areas subsequently receiving fill should be checked for their pavement suitability prior to fill placement. Where existing below-grade structures have been removed, such as the fuel tanks in northwestern portions of the site, we recommend the exposed subgrades be evaluated for their pavement support suitability, prior to recompaction and placing backfill as described above.

*Note that due to the presence of potentially impacted soils at the site, we recommend that excavated soils either be kept on-site and appropriately capped (if impacted soils are determined to be within regulatory limits for this approach) or screened for environmental contaminants before being hauled off site.* A materials management plan should be developed, and impacted soils removed from the site should be properly disposed of in a licensed landfill. We recommend that the City's hydrogeologist or an environmental consultant provide guidance on the need for special handling and disposal of impacted soils, as well as other environmental-related questions.

Fill placement to establish site and pavement grades, where required, can then proceed. To the extent possible, we recommend using granular soils (i.e., sands/gravels, including natural inorganic sand soils excavated on-site) as structural fill within pavement areas because these soils are relatively easy to place and compact in most weather conditions compared to clay/silt soils. To the extent possible, clay and silt soils excavated on-site are generally not recommended as structural fill because moisture conditioning by discing and drying (aeration) will likely be required to achieve desired compaction levels, which is highly weather-dependent (i.e., dry, warm and windy conditions) and could delay construction progress. In our opinion, clay/silt soils are best used as fill in landscaping or potentially as lower lifts in pavement areas provided the moisture contents can be sufficiently lowered from the natural states to facilitate compaction efforts. We recommend that structural fill be compacted to at least 95% compaction based on modified Proctor methods (ASTM D1557) following Appendix D guidelines. Periodic field density tests should be taken by CGC staff within the fill to document the adequacy of compactive effort. *Note however, that we do not recommend raising grades more than about 0.5 ft above existing site grades, unless the peat layers that were typically encountered below the existing fill are first undercut.* The increase in stress within the peat from additional fill above current site grades would likely result in significant settlement. One potential way of raising grades above existing site grades with the peat remaining in-place would be to surcharge the area, but this approach would require a time delay between placing the surcharge pile and beginning construction on the order of several months to a year or more. We can provide additional information and recommendations regarding surcharging, if requested.

We understand that the current plan is to support the canopies on conventional spread footings, with footing grades matching the footing grades of the existing building at about 13.5 ft below current site grades. Alternatively, it is our opinion that shallower footings a sufficient distance away from the existing building can likely be realized provided the existing fill and organic soils/peat layers are undercut below the bottom of footings. Excavation sidewalls should be braced or sloped back according to OSHA requirements. We anticipate that excavation slopes will be controlled by variable fill, softer clays, peat and very loose to loose sands, typically classified as OSHA "Type C" soils, with slopes of 1.5H:1.0V or flatter expected to be at least temporarily stable. Note that flatter side slopes will likely be required where perched or seeping water is present that destabilizes the side slopes. *The appropriate excavation side slopes should be determined by a competent person completing the earthwork in accordance with OSHA slope guidelines.* Where adequate sloping is not possible, temporary earth retention will be required. Earth retention systems should be designed by a qualified professional engineer. Care should be exercised not to undermine the existing building foundations (e.g., if undercutting will be required extending below existing footing grades), and underpinning of existing footings could potentially be required, which should be evaluated by the contractor.

It is important to note that footing and undercut excavations will likely extend on the order of 0.5 to 8 ft (potentially more) below the groundwater table. *In light of this, dewatering is anticipated to play a critically important role in order to develop suitable subgrades* and a significant dewatering effort should generally be expected. To allow for construction in the dry, water levels should be lowered a minimum of 2 ft below the bottom of excavations *in advance of final excavation*. It has been our experience that groundwater drawdowns on the order of 1 to 2 ft can typically be achieved using submersible pumps that operate from filtered sump pits. Drawdowns exceeding about 2 ft will likely require alternative dewatering measures, such as deep well or vacuum well point systems. Note, however, that the silt and clay strata encountered in some of the soil borings are expected to be difficult to dewater, likely requiring the use of a vacuum well point system regardless of drawdown depths. Cleaner sand layers, on the other hand, are expected to have a fairly high hydraulic conductivity which may result in significant pumping rates. Supplemental dewatering in shallow sumps outside the footing lines may also be required. Dewatering means and methods are the contractor's responsibility. *If groundwater is not adequately controlled, significantly deeper undercuts, flatter side slopes, wider excavations and modifications to the temporary earth retention systems (if any) could be required.* The dewatering systems should be designed by a qualified professional engineer in conjunction with the temporary earth retention systems (if any) such that appropriate hydrostatic pressures are accounted for. *We recommend the existing structures be monitored for potential dewatering-induced settlement during construction.* Depending on the effectiveness of the dewatering system at lowering the water table below the bottom of the excavation, it may be necessary to install a stone stabilization layer at the bottom of the excavations to develop a working platform for construction activities. On past projects this has involved about 12 in. of coarse stone underlain or potentially enveloped by a geotextile fabric for separation and reinforcement purposes.

## 3. Foundation Design

We understand that new footings are generally planned to be extended about 13.5 ft below current site grades to match footing grades of the existing building, and footing subgrades at that depth are generally expected to consist of loose to medium dense sand and silt soils. However, it is our opinion that footings at somewhat shallower depths may also be feasible in some areas, which would likely reduce the dewatering effort and potentially the cost for disposal of decontaminated excavation spoils and dewatering effluent. As a third option, new structures could also be supported on deep foundations, such as helical piers, in order to further reduce the potential need for and/or extent of dewatering and disposal of contaminated soils and groundwater. The foundation alternatives are further discussed in the following subsections.

### *A. Conventional Spread Footing Foundations*

We understand that the new canopies are envisioned to be supported on conventional spread footings extending about 13.5 ft below current site grades to match footing grades of the existing building. A similar foundation system could also be considered for the raised patio (in lieu of mass undercutting or surcharging the peat, as discussed previously). Based on Borings 3, 4, 9 and 11, footing subgrades at these depths are anticipated to consist of native, loose to medium dense sand and silt soils. Note that some of the looser sands or sand layers containing peat seams could potentially require undercutting slightly below footing grades. Where undercutting occurs close to existing footings, care should be exercised not to undermine the existing foundations.

As discussed previously, effective dewatering is considered paramount in order to establish and maintain suitable foundation subgrades. However, even with effective dewatering measures in-place, some footing subgrades may remain fairly wet, and these subgrades should be stabilized with a thin (approximately 6-in. thick or more) layer of crushed clear stone that is compacted into the subgrade until deflection ceases. If the clear stone layer exceeds 12 in., it should be enveloped with non-woven geotextile fabric (e.g., Mirafi 160N or equivalent). Alternatively, footing subgrades could be stabilized with thin (i.e., 3 to 4-in. thick) lean mix concrete mud mats. The lean mix concrete should be able to develop a minimum 28-day design strength of 1,000 psi.

As noted above, dewatering to establish suitable foundation subgrades at about 13.5 ft below current site grades is anticipated to be a significant effort. In order to somewhat reduce the dewatering effort, as well as potentially the disposal costs for contaminated excavation spoils and contaminated dewatering effluent, it is our opinion that footings could potentially be constructed at shallower depths in some areas (i.e., at a sufficient distance from the existing building such that existing footings are outside of the influence zone from new footings), provided existing fill soils and peat/organic soils are undercut below the bottom of footings. Based on Borings 1, 3, 4, 9 and 11, we anticipate that undercut excavations would likely extend about 6.5 to 9.5 ft below current site grades. Undercut excavations should be dewatered as previously discussed, but required drawdown depths are expected to be reduced compared to the first foundation alternative. Once existing fill soils and peat layers have been undercut, footings could either be constructed directly on the exposed sand layers, or footing grades (e.g., at frost depth, a minimum of 4 ft below finish site grades) can be restored as discussed below.

We recommend the following parameters be used for foundation design:

- <u>Maximum net allowable bearing pressure</u>:
  - Footings bearing about 13.5 ft below the ground surface on native, loose to medium dense sand or silt soils: 3,000 psf

- Footings bearing on the top of native, loose sands, or on engineered backfill over native sands: 1,500 psf

- Minimum foundation widths:
  - Continuous wall footings: 18 in.
  - Column pad footings: 30 in.

- Minimum footing depths below finish site grades:
  - Exterior/perimeter footings: 4 ft
  - Interior footings: no minimum requirement

Footing subgrades should be checked by a CGC field representative to document that the subgrade soils are suitable for footing support and advise on corrective measures, if necessary. We recommend using a smooth-edged backhoe bucket for footing and undercut excavations. The base of undercut excavations should be widened beyond the footing edges at least 0.5 ft in each direction for each foot of undercut depth for stress distribution purposes. Granular soils exposed at footing grade or the bottom of undercut excavations *above the water table or with an effective dewatering system in-place* should be thoroughly recompacted with a large vibratory plate compactor or an excavator-mounted hoe-pack prior to backfilling or formwork/concrete placement to densify soils loosened during the excavation process. Soils potentially susceptible to disturbance from vibratory compaction (e.g., cohesive/fine-grained soils or sands near or below the water table) should be hand-trimmed. Subgrades that are fairly wet should be stabilized with a thin (approximately 6 in. thick) layer of crushed clear stone that is compacted into the subgrade until deflection ceases or protected with lean mix mud mats, as described above. OSHA slope guidelines should be followed if workers need to enter footing excavations.

In order to re-establish footing grade in undercut areas above the water table or with an effective dewatering system in-place, we generally recommend using granular backfill compacted to at least 95% compaction based on modified Proctor methods (ASTM D1557), in accordance with the Recommended Compacted Fill Specifications presented in Appendix D. Alternatively, 3-in. DGB that is placed in loose 10-in. lifts and compacted until deflection ceases can also be used to restore grades above the water table in undercut areas. Below the water table or where saturated soils remain despite concerted dewatering efforts, undercut excavations should be backfilled with crushed clear stone that is placed in loose lifts of 12 in. or less, which are subsequently compacted with a large vibratory plate compactor or excavator-mounted hoe-pack until deflection ceases. Where total clear stone layer thickness exceeds 12 in., the clear stone should be wrapped in non-woven geotextile fabric (e.g. Mirafi 160N or equivalent) to prevent migration of fines into the void spaces of the clear stone. Alternatively, foundation grade below the water table can be restored with lean mix concrete that is capable of developing a minimum 28-day strength of 1,000 psi. Note that with the use of lean mix concrete as backfill, undercut excavations should be laterally oversized 0.5 ft from the edges of the foundation and geotextile fabric is not required at the bottom of the excavation.

Provided the foundation design/construction recommendations discussed above are followed, we estimate that total and differential settlements should be on the order of 1.0 and 0.5 in., respectively.

### *B. Deep Foundations*

As an alternative to conventional spread footing foundations, deep foundations could be considered to support the new structures. The advantage with deep foundations compared to conventional spread footing foundations is that excavations can generally be limited to fairly shallow depths (i.e., frost depth, a minimum of 4 ft below finish site grades for pile caps/grade beams), which is anticipated to significantly reduce the need for dewatering and likely also reduce the potential/cost for disposal of contaminated excavation spoils. Furthermore, the fairly shallow pile cap/grade beam excavations can most likely be sloped back, potentially eliminating the need for temporary earth retention and undermining/the potential for underpinning of existing footings. As structural loads are generally anticipated to be fairly light, helical piers would likely be a feasible foundation system for the planned site improvements, and helical piers may even be economically favorable compared to conventional spread footing foundations due to savings on dewatering and landfill fees.

Helical piers are generally expected to extend through the existing fill, peat and lower-strength soils, and bear within at least medium dense inorganic sand and silt strata, or potentially in the underlying stiff to very stiff clays. If higher helical pier capacities are desired, the piers may potentially have to be extended somewhat deeper to bear within dense to very dense sand strata. *Note that supplemental, deeper soil borings are recommended if higher-capacity helical piers will be required.* Helical pier capacity will vary depending on the number and size of helices, depth of installation and bearing stratum. Soil parameters for the design of helical piers are included in Table 2. Using these parameters, we used the commercially available software HeliCAP® 2.5.1, produced by Hubbell Power Systems, to estimate *ultimate* helical pier capacities for *vertically installed* helical piers with a three-helix configuration (10 in., 12 in. and 14 in.). Approximate target lengths (measured from existing site grades) for several *ultimate* helical pier capacities (in compression) are summarized in Table 2. *Since helical piers are proprietary, the helical pier capacities should be considered approximate, and the helical pier installer should determine the helix configuration and depth necessary to satisfy project requirements. Soil stratigraphy and properties should be expected to vary across the site, as shown in the borings, which will affect helical pier installation depths to achieve given capacity. Actual design depths should be determined by a separate, independent analysis using specific helix configurations proposed on the project.*

# TABLE 2

## Recommended Soil Parameters for Helical Pier Foundations (1)

*Proposed Redevelopment*

*200 North First Street, City of Madison, Dane County, Wisconsin*

| Boring | Description | Approximate Depth below Existing Ground Surface (ft) | Moist Unit Weight (pcf) | Saturated Unit Weight (pcf) | Buoyant Unit Weight (pcf) | Angle of Internal Friction (deg) | Cohesion (psf) |
|---|---|---|---|---|---|---|---|
| 3 | Loose Variable Fill | 0 to 5.0 | 115 | 125 | 63 | Variable | |
| | Loose Peat | 5.0 to 6.5 | 80 | 100 | 38 | 0 | 0 |
| | Very Loose to Loose Sand with Shells and Occasional Peat Seams (Possible Sandy Marl) | 6.5 to 17 | 115 | 125 | 63 | 30 | 0 |
| | Medium Dense Sand with Shells (Possible Sandy Marl) | 17 to 22 | 120 | 130 | 68 | 33 | 0 |
| | Stiff Lean Clay | 22 to 27 | 120 | 125 | 63 | 0 (2) / 25 (3) | 1,500 (2) / 30 (3) |
| | Very Stiff Lean Clay | 27 to 30+ | 125 | 130 | 68 | 0 (2) / 25 (3) | 2,250 (2) / 45 (3) |
| 4 | Loose to Medium Dense Variable Fill | 0 to 5.5 | 115 | 125 | 63 | Variable | |
| | Loose Peat | 5.5 to 8.0 | 80 | 100 | 38 | 0 | 0 |
| | Loose Sand with Shells (Possible Sandy Marl) | 8.0 to 11 | 115 | 125 | 63 | 30 | 0 |
| | Medium Dense Sand with Shells (Possible Sandy Marl) | 11 to 17 | 120 | 130 | 68 | 33 | 0 |
| | Stiff Lean Clay | 17 to 22 | 120 | 125 | 63 | 0 (2) / 25 (3) | 1,250 (2) / 25 (3) |
| | Medium Dense Silt and Sand | 22 to 27 | 120 | 130 | 68 | 32 | 0 |
| | Stiff Lean to Silty Clay | 27 to 30+ | 120 | 125 | 63 | 0 (2) / 25 (3) | 1,000 (2) / 20 (3) |
| 8 | Very Loose to Loose Variable Fill | 0 to 5.5 | 115 | 125 | 63 | Variable | |
| | Loose Peat | 5.5 to 7.0 | 80 | 100 | 38 | 0 | 0 |
| | Loose Sand with Shells (Possible Sandy Marl) | 7.0 to 11 | 115 | 125 | 63 | 30 | 0 |
| | Medium Dense Silt | 11 to 13 | 120 | 130 | 68 | 31 | 0 |
| | Stiff Lean Clay | 13 to 17 | 120 | 125 | 63 | 0 (2) / 25 (3) | 1,500 (2) / 30 (3) |
| | Loose Sand | 17 to 19 | 115 | 125 | 63 | 30 | 0 |
| | Stiff Lean Clay | 19 to 24 | 120 | 125 | 63 | 0 (2) / 25 (3) | 1,500 (2) / 30 (3) |
| | Stiff to Very Stiff Lean Clay | 24 to 30+ | 125 | 130 | 68 | 0 (2) / 25 (3) | 2,000 (2) / 40 (3) |

**Notes:** (1) Generalized to some degree; refer to boring logs for more detailed soil descriptions. Not including factor of safety (i.e., FS = 1).

(2) Short-term loading conditions.

(3) Long-term loading conditions.

| Boring | Description | Approximate Depth below Existing Ground Surface (ft) | Moist Unit Weight (pcf) | Saturated Unit Weight (pcf) | Buoyant Unit Weight (pcf) | Angle of Internal Friction (deg) | Cohesion (psf) |
|---|---|---|---|---|---|---|---|
| 9 | Loose Variable Fill | 0 to 5.5 | 115 | 125 | 63 | Variable | |
| | Very Loose Peat | 5.5 to 8.0 | 75 | 95 | 33 | 0 | 0 |
| | Very Loose to Loose Sand with Shells (Possible Sandy Marl) | 8.0 to 12 | 115 | 125 | 63 | 30 | 0 |
| | Medium Dense Sand | 12 to 22 | 120 | 130 | 68 | 33 | 0 |
| | Stiff to Very Stiff Lean Clay | 22 to 27 | 125 | 130 | 68 | 0 (2) / 25 (3) | 2,000 (2) / 40 (3) |
| | Medium Stiff Lean Clay | 27 to 32 | 115 | 120 | 58 | 0 (2) / 25 (3) | 750 (2) / 15 (3) |
| | Medium Stiff to Stiff Lean Clay | 32 to 42 | 120 | 125 | 63 | 0 (2) / 25 (3) | 1,000 (2) / 20 (3) |
| | Very Stiff Lean Clay | 42 to 47 | 125 | 130 | 68 | 0 (2) / 25 (3) | 2,000 (2) / 40 (3) |
| | Very Dense Sand | 47 to 52 | 130 | 140 | 78 | 36 | 0 |
| | Very Dense Glacial Till | 52 to 57 | 130 | 140 | 78 | 36 | 0 |
| | Very Dense Probable Weathered Sandstone Bedrock | 57 to 63 | 130 | 140 | 78 | 36 | 0 |
| 11 | Very Loose to Medium Dense Variable Fill | 0 to 7.5 | 115 | 125 | 63 | Variable | |
| | Loose Peat | 7.5 to 9.5 | 80 | 100 | 38 | 0 | 0 |
| | Loose Sand with Shells (Possible Sandy Marl) | 9.5 to 13 | 115 | 125 | 63 | 30 | 0 |
| | Medium Dense Silt | 13 to 17 | 120 | 130 | 68 | 31 | 0 |
| | Dense Silt and Sand | 17 to 22 | 125 | 135 | 73 | 33 | 0 |
| | Stiff to Very Stiff Lean Clay | 22 to 53 | 125 | 130 | 68 | 0 (2) / 25 (3) | 2,000 (2) / 40 (3) |
| 14 | Stiff Cohesive Fill | 0 to 3.0 | 120 | 125 | 63 | 0 (2) / 25 (3) | 1,000 (2) / 20 (3) |
| | Medium Dense Granular Fill | 3.0 to 5.5 | 120 | 130 | 68 | 31 | 0 |
| | Medium Stiff Sandy Lean Clay | 5.5 to 7.0 | 115 | 120 | 58 | 0 (2) / 25 (3) | 750 (2) / 15 (3) |
| | Loose to Medium Dense Sand with Shells (Possible Sandy Marl) | 7.0 to 12 | 115 | 125 | 63 | 30 | 0 |
| | Medium Dense Silt and Sand | 12 to 17 | 120 | 130 | 68 | 31 | 0 |
| | Medium Dense Sand | 17 to 20+ | 120 | 130 | 68 | 33 | 0 |

**Notes:** (1) Generalized to some degree; refer to boring logs for more detailed soil descriptions. Not including factor of safety (i.e., FS = 1).
(2) Short-term loading conditions.
(3) Long-term loading conditions.

### Table 3 - Estimated Helical Pier Depths for a Representative 10 in., 12 in. and 14 in. Helix Configuration

| Boring | Approximate Helical Pier Depths below Existing Grade (ft) | | |
|---|---|---|---|
| | Ultimate Capacity of 40 kips (Compression) (1) | Ultimate Capacity of 60 kips (Compression) (1) | Ultimate Capacity of 80 kips (Compression) (1) |
| 3 | 18 | Below 30 (2) | Below 30 (2) |
| 4 | 15 | 26 | Below 30 (2) |
| 8 | 30 | Below 30 (2) | Below 30 (2) |
| 9 | 15 | 20 | 48 |
| 11 | 17 | 21 | Below 53 (2) |
| 14 | 16 | 20 | Below 20 (2) |

Notes:

1) Ultimate capacities do not include a factor of safety (i.e., FS = 1); appropriate factor of safety of 2 to 3, depending on level of load testing, should be applied to ultimate capacity to determine allowable capacity.
2) Deeper boring required to estimate anticipated pier depth.

The installation torque is correlated with capacity, although static load tests can also be completed to confirm the ultimate and allowable capacities. A minimum factor of safety of 2.0 to 3.0 is generally used for helical pier design. If a factor of safety of 2.0 is used to determine the allowable helical pier capacity, we recommend that a minimum of one static load test be performed to confirm the helical pier design satisfies the project requirements. The static load test should be performed on a pier installed to similar installation depth and torque as production piers. Additionally, the torque of each pier should be monitored during installation to document that each pier is torqued to the minimum torque established by the static load test or empirical correlations to ultimate capacity. If a static load test is not performed, we recommend using a minimum factor of safety of 2.5 to 3.0 in determining the allowable capacity, and the installation torque of each pier should be monitored, which is empirically correlated to the ultimate capacity. *Since there are multiple proprietary helical pier systems, as well as different methods for estimating helical pier capacities, it is the responsibility of the contractor to determine that their selected helical pier configuration, installation procedures and termination criteria satisfy the project requirements.*

Other helical pier considerations include the following:

- Prospective helical pier contractors should be aware of the potential presence of miscellaneous debris within the existing fill soils, as well as elevated gravel contents and cobbles/boulders in some of the deeper natural sand strata, which will likely impact helical pier installation and may require removal prior to installation. The helical pier installer should have provisions to deal with the presence of potential obstructions. If obstructions are encountered at shallow depths, removing obstructions with an excavator would be one method to deal with the obstructions. Under some circumstances, using smaller diameter helix configuration may also assist in the installation process but may require deeper piers to develop capacity.

- The organic soils and potentially some of the existing fill may be corrosive, so the helical pier shafts should include corrosion protection, which may include hot-dip galvanizing, anti-corrosion coatings or increased steel shaft thickness.

- Loose fill, organic and lower-strength cohesive and fine-grained soils have relatively low lateral capacity, so *round helical pier shafts*, which have higher resistance to buckling, are recommended over square shafts. A buckling analysis should be completed to check that the pier shaft has adequate buckling resistance.

- If lateral loads are high enough such that vertical helical piers do not provide sufficient lateral resistance, battered helical piers can be considered. It is also possible that, as an alternative, battered micropiles could be considered in the event that high lateral loads need to be resisted.

- Pile caps should be located a minimum of 4 ft below finish grade for frost protection.

- Pile cap excavations should be sloped in accordance with OSHA slope guidelines if workers need to enter the excavations, and the excavation should be monitored by a competent person to determine the appropriate excavation slopes.

## 4. Seismic Site Class

In our opinion, the average soil properties in the upper 100 ft of the site (based on SPT blow counts "N-values" between 15 and 50 blows/ft, on average, in the sand and silt soils, and an average undrained shar strength between 1 and 2 ksf in the clays underlying the site) may be characterized as a stiff soil profile. This characterization would place the site in Site Class D for seismic design according to the International Building Code (see Table 1613.5.2).

## 5. Elevator and Loading Dock Lift Pits

Based on the findings in Boring 14, elevator and loading dock lift pit base slab subgrades are generally anticipated to consist of existing, medium dense granular fill over medium stiff clay (possible fill) and loose to medium dense native sand and silt soils. Compared to fill soils encountered in other portions of the site, the fill soils below the existing building appear to have been placed in a somewhat engineered manner, and the peat layer appears to have been removed prior to fill placement within the building pad. It the existing fill soils are found to be unsuitable for base slab support at the time of construction, or peat/organic soils are encountered at or slightly below base slab grades, these soils should be undercut below the bottom of the base slabs, although the capacity for undercutting within the existing building is anticipated to be fairly limited.

To serve as a capillary break below the elevator and loading dock lift pit base slabs, the final 4 to 6 in. of soil placed below the slabs should consist of well-graded sand or gravel with no more than 5% by weight passing a No. 200 U.S. standard sieve. Note that some structural engineers require a 6-in. layer of DGB, such as 1¼ -in. DGB, below the slabs to increase the subgrade modulus immediately below the slabs. Fill and base layer material below the base slabs should be placed as described in the Site Preparation section of this report. For conventional slabs bearing on a 4 to 6-in. thick sand/gravel layer above a firm or adequately stabilized subgrade, a subgrade modulus of 75 pci can be used for slab design. Base slabs bearing on a minimum 6-in. thick layer of DGB above a firm or adequately stabilized base may be designed using a subgrade modulus of 100 pci. To further minimize the potential for moisture migration, a plastic vapor barrier can be also be utilized below the slabs.

The contact pressure at the bottom of the slabs should be limited to 1,500 psf in order to limit settlement to typically tolerable levels. If higher loads are expected, or unsuitable soils are found to extend fairly deep below the bottom of the slabs, the base slabs could be supported on helical piers, as discussed above. Helical piers can be installed with fairly compact equipment, such as a skid loader or mini excavator, capable of operating within the confines of the existing building.

We anticipate that the elevator pit and loading dock lift walls will be laterally supported by the base slabs, orthogonal walls and/or other structural means. Therefore, *at-rest* lateral earth pressures should be used during design of these walls. To reduce the buildup of such pressures, high-quality fill/backfill should be placed within 4 to 6 ft of the walls, consisting of well-graded sand or gravel having no more than 12% by weight passing the No. 200 U.S. standard sieve (i.e., USCS designations SP, SP-SM, GP or GP-GM). Soils containing cobbles/boulders should not be used in direct contact with the below-grade walls.

Compaction of the backfill within 3 to 5 ft of the walls should be performed with lightweight equipment to avoid the development of excessive lateral earth pressures. The wall backfill should be compacted to a minimum of 95% modified Proctor following Appendix D guidelines. Walls that are restrained from rotating and constructed in accordance with the above recommendations may be designed for an equivalent fluid pressure of 55 psf per ft of depth (*at rest conditions*). Additionally, the wall design should also account for hydraulic pressures (if any, such as potentially during the event of high groundwater levels) as well as surcharge effects that could be applied during or after construction. In the event of high groundwater levels, we recommend wrapping the elevator pit and loading dock lift pit in geomembrane to create a watertight structure ("bath tub"), and a sump crock be included in the base slab.

## 6. Pavement Design

We anticipate that pavement design will be controlled by the existing variable fill soils, and subgrades should be prepared as described in the Site Preparation section of this report, with recompaction/proof-rolling completed prior to base course placement. *Due to the widespread presence of mixed fill, we recommend that the budget include a generous contingency for subgrade undercutting/stabilization, which could potentially include about 12 in. (or more) of additional coarse aggregate (e.g., 3-in. DGB) over biaxial geogrid (e.g., Tensar BX Type 1 or equivalent).*

We anticipate that asphalt pavement in parking lots will primarily be exposed to automobile traffic with less than one 18-kip equivalent single axle load (ESAL) per day. In view of this, we have assumed Traffic Class I following Wisconsin Asphalt Pavement Association (WAPA) recommendations for smaller parking areas (i.e., up to 50 stalls) and driveways that are mainly used by light passenger vehicles. However, main sections of driveways are likely to experience heavier traffic loads due to truck traffic, and we understand that larger parking areas (i.e., over 50 stalls) may also be planned. For pavement areas where trucks will routinely travel and parking lots with more than 50 stalls, we have assumed a traffic load of less than 10 ESALs per day and Traffic Class II according to WAPA. We have also included a heavy-duty pavement section where higher truck traffic loads (up to 50 ESALs per day) are expected, such as in loading dock areas. The pavement sections summarized in Table 4 below were selected assuming a Soil Support Value "SSV" of 4.0 for a firm or adequately stabilized mixed fill subgrade and a design life of 20 years. Note that the pavement lifespan may be reduced somewhat by the presence of organic soils/peat that may settle over time, which may require additional maintenance.

**TABLE 4 – Recommended Pavement Sections**

| **Material** | **Thicknesses (in.)** | | | **WDOT Specification** [1] |
|---|---|---|---|---|
| | **Traffic Class I (Light Duty)** | **Traffic Class II (Medium Duty)** | **Traffic Class III (Heavy Duty)** | |
| Bituminous Upper Layer (2,3) | 1.5 | 1.75 | 2.0 | Section 460,<br>Table 460-1,<br>9.5 mm (light duty),<br>12.5 mm (medium and heavy duty) |
| Bituminous Lower Layer (2,3) | 2.0 | 2.25 | 3.0 | Section 460,<br>Table 460-1,<br>12.5 mm (light duty),<br>19 mm (medium and heavy duty) |
| Dense Graded Base Course (2,4) | 8.0 | 10.0 | 12.0 | Sections 301 and 305, 3 in. and 1¼ in. |
| **Total Thickness** | **11.5** | **14.0** | **17.0** | |

Notes:

1) Wisconsin DOT *Standard Specifications for Highway and Structure Construction*, latest edition, including supplemental specifications, and Wisconsin Asphalt Pavement Association *2018 Asphalt Pavement Design Guide*.

2) Compaction requirements:
    - Bituminous concrete: Refer to Section 460-3.
    - Base course: Refer to Section 301.3.4.2, Standard Compaction

3) Mixture Type LT bituminous; refer to Section 460, Table 460-2 of the *Standard Specifications*. Mixture type MT is recommended in heavy duty traffic areas. Note that an “H Grade” asphalt surface layer is recommended where there will be slow moving heavy truck traffic making turning movements.

4) The upper 4 in. should consist of 1¼-in. DGB; the bottom part of the layer can consist of 3-in. DGB.

The recommended pavement sections assume regular maintenance (crack sealing, etc.) will occur, as needed. Note that if traffic volumes are greater than those assumed, CGC should be allowed to review the recommended pavement sections and adjust them accordingly. Alternative pavement designs may prove acceptable and should be reviewed by CGC. If there is a delay between subgrade preparation and placing the base course, the subgrade should be recompacted.

Where concrete pavement may be used, such as in pavement areas subjected to concentrated wheel loads (e.g., dumpster pads, loading dock aprons, etc.), we recommend that the concrete pavement should be at least 6-in. thick, be underlain by at least 6 in. of DGB and contain mesh reinforcement for crack control. Concrete slabs underlain by a minimum 6-in. thick dense graded base layer over a firm or stabilized subgrade can be designed utilizing a subgrade modulus of 100 pci. Note that a thicker pavement section (more than 6 in. of concrete) may be required depending on pavement loads, which should be evaluated by a structural engineer.

## 7. Preliminary Stormwater Infiltration Potential

We understand the redevelopment of the site may involve stormwater infiltration areas. As the locations of the stormwater infiltration areas had not been determined at the time the soil borings were conducted, our preliminary evaluation of the stormwater infiltration potential encompasses the entire site and is fairly generalized. However, shallow soil conditions in the borings were fairly consistent and generally involved mixed fill with highly variable infiltration potential over lower-permeability organic/peat layers. The peat and organic layers were generally underlain by more permeable sand soils, but the groundwater table, which is the limiting layer for stormwater infiltration, was typically encountered within or just slightly below the peat/organic layers. Therefore, it is our opinion that the site is not suitable for infiltrating significant quantities of stormwater.

**Infiltration Potential:** The following is a summary of the estimated *preliminary* infiltration rates for the soils encountered in Borings 1 through 13, per Table 2 of the WDNR Conservation Practice Standard 1002, *Site Evaluation for Storm Water Infiltration*. The estimated *preliminary* infiltration rates are as follows:

| | |
|---|---|
| • Silty clay loam (SiCL) | 0.04 in./hr |
| • Sandy clay loam (SCL) | 0.11 in./hr |
| • Peat (approximation) | 0.13 in./hr |
| • Silt loam (SiL) | 0.13 in./hr |
| • Loam (L) | 0.24 in./hr |
| • Sandy loam (SL), gravelly sandy loam (GRSL) | 0.50 in./hr |
| • Fine sandy loam (FSL) | 0.50 in./hr |
| • Loamy fine sand (LFS) | 0.50 in./hr |
| • Fine sand (FS) | 0.50 in./hr |
| • Sand (S) | 3.60 in./hr |

Note that the infiltration rates should be considered very approximate since they are merely based on soil texture and do not account for in-place soil density and other factors, which will affect the infiltration rate. We recommend that the soils at and several feet below the bottom of stormwater management systems be checked by a geotechnical engineer or certified soil tester *in conjunction with the basin designer* to document that the soils are appropriate for the design infiltration rate or recommend remedial measures, if necessary. *Variability in the soil conditions should be expected across the site and within the stormwater basin that could result in a wide range of undercut depths to reach soil suitable for the design infiltration rate.* The Wisconsin Department of Safety and Professional Services Soil and Site Evaluation – Storm forms for Borings 1 through 13 are contained in Appendix E. Note that supplemental test pits may be required to develop final design infiltration rates for stormwater management design.

**Groundwater:** Groundwater was generally encountered at depths of about 5 to 8.5 ft in the soil borings. It must also be noted that some of the on-site soils exhibit redoximorphic features (redox or mottling) and/or low-chroma/high-value (gray) dominant color, which suggests the level of past saturation from perched water, periodically infiltrating surface water or seasonally elevated groundwater. The groundwater table should be expected to fluctuate as discussed in the Subsurface Conditions section. Groundwater mounding effects should be considered during the design of infiltration systems.

**Bedrock:** Apparent sandstone bedrock was encountered in Boring 9 at about 57 ft below the ground surface. The depth and consistency of bedrock should be expected to vary across the site.

During construction, appropriate erosion control should be provided to prevent eroded soil from contaminating the stormwater management areas. Where appropriate, the stormwater system design should include pretreatment to remove fine-grained soils (silt/clay) and clogging materials (oils/greases) from stormwater prior to entering the infiltration areas. Additionally, a regular maintenance plan should be developed to remove silt/clay soils and clogging materials that may accumulate in the bottom of the stormwater management areas over time. Failure to adequately control fine-grained soils and clogging materials from entering the infiltration areas or failure to regularly remove fine-grained soils and clogging materials that accumulate at the base of the stormwater infiltration systems will likely cause the stormwater management systems to fail. Additionally, it is important that the soils in the bottom of the infiltration systems do not become compacted during construction or measures are taken to mitigate soils that are compacted during construction. Refer to WDNR Conservation Practice Standards 1002, 1003 and 1004, as well as NR151 for additional information.

## CONSTRUCTION CONSIDERATIONS

Due to variations in weather, construction methods and other factors, specific construction problems are difficult to predict. Soil related difficulties which could be encountered on the site are discussed below:

- Due to the potentially sensitive nature of some of the on-site soils, we recommend that final site grading activities be completed during dry weather, if possible. Construction traffic should be avoided on prepared subgrades to minimize potential disturbance.

- Contingencies in the project budget for subgrade stabilization with coarse aggregate in pavement and floor slab areas should be increased if the project schedule requires that work proceed during adverse weather conditions.

- Earthwork construction during the late fall through early spring could be complicated as a result of wet weather and freezing temperatures. During cold weather, exposed subgrades should be protected from freezing before and after footing construction. Fill should never be placed while frozen or on frozen ground.

- Excavations extending greater than 4 ft in depth below the existing ground surface should be sloped or braced in accordance with current OSHA standards. Where adequate sloping is not possible, temporary earth retention systems will be required. Special care should be exercised not to undermine existing foundations.

- Based on the observations made during our field exploration, dewatering of footing and undercut excavations is expected, as previously discussed. In addition, water accumulating at the bottom of excavations as a result of precipitation or seepage should be quickly removed in a similar manner, with dewatering means and methods being the contractor’s responsibility.

## RECOMMENDED CONSTRUCTION MONITORING

The quality of the foundation, floor slab and pavement subgrades will be largely determined by the level of care exercised during site development. To check that earthwork and foundation construction proceed in accordance with our recommendations, the following operations should be monitored by CGC:

- Topsoil stripping and subgrade proof-rolling/compaction;
- Fill/backfill placement and compaction;
- Deep foundation installation (if any);
- Foundation excavation/subgrade preparation; and
- Concrete placement.

* * * * *

It has been a pleasure to serve you on this project. If you have any questions or need additional consultation, please contact us.

Sincerely,

**CGC, Inc.**

Tim F. Gassenheimer, EIT, CST
Staff Engineer

Ryan J. Portman

Ryan J. Portman, PE, CST
Consulting Professional

Encl: Appendix A - Field Exploration
Appendix B - Soil Boring Location Exhibit
Logs of Test Borings (14)
Particle Size Distribution Test Reports (2)
Log of Test Boring-General Notes
Unified Soil Classification System
Appendix C - Document Qualifications
Appendix D - Recommended Compacted Fill Specifications
Appendix E - WDSPS Soil and Site Evaluation – Storm Forms (13 Borings)

# APPENDIX A

# FIELD EXPLORATION

# APPENDIX A

## FIELD EXPLORATION

Subsurface conditions for this study were explored by drilling 14 Standard Penetration Test (SPT) soil borings to planned depths between 10 and 75 ft below current site grades at locations selected by the planning team and located in the field by CGC in conjunction with City personnel. The borings were conducted by Badger State Drilling (under subcontract to CGC) on June 10 through 12 and 17, 2019 using a truck-mounted CME-55 and a track-mounted D-50 rotary drill rig equipped with hollow stem augers, mud rotary tooling and automatic SPT hammers. Note that auger and split-spoon refusal occurred in Borings 9 and 11, which were planned to be extended to 75 ft, at depths of about 63.5 ft on apparent sandstone bedrock and about 53 ft on a cobble/boulder or bedrock, respectively.

The soil borings were generally sampled at 2.5-ft intervals to a depth of 15 ft and at 5-ft intervals thereafter. The samples were obtained in general accordance with specifications for standard penetration testing, ASTM D 1586. The specific procedures used for drilling and sampling are described below.

1. Boring Procedures between Samples

   The boring is extended downward, between samples, by a hollow-stem auger. In the deeper Borings 9 and 11, mud-rotary drilling techniques were used below depths of 10 ft, implementing drilling mud/slurry to support the sidewalls of the boreholes and prevent hydrostatic failure of the bottom, while also transporting the drill cutting loosened by a roller bit to the ground surface.

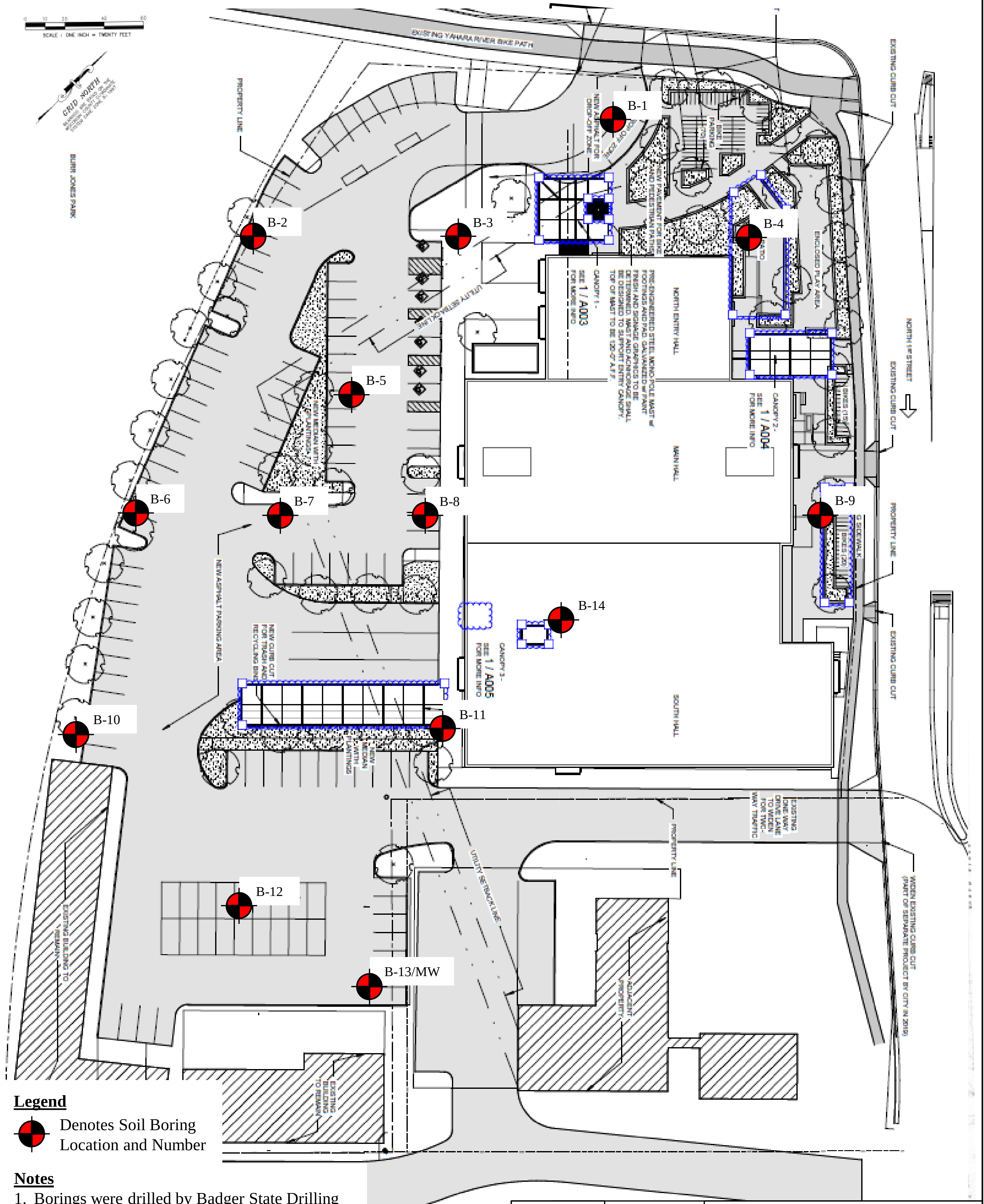
2. Standard Penetration Test and Split-Barrel Sampling of Soils
   (ASTM Designation: D 1586)

   This method consists of driving a 2-inch outside diameter split-barrel sampler using a 140-pound weight falling freely through a distance of 30 inches. The sampler is first seated 6 inches into the material to be sampled and then driven 12 inches. The number of blows required to drive the sampler the final 12 inches is recorded on the log of borings and is known as the Standard Penetration Resistance.

During the field exploration, the driller visually classified the soil and prepared a field log. Field screening of the soil samples for possible environmental contaminants was conducted by a City of Madison hydrogeologist during drilling. Water level observations were made in each boring during and after drilling and are shown at the bottom of each boring log. Upon completion of drilling, the borings were generally backfilled to satisfy WDNR regulations. As an exception, a temporary groundwater monitoring well was installed in Boring 13 after the completion of drilling. The soil samples were delivered to our laboratory for visual classification by a geotechnical engineer using the Unified Soil Classification System, as well as laboratory testing. The final logs prepared by the engineer including laboratory test results, along with a Soil Boring Location Exhibit and a description of the Unified Soil Classification System are presented in Appendix B.

# APPENDIX B

## SOIL BORING LOCATION EXHIBIT
## LOGS OF TEST BORINGS (13)
## PARTICLE SIZE DISTRIBUTION TEST REPORTS (2)
## LOG OF TEST BORING-GENERAL NOTES
## UNIFIED SOIL CLASSIFICATION SYSTEM



## Legend

⊕ Denotes Soil Boring Location and Number

## Notes

1. Borings were drilled by Badger State Drilling on June 10 through 12 and 17, 2019.
2. Boring locations are approximate.
3. Base map was prepared by MSR.

| | | |
|---|---|---|
| **Job No.:**<br>**C19051-10** | **CGC, Inc.** | **SOIL BORING LOCATION EXHIBIT**<br>**Proposed Redevelopment**<br>**200 North First Street**<br>**City of Madison, Dane Co., WI** |
| **Date:**<br>**06/2019** | | |

**CGC Inc.**

# LOG OF TEST BORING

Project **Proposed Redevelopment**
**200 North First Street**
Location **City of Madison, Dane Co., WI**

Boring No. **1**
Surface Elevation (ft) **852.0±**
Job No. **C19051-10**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

| SAMPLE | | | | | | VISUAL CLASSIFICATION and Remarks | SOIL PROPERTIES | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | TYPE | Rec (in.) | Moist | N | Depth (ft) | | qu (qa) (tsf) | W | LL | PL | LI |
| | | | | | | 4± in. Topsoil FILL (OL) | | | | | |
| 1 | ■ | 16 | M | 14 | | FILL: Loose to Medium Dense, Very Dark Brown Fine to Coarse Sand, Some Silt, Little Gravel, Trace Organics, Scattered Ceramic Tile Fragments, Possible Cinders and/or Asphalt Pieces | | | | | |
| 2 | ■ | 12 | M | 4 | | | | | | | |
| | | | | | 5 | *10YR 2/2 Sandy Loam (Fill)* | | | | | |
| 3 | ■ | 16 | M/W | 6 | ∇ | Loose, Black Sedimentary to Fibrous PEAT, Trace Sand (PT) | | 50.1 | | | |
| | | | | | | *10YR 2/1 Silt Loam/Peat* | | | | | |
| 4 | ■ | 18 | W | 10 | | Loose, Gray to Light Brownish Gray Fine SAND, Trace Silt and Gravel, Scattered Shells (SP) | | | | | |
| | | | | | 10 | *10YR 6/1, 6/2 Fine Sand* | | | | | |
| | | | | | | End of Boring at 10 ft<br>Borehole Backfilled with Bentonite Chips | | | | | |
| | | | | | 15 | | | | | | |
| | | | | | 20 | | | | | | |
| | | | | | 25 | | | | | | |
| | | | | | 30 | | | | | | |
| | | | | | 35 | | | | | | |

## WATER LEVEL OBSERVATIONS

| | | | | |
|---|---|---|---|---|
| While Drilling | ∇ 7.0' | Upon Completion of Drilling | | |
| Time After Drilling | | | | 20 Mins. |
| Depth to Water | | | | NW ▼ |
| Depth to Cave in | | | | 5.4' |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

## GENERAL NOTES

Start **6/10/19** End **6/10/19**
Driller **BSD** Chief **MC** Rig **CME-55**
Logger **MG** Editor **TFG**
Drill Method **2.25" HSA; Autohammer**

**CGC Inc.**

# LOG OF TEST BORING

Project **Proposed Redevelopment**
**200 North First Street**
Location **City of Madison, Dane Co., WI**

Boring No. **2**
Surface Elevation (ft) **851.0±**
Job No. **C19051-10**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

| SAMPLE | | | | | | VISUAL CLASSIFICATION and Remarks | SOIL PROPERTIES | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | TYPE | Rec (in.) | Moist | N | Depth (ft) | | qu (qa) (tsf) | W | LL | PL | LI |
| | | | | | | 10± in. Asphalt Pavement / 8± in. Base Course | | | | | |
| 1 | ▮ | 16 | M | 17 | | FILL: Very Loose to Medium Dense, Light Yellowish Brown Fine to Coarse Sand, Some Silt and Gravel<br>*10YR 6/4 Gravelly Sandy Loam (Fill)* | | | | | |
| | | | | | ∇ | | | | | | |
| 2 | ▮ | 12 | W | 2 | | | | | | | |
| | | | | | 5 | | | | | | |
| 3 | ▮ | 18 | M/W | 3 | | Very Loose, Very Dark Gray to Black/Strong Brown (Mottled) Sedimentary PEAT, Trace Sand (PT - Possible Fill)<br>*Faint Possible Petroleum/Chemical Odor*<br>*2.5Y 3/1, 2.5/1 (Redox: c2d 7.5YR 4/6) Silt Loam/Peat* | (0.5) | 86.8 | | | 17.2 |
| 4 | ▮ | 18 | W | 11 | | Medium Dense, Gray Fine to Coarse SAND, Little Gravel, Trace Silt, Scattered Shells and Organic Pockets (SP)<br>*Faint Possible Petroleum/Chemical Odor*<br>*2.5Y 5/1 Sand* | | | | | |
| | | | | | 10 | End of Boring at 10 ft<br>Borehole Backfilled with Bentonite Chips; Surface Patched with Asphalt Cold Patch | | | | | |
| | | | | | 15 | | | | | | |
| | | | | | 20 | | | | | | |
| | | | | | 25 | | | | | | |
| | | | | | 30 | | | | | | |
| | | | | | 35 | | | | | | |

## WATER LEVEL OBSERVATIONS

| | | | | | |
|---|---|---|---|---|---|
| While Drilling | ∇ 3.0' | Upon Completion of Drilling | | | |
| Time After Drilling | (Probable | | | 20 Mins. | |
| Depth to Water | Perched | | | NW | ▼ |
| Depth to Cave in | Water) | | | 4.0' | |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

## GENERAL NOTES

Start **6/10/19** End **6/10/19**
Driller **BSD** Chief **MC** Rig **CME-55**
Logger **MG** Editor **TFG**
Drill Method **2.25" HSA; Autohammer**

CGC Inc.

# LOG OF TEST BORING

Project **Proposed Redevelopment**
**200 North First Street**
Location **City of Madison, Dane Co., WI**

Boring No. **3**
Surface Elevation (ft) **851.5±**
Job No. **C19051-10**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

| SAMPLE | | | | | | VISUAL CLASSIFICATION and Remarks | SOIL PROPERTIES | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | TYPE | Rec (in.) | Moist | N | Depth (ft) | | qu (qa) (tsf) | W | LL | PL | LI |
| | | | | | | 4± in. Asphalt Pavement / 7± in. Base Course | | | | | |
| 1 | ■ | 12 | M | 6 | | FILL: Loose Mixture of Sand and Silt, Little Gravel, Scattered Possible Cinders<br>*Faint Possible Petroleum/Chemical Odor*<br>*Variable Fill* | | | | | |
| 2 | ■ | 10 | M | 7 | ▼ | | | | | | |
| | | | | | 5 | FILL: Loose Mixture of Sand and Clay, Scattered Glass Fragments and Organic Seams<br>*Faint Possible Petroleum/Chemical Odor*<br>*Variable Fill* | | | | | |
| 3A/3B | ■ | 12 | M | 6 | | | | 74.2 | | | |
| | | | | | ▽ | | | | | | |
| 4 | ■ | 18 | W | 3 | | Loose, Black Sedimentary to Fibrous PEAT, Trace Sand (PT)<br>*10YR 2/1 Silt Loam/Peat* | | | | | |
| | | | | | 10 | | | | | | |
| 5 | ■ | 18 | W | 7 | | Loose, Gray Fine SAND, Trace Silt and Gravel, Scattered Shells and Peat Seams (SP)<br>*2.5Y 5/1 Fine Sand, Silt Loam/Peat Seams* | | | | | |
| 6 | ■ | 12 | W | 8 | | Very Loose, Gray Fine SAND, Trace Silt and Gravel, Scattered Shells (SP)<br>*2.5Y 5/1 Fine Sand* | | | | | |
| | | | | | 15 | | | | | | |
| | | | | | | Loose, Gray Fine to Medium SAND, Trace Silt and Gravel, Scattered Shells (SP)<br>*10YR 5/1 Sand* | | | | | |
| 7 | ■ | 16 | W | 14 | | | | | | | |
| | | | | | 20 | Loose, Grayish Brown Fine SAND, Trace Silt and Gravel (SP)<br>*10YR 5/2 Fine Sand* | | | | | |
| | | | | | | Medium Dense, Gray Fine to Medium SAND, Trace Silt and Gravel, Scattered Shells (SP) | | | | | |
| 8 | ■ | 18 | W | 14 | | Stiff, Gray Lean CLAY, Trace Sand, Scattered Thin Silt and Fine Sand Seams (CL) | (1.5-1.75) | 24.0 | | | |
| | | | | | 25 | | | | | | |
| | | | | | | Very Stiff, Gray Lean CLAY, Trace Sand (CL) | | | | | |
| 9 | ■ | 18 | W | 21 | | | (2.0-2.5) | 21.6 | 30 | 16 | |
| | | | | | 30 | End of Boring at 30 ft<br><br>Borehole Backfilled with Bentonite Chips;<br>Surface Patched with Asphalt Cold Patch | | | | | |
| | | | | | 35 | | | | | | |

## WATER LEVEL OBSERVATIONS

While Drilling ▽ **8.0'** Upon Completion of Drilling ____

| | | | | |
|---|---|---|---|---|
| Time After Drilling | | | | **20 Mins.** |
| Depth to Water | | | | **5.0'** ▼ |
| Depth to Cave in | | | | **7.0'** |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

## GENERAL NOTES

Start **6/11/19** End **6/11/19**
Driller **BSD** Chief **MC** Rig **CME-55**
Logger **MG** Editor **TFG**
Drill Method **2.25" HSA; Autohammer**

CGC Inc.

# LOG OF TEST BORING

Project **Proposed Redevelopment**
**200 North First Street**
Location **City of Madison, Dane Co., WI**

Boring No. **4**
Surface Elevation (ft) **852.0±**
Job No. **C19051-10**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

| SAMPLE | | | | | | VISUAL CLASSIFICATION and Remarks | SOIL PROPERTIES | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | TYPE | Rec (in.) | Moist | N | Depth (ft) | | qu (qa) (tsf) | W | LL | PL | LI |
| | | | | | | 4± in. Topsoil FILL (OL) | | | | | |
| 1 | ■ | 10 | M | 12 | | FILL: Medium Dense Mixture of Sand and Clay, Little Gravel, Trace Organics<br>*Variable Fill* | | | | | |
| 2 | ■ | 12 | M | 4 | 5 | FILL: Very Loose to Loose, Yellowish Brown Fine Sand, Trace to Little Silt, Trace Gravel<br>*10YR 5/4 Fine Sand to Loamy Fine Sand (Fill)* | | | | | |
| 3 | ■ | 14 | M | 5 | | Loose, Black Sedimentary PEAT, Trace Sand (PT)<br>*10YR 2/1 Silt Loam/Peat* | | 139.3 | | | 38.2 |
| 4 | ■ | 12 | W | 5 | 10 | Loose, Light Gray to Gray Fine to Medium SAND, Trace Silt and Gravel, Scattered Shells (SP)<br>*2.5Y 7/1, 10YR 6/1 Sand* | | | | | |
| 5 | ■ | 10 | W | 20 | | Medium Dense, Gray to Brown Fine to Medium SAND, Little Gravel, Trace Silt, Scattered Shells (SP)<br>*2.5Y 5/1, 10YR 5/3 Sand* | | | | | |
| 6 | ■ | 10 | W | 24 | 15 | | | | | | |
| | | | | | | Medium Dense, Gray Fine SAND, Trace Silt and Gravel, Scattered Shells and Organic Pockets (SP)<br>*2.5Y 5/1, 10YR 6/1 Fine Sand* | | | | | |
| 7 | ■ | 14 | W | 5 | 20 | Stiff, Gray Lean CLAY, Trace Sand (CL) | (1.0-1.5) | 23.2 | | | |
| 8 | ■ | 16 | W | 18 | 25 | Medium Dense, Light Brownish Gray Laminated SILT and Fine SAND (ML/SP) | | | | | |
| 9 | ■ | 16 | W | 17 | 30 | Stiff, Gray Lean to Silty CLAY, Trace Sand, Scattered Thin Silt Seams (CL/CL-ML) | (1.0-1.25) | 20.8 | | | |
| | | | | | 35 | End of Boring at 30 ft<br>Borehole Backfilled with Bentonite Chips | | | | | |

## WATER LEVEL OBSERVATIONS

While Drilling ▽ **8.0'** Upon Completion of Drilling
Time After Drilling **20 Mins.**
Depth to Water **7.6'** ▼
Depth to Cave in **8.3'**

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

## GENERAL NOTES

Start **6/12/19** End **6/12/19**
Driller **BSD** Chief **MC** Rig **CME-55**
Logger **MG** Editor **TFG**
Drill Method **2.25" HSA; Autohammer**

**CGC Inc.**

# LOG OF TEST BORING

Project: **Proposed Redevelopment**
**200 North First Street**
Location: **City of Madison, Dane Co., WI**

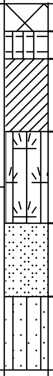
Boring No. **5**
Surface Elevation (ft) **851.5±**
Job No. **C19051-10**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

## SAMPLE / SOIL PROPERTIES

| No. | TYPE | Rec (in.) | Moist | N | qu (qa) (tsf) | W | LL | PL | LI |
|---|---|---|---|---|---|---|---|---|---|
| 1A/1B | ■ | 12 | M | 9 | (1.0-1.5) | 18.2 | | | |
| 2 | ■ | 16 | M | 4 | | 37.1 | | | 8.3 |
| 3 | ■ | 14 | M/W | 8 | | | | | |
| 4 | ■ | 18 | W | 15 | | | | | |

## VISUAL CLASSIFICATION and Remarks



5± in. Asphalt Pavement / 4± in. Base Course

FILL: Loose, Light Yellowish Brown Fine to Medium Sand, Some Silt and Gravel
*10YR 6/4 Gravelly Sandy Loam (Fill)*

Stiff, Gray Lean CLAY, Little Sand (CL - Possible Fill)
*Possible Petroleum Odor*
*2.5Y 6/1 Silty Clay Loam*

Very Loose to Loose, Black Organic SILT, Little Sand, Scattered Sand Seams (OL/ML)
*Possible Petroleum/Chemical Odor*
*10YR 2/1 Silt Loam*

Loose, Gray Fine SAND, Trace Silt and Gravel, Scattered Shells (SP)
*Faint Possible Petroleum/Chemical Odor*
*2.5Y 5/1 Fine Sand*

Medium Dense, Dark Gray Fine to Medium SAND, Little Gravel, Trace Silt, Scattered Shells, Interbedded with Very Dark Gray SILT, Trace Sand and Organics (SP/ML)
*Possible Petroleum/Chemical Odor*
*2.5Y 4/1, GLEY1 3/N Stratified Sand and Silt Loam*

End of Boring at 10 ft

Borehole Backfilled with Bentonite Chips;
Surface Patched with Asphalt Cold Patch

## WATER LEVEL OBSERVATIONS

While Drilling ∇ **8.0'** Upon Completion of Drilling ______
Time After Drilling ______ ______ ______ **30 Mins.**
Depth to Water ______ ______ ______ **6.8'** ▼
Depth to Cave in ______ ______ ______ **7.8'**

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

## GENERAL NOTES

Start **6/11/19** End **6/11/19**
Driller **BSD** Chief **MC** Rig **CME-55**
Logger **MG** Editor **TFG**
Drill Method **2.25" HSA; Autohammer**

CGC Inc.

# LOG OF TEST BORING

Project **Proposed Redevelopment**
**200 North First Street**
Location **City of Madison, Dane Co., WI**

Boring No. **6**
Surface Elevation (ft) **851.0±**
Job No. **C19051-10**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

| SAMPLE | | | | | | VISUAL CLASSIFICATION and Remarks | SOIL PROPERTIES | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | TYPE | Rec (in.) | Moist | N | Depth (ft) | | qu (qa) (tsf) | W | LL | PL | LI |
| | | | | | | 10± in. Asphalt Pavement / 5± in. Base Course | | | | | |
| 1 | ■ | 10 | M | 10 | | FILL: Very Loose to Loose Mixture of Sand and Sandy Silt<br>*Variable Fill*<br>Very Limited Recovery in Sample 2 | | | | | |
| 2 | ■ | 2 | M | 2 | | | | | | | |
| | | | | | 5 ▼ | Loose, Black Sedimentary to Fibrous PEAT, Trace Sand (PT)<br>*10YR 2/1 Silt Loam/Peat* | | | | | |
| 3 | ■ | 16 | M/W | 8 | ▽ | | | | | | |
| 4 | ■ | 18 | W | 11 | | Loose, Gray Fine to Medium SAND, Trace Silt and Gravel, Scattered Shells (SP)<br>*10YR 6/1 Sand* | | | | | |
| | | | | | 10 | Medium Dense, Gray Fine SAND, Trace Silt and Gravel, Numerous Shells, Scattered Thin Peat Seams (SP)<br>*Faint Foul/Organic Odor*<br>*2.5Y 5/1 Fine Sand* | | | | | |
| | | | | | 15 | End of Boring at 10 ft<br>Borehole Backfilled with Bentonite Chips; Surface Patched with Asphalt Cold Patch | | | | | |
| | | | | | 20 | | | | | | |
| | | | | | 25 | | | | | | |
| | | | | | 30 | | | | | | |
| | | | | | 35 | | | | | | |

## WATER LEVEL OBSERVATIONS

| | | | | | |
|---|---|---|---|---|---|
| While Drilling | ▽ 8.0' | Upon Completion of Drilling | | | |
| Time After Drilling | | | | 20 Mins. | |
| Depth to Water | | | | 6.0' | ▼ |
| Depth to Cave in | | | | 7.0' | |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

## GENERAL NOTES

Start **6/10/19** End **6/10/19**
Driller **BSD** Chief **MC** Rig **CME-55**
Logger **MG** Editor **TFG**
Drill Method **2.25" HSA; Autohammer**

CGC Inc.

# LOG OF TEST BORING

Project **Proposed Redevelopment**
**200 North First Street**
Location **City of Madison, Dane Co., WI**

Boring No. **7**
Surface Elevation (ft) **851.5±**
Job No. **C19051-10**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

| SAMPLE | | | | | | VISUAL CLASSIFICATION and Remarks | SOIL PROPERTIES | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | TYPE | Rec (in.) | Moist | N | Depth (ft) | | qu (qa) (tsf) | W | LL | PL | LI |
| | | | | | | 7± in. Asphalt Pavement / 4± in. Base Course | | | | | |
| 1 | ■ | 12 | M | 10 | | FILL: Stiff, Yellowish Brown Sandy Lean Clay, Little Gravel, Scattered Concrete Fragments and Possible Cinders<br>*10YR 5/6 Sandy Clay Loam (Fill)* | (1.25-1.5) | 9.8 | | | |
| 2 | ■ | 14 | M | 4 | | | | 48.8 | | | |
| | | | | | 5 | FILL: Very Loose to Loose, Very Dark Brown Organic Silt to Sedimentary Peat, Little Sand and Gravel, Scattered Possible Cinders<br>*10YR 2/2 Silt Loam/Peat (Fill)* | | | | | |
| 3 | ■ | 16 | M/W | 7 | | | | 24.2 | | | |
| | | | | | ▼ | | | | | | |
| 4 | ■ | 18 | W | 7 | | Loose, Gray Fine to Medium SAND, Trace Silt and Gravel, Scattered Shells and Thin Peat Seams (SP)<br>*USDA: 2.5Y 6/1 Fine Sand, Silt Loam/Peat Seams*<br>P200 (Sample 4): 4.1% | | | | | |
| | | | | | 10 | End of Boring at 10 ft<br>Borehole Backfilled with Bentonite Chips; Surface Patched with Asphalt Cold Patch | | | | | |
| | | | | | 15 | | | | | | |
| | | | | | 20 | | | | | | |
| | | | | | 25 | | | | | | |
| | | | | | 30 | | | | | | |
| | | | | | 35 | | | | | | |

## WATER LEVEL OBSERVATIONS

While Drilling ▽ **8.0'** Upon Completion of Drilling

| | | | | |
|---|---|---|---|---|
| Time After Drilling | | | | **30 Mins.** |
| Depth to Water | | | | **7.8'** ▼ |
| Depth to Cave in | | | | **8.0'** |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

## GENERAL NOTES

Start **6/11/19** End **6/11/19**
Driller **BSD** Chief **MC** Rig **CME-55**
Logger **MG** Editor **TFG**
Drill Method **2.25" HSA; Autohammer**

CGC Inc.

# LOG OF TEST BORING

Project **Proposed Redevelopment**
**200 North First Street**
Location **City of Madison, Dane Co., WI**

Boring No. **8**
Surface Elevation (ft) **852.0±**
Job No. **C19051-10**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

| SAMPLE | | | | | | VISUAL CLASSIFICATION and Remarks | SOIL PROPERTIES | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | TYPE | Rec (in.) | Moist | N | Depth (ft) | | qu (qa) (tsf) | W | LL | PL | LI |
| | | | | | | 4± in. Asphalt Pavement / 8± in. Base Course | | | | | |
| 1 | ■ | 14 | M | 6 | | FILL: Very Loose to Loose Mixture of Sand and Organic Silt<br>*Variable Fill* | | | | | |
| 2 | ■ | 14 | M | 2 | 5 | FILL: Very Loose, Black Fine to Coarse Sand, Trace Silt and Gravel (Possible Foundry Sand)<br>*2.5Y 2.5/1 Sand (Fill)* | | | | | |
| 3A/3B | ■ | 16 | M | 8 | ▼ ▽ | Loose, Black Sedimentary to Fibrous PEAT, Trace Sand (PT)<br>*10YR 2/1 Silt Loam/Peat* | | | | | |
| 4 | ■ | 16 | W | 8 | 10 | Loose, Gray Fine SAND, Trace Silt and Gravel, Scattered Shells (SP)<br>*2.5Y 6/1 Fine Sand* | | | | | |
| 5 | ■ | 16 | W | 15 | | Loose, Gray to Dark Gray Fine to Medium SAND, Trace Silt and Gravel, Scattered to Numerous Shells (SP)<br>*Faint Possible Petroleum/Chemical Odor*<br>*2.5Y, 5Y 4/1 Sand* | (0.5-1.0) | | | | |
| 6 | ■ | 14 | W | 7 | 15 | | (1.0-2.0) | 20.3 | 26 | 16 | |
| | | | | | | Medium Dense, Gray SILT, Trace Sand (ML)<br>*10YR 5/1 Silt Loam* | | | | | |
| 7A/7B | ■ | 18 | W | 7 | 20 | Stiff, Gray Lean CLAY, Trace Sand (CL)<br>*10YR 5/1 Silty Clay Loam* | (1.25-2.0) | 21.3 | | | |
| | | | | | | Loose, Gray Fine SAND, Trace Silt and Gravel (SP) | | | | | |
| 8 | ■ | 16 | W | 7 | 25 | Stiff to Very Stiff, Gray Lean CLAY, Trace Sand (CL) | (1.5-2.25) | 22.3 | | | |
| 9 | ■ | 16 | W | 9 | | | (1.75-2.25) | 21.1 | | | |
| | | | | | 30 | End of Boring at 30 ft<br><br>Borehole Backfilled with Bentonite Chips;<br>Surface Patched with Asphalt Cold Patch | | | | | |
| | | | | | 35 | | | | | | |

## WATER LEVEL OBSERVATIONS

While Drilling ▽ **8.5'** Upon Completion of Drilling

| | | | | |
|---|---|---|---|---|
| Time After Drilling | | | | **20 Mins.** |
| Depth to Water | | | | **8.0'** ▼ |
| Depth to Cave in | | | | **8.5'** |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

## GENERAL NOTES

Start **6/11/19** End **6/11/19**
Driller **BSD** Chief **MC** Rig **CME-55**
Logger **MG** Editor **TFG**
Drill Method **2.25" HSA; Autohammer**

# LOG OF TEST BORING

CGC Inc.

Project: **Proposed Redevelopment**
**200 North First Street**
Location: **City of Madison, Dane Co., WI**

Boring No. **9**
Surface Elevation (ft) **851.5±**
Job No. **C19051-10**
Sheet **1** of **2**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

| SAMPLE | | | | | | VISUAL CLASSIFICATION and Remarks | SOIL PROPERTIES | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | TYPE | Rec (in.) | Moist | N | Depth (ft) | | qu (qa) (tsf) | W | LL | PL | LI |
| | | | | | | 8± in. Topsoil FILL (OL) | | | | | |
| 1 | ■ | 16 | M | 6 | | FILL: Loose Mixture of Sand and Sandy Silt<br>*Variable Fill* | | | | | |
| 2 | ■ | 6 | M | 4 | 5 | FILL: Very Loose to Loose Mixture of Sand and Organic Silt, Scattered Possible Cinders<br>*Variable Fill* | | | | | |
| 3 | ■ | 14 | M/W | 2 | ▽ | Very Loose, Black Sedimentary PEAT, Trace Sand (PT)<br>*10YR 2/1 Silt Loam/Peat* | | 111.7 | | | 31.4 |
| 4 | ■ | 16 | W | 4 | 10 | Very Loose to Loose, Gray to Dark Gray Fine to Medium SAND, Trace Silt and Gravel, Scattered to Numerous Shells (SP)<br>*Foul/Organic Odor*<br>*2.5Y 5/1, 5Y 4/1 Sand* | | | | | |
| 5 | ■ | 16 | W | 20 | 15 | Medium Dense, Gray Laminated Fine SAND, Trace and Some Silt (SP/SM)<br>*2.5Y 5/1 Stratified Fine Sand and Loamy Fine Sand* | | | | | |
| | | | | | | Medium Dense, Grayish Brown Fine to Medium SAND, Trace Silt and Gravel (SP) | | | | | |
| 6 | ■ | 10 | W | 22 | 20 | | | | | | |
| | | | | | | Stiff to Very Stiff, Gray Lean CLAY, Trace Sand (CL) | | | | | |
| 7 | ■ | 18 | W | 7 | 25 | | (1.75-2.25) | 21.9 | | | |
| | | | | | | Medium Stiff, Grayish Brown Lean CLAY, Trace Sand, Scattered Thin Silt and Fine Sand Seams (CL) | | | | | |
| 8 | ■ | 16 | W | 13 | 30 | | (0.5-1.0) | 23.1 | 25 | 14 | |
| | | | | | | Medium Stiff to Stiff, Grayish Brown Lean CLAY, Trace Sand, Scattered Silt Seams (CL) | | | | | |
| 9 | ■ | 18 | W | 8 | 35 | | (1.25-1.5) | 23.4 | | | |

## WATER LEVEL OBSERVATIONS

While Drilling ▽ **7.0'** Upon Completion of Drilling ______
Time After Drilling ______ ______ ______ ______
Depth to Water ______ ______ ______ ______ ▼
Depth to Cave in ______ ______ ______ ______

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

## GENERAL NOTES

Start **6/12/19** End **6/12/19**
Driller **BSD** Chief **JF** Rig **D-50**
Logger **DC** Editor **TFG**
Drill Method **4.25" HSA (0-10') / 3.875" RB-DM (10-63.5'); Autohammer**

CGC Inc.

# LOG OF TEST BORING

Project **Proposed Redevelopment**
**200 North First Street**
Location **City of Madison, Dane Co., WI**

Boring No. **9**
Surface Elevation **851.5±**
Job No. **C19051-10**
Sheet **2** of **2**

2921 PERRY STREET, MADISON, WIS. 53713 (608) 288-4100, FAX (608) 288-7887

| SAMPLE | | | | | | VISUAL CLASSIFICATION and Remarks | SOIL PROPERTIES | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | TYPE | Rec (in.) | Moist | N | Depth (ft) | | qu (qa) (tsf) | W | LL | PL | LI |
| | | | | | | Medium Stiff to Stiff, Grayish Brown Lean CLAY, Trace Sand, Scattered Silt Seams (CL) | | | | | |
| 10 | ■ | 18 | W | 12 | | | (0.75-1.0) | 22.9 | | | |
| | | | | | 40 | | | | | | |
| | | | | | | Very Stiff, Gray Lean CLAY, Trace Sand (CL) | | | | | |
| 11 | ■ | 16 | W | 12 | | | (2.0-2.25) | 25.3 | | | |
| | | | | | 45 | | | | | | |
| | | | | | | Very Dense, Light Brownish Gray Fine to Coarse SAND, Trace Silt and Gravel (SP) | | | | | |
| 12 | ■ | 18 | W | 65 | | | | | | | |
| | | | | | 50 | | | | | | |
| | | | | | | Very Dense, Gray Fine to Coarse SAND, Some Silt and Gravel, Scattered Cobbles/Boulders (SM) | | | | | |
| 13 | ■ | 4 | W | 50/4" | | | | | | | |
| | | | | | 55 | | | | | | |
| | | | | | | Very Dense, Pale Brown Fine to Medium SAND, Little Silt and Gravel (SP-SM - Probable Weathered Sandstone Bedrock) | | | | | |
| 14 | ■ | 6 | W | 50/2" | | | | | | | |
| | | | | | 60 | | | | | | |
| 15 | ■ | 0 | - | 50/0" | | End of Boring/Auger and Split-Spoon Refusal on Apparent Sandstone Bedrock at 63.5 ft<br>Borehole Backfilled with Bentonite Chips/Slurry | | | | | |
| | | | | | 65 | | | | | | |
| | | | | | 70 | | | | | | |

CGC Inc.

# LOG OF TEST BORING

Project **Proposed Redevelopment**
**200 North First Street**
Location **City of Madison, Dane Co., WI**

Boring No. **10**
Surface Elevation (ft) **851.0±**
Job No. **C19051-10**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

| SAMPLE | | | | | | VISUAL CLASSIFICATION and Remarks | SOIL PROPERTIES | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | TYPE | Rec (in.) | Moist | N | Depth (ft) | | qu (qa) (tsf) | W | LL | PL | LI |
| | | | | | | 7± in. Asphalt Pavement / 6± in. Base Course | | | | | |
| 1 | ■ | 14 | M | 8 | | FILL: Loose, Pale Brown Fine Sand, Trace Silt and Gravel<br>*10YR 6/3 Fine Sand (Fill)* | | | | | |
| 2 | ■ | 14 | M/W | 2 | ▼ 5 | FILL: Very Loose Mixture of Sand and Clay, Little Gravel, Trace Organics<br>*Variable Fill* | | | | | |
| 3A/3B | ■ | 18 | M/W | 6 | | Loose, Black Sedimentary PEAT, Some Sand (PT)<br>*2.5Y 2.5/1 Fine Sandy Loam to Loam/Peat* | | 42.0 | | | |
| 4 | ■ | 18 | W | 8 | ▽ | Loose, Gray Fine SAND, Little Silt, Trace Gravel, Numerous Shells, Scattered Peat Seams (SP-SM)<br>*2.5Y 5/1 Loamy Fine Sand, Silt Loam/Peat Seams* | | | | | |
| | | | | | 10 | Loose, Gray Fine SAND, Trace Silt and Gravel, Scattered Shells (SP)<br>*2.5Y 5/1 Fine Sand* | | | | | |
| | | | | | | End of Boring at 10 ft<br><br>Borehole Backfilled with Bentonite Chips;<br>Surface Patched with Asphalt Cold Patch | | | | | |
| | | | | | 15 | | | | | | |
| | | | | | 20 | | | | | | |
| | | | | | 25 | | | | | | |
| | | | | | 30 | | | | | | |
| | | | | | 35 | | | | | | |

## WATER LEVEL OBSERVATIONS

While Drilling ▽ **8.5'** Upon Completion of Drilling ______

| | | | | |
|---|---|---|---|---|
| Time After Drilling | | | | **20 Mins.** |
| Depth to Water | | | | **5.3'** ▼ |
| Depth to Cave in | | | | **5.3'** |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

## GENERAL NOTES

Start **6/12/19** End **6/12/19**
Driller **BSD** Chief **MC** Rig **CME-55**
Logger **MG** Editor **TFG**
Drill Method **2.25" HSA; Autohammer**

CGC Inc.

# LOG OF TEST BORING

Project **Proposed Redevelopment**
**200 North First Street**
Location **City of Madison, Dane Co., WI**

Boring No. **11**
Surface Elevation (ft) **852.0±**
Job No. **C19051-10**
Sheet **1** of **2**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

## SAMPLE

| No. | TYPE | Rec (in.) | Moist | N | qu (qa) (tsf) | W | LL | PL | LI |
|---|---|---|---|---|---|---|---|---|---|
| 1 | ▮ | 10 | M | 17 | | | | | |
| 2 | ▮ | 12 | M | 6 | | | | | |
| 3 | ▮ | 16 | W | 2 | (<0.25) | 104.9 | | | 21.5 |
| 4A/4B | ▮ | 18 | M/W | 9 | | 126.5 | | | |
| 5 | ▮ | 12 | M/W | 8 | | | | | |
| 6 | ▮ | 18 | W | 25 | | | | | |
| 7 | ▮ | 14 | W | 33 | | | | | |
| 8 | ▮ | 18 | W | 17 | (1.25-3.0) | 21.6 | | | |
| 9 | ▮ | 18 | W | 12 | (2.5-2.75) | 21.7 | | | |
| 10 | ▮ | 18 | W | 11 | (1.0-1.75) | | | | |

## VISUAL CLASSIFICATION and Remarks

5± in. Asphalt Pavement / 10± in. Base Course

FILL: Medium Dense Mixture of Sand and Concrete/Asphalt Rubble
*Variable Fill*

FILL: Loose, Yellowish Brown Silty to Clayey Fine to Medium Sand, Trace Gravel, Scattered Coal/Organic Pockets
*10YR 5/4 Sandy Loam (Fill)*

FILL: Very Loose Mixture of Silty Sand and Sedimentary Peat
*Possible Chemical/Petroleum Odor*
*Variable Fill*

Loose, Black Sedimentary to Fibrous PEAT, Trace Sand (PT)
*10YR 2/1 Silt Loam/Peat*

Loose, Gray Fine SAND, Trace Silt and Gravel, Scattered Shells (SP)
*2.5Y 6/1 Fine Sand*

Loose, Gray Fine to Medium SAND, Trace Silt and Gravel, Scattered Shells (SP)
*2.5Y 6/1 Sand*

Medium Dense, Gray SILT to Sandy SILT (ML)
*2.5Y 6/1 Silt Loam to Loam*

Dense, Gray to Yellowish Brown Laminated Sandy SILT and Fine SAND, Trace Silt (ML/SP)

Stiff to Very Stiff, Grayish Brown Lean CLAY, Scattered Thin Fine Sand and Silt Seams (CL)

## WATER LEVEL OBSERVATIONS

While Drilling ∇ **6.0'** Upon Completion of Drilling ______
Time After Drilling **(Possible** ______ ______ **30 Mins.**
Depth to Water **Perched** ______ ______ **NW** ▼
Depth to Cave in **Water)** ______ ______ **3.0'**

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

## GENERAL NOTES

Start **6/10/19** End **6/10/19**
Driller **BSD** Chief **MC** Rig **CME-55**
Logger **MG** Editor **TFG**
Drill Method **4.25" HSA (0-10') / 3.875" RB-DM (10-53'); Autohammer**

CGC Inc.

# LOG OF TEST BORING

Project **Proposed Redevelopment**
**200 North First Street**
Location **City of Madison, Dane Co., WI**

Boring No. **11**
Surface Elevation **852.0±**
Job No. **C19051-10**
Sheet **2** of **2**

2921 PERRY STREET, MADISON, WIS. 53713 (608) 288-4100, FAX (608) 288-7887

| SAMPLE | | | | | | VISUAL CLASSIFICATION and Remarks | SOIL PROPERTIES | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | TYPE | Rec (in.) | Moist | N | Depth (ft) | | qu (qa) (tsf) | W | LL | PL | LI |
| | | | | | | Stiff to Very Stiff, Grayish Brown Lean CLAY, Scattered Thin Fine Sand/Silt Seams (CL) | | | | | |
| 11 | ■ | 18 | W | 12 | | | (2.0-2.75) | | | | |
| | | | | | 40 | | | | | | |
| 12 | ■ | 18 | W | 24 | | | (1.75) | 19.5 | | | |
| | | | | | 45 | | | | | | |
| 13 | ■ | 18 | W | 21 | | | (1.75-2.25) | | | | |
| | | | | | 50 | | | | | | |
| 14 | ■ | 0 | - | 50/0" | | End of Boring/Auger and Split-Spoon Refusal on Possible Cobble/Boulder or Bedrock at 53 ft | | | | | |
| | | | | | 55 | Borehole Backfilled with Bentonite Chips/Slurry; Surface Patched with Asphalt Cold Patch | | | | | |
| | | | | | 60 | | | | | | |
| | | | | | 65 | | | | | | |
| | | | | | 70 | | | | | | |

CGC Inc.

# LOG OF TEST BORING

Project **Proposed Redevelopment**
**200 North First Street**
Location **City of Madison, Dane Co., WI**

Boring No. **12**
Surface Elevation (ft) **852.0±**
Job No. **C19051-10**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

| SAMPLE | | | | | | VISUAL CLASSIFICATION and Remarks | SOIL PROPERTIES | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | TYPE | Rec (in.) | Moist | N | Depth (ft) | | qu (qa) (tsf) | W | LL | PL | LI |
| | | | | | | 4± in. Asphalt Pavement / 7± in. Base Course | | | | | |
| 1 | ■ | 10 | M | 34 | | FILL: Dense to Very Dense Mixture of Sand and Gravel, Trace Silt<br>*Variable Fill*<br>Drove Stone near 3.5 ft - Very Limited Recovery in Sample 2 | | | | | |
| 2 | ■ | 1 | M | 50/1" | | | | | | | |
| | | | | | 5 ▽ ▼ | | | | | | |
| 3 | ■ | 12 | M/W | 12 | | Loose to Medium Dense, Gray Fine to Medium SAND, Trace Silt and Gravel, Scattered Shells and Wood Pieces (SP)<br>*2.5Y 6/1 Sand* | | | | | |
| 4 | ■ | 18 | W | 8 | | | | | | | |
| | | | | | 10 | End of Boring at 10 ft<br>Borehole Backfilled with Bentonite Chips;<br>Surface Patched with Asphalt Cold Patch | | | | | |
| | | | | | 15 | | | | | | |
| | | | | | 20 | | | | | | |
| | | | | | 25 | | | | | | |
| | | | | | 30 | | | | | | |
| | | | | | 35 | | | | | | |

## WATER LEVEL OBSERVATIONS

While Drilling ▽ **5.5'** Upon Completion of Drilling

| | | | | |
|---|---|---|---|---|
| Time After Drilling | | | | **20 Mins.** |
| Depth to Water | | | | **6.0'** ▼ |
| Depth to Cave in | | | | **6.0'** |

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

## GENERAL NOTES

Start **6/12/19** End **6/12/19**
Driller **BSD** Chief **MC** Rig **CME-55**
Logger **MG** Editor **TFG**
Drill Method **2.25" HSA; Autohammer**

CGC Inc.

# LOG OF TEST BORING

Project **Proposed Redevelopment**
**200 North First Street**
Location **City of Madison, Dane Co., WI**

Boring No. **13**
Surface Elevation (ft) **852.0±**
Job No. **C19051-10**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

## SAMPLE

| No. | TYPE | Rec (in.) | Moist | N | qu (qa) (tsf) | W | LL | PL | LI |
|---|---|---|---|---|---|---|---|---|---|
| 1 | ■ | 6 | M | 50/2" | | | | | |
| 2 | ■ | 4 | M | 24 | | | | | |
| 3A/3B | ■ | 16 | M | 3 | | 173.5 | | | |
| 4 | ■ | 16 | W | 6 | | | | | |
| 5 | ■ | 14 | W | 18 | | | | | |
| | | | | | | 21.5 | | | |
| 6 | ■ | 18 | W | 30 | | | | | |

## VISUAL CLASSIFICATION and Remarks

4± in. Asphalt Pavement / 8± in. Base Course

FILL: Very Dense, Dark Grayish Brown Fine to Coarse Sand, Some Silt, Little Gravel, Scattered Cobbles and Possible Cinders
*10YR 4/2 Sandy Loam (Fill)*

FILL: Medium Dense Mixture of Concrete and Asphalt Rubble
*Variable Fill*

Very Loose, Gray to Dark Gray to Black Laminated Fine SAND, SILT and Sedimentary PEAT (SP/ML/PT - Possible Fill)
*2.5Y 6/1, 4/1, 2.5/1 Stratified Fine Sand, Silt Loam and Silt Loam/Peat*

Very Loose, Black Sedimentary to Fibrous PEAT, Trace Sand (PT)
*10YR 2/1 Silt Loam/Peat*

Loose, Gray Fine SAND, Trace Silt and Gravel, Scattered Shells (SP)
*2.5Y 5/1 Fine Sand*

Medium Dense, Gray Fine SAND, Little to Some Silt (SP-SM/SM)
*10YR 5/1 Fine Sand*
P200 (Samples 5 and 6): 14.8%

End of Boring at 15 ft

Set Temporary 1-in. PVC Monitoring Well at 14 ft; see attached Monitoring Well Construction and Development Forms for Details

Depth (ft): 5, 10, 15, 20, 25, 30, 35

## WATER LEVEL OBSERVATIONS

While Drilling ∇ **8.0'** Upon Completion of Drilling ____
Time After Drilling ____ ____ ____ **7/3/19**
Depth to Water ____ ____ ____ **6.0'** ▼
Depth to Cave in ____ ____ ____ ____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

## GENERAL NOTES

Start **6/11/19** End **6/11/19**
Driller **BSD** Chief **MC** Rig **CME-55**
Logger **MG** Editor **TFG**
Drill Method **2.25" HSA; Autohammer**

CGC Inc.

# LOG OF TEST BORING

Project **Proposed Redevelopment**
**200 North First Street**
Location **City of Madison, Dane Co., WI**

Boring No. **14**
Surface Elevation (ft) **852.0±**
Job No. **C19051-10**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

| SAMPLE | | | | | | VISUAL CLASSIFICATION and Remarks | SOIL PROPERTIES | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | TYPE | Rec (in.) | Moist | N | Depth (ft) | | qu (qa) (tsf) | W | LL | PL | LI |
| | | | | | | 4.5± in. Concrete Slab / 8± in. Base Course | | | | | |
| 1 | ■ | 12 | M | 13 | | FILL: Stiff, Yellowish Brown Lean Clay, Little to Some Sand, Little Gravel, Scattered Sand Seams | (1.0-1.25) | | | | |
| 2 | ■ | 15 | M | 19 | | FILL: Medium Dense, Light Yellowish Brown Fine to Coarse Sand, Some Silt and Gravel | | | | | |
| | | | | | 5 | | | | | | |
| 3 | ■ | 18 | M/W | 7 | ▽ ▼ | Medium Stiff, Gray to Yellowish Brown Sandy Lean CLAY, Little Gravel (CL - Possible Fill) | (0.75-1.0) | | | | |
| | | | | | | Loose to Medium Dense, Gray Fine SAND, Trace Silt and Gravel, Scattered Shells and Organic Matter (SP) | | | | | |
| 4 | ■ | 18 | W | 7 | | | | | | | |
| | | | | | 10 | | | | | | |
| 5 | ■ | 18 | W | 12 | | | | | | | |
| | | | | | | Medium Dense, Gray SILT to Clayey SILT, Trace Sand (ML) | (0.5-1.5) | | | | |
| 6 | ■ | 10 | W | 24 | | Medium Dense, Gray to Yellowish Brown Laminated Sandy SILT and Fine SAND, Trace Silt (ML/SP) | | | | | |
| | | | | | 15 | | | | | | |
| | | | | | | Medium Dense, Grayish Brown Fine SAND, Little Silt, Trace Gravel (SP-SM) | | | | | |
| 7 | ■ | 18 | W | 15 | | | | | | | |
| | | | | | 20 | End of Boring at 20 ft<br>Borehole Backfilled with Bentonite Chips;<br>Surface Patched with Concrete Patch | | | | | |
| | | | | | 25 | | | | | | |
| | | | | | 30 | | | | | | |
| | | | | | 35 | | | | | | |

## WATER LEVEL OBSERVATIONS

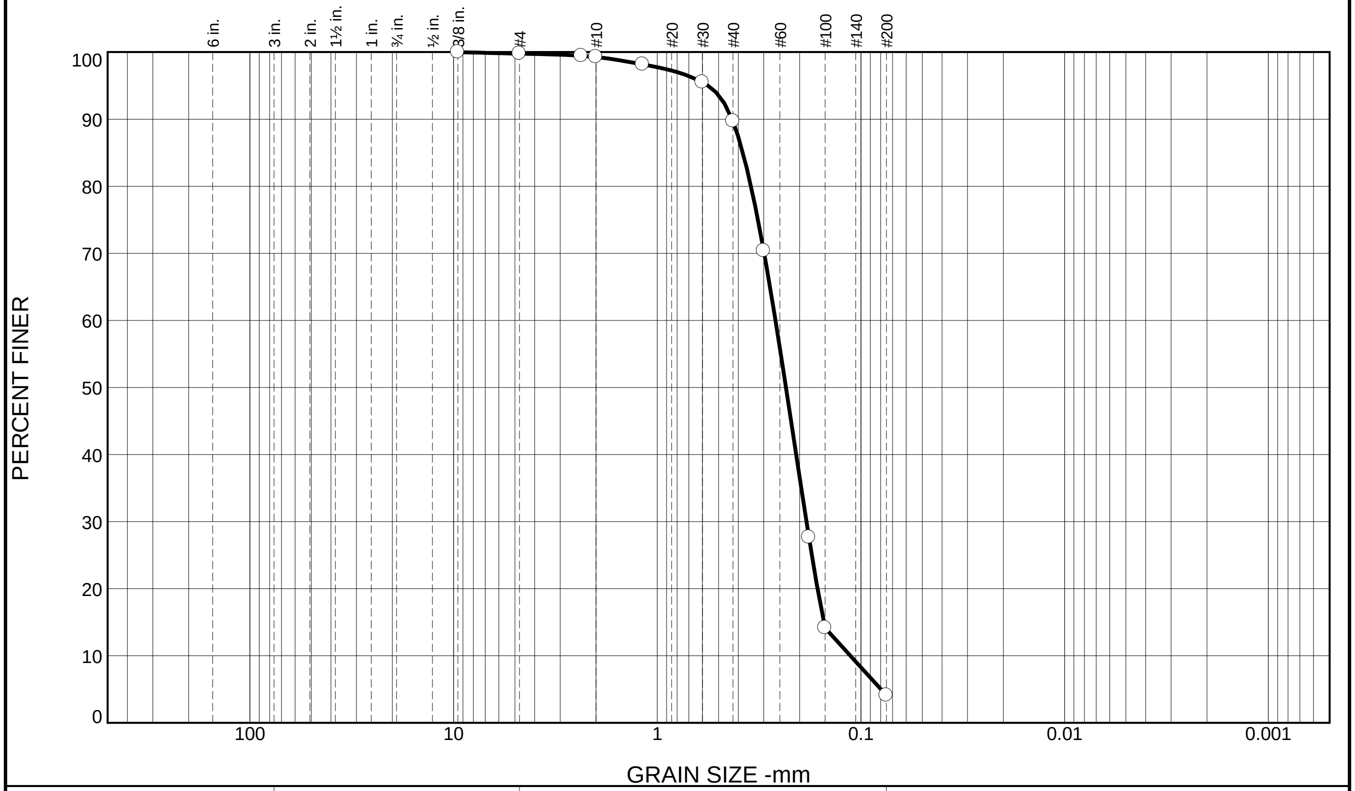
While Drilling ▽ 7.0' Upon Completion of Drilling ________
Time After Drilling 30 Mins.
Depth to Water 7.2' ▼
Depth to Cave in 7.5'

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

## GENERAL NOTES

Start **6/17/19** End **6/17/19**
Driller **BSD** Chief **JF** Rig **D-50**
Logger **MG** Editor **TFG**
Drill Method **2.25" HSA; Autohammer**

# Particle Size Distribution Report



| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.2 | 0.5 | 9.6 | 85.6 | 4.1 | |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 3/8 | 100.0 | | |
| #4 | 99.8 | | |
| #8 | 99.4 | | |
| #10 | 99.3 | | |
| #16 | 98.2 | | |
| #30 | 95.5 | | |
| #40 | 89.7 | | |
| #50 | 70.4 | | |
| #80 | 27.6 | | |
| #100 | 14.1 | | |
| #200 | 4.1 | | |

* (no specification provided)

**Material Description**

Gray Fine to Medium Sand, Trace Silt and Gravel

**Atterberg Limits**

PL= LL= PI=

**Coefficients**

$D_{90}$= 0.4291 $D_{85}$= 0.3799 $D_{60}$= 0.2627
$D_{50}$= 0.2334 $D_{30}$= 0.1851 $D_{15}$= 0.1521
$D_{10}$= 0.1127 $C_u$= 2.33 $C_c$= 1.16

**Classification**

USCS= SP AASHTO=

**Remarks**

USDA: Fine Sand

**Sample Number:** B-7: S-3

**Date:** 6/19/19

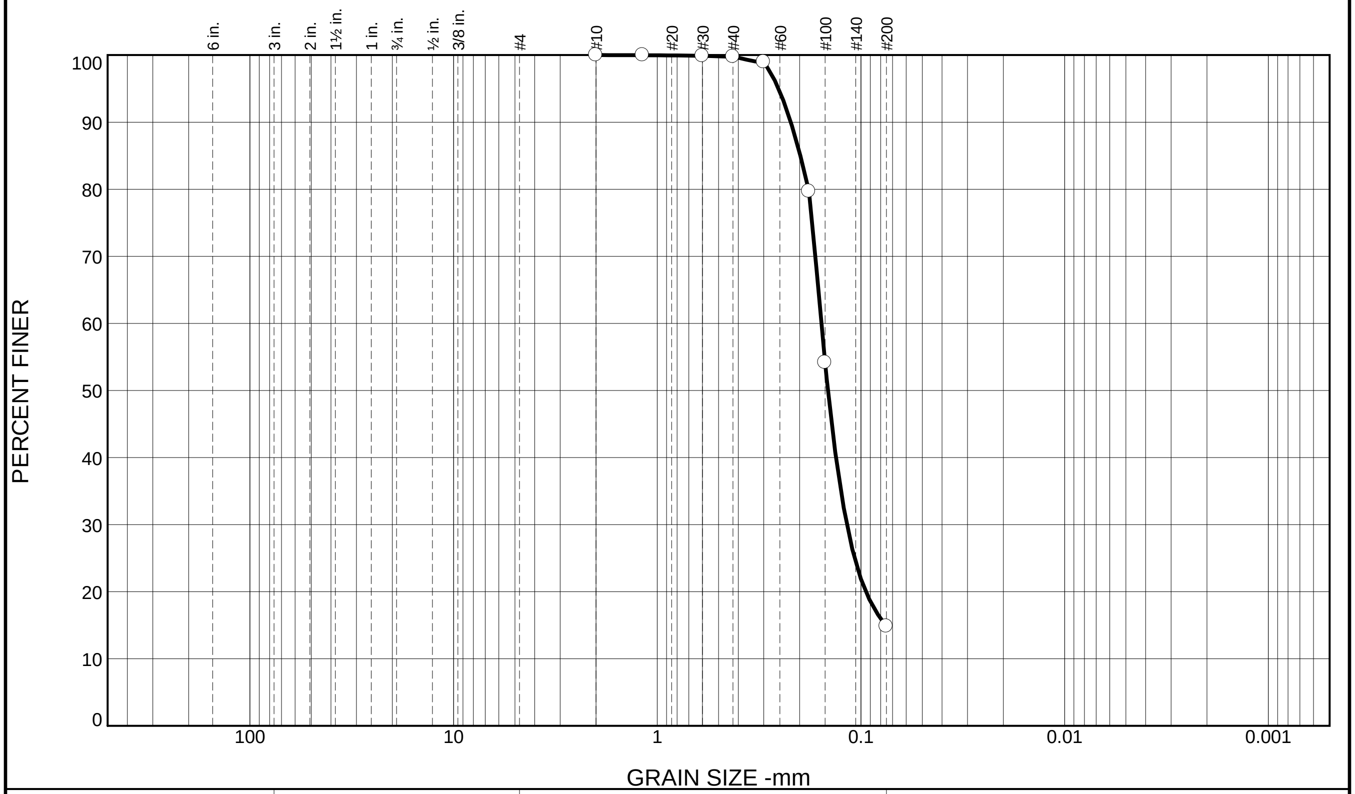
CGC,Inc.

**Client:** City of Madison - Engineering
**Project:** Redevelopment 200 N. First St., Madison

**Project No:** C19051-10 **Figure**

**Tested By:** DRW **Checked By:** TFG

# Particle Size Distribution Report



| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 85.0 | 14.8 | |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #10 | 100.0 | | |
| #16 | 100.0 | | |
| #30 | 99.9 | | |
| #40 | 99.8 | | |
| #50 | 98.9 | | |
| #80 | 79.7 | | |
| #100 | 54.2 | | |
| #200 | 14.8 | | |

* (no specification provided)

### Material Description

Brown Fine Sand, Some Silt

### Atterberg Limits

PL= LL= PI=

### Coefficients

$D_{90}$= 0.2210 $D_{85}$= 0.1984 $D_{60}$= 0.1564
$D_{50}$= 0.1452 $D_{30}$= 0.1172 $D_{15}$= 0.0758
$D_{10}$= $C_u$= $C_c$=

### Classification

USCS= SM AASHTO=

### Remarks

USDA: Fine Sand

**Sample Number:** B-13: S-5 + S-6

**Date:** 6/19/19

CGC,Inc.

**Client:** City of Madison - Engineering
**Project:** Redevelopment 200 N. First St., Madison

**Project No:** C19051-10 **Figure**

**Tested By:** DRW **Checked By:** TFG

CGC, Inc.

# *LOG OF TEST BORING*

## *General Notes*

## DESCRIPTIVE SOIL CLASSIFICATION

### Grain Size Terminology

| Soil Fraction | | Particle Size | U.S. Standard Sieve Size |
|---|---|---|---|
| Boulders | | Larger than 12” | Larger than 12” |
| Cobbles | | 3” to 12” | 3” to 12” |
| Gravel: | Coarse | ¾” to 3” | ¾” to 3” |
| | Fine | 4.76 mm to ¾” | #4 to ¾” |
| Sand: | Coarse | 2.00 mm to 4.76 mm | #10 to #4 |
| | Medium | 0.42 to mm to 2.00 mm | #40 to #10 |
| | Fine | 0.074 mm to 0.42 mm | #200 to #40 |
| Silt | | 0.005 mm to 0.074 mm | Smaller than #200 |
| Clay | | Smaller than 0.005 mm | Smaller than #200 |

Plasticity characteristics differentiate between silt and clay.

### General Terminology

Physical Characteristics
  Color, moisture, grain shape, fineness, etc.
Major Constituents
  Clay, silt, sand, gravel
Structure
  Laminated, varved, fibrous, stratified, cemented, fissured, etc.
Geologic Origin
  Glacial, alluvial, eolian, residual, etc.

### Relative Density

| Term | “N” Value |
|---|---|
| Very Loose | 0 - 4 |
| Loose | 4 - 10 |
| Medium Dense | 10 - 30 |
| Dense | 30 - 50 |
| Very Dense | Over 50 |

### Relative Proportions Of Cohesionless Soils

| Proportional Term | Defining Range by Percentage of Weight |
|---|---|
| Trace | 0% - 5% |
| Little | 5% - 12% |
| Some | 12% - 35% |
| And | 35% - 50% |

### Consistency

| Term | $q_u$-tons/sq. ft |
|---|---|
| Very Soft | 0.0 to 0.25 |
| Soft | 0.25 to 0.50 |
| Medium | 0.50 to 1.0 |
| Stiff | 1.0 to 2.0 |
| Very Stiff | 2.0 to 4.0 |
| Hard | Over 4.0 |

### Organic Content by Combustion Method

| Soil Description | Loss on Ignition |
|---|---|
| Non Organic | Less than 4% |
| Organic Silt/Clay | 4 – 12% |
| Sedimentary Peat | 12% - 50% |
| Fibrous and Woody Peat | More than 50% |

### Plasticity

| Term | Plastic Index |
|---|---|
| None to Slight | 0 - 4 |
| Slight | 5 - 7 |
| Medium | 8 - 22 |
| High to Very High | Over 22 |

The penetration resistance, N, is the summation of the number of blows required to effect two successive 6” penetrations of the 2” split-barrel sampler. The sampler is driven with a 140 lb. weight falling 30” and is seated to a depth of 6” before commencing the standard penetration test.

## SYMBOLS

### Drilling and Sampling

CS – Continuous Sampling
RC – Rock Coring: Size AW, BW, NW, 2”W
RQD – Rock Quality Designation
RB – Rock Bit/Roller Bit
FT – Fish Tail
DC – Drove Casing
C – Casing: Size 2 ½”, NW, 4”, HW
CW – Clear Water
DM – Drilling Mud
HSA – Hollow Stem Auger
FA – Flight Auger
HA – Hand Auger
COA – Clean-Out Auger
SS - 2” Dia. Split-Barrel Sample
2ST – 2” Dia. Thin-Walled Tube Sample
3ST – 3” Dia. Thin-Walled Tube Sample
PT – 3” Dia. Piston Tube Sample
AS – Auger Sample
WS – Wash Sample
PTS – Peat Sample
PS – Pitcher Sample
NR – No Recovery
S – Sounding
PMT – Borehole Pressuremeter Test
VS – Vane Shear Test
WPT – Water Pressure Test

### Laboratory Tests

$q_a$ – Penetrometer Reading, tons/sq ft
$q_a$ – Unconfined Strength, tons/sq ft
W – Moisture Content, %
LL – Liquid Limit, %
PL – Plastic Limit, %
SL – Shrinkage Limit, %
LI – Loss on Ignition
D – Dry Unit Weight, lbs/cu ft
pH – Measure of Soil Alkalinity or Acidity
FS – Free Swell, %

### Water Level Measurement

▽- Water Level at Time Shown
NW – No Water Encountered
WD – While Drilling
BCR – Before Casing Removal
ACR – After Casing Removal
CW – Cave and Wet
CM – Caved and Moist

Note: Water level measurements shown on the boring logs represent conditions at the time indicated and may not reflect static levels, especially in cohesive soils.

**CGC, Inc.**

**Madison - Milwaukee**

# Unified Soil Classification System

## UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

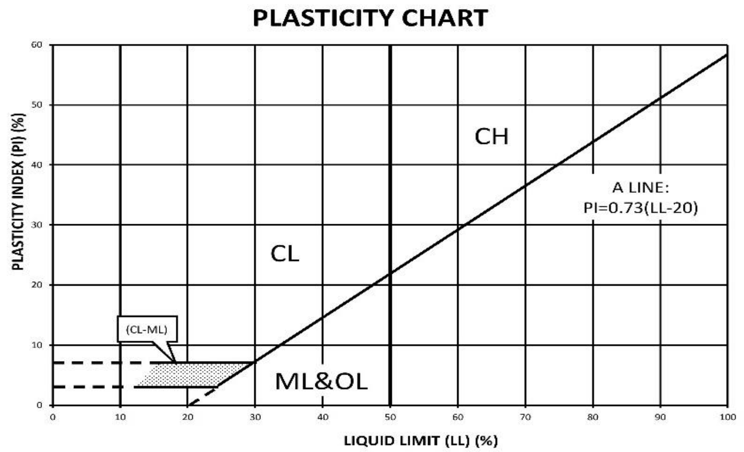
| | | | |
|---|---|---|---|
| COARSE-GRAINED SOILS<br>(more than 50% of material is larger than No. 200 sieve size) | | | |
| **GRAVELS**<br>More than 50% of coarse fraction larger than No. 4 sieve size | Clean Gravels (Less than 5% fines) | | |
| | ▨ | GW | Well-graded gravels, gravel-sand mixtures, little or no fines |
| | ▨ | GP | Poorly-graded gravels, gravel-sand mixtures, little or no fines |
| | Gravels with fines (More than 12% fines) | | |
| | ▨ | GM | Silty gravels, gravel-sand-silt mixtures |
| | ▨ | GC | Clayey gravels, gravel-sand-clay mixtures |
| **SANDS**<br>50% or more of coarse fraction smaller than No. 4 sieve size | Clean Sands (Less than 5% fines) | | |
| | ▨ | SW | Well-graded sands, gravelly sands, little or no fines |
| | ▨ | SP | Poorly graded sands, gravelly sands, little or no fines |
| | Sands with fines (More than 12% fines) | | |
| | ▨ | SM | Silty sands, sand-silt mixtures |
| | ▨ | SC | Clayey sands, sand-clay mixtures |
| FINE-GRAINED SOILS<br>(50% or more of material is smaller than No. 200 sieve size.) | | | |
| **SILTS AND CLAYS**<br>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, silty clays, lean clays |
| | ▨ | OL | Organic silts and organic silty clays of low plasticity |
| **SILTS AND CLAYS**<br>Liquid limit 50% or greater | ▨ | MH | Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, 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 |

## LABORATORY CLASSIFICATION CRITERIA

| | | |
|---|---|---|
| GW | $C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_C = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3 | |
| GP | Not meeting all gradation requirements for GW | |
| GM | Atterberg limts below "A" line or P.I. less than 4 | Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols |
| GC | Atterberg limts above "A" line or P.I. greater than 7 | |
| SW | $C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_C = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3 | |
| SP | Not meeting all gradation requirements for GW | |
| SM | Atterberg limits below "A" line or P.I. less than 4 | Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols |
| SC | Atterberg limits above "A" line with P.I. greater than 7 | |

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



# APPENDIX C

# DOCUMENT QUALIFICATIONS

# APPENDIX C
# DOCUMENT QUALIFICATIONS

## I. GENERAL RECOMMENDATIONS/LIMITATIONS

CGC, Inc. should be provided the opportunity for a general review of the final design and specifications to confirm that earthwork and foundation requirements have been properly interpreted in the design and specifications. CGC should be retained to provide soil engineering services during excavation and subgrade preparation. This will allow us to observe that construction proceeds in compliance with the design concepts, specifications and recommendations, and also will allow design changes to be made in the event that subsurface conditions differ from those anticipated prior to the start of construction. CGC does not assume responsibility for compliance with the recommendations in this report unless we are retained to provide construction testing and observation services.

This report has been prepared in accordance with generally accepted soil and foundation engineering practices and no other warranties are expressed or implied. The opinions and recommendations submitted in this report are based on interpretation of the subsurface information revealed by the test borings indicated on the location plan. The report does not reflect potential variations in subsurface conditions between or beyond these borings. Therefore, variations in soil conditions can be expected between the boring locations and fluctuations of groundwater levels may occur with time. The nature and extent of the variations may not become evident until construction.

## II. IMPORTANT INFORMATION
## ABOUT YOUR
## GEOTECHNICAL ENGINEERING REPORT

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes. While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. *No one except you* should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one - not even you* - should apply the report for any purpose or project except the one originally contemplated.

### READ THE FULL REPORT

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

### A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, *do not rely on a geotechnical engineering report* that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes - even minor ones - and request an assessment of their impact. *CGC cannot accept responsibility or liability for problems that occur because our reports do not consider developments of which we were not informed.*

### SUBSURFACE CONDITIONS CAN CHANGE

A geotechnical engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

### MOST GEOTECHNICAL FINDINGS ARE PROFESSIONAL OPINION

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgement to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ - sometimes significantly - from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

## A REPORT'S RECOMMENDATIONS ARE NOT FINAL

Do not over-rely on the confirmation-dependent recommendations included in your report. *Those confirmation-dependent recommendations are not final*, because geotechnical engineers develop them principally from judgement and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *CGC cannot assume responsibility or liability for the report's confirmation-dependent recommendations if we do not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

## A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical engineering report. Confront that risk by having CGC participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

## DO NOT REDRAW THE ENGINEER'S LOGS

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

## GIVE CONSTRUCTORS A COMPLETE REPORT AND GUIDANCE

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

## READ RESPONSIBILITY PROVISIONS CLOSELY

Some clients, design professionals, and constructors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineer's responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

## ENVIRONMENTAL CONCERNS ARE NOT COVERED

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

## OBTAIN PROFESSIONAL ASSISTANCE TO DEAL WITH MOLD

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

## RELY ON YOUR GEOTECHNICAL ENGINEER FOR ADDITIONAL ASSISTANCE

Membership in the Geotechnical Business Council (GBC) of Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with CGC, a member of GBC, for more information.

Modified and reprinted with permission from:

Geotechnical Business Council
of the Geoprofessional Business Association
8811 Colesville Road, Suite G 106
Silver Spring, MD 20910

# APPENDIX D

# RECOMMENDED COMPACTED FILL SPECIFICATIONS

# APPENDIX D

# CGC, INC.

# RECOMMENDED COMPACTED FILL SPECIFICATIONS

## General Fill Materials

Proposed fill shall contain no vegetation, roots, topsoil, peat, ash, wood or any other non-soil material which by decomposition might cause settlement. Also, fill shall never be placed while frozen or on frozen surfaces. Rock, stone or broken concrete greater than 6 in. in the largest dimension shall not be placed within 10 ft of the building area. Fill used greater than 10 ft beyond the building limits shall not contain rock, boulders or concrete pieces greater than a 2 sq ft area and shall not be placed within the final 2 ft of finish subgrade or in designated utility construction areas. Fill containing rock, boulders or concrete pieces should include sufficient finer material to fill voids among the larger fragments.

## Special Fill Materials

In certain cases, special fill materials may be required for specific purposes, such as stabilizing subgrades, backfilling undercut excavations or filling behind retaining walls. For reference, WisDOT gradation specifications for various types of granular fill are attached in Table 1.

## Placement Method

The approved fill shall be placed, spread and leveled in layers generally not exceeding 10 in. in thickness before compaction. The fill shall be placed at moisture content capable of achieving the desired compaction level. For clay soils or granular soils containing an appreciable amount of cohesive fines, moisture conditioning will likely be required.

It is the Contractor's responsibility to provide all necessary compaction equipment and other grading equipment that may be required to attain the specified compaction. Hand-guided vibratory or tamping compactors will be required whenever fill is placed adjacent to walls, footings, columns or in confined areas.

## Compaction Specifications

Maximum dry density and optimum moisture content of the fill soil shall be determined in accordance with modified Proctor methods (ASTM D1557). The recommended field compaction as a percentage of the maximum dry density is shown in Table 2. Note that these compaction guidelines would generally not apply to coarse gravel/stone fill. Instead, a method specification would apply (e.g., compact in thin lifts with a vibratory compactor until no further consolidation is evident).

## Testing Procedures

Representative samples of proposed fill shall be submitted to CGC, Inc. for optimum moisture-maximum density determination (ASTM D1557) prior to the start of fill placement. The sample size should be approximately 50 lb.

CGC, Inc. shall be retained to perform field density tests to determine the level of compaction being achieved in the fill. The tests shall generally be conducted on each lift at the beginning of fill placement and at a frequency mutually agreed upon by the project team for the remainder of the project.

## Table 1
## Gradation of Special Fill Materials

| Material | WisDOT Section 311 | WisDOT Section 312 | WisDOT Section 305 | | | WisDOT Section 209 | | WisDOT Section 210 |
|---|---|---|---|---|---|---|---|---|
| | Breaker Run | Select Crushed Material | 3-in. Dense Graded Base | 1 1/4-in. Dense Graded Base | 3/4-in. Dense Graded Base | Grade 1 Granular Backfill | Grade 2 Granular Backfill | Structure Backfill |
| Sieve Size | Percent Passing by Weight | | | | | | | |
| 6 in. | 100 | | | | | | | |
| 5 in. | | 90-100 | | | | | | |
| 3 in. | | | 90-100 | | | | | 100 |
| 1 1/2 in. | | 20-50 | 60-85 | | | | | |
| 1 1/4 in. | | | | 95-100 | | | | |
| 1 in. | | | | | 100 | | | |
| 3/4 in. | | | 40-65 | 70-93 | 95-100 | | | |
| 3/8 in. | | | | 42-80 | 50-90 | | | |
| No. 4 | | | 15-40 | 25-63 | 35-70 | 100 (2) | 100 (2) | 25-100 |
| No. 10 | | 0-10 | 10-30 | 16-48 | 15-55 | | | |
| No. 40 | | | 5-20 | 8-28 | 10-35 | 75 (2) | | |
| No. 100 | | | | | | 15 (2) | 30 (2) | |
| No. 200 | | | 2-12 | 2-12 | 5-15 | 8 (2) | 15 (2) | 15 (2) |

***Notes:***

1. Reference: Wisconsin Department of Transportation *Standard Specifications for Highway and Structure Construction.*
2. Percentage applies to the material passing the No. 4 sieve, not the entire sample.
3. Per WisDOT specifications, both breaker run and select crushed material can include concrete that is 'substantially free of steel, building materials and other deleterious material'.

## Table 2
## Compaction Guidelines

| | Percent Compaction (1) | |
|---|---|---|
| Area | Clay/Silt | Sand/Gravel |
| **Within 10 ft of building lines** | | |
| Footing bearing soils | 93 - 95 | 95 |
| Under floors, steps and walks | | |
| - Lightly loaded floor slab | 90 | 90 |
| - Heavily loaded floor slab and thicker fill zones | 92 | 95 |
| **Beyond 10 ft of building lines** | | |
| Under walks and pavements | | |
| - Less than 2 ft below subgrade | 92 | 95 |
| - Greater than 2 ft below subgrade | 90 | 90 |
| Landscaping | 85 | 90 |

***Notes:***

1. Based on Modified Proctor Dry Density (ASTM D 1557)

# APPENDIX E

# WISCONSIN DEPARTMENT OF SAFETY & PROFESSIONAL SERVICES SOIL AND SITE EVALUATION – STORM FORMS (13 BORINGS)

1002-CPS-23

**Division of Industry Services**
**P.O. Box 2658**
**Madison, Wisconsin 53701**
Scott Walker, Governor
Laura Gutierrez, Secretary

# Attachment 2:

## SOIL AND SITE EVALUATION - STORM

In accordance with SPS 382.365, 385, Wis. Adm. Code, and WDNR Standard 1002

Page 1 of 5

Attach a complete site plan on paper not less than 8 ½ x 11 inches in size. Plan must include, but not limited to: vertical and horizontal reference point (BM), direction and percent of slope, scale or dimensions, north arrow, and BM referenced to nearest road

***Please print all information***

Personal information you provide may be used for secondary purposes [Privacy Law, s. 15.04(1)(m)]

County Dane
Parcel I.D. 251/0710-063-1507-4
Reviewed by:
Date:

Property Owner City of Madison Motor Equipment
Property Location
Govt. Lot ¼ ¼ S T N R E (or) W
Property Owner's Mail Address 200 North First Street
Lot # Block# Subd. Name or CSM #
City Madison State WI Zip Code 53704 Phone Number
☒ City ☐ Village ☐ Town Madison
Nearest Road 120 North First Street

Drainage area ________ ☐ sq ft ☐ acres
Test site suitable for (check all that apply): ☐ Site not suitable;
☐ Bioretention; ☐ Subsurface Disperal System;
☐ Reuse; ☐ Irrigation; ☐ Other ________

Hydraulic Application Test Method
☒ Morphological Evaluation
☐ Double Ring Infiltrometer
☐ Other: (specify) ________

Soil Moisture
Date of soil borings: ________
USDA-NRCS WETS Value:
☐ Dry = 1;
☐ Normal = 2;
☐ Wet = 3.

B-1 #OBS. ☐ Pit ☒ Boring Ground surface elevation 852.0 ft. Elevation of limiting factor 846.6 ft. (Poss. GW)

| Horizon | Depth in. | Dominant Color Munsell | Redox Description Qu. Sz. Cont. Color | Texture | Structure Gr. Sz. Sh. | Consistence | Boundary | % Rock Frags. | % Fines | Hydraulic App Rate Inches/Hr |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0-4 | Topsoil Fill (not sampled) | | | | | | | | |
| 2 | 4-60 | 10YR 2/2 | none | SL (Fill) | 1fsbk | mvfr | | 5-15 | | 0.50 (1) |
| 3 | 60-84 | 10YR 2/1 | none | SiL/Peat | 1fgr | mfi | | <5 | | 0.13 (2) |
| 4 | 84-120 | 10YR 6/1, 6/2 | none | FS | 0sg | ml | | <5 | | 0.50 |

Comments: Groundwater was encountered at about 7 ft during drilling; cave-in at about 5.4 ft after the completion of drilling may indicate groundwater near that depth. (1) Infiltration rate of Horizon 2 (granular fill) should be considered very approximate. (2) Infiltration rate of Horizon 3 (peat) should be considered very approximate.

B-2 #OBS. ☐ Pit ☒ Boring Ground surface elevation 851.0 ft. Elevation of limiting factor 847.0 ft. (Poss. GW)
845.5 ft. (Redox)

| Horizon | Depth in. | Dominant Color Munsell | Redox Description Qu. Sz. Cont. Color | Texture | Structure Gr. Sz. Sh. | Consistence | Boundary | % Rock Frags. | % Fines | Hydraulic App Rate Inches/Hr |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0-18 | Asphalt Pavement and Aggregate Base Course (not sampled) | | | | | | | | |
| 2 | 18-66 | 10YR 6/4 | none | GRSL (Fill) | 1msbk | mfr | | 15-25 | | 0.50 (1) |
| 3 | 66-96 | 2.5Y 3/1, 2.5/1 | c2d 7.5YR 4/6 | SiL/Peat | 1fabk | mfi | | <5 | | 0.13 (2) |
| 4 | 96-120 | 2.5Y 5/1 | none | S | 0sg | ml | | <5 | | 3.60 |

Comments: Groundwater level was obscured by presence of probable perched water at about 3 ft; cave-in at about 4.0 ft after the completion of drilling may indicate groundwater near that depth. Redox in Horizon 3 indicates the level of past saturation from perched water, periodically infiltrating surface water or seasonally elevated groundwater. (1) Infiltration rate of Horizon 2 (granular fill) should be considered very approximate. (2) Infiltration rate of Horizon 3 (peat) should be considered very approximate.

Name (Please Print) Tim F. Gassenheimer
Signature
Credential Number SP-011900004
Address 129 Milky Way, Madison, WI 53718
Date Evaluation Conducted June 12, 2019
Telephone Number (608) 288-4100

B-3 #OBS. ☐ Pit ☒ Boring Ground surface elevation 851.5 ft. Elevation of limiting factor 846.5 ft. (Groundwater)

| Horizon | Depth in. | Dominant Color Munsell | Redox Description Qu. Sz. Cont. Color | Texture | Structure Gr. Sz. Sh. | Consistence | Boundary | % Rock Frags. | % Fines | Hydraulic App Rate Inches/Hr |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0-11 | Asphalt Pavement and Aggregate Base Course (not sampled) | | | | | | | | |
| 2 | 11-60 | Variable Fill (1) | | | | | | | | |
| 3 | 60-78 | 10YR 2/1 | none | SiL/Peat | 1fgr | mfi | | <5 | | 0.13 (2) |
| 4 | 78-96 | 2.5Y 5/1 | none | FS, SiL/ Peat Sms | 0sg | ml | | <5 | | 0.13-0.50 (3) |
| 5 | 96-126 | 2.5Y 5/1 | none | FS | 0sg | ml | | <5 | | 0.50 |
| 6 | 126-156 | 10YR 5/1 | none | S | 0sg | ml | | <5 | | 3.60 |
| 7 | 156-180 | 10YR 5/2 | none | FS | 0sg | ml | | <5 | | 0.50 |

Comments: Groundwater was encountered at about 8 ft during drilling and at about 5.0 ft after the completion of drilling. (1) Infiltration rate of Horizon 2 (mixed fill) should be expected to vary considerably. (2) Infiltration rate of Horizon 3 (peat) should be considered very approximate. (3) Infiltration potential of Horizon 4 may be limited by silt loam/peat seams. Infiltration rate can potentially be improved by deep-tilling or excavating/turning-over fine sand layer to disrupt silt loam/peat seams. Gradations should be collected during construction to check that the blended soil is consistent with the design infiltration rate.

B-5 #OBS. ☐ Pit ☒ Boring Ground surface elevation 851.5 ft. Elevation of limiting factor 850.0 ft. (Low-chr./high-val.
844.7 ft. (Groundwater)

| Horizon | Depth in. | Dominant Color Munsell | Redox Description Qu. Sz. Cont. Color | Texture | Structure Gr. Sz. Sh. | Consistence | Boundary | % Rock Frags. | % Fines | Hydraulic App Rate Inches/Hr |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0-9 | Asphalt Pavement and Aggregate Base Course (not sampled) | | | | | | | | |
| 2 | 9-18 | 10YR 6/4 | none | GRSL (Fill) | 1msbk | mfr | | 20-30 | | 0.50 (1) |
| 3 | 18-42 | 2.5Y 6/1 | none | SiCL | 0m | mfi | | <5 | | 0.04 |
| 4 | 42-72 | 10YR 2/1 | none | SiL | 1mabk | mfi | | <5 | | 0.13 |
| 5 | 72-96 | 2.5Y 5/1 | none | FS | 0sg | ml | | <5 | | 0.50 |
| 6 | 96-120 | 2.5Y 4/1, GLEY1 3/N | none | Stratified S and SiL | variable | | | <5 | | 0.13 (2) |

Comments: Groundwater was encountered at about 8 ft during drilling and at about 6.8 ft after the completion of drilling. Low-chroma/high-value dominant color in Horizon 3 indicates the level of past saturation from perched water, periodically infiltrating surface water or seasonally elevated groundwater. (1) Infiltration rate of Horizon 2 (granular fill) should be considered very approximate. (2) Infiltration rate of Horizon 6 will be controlled by silt loam.

B-6 #OBS. ☐ Pit ☒ Boring Ground surface elevation 851.0 ft. Elevation of limiting factor 845.0 ft. (Groundwater)

| Horizon | Depth in. | Dominant Color Munsell | Redox Description Qu. Sz. Cont. Color | Texture | Structure Gr. Sz. Sh. | Consistence | Boundary | % Rock Frags. | % Fines | Hydraulic App Rate Inches/Hr |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0-15 | Asphalt Pavement and Aggregate Base Course (not sampled) | | | | | | | | |
| 2 | 15-60 | Variable Fill (1) | | | | | | | | |
| 3 | 60-78 | 10YR 2/1 | none | SiL/Peat | 2mgr | mfi | | <5 | | 0.13 (2) |
| 4 | 78-96 | 10YR 6/1 | none | S | 0sg | ml | | <5 | | 3.60 |
| 5 | 96-120 | 2.5Y 5/1 | none | FS | 0sg | ml | | <5 | | 0.50 |

Comments: Groundwater was encountered at about 8 ft during drilling and at about 6.0 ft after the completion of drilling. (1) Infiltration rate of Horizon 2 (mixed fill) should be expected to vary considerably. (2) Infiltration rate of Horizon 3 (peat) should be considered very approximate.

B-7 #OBS. ☐ Pit ☒ Boring Ground surface elevation 851.5 ft. Elevation of limiting factor 843.7 ft. (Groundwater)

| Horizon | Depth in. | Dominant Color Munsell | Redox Description Qu. Sz. Cont. Color | Texture | Structure Gr. Sz. Sh. | Consistence | Boundary | % Rock Frags. | % Fines | Hydraulic App Rate Inches/Hr |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0-11 | Asphalt Pavement and Aggregate Base Course (not sampled) | | | | | | | | |
| 2 | 11-36 | 10YR 5/6 | none | SCL (Fill) | 0m | mfi | | 5-15 | | 0.11 (1) |
| 3 | 36-66 | 10YR 2/2 | none | SiL/Peat (Fill) | 2mabk | mfi | | <10 | | 0.13 (2) |
| 4 | 66-120 | 2.5Y 6/1 | none | FS, SiL/ Peat Sms | 0m | mfi | | <1 | 4 | 0.13-0.50 (3) |

Comments: Groundwater was encountered at about 8 ft during drilling and at about 7.8 ft after the completion of drilling. (1) Infiltration rate of Horizon 2 (cohesive fill) should be considered very approximate. (2) Infiltration rate of Horizon 3 (organic fill) should be considered very approximate. (3) Infiltration potential of Horizon 4 may be limited by silt loam/peat seams. Infiltration rate can potentially be improved by deep-tilling or excavating/turning-over fine sand layer to disrupt silt loam/peat seams. Gradations should be collected during construction to check that the blended soil is consistent with the design infiltration rate.

B-8 #OBS. ☐ Pit ☒ Boring Ground surface elevation 852.0 ft. Elevation of limiting factor 844.0 ft. (Groundwater)

| Horizon | Depth in. | Dominant Color Munsell | Redox Description Qu. Sz. Cont. Color | Texture | Structure Gr. Sz. Sh. | Consistence | Boundary | % Rock Frags. | % Fines | Hydraulic App Rate Inches/Hr |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0-12 | Asphalt Pavement and Aggregate Base Course (not sampled) | | | | | | | | |
| 2 | 12-48 | Variable Fill (1) | | | | | | | | |
| 3 | 48-66 | 2.5Y 2.5/1 | none | S (Fill) | 0sg | ml | | <5 | | 3.60 (2) |
| 4 | 66-84 | 10YR 2/1 | none | SiL/Peat | 2mgr | mfi | | <5 | | 0.13 (3) |
| 5 | 84-102 | 2.5Y 6/1 | none | FS | 0sg | ml | | <5 | | 0.50 |
| 6 | 102-138 | 2.5Y 5/1, 5Y 4/1 | none | S | 0sg | ml | | <5 | | 3.60 |
| 7 | 138-162 | 10YR 5/1 | none | SiL | 1mabk | mfi | | <5 | | 0.13 |
| 8 | 162-180 | 10YR 5/1 | none | SiCL | 0m | mfi | | <5 | | 0.04 |

Comments: Groundwater was encountered at about 8.5 ft during drilling and at about 8.0 ft after the completion of drilling. (1) Infiltration rate of Horizon 2 (mixed fill) should be expected to vary considerably. (2) Infiltration rate of Horizon 3 (granular fill) should be considered very approximate. (3) Infiltration rate of Horizon 4 (peat) should be considered very approximate.

B-9 #OBS. ☐ Pit ☒ Boring Ground surface elevation 851.5 ft. Elevation of limiting factor 844.5 ft. (Groundwater)

| Horizon | Depth in. | Dominant Color Munsell | Redox Description Qu. Sz. Cont. Color | Texture | Structure Gr. Sz. Sh. | Consistence | Boundary | % Rock Frags. | % Fines | Hydraulic App Rate Inches/Hr |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0-8 | Topsoil Fill (not sampled) | | | | | | | | |
| 2 | 8-66 | Variable Fill (1) | | | | | | | | |
| 3 | 66-96 | 10YR 2/1 | none | SiL/Peat | 2mgr | mfi | | <5 | | 0.13 (2) |
| 4 | 96-144 | 2.5Y 5/1, 5Y 4/1 | none | S | 0sg | ml | | <5 | | 3.60 |
| 5 | 144-180 | 2.5Y 5/1 | none | Stratified FS + LFS | variable | | | <5 | | 0.50 |

Comments: Groundwater was encountered at about 7 ft during drilling. (1) Infiltration rate of Horizon 2 (mixed fill) should be expected to vary considerably. (2) Infiltration rate of Horizon 3 (peat) should be considered very approximate.

B-10 #OBS. ☐ Pit ☒ Boring Ground surface elevation 851.0 ft. Elevation of limiting factor 845.7 ft. (Groundwater)

| Horizon | Depth in. | Dominant Color Munsell | Redox Description Qu. Sz. Cont. Color | Texture | Structure Gr. Sz. Sh. | Consistence | Boundary | % Rock Frags. | % Fines | Hydraulic App Rate Inches/Hr |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0-13 | Asphalt Pavement and Aggregate Base Course (not sampled) | | | | | | | | |
| 2 | 13-36 | 10YR 6/3 | none | FS (Fill) | 0sg | ml | | <5 | | 0.50 (1) |
| 3 | 36-66 | Variable Fill (2) | | | | | | | | |
| 4 | 66-84 | 2.5Y 2.5/1 | none | L-FSL/ Peat | 1fgr | mfi | | <5 | | 0.24-0.50 (3) |
| 5 | 84-102 | 2.5Y 5/1 | none | LFS, SiL/ Peat Sms | 1fsbk | mfr | | <5 | | 0.13-0.50 (4) |
| 6 | 102-120 | 2.5Y 5/1 | none | FS | 0sg | ml | | <5 | | 0.50 |

Comments: Groundwater was encountered at about 8.5 ft during drilling and at about 5.3 ft after the completion of drilling. (1) Infiltration rate of Horizon 2 (granular fill) should be considered very approximate. (2) Infiltration rate of Horizon 3 (mixed fill) should be expected to vary considerably. (3) Infiltration rate of Horizon 4 (peat) should be considered very approximate. (4) Infiltration potential of Horizon 5 may be limited by silt loam/peat seams. Infiltration rate can potentially be improved by deep-tilling or excavating/turning-over loamy fine sand layer to disrupt silt loam/peat seams. Gradations should be collected during construction to check that the blended soil is consistent with the design infiltration rate.

B-11 #OBS. ☐ Pit ☒ Boring Ground surface elevation 852.0 ft. Elevation of limiting factor 846.0 ft. (Poss. GW)

| Horizon | Depth in. | Dominant Color Munsell | Redox Description Qu. Sz. Cont. Color | Texture | Structure Gr. Sz. Sh. | Consistence | Boundary | % Rock Frags. | % Fines | Hydraulic App Rate Inches/Hr |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0-15 | Asphalt Pavement and Aggregate Base Course (not sampled) | | | | | | | | |
| 2 | 15-36 | Variable Fill (1) | | | | | | | | |
| 3 | 36-72 | 10YR 5/4 | none | SL (Fill) | 1fsbk | mfr | | <10 | | 0.50 (2) |
| 4 | 72-90 | Variable Fill (1) | | | | | | | | |
| 5 | 90-114 | 10YR 2/1 | none | SiL/Peat | 2mgr | mfi | | <5 | | 0.13 (3) |
| 6 | 114-132 | 2.5Y 6/1 | none | FS | 0sg | ml | | <5 | | 0.50 |
| 7 | 132-156 | 2.5Y 6/1 | none | S | 0sg | ml | | <5 | | 3.60 |
| 8 | 156-180 | 2.5Y 6/1 | none | SiL-L | 2mabk | mfi | | <5 | | 0.13-0.24 |

Comments: Groundwater or possible perched water was encountered at about 6 ft during drilling. (1) Infiltration rate of Horizons 2 and 4 (mixed fill) should be expected to vary considerably. (2) Infiltration rate of Horizon 3 (granular fill) should be considered very approximate. (3) Infiltration rate of Horizon 5 (peat) should be considered very approximate.

B-12 #OBS. ☐ Pit ☒ Boring Ground surface elevation 852.0 ft. Elevation of limiting factor 846.5 ft. (Groundwater)

| Horizon | Depth in. | Dominant Color Munsell | Redox Description Qu. Sz. Cont. Color | Texture | Structure Gr. Sz. Sh. | Consistence | Boundary | % Rock Frags. | % Fines | Hydraulic App Rate Inches/Hr |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0-11 | Asphalt Pavement and Aggregate Base Course (not sampled) | | | | | | | | |
| 2 | 11-66 | Variable Fill (1) | | | | | | | | |
| 3 | 66-120 | 2.5Y 6/1 | none | S | 0sg | ml | | <5 | | 3.60 |

Comments: Groundwater was encountered at about 5.5 ft during drilling and at about 6.0 ft after the completion of drilling. (1) Infiltration rate of Horizon 2 (mixed fill) should be expected to vary considerably.

B-13 #OBS. ☐ Pit ☒ Boring Ground surface elevation 852.0 ft. Elevation of limiting factor 846.0 ft. (Groundwater)

| Horizon | Depth in. | Dominant Color Munsell | Redox Description Qu. Sz. Cont. Color | Texture | Structure Gr. Sz. Sh. | Consistence | Boundary | % Rock Frags. | % Fines | Hydraulic App Rate Inches/Hr |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0-12 | Asphalt Pavement and Aggregate Base Course (not sampled) | | | | | | | | |
| 2 | 12-36 | 10YR 4/2 | none | SL (Fill) | 1fsbk | mvfr | | 5-15 | | 0.50 (1) |
| 3 | 36-60 | Variable Fill (2) | | | | | | | | |
| 4 | 60-78 | 2.5Y 6/1, 4/1, 2.5/1 | none | Strat. FS,<br>SiL+SiL/Peat | variable | | | <5 | | 0.13 (3) |
| 5 | 78-96 | 10YR 2/1 | none | SiL/Peat | 1fgr | mfi | | <5 | | 0.13 (4) |
| 6 | 96-126 | 2.5Y 5/1 | none | FS | 0sg | ml | | <5 | | 0.50 |
| 7 | 126-180 | 10YR 5/1 | none | FS | 0sg | ml | | <1 | 15 | 0.50 |

Comments: Groundwater was encountered at about 8 ft during drilling; groundwater level in monitoring well was observed at about 6.0 ft on July 3, 2019. (1) Infiltration rate of Horizon 2 (granular fill) should be considered very approximate. (2) Infiltration rate of Horizon 3 (mixed fill) should be expected to vary considerably. (3) Infiltration rate of Horizon 4 will be controlled by peat and should be considered very approximate. (4) Infiltration rate of Horizon 5 (peat) should be considered very approximate.

Overall Site Comments: See Comments above and Preliminary Stormwater Infiltration Potential section in Geotechnical Exploration Report.

1002-CPS-23

**Division of Industry Services**
**P.O. Box 2658**
**Madison, Wisconsin 53701**
Scott Walker, Governor
Laura Gutierrez, Secretary

# Attachment 2:

## SOIL AND SITE EVALUATION - STORM

In accordance with SPS 382.365, 385, Wis. Adm. Code, and WDNR Standard 1002

Page 1 of 1

Attach a complete site plan on paper not less than 8 ½ x 11 inches in size. Plan must include, but not limited to: vertical and horizontal reference point (BM), direction and percent of slope, scale or dimensions, north arrow, and BM referenced to nearest road

***Please print all information***

Personal information you provide may be used for secondary purposes [Privacy Law, s. 15.04(1)(m)]

County Dane

Parcel I.D. 251/0710-063-1509-0

Reviewed by:

Date:

Property Owner City of Madison Motor Equipment

Property Location
Govt. Lot ¼ ¼ S T N R E (or) W

Property Owner's Mail Address 200 North First Street

Lot #

Block#

Subd. Name or CSM #

City Madison

State WI

Zip Code 53704

Phone Number

☒ City ☐ Village ☐ Town
Madison

Nearest Road 212 North First Street

Drainage area ________ ☐ sq ft ☐ acres

Test site suitable for (check all that apply): ☐ Site not suitable;
☐ Bioretention; ☐ Subsurface Disperal System;
☐ Reuse; ☐ Irrigation; ☐ Other ________

Hydraulic Application Test Method
☒ Morphological Evaluation
☐ Double Ring Infiltrometer
☐ Other: (specify) ________

Soil Moisture
Date of soil borings: ________
USDA-NRCS WETS Value:
☐ Dry = 1;
☐ Normal = 2;
☐ Wet = 3.

B-4 #OBS. ☐ Pit ☒ Boring Ground surface elevation 852.0 ft. Elevation of limiting factor 844.4 ft. (Groundwater)

| Horizon | Depth in. | Dominant Color Munsell | Redox Description Qu. Sz. Cont. Color | Texture | Structure Gr. Sz. Sh. | Consistence | Boundary | % Rock Frags. | % Fines | Hydraulic App Rate Inches/Hr |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0-4 | Topsoil Fill (not sampled) | | | | | | | | |
| 2 | 4-36 | Variable Fill (1) | | | | | | | | |
| 3 | 36-66 | 10YR 5/4 | none | FS-LFS (Fill) | 0sg | ml | | <5 | | 0.50 (2) |
| 4 | 66-96 | 10YR 2/1 | none | SiL/Peat | 1fgr | mfi | | <5 | | 0.13 (3) |
| 5 | 96-126 | 2.5Y 7/1, 10YR 6/1 | none | S | 0sg | ml | | <5 | | 3.60 |
| 6 | 126-156 | 2.5Y 5/1, 10YR 5/3 | none | S | 0sg | ml | | <5 | | 3.60 |
| 7 | 156-180 | 2.5Y 5/1, 10YR 6/1 | none | FS | 0sg | ml | | <5 | | 0.50 |

Comments: Groundwater was encountered at about 8 ft during drilling and at about 7.6 ft after the completion of drilling. (1) Infiltration rate of Horizon 2 (mixed fill) should be expected to vary considerably. (2) Infiltration rate of Horizon 3 (granular fill) should be considered very approximate. (3) Infiltration rate of Horizon 3 (peat) should be considered very approximate.

Overall Site Comments: See Comments above and Preliminary Stormwater Infiltration Potential section in Geotechnical Exploration Report.

Name (Please Print) Tim F. Gassenheimer

Signature

Credential Number SP-011900004

Address 129 Milky Way, Madison, WI 53718

Date Evaluation Conducted June 12, 2019

Telephone Number (608) 288-4100