COMMONWEALTH OF KENTUCKY
DEPARTMENT FOR FACILITIES AND SUPPORT SERVICES
DIVISION OF ENGINEERING AND CONTRACT ADMINISTRATION

INVITATION TO BID NO: RFB-242-23 **DATE:** April 25, 2023
FOR: Non-Heated Storage Building
Springfield Readiness Center
Department of Military Affairs
Springfield, Kentucky RFB-785-2300000701

ADDENDUM NO. One (1)

BIDDER SHALL CONFORM TO THE FOLLOWING CHANGES AS SAME SHALL BECOME BINDING UPON THE CONTRACT TO BE ISSUED IN RESPONSE TO THIS INVITATION TO BID.

Item 1: Refer to addendum to be distributed by Lynn Imaging for all additions, deletions, and/or changes to specifications and/or drawings.

END OF ADDENDUM

Invitation to Bid No. RFB-242-23
For: Non-Heated Storage Building
Springfield Readiness Center
Department of Military Affairs
Springfield, Kentucky

Susan Ward, Statewide Procurement Analyst II
Division of Engineering and Contract Administration

KESLER SIMPSON
KSA
ARCHITECTS

DMA SPRINGFIELD RC NON-HEATED STORAGE FACILITY

ADDENDUM #1

This Addendum forms a part of Contract and clarifies, corrects or modifies original Bid Documents, dated March 24, 2023. Acknowledge receipt of this addendum in space provided on bid form. Failure to do so may subject bidder to disqualification.

This addendum contains 1 sheet including this sheet.

1) Is this building to have any insulation or condensation prevention material?
   R-19 vinyl faced bag and sag in the roof.

2) Is the building to have a standing seam roof or a screw down roof system?
   Standing Seam.

3) Are the overhead doors to have minimal insulation?
   No wall insulation required.

4) Is there a specific door hardware that is required?
   PEMB manufacturer's standard HM door and frame with 3 butt hinges, push bar panic hardware, closer and weatherstripping.

5) There is mention of a Geotech report. Is it available?
   Geo-tech report will be included in this addendum.

6) Is the R-19 insulation in the roof only?
   R-19 roof only.

7) Since there is no wage schedules included in the bid information, are we to assume this project is not a prevailing wage job?
   Not a prevailing wage project.

8) Jesco Industries is an acceptable vendor.

9) Enamel finish may be substituted in lieu of a galvanized finish on the caging.

10) Issue sheet E101

Report of Geotechnical Exploration

DMA Springfield

CSI Project No. LX220202

Prepared for :
Finance and Administration
Cabinet

December 08, 2022

CONSULTING SERVICES INCORPORATED
Geotechnical & Materials Engineering | IBC Special Inspection | Material Testing

December 08, 2022

Finance and Administration Cabinet
Division of Engineering and Contract Administration
403 Wapping Street
Frankfort, Kentucky 40601

ATTN: Mr. Carl Kratzer
Email: carl.kratzer@ky.gov

Subject: **Report of Geotechnical Exploration**
DMA Springfield Cold Storage Building
Springfield, Kentucky
CSI Project No. LX220202

Dear Mr. Kratzer:

Consulting Services Incorporated of Kentucky (CSI) is pleased to present our report for the geotechnical services completed for your cold storage facility project located in Springfield, Kentucky. We provided our services in general accordance with CSI's proposal number 8125 dated July 7, 2022.

Our report represents information provided to us, readily available published data relevant to the site and site area, our observations and subsurface conditions encountered and our opinion of primary geotechnical conditions (discussion and recommendations) affecting design, construction and performance of the proposed earth supported portions of the project.

We appreciate the opportunity to provide our geotechnical services to you and the design team. Please do not hesitate to contact us for questions or comments about the information contained herein.

Cordially,

Carole Gibbs

BARRY F. BISHOP
36777
12.08.22

Carole A. Gibbs, SI
Asst. Engineering Group Leader

Barry F. Bishop, PE
Engineering Group Leader
Licensed KY 36777

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INTRODUCTION

1 SCOPE OF THE GEOTECHNICAL EXPLORATION

We conducted a geotechnical exploration which is summarized in the following report. Our services included a review of the project information provided, conducting a geotechnical exploration that utilized soil test borings and rock coring to obtain samples for modeling the soil and rock conditions at the subject site, an analysis of the data and information obtained, and providing recommendations for the soil supported portions of the project site as listed in our proposal.

2 PROVIDED INFORMATION

Project information was provided to us via email correspondence from you. We were provided with a brief project description and an aerial map depicting the location.

Based on the information obtained, the following is our understanding of the project:

- The project site is located at the existing National Guard Armory in Springfield, Kentucky. Reference the *Site Location Plan* in the Appendix for further details.
- We understand that the project consists of a new, cold storage building. The new building is planned to be PEMB (Pre Engineered Metal Building) and encompass approximately 2400 square feet. At this time, the project does not include any basements, partial basements, or pits.

We have based our report on the following assumed information:

Table 1: Anticipated Conditions	
Site Grading - Building Pad	
Finished Floor Elevation	Near existing grades
Maximum anticipated cut	< 5 feet
Maximum anticipated fill	< 5 feet
Anticipated Foundation Loading Conditions	
Load Type	Load
Column	20 kips
Wall	2 kips/LF
Floor Slab	100 pounds/SF

If any of the aforementioned information is in error or if the information changes during the course of the project, please contact our office so that we can re-evaluate the new information with respect to our recommendations.

3 AREA/SITE INFORMATION

3A AREA TOPOGRAPHY/PHYSIOGRAPHY

The site is located in the Outer Bluegrass Physiographic Region of Kentucky. This area consists of gently rolling topography with steep slopes generally found near streams rich, fertile soils. Published topographic mapping by the United States Geologic Survey (USGS) indicates the elevations in the site vicinity are approximately 740 to 780 feet. Figure 1 depicts the location of the site with respect to the regional physiography.

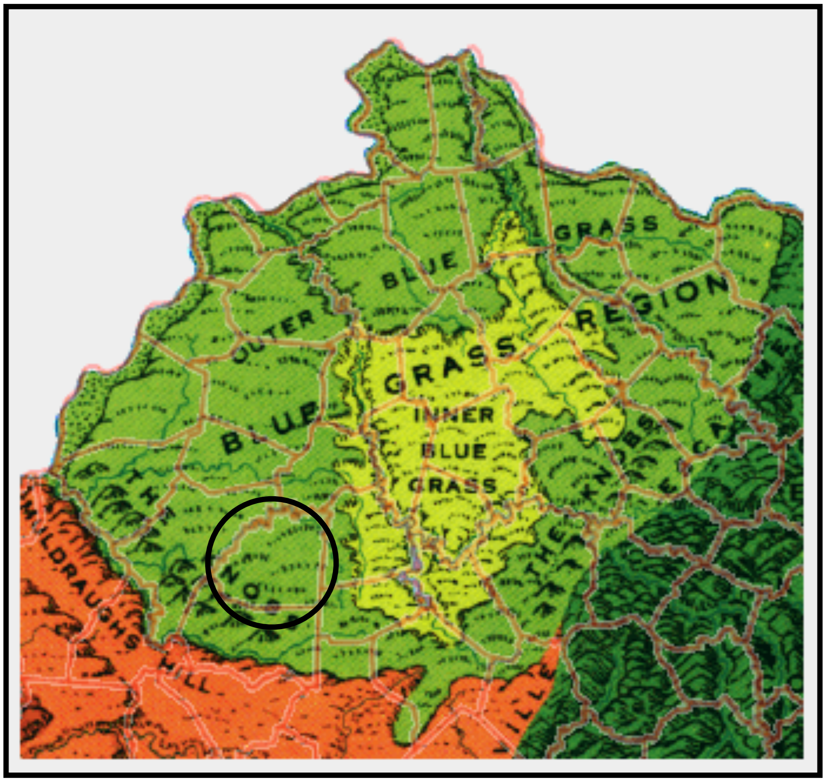


Figure 1. Kentucky Physiographic Map (site vicinity shown in the circle)

3B SITE GEOLOGY

A review of the *USGS Geologic Map of the Springfield Quadrangle* (dated 1977) indicates the project site is located in an area underlain by the Grant Lake Limestone, lower member.

As mapped, the Grant Lake Limestone Member consists of limestone and shale. The limestone is described as medium gray, crypto grained to medium grained, and in even to lumpy beds. The shale is described as medium to dark gray, calcareous, carbonaceous in part, weakly fissile and in partings to thin wavy beds.

There are no faults mapped within the project vicinity. The geologic dip near the project site is approximately 1 percent to the southeast. Please reference Figure 2 for further details regarding the site geology.

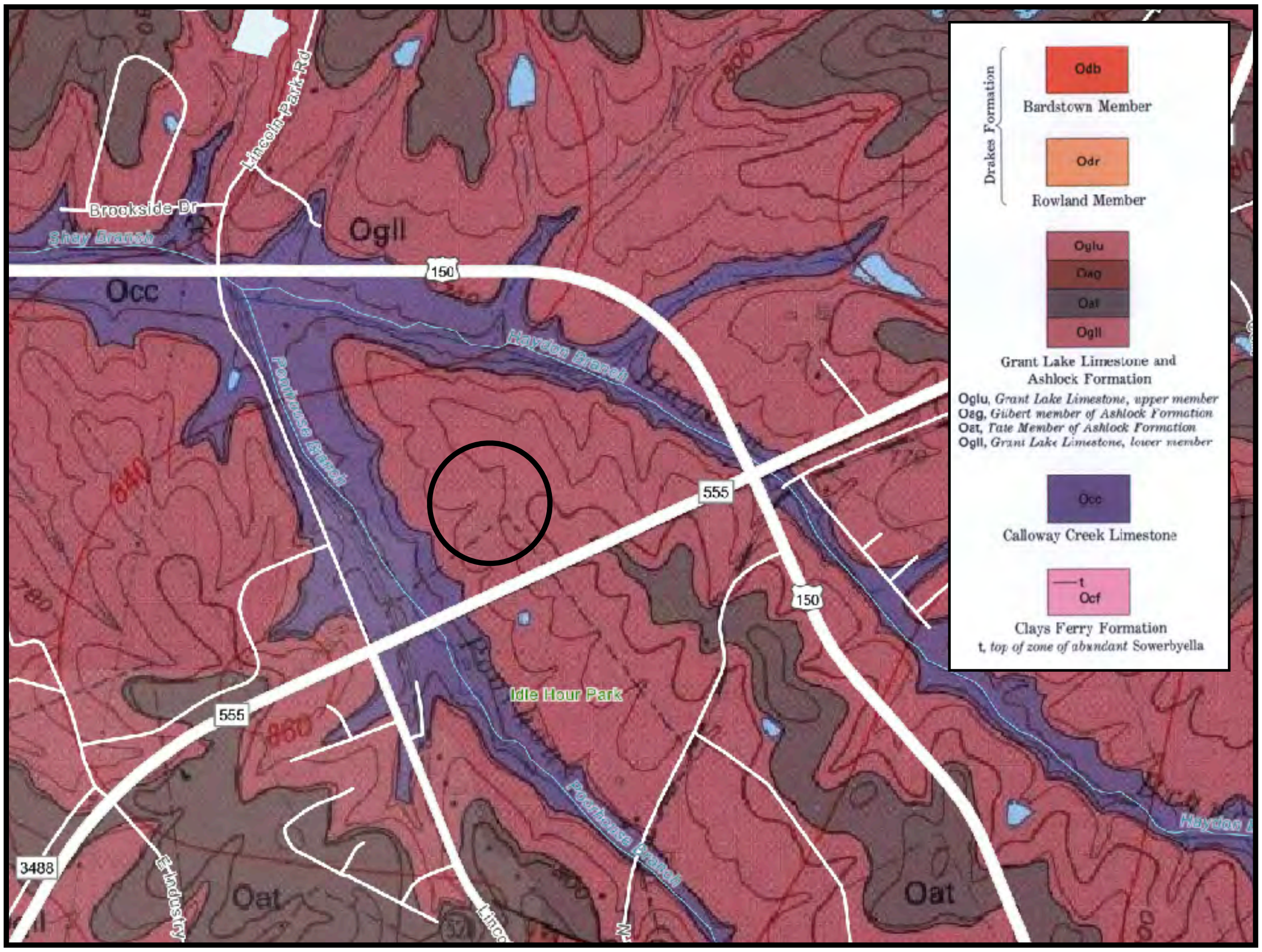


Figure 2. Site Geology USGS Springfield Quadrangle, dated 1977
(site vicinity indicated by circle)

As with most of the geology of this portion of Kentucky, Karst (sinkholes, weathered bedrock, caverns, erratic bedrock, etc.) is associated with the site geology. No closed depressions were mapped within the immediate vicinity of the site. Additionally, no obvious signs of Karst activity were observed in our recovered soil samples, auger cuttings, or rock core. The Washington County Karst Areas map published by the Kentucky Geological Survey (KGS) indicates that the project site is in an area with very high Karst potential. Figure 3 indicates the likelihood of Karst occurrence.

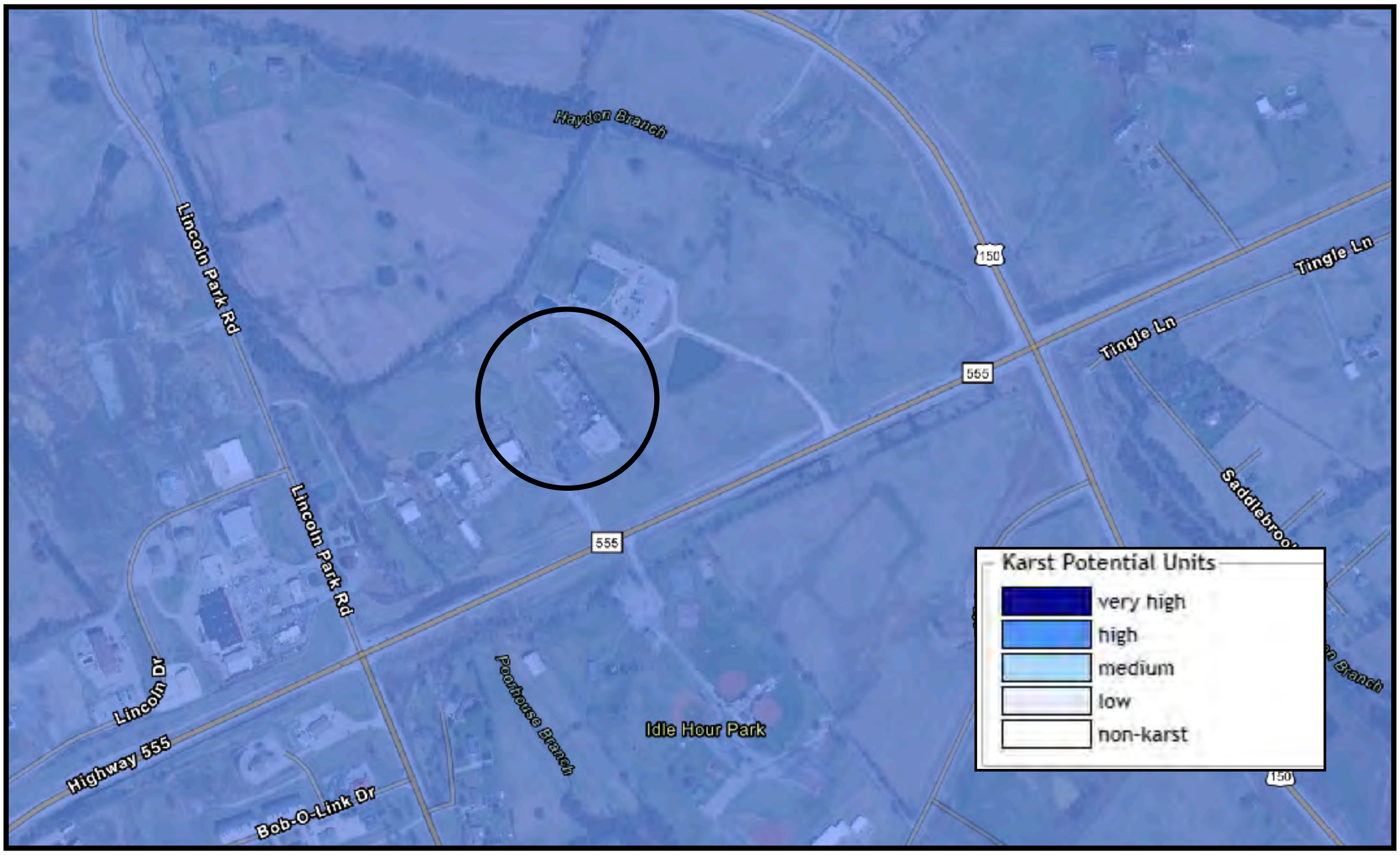


Figure 3. Karst Areas Map, KGS (site vicinity shown in circle)

3C PUBLISHED SITE SOIL CONDITIONS

According to the USDA Soil Survey of Washington County (NRCS website), the soils underlying the site consist of the following series:

- uLfC—Lowell-Faywood silt loams, 6 to 12 percent slopes
- uLsoB—Lowell-Sandview silt loams, 2 to 6 percent slopes

The following describes the soil series characteristics and limitations with respect to construction.

- Depth to restrictive feature for these soil series is listed as being approximately 53 inches.
- These soil series are generally listed as being well drained with a depth to water table of greater than 80 inches.
- These soil series are listed as being somewhat limited for shallow excavations. Particular issues affecting construction include unstable excavation walls, being too clayey, depth to hard bedrock, being dusty, and slope.

- These soil series are listed as being somewhat limited for the construction of small commercial buildings. Particular issues affecting construction include depth to hard bedrock, shrink-swell potential, depth to saturated zone, and slope.

- These soil series are listed as being very limited for the construction of small commercial buildings. Particular issues affecting construction include shrink-swell potential, slope, and depth to hard bedrock.

Due to the previous site development, the soil survey information listed above may no longer be useful since the site soils may have been altered. Thus, the soils described above may be on-site but not in their natural condition. Figure 4 shows the soils map from the USDA website.

Figure 4: USDA Soil Survey Map of Project Site (site vicinity outlined in orange)

3D OTHER PUBLISHED SITE INFORMATION

We have reviewed several available aerial photographs, dated as far back as February 1997. The February 1997 aerial photograph indicates the project site was occupied by the existing National Guard Armory. Between September 2006 and August 2010, a church was constructed directly north of the project. No other changes were indicated within the project vicinity. Please reference the following aerial photographs for further details.

Figure 5: Aerial photograph, dated February 1997 from Google Earth (site vicinity shown in circle)

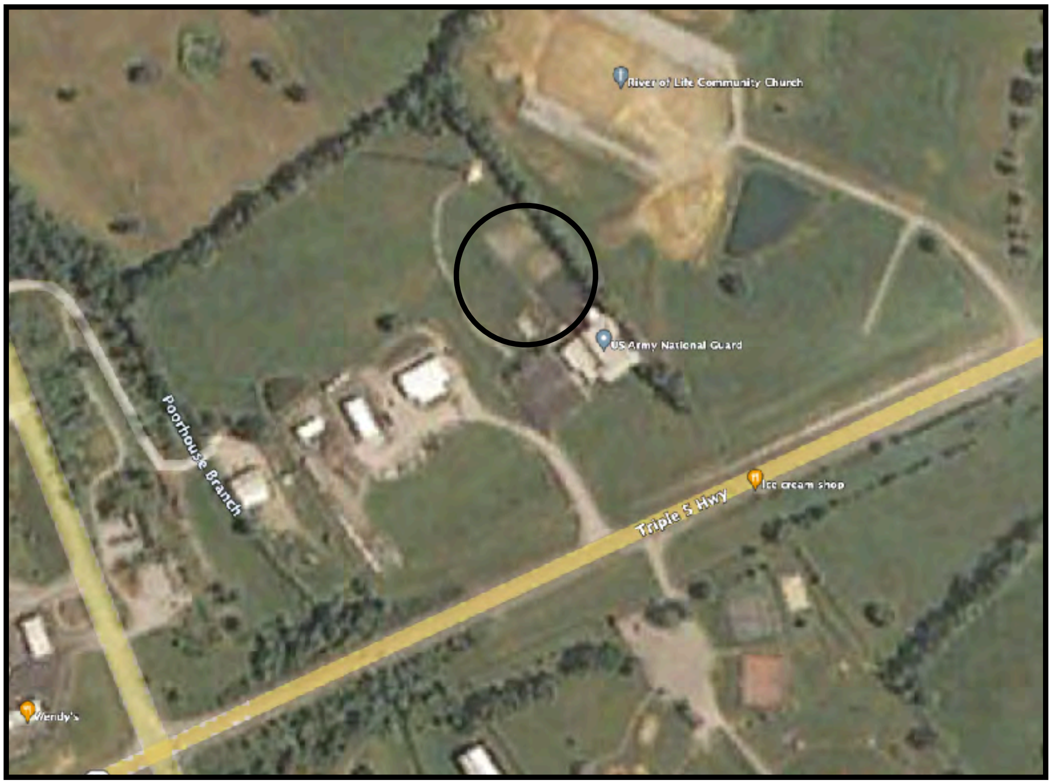


Figure 6: Aerial photograph, dated September 2006 from Google Earth (site vicinity shown in circle)

Figure 7: Aerial photograph, dated August 2010 from Google Earth (site vicinity shown in circle)

Figure 8: Aerial photograph, dated November 2020 from Google Earth (site vicinity shown in circle)

4 SITE SURFACE OBSERVATIONS

Mrs. Carole Gibbs of CSI conducted a site visit, performed a field reconnaissance, logged soil borings, rock coring, and directed drilling operations within the proposed project area on November 21, 2022.

The project site is located at the existing National Guard Armory in Springfield, Kentucky. The building area is relatively flat to gently sloping. Based on our top of boring elevations, there is approximately 3 feet of vertical relief within the building footprint.

The project area is occupied by an existing cell tower, a chain link fence, gravel storage lot, and grass covered areas. The project area is bordered to the north by a church, to the south by the National Guard Armory, to the east by a tree line, and to the west by a grass covered field.

Overhead electric lines were observed extending near the northern perimeter of the site. No other marked utility lines were observed within the project area. The following photos depict the site conditions as they existed at the time of our geotechnical exploration.

Photo 1. View looking northeast across building area.

Photo 2. View looking southwest across building area.

Photo 3. View looking southeast across building area.

5 SUBSURFACE CONDITIONS

The subsurface conditions encountered at each of our soil boring locations are shown on the Boring Logs in the Appendix. It should be noted that our soil borings were sampled according to the procedures presented in the Appendix. The Boring Logs represent our interpretations of the subsurface conditions based on field logs, visual examination of field samples by an engineer, visual examination of auger cuttings, and tests of the samples collected. The letters in parentheses following the soil descriptions are the soil classifications in accordance with the Unified Soil Classification System. It should be noted that the stratification lines shown on the logs represent approximate transitions between material types. In-situ stratum changes could occur gradually or at slightly different depths. Water levels shown on the Boring Logs represent the conditions only at the time of our exploration.

5A SOIL CONDITIONS

We performed 3 borings within/near the new building footprint. Please reference the *Boring Location Plan* in the Appendix for the approximate locations.

In general, we encountered the following in our soil borings: a surficial layer of gravel or topsoil, overlying previously placed fill (where encountered), overlying possible fill (where encountered), overlying bedrock.

Gravel was encountered at the surface of boring B-103 and was approximately 3 inches thick. Topsoil was encountered at the surface of borings B-101 and B-102. The topsoil ranged in thickness from approximately 1 to 2 inches and generally consisted of the root mat.

Previously placed fill was encountered beneath the surficial layer in boring B-101 and B-102. The previously placed fill material generally consisted of orange and brown mixed clay, with trace black oxide nodules and varying amounts of rock fragments. The previously placed fill was approximately 8 feet thick and was generally sampled as very stiff to hard. Please note, we expect some of our blow counts are inflated due to the inclusion of rock fragments. Thus, the soils could be softer than indicated.

Possible fill was encountered in boring B-103 beneath the surficial layer. The possible fill generally consisted of orangish-brown fat clay (CH), with black oxide nodules and trace fine roots. Possible fill was approximately 8 feet thick and was generally sampled as stiff to firm.

Table 2 summarizes the general subsurface conditions encountered at our boring locations.

Table 2: General Subsurface Strata

Strata	Thickness	Notes
Surface Cover: Gravel	Approximately 3 inches	Present in boring B-103
Surface Cover: Topsoil	Approximately 1 to 2 inches	Present in borings B-101 and B-102
Fill - orange and brown mixed clay, with trace black oxide nodules and varying amounts of rock fragments	Approximately 8 feet	Present in borings B-101 and B-102
Possible Fill - orangish-brown fat clay (CH), with black oxide nodules and trace fine roots	Approximately 8 feet	Present in boring B-103

5B GROUNDWATER CONDITIONS

Groundwater was not observed in any of our borings upon completion of soil augering. All of our borings were immediately backfilled with auger cuttings upon the completion of soil augering (due to safety concerns).

Water conditions that usually affect construction and performance of projects consist of trapped/ perched water zones which occur in various areas in the soil mass, at or near the bedrock bedding planes, or at or near the soil/rock interface. Perched water sources are often not linked to the more continuous relatively stable groundwater table that typically occurs at greater depths. Finally, water issues are also dependent upon recent rainfall activity and surface and subsurface drainage patterns in the area.

5C BEDROCK INFORMATION

Auger refusal was encountered in all 3 of our borings at depths ranging from 8.2 feet to 8.5 feet. We have interpreted auger refusal to be the top of hard bedrock.

Rock coring was performed at boring B-102. The recovered rock core generally consisted of light to medium gray limestone, with interbedded shale and few vugs. The rock core had a recovery of 77 percent and was of very poor engineering quality with a Rock Quality Designation (RQD) of 8 percent. No voids and no core water return was observed during coring operations.

6 LABORATORY TESTING

Laboratory tests were performed on selected recovered samples from our borings. Detailed descriptions of these tests and the results of our testing are included in the Appendix. Tests performed included:

- Natural moisture contents
- Atterberg limits
- Percent finer than No. 200 sieve

GEOTECHNICAL DISCUSSION AND RECOMMENDATIONS

7 DISCUSSION-GEOTECHNICAL ISSUES

Based on our experience with similar projects and the conditions observed during our subsurface exploration, we believe the site can be adapted for the proposed building. However, this site will be more difficult (and more expensive) to develop when compared to some sites due to the previous site improvements, the presence of existing fill material, and the presence of swelling fat clays. The primary geotechnical concerns are:

- Previous Site Improvements
- Previously Placed Fill
- High Plasticity (Fat) Clay Soils

- Karst Geology

The following sections discuss each issue. However, recommendations to address the issues are contained in later sections of the report.

7A PREVIOUS SITE IMPROVEMENTS

The site is currently occupied by the National Guard Armory. There is one building and asphalt pavement on-site. Expect that old fill or other deleterious material will be encountered in the project area. Your project budget should include a contingency for the removal and remediation of any encountered underground structures.

7B PREVIOUSLY PLACED FILL

Previously placed fill material was encountered in 2 of our 3 borings. Possible fill was encountered in boring B-103. Although no deleterious material was observed, the recovered samples lacked the relic structure typically found in residual soils. We expect this fill is from the previous structures on-site. Fills placed in an uncontrolled manner have proven to be very problematic. The problems generally arise not from general settlement, but from erratic differential settling of the fill. The settlement of large masses is dependent upon several factors such as fill thickness, degree of compaction, fill contents, and age of the fill mass. Also, fills tend to settle linearly with thickness.

We typically recommend complete removal of any encountered previously placed fill within the proposed building areas. However, due to the encountered depths of the fill material, this may not be economical or feasible. If any old fill is left in-place beneath any future site improvements, you must be aware of the risk of construction over old fill material and hold CSI harmless for poor performance of the site improvements due to construction in the old fill. We can provide recommendations to reduce (but not eliminate) the risk if you choose to leave any of the existing fill in-place.

7C HIGH PLASTICITY (FAT) CLAY SOILS

Atterberg limits testing was performed on 1 representative sample. Our laboratory testing indicated that the tested soil sample was fat clay (CH) with a PI (Plasticity Index) of 33 percent. Soils with a PI above 30 percent can have a tendency to shrink/swell with changes in moisture content. Soils with a PI greater than 50 are generally highly susceptible to volume change. Soils with a PI between these limits have moderate volume change potential.

Shrinking and swelling of bearing soils are generally not as severe in the central Kentucky area as in other areas because long periods of excessively wet or dry weather do not normally occur. Where the soil moisture fluctuates, movement may be ongoing throughout the building's life, resulting in deterioration and building distress. Strength loss may also affect building components, but is more likely to adversely affect parking lots - especially flexible asphalt pavements. Accumulation of water beneath pavement followed by repeated traffic loads, may result in the failure of both pavement and the subgrade materials.

Methods to control the adverse effects of these soils include soil modification methods (i.e.- undercut/ replace, lime stabilization, etc.). However, due to the relatively small size of this building, lime stabilization may not be economically viable. Additionally, providing efficient drainage around the building and pavements, installation of foundation components at depths below levels where moisture contents are subject to significant fluctuation, and implementing more stringent fill specifications for new fill placement. Please reference the later sections of this report for specific details pertaining to these fat clay soils.

7D KARST GEOLOGY

Karst is common in Kentucky and typically includes, sinkholes, caverns, erratic/irregular (pinnacle and rock channels) bedrock surfaces, and “floater” type boulders or rock cobbles in the native soil overburden. The prominent topographic feature of Karst regions in Kentucky is the sinkhole. This is defined as areas underlain by carbonate rocks that are characterized by closed surface depressions and internal drainage systems. No obvious signs of Karst activity were observed in our recovered soil samples, auger cuttings, or rock core. There are no mapped sinkholes at the project site. However, this site is in an area underlain by rock with a high risk for Karst potential. Thus, due to geologic formations in the area there is an inherent risk associated with Karst-related issues for this project site.

Based on our knowledge of the area geology, sinkholes could be exposed during grading activities and foundation and utility construction. Detailed site proofrolling and foundation observations are frequently utilized in an attempt to locate incipient soil dropouts. Sinkholes, mud seams, or slots in bedrock must be evaluated and treated on an individual basis. A CSI geotechnical engineer must be retained for remediation recommendations if any of these features are exposed during construction. Where the soil overburden is relatively thick, treatment of depressions will likely involve monitoring by a CSI geotechnical engineer during earthwork operations to observe indications of sinkhole throats and conduits after soil cutting activities are complete.

8 DESIGN TEAM MEETING

On November 29, 2022, we discussed our findings and the project in general with Andrew Kesler, AIA (project architect). Several risk-based options were discussed. These options are listed below in order of increasing risk:

- Option 1: Undercut the entire building pad to bedrock and replacing with compacted fill. We expect the on-site soils could be re-used as new fill provided no deleterious materials are encountered.
- Option 2: A mat foundation bearing on the existing fill material.
- Option 3: Undercut the foundations to bedrock and either backfill to BOF (bottom of foundation) with flowable or bear the foundations on bedrock. The floor slab would be free floating from the foundations and would bear on the existing fill.
- Option 4: Utilize shallow spread foundations bearing on the existing fill material. Note: this is a high risk option. CSI will not be responsible for poor performance due to construction over old fill.

After further discussion with Mr. Kesler, we understand that Option 4 has been selected for the construction approach. Additionally we understand the floor slab will be constructed over the previously placed fill.

9 EARTHWORK

Historically, more change orders (in total number and costs) occur during the earthwork portion of construction than in almost any other part of the project. Further, the site preparation phase of construction always affects the future performance of project structures and pavements. Add into this, the fact that earthwork is the portion of work most influenced by wet weather and unknown conditions and time-wise, this section of the report could be the most important to prevent and minimize delays and costs during construction and for the life of the project.

Please review the concerns listed in section 7 prior to reading the following recommendations. If problems occur that the recommendations do not address or do not adequately remedy, please contact CSI as soon as possible.

9A SITE PREPARATION (WORK PRIOR TO FILLING)

- Existing structures (fence, etc) should be demolished as required by the construction plans;
- The site should be cleared/grubbed removing all topsoil and vegetation within the proposed building and pavement areas. Organic materials should be wasted off-site. Topsoil can be stockpiled for use in landscape areas;
- If applicable, remove/relocate underground utilities as required by the construction plans;
- Please note that the Owner has elected to leave the old fill in-place beneath the proposed foundations and floor slab. If any areas of deleterious materials (i.e.- wood, trash, etc.) are encountered during site grading operations, then it must be removed entirely (even beyond the required depths or limits);
- Areas ready to receive new fill should be proofrolled with a heavily loaded dump truck (GVW of 80,000 pounds) or similar equipment judged acceptable by a CSI geotechnical engineer;
- The level of proofroll for any site area should be determined by a CSI geotechnical engineer on a case-by-case basis;
- Perform the proofrolling after a suitable period of dry weather to avoid degrading the subgrade;
- Areas which pump, rut, or wave during proofrolling may require undercutting, depending on the location of the area and the use of the area, so the geotechnical engineer should be contacted for guidance;
- Backfill of undercut areas should be performed in accordance with sections 9B and 9C;
- Retain CSI to observe the proofrolling operations and make recommendations for any unstable or unsuitable conditions encountered. This can save time on the construction schedule and save unnecessary undercutting.

We recommend that site grading should take place between about late April to late October. Earthwork taking place outside this time period will likely encounter wet conditions and weather conditions that will provide little to no assistance with drying the soils.

9B NEW FILL OPERATIONS

We were not provided any grading information for this project. However, we expect the FFE will be near existing grades. We expect that some (but not all) of the existing fill material on-site can be re-used as new fill material. Oversize rock fragments (or concrete/asphalt rubble) can be removed and wasted off-site - OR - they can be broken down into an acceptable size and used in the new fill. Any off-site fill material should be tested and approved before it is imported to the project site. Off-site soils with a plasticity index (PI) greater than 25 percent should not be used for new fill.

After the subgrade has been approved to receive new fill, the fill may commence with the following procedures and guidelines recommended:

- Place fill in maximum 8-inch thick loose lifts.
- DGA (Dense Graded Aggregate) fill lifts should be compacted to at least 95 percent of its maximum dry density (ASTM D698) and maintain the moisture content of compacted fill within 3 percent of optimum moisture;
- Soil fill lifts should be compacted to at least 98 percent of the soil's maximum dry density (ASTM D698) and maintain the moisture content of compacted fill within 2 percent of optimum moisture;
- Off-site soils with a plasticity index (PI) of greater than 25 percent should not be used new fill;
- Fill compaction requirements should be extended to at least 5 feet outside the building footprint.
- Maximum particle size of the soil should be limited to 4 inches in any dimension with no large concentrations of large fragments.
- Density testing should be performed as a means to verify percent compaction and moisture content of the material as it is being placed and compacted.
- Observation of fill “stability” is also critical, so it is recommended to observe the operation of the filling equipment traversing over the new fill to document movement (similar to proofrolling).
- Soils should not be “overcompacted” and construction traffic should be kept to minimum to assure compaction is achieved and that the soil is not allowed to “break down”.
- Retain a representative of CSI to observe and document fill placement and compaction operations.

9C BACKFILL OPERATIONS (FOUNDATION WALLS, UTILITIES, ETC.)

These materials are placed in more confined areas than mass earthwork materials or pavement materials and therefore cannot be placed in full compliance with sections 9A or 9B. The following are general recommendations for backfill areas:

- Fill lift thicknesses will vary dependent on compaction equipment available and material types, but in no case should exceed 8 inches.

- For crushed stone/aggregate backfills in trenches or wall backfill and when using smaller compaction equipment (such as a plate compactor or trench compactor or similar) the lift thickness should not exceed 4 inches.
- Compaction/moisture percentages and density testing requirements should be the same as in section 9B.
- CSI should be retained to provide additional recommendations for backfill (if necessary).

9D GENERAL NOTES

- For all earthwork operations, positive surface drainage is prudent to keep water from ponding on the surface and to assist in maintaining surface stability.
- The surface should be sealed prior to expected wet weather. This can usually be accomplished with rubber-tired construction equipment or a steel-drum roller.
- If any soil placement problems occur, CSI should be retained to provide additional recommendations, as needed.

10 SITE DRAINAGE

During construction, water should not be allowed to pond in excavations or undercutting will likely be required. Additionally, allowing water to pond in excavations greatly increases the risk for activating latent Karst features if water is allowed to access the subgrade. During the life of the project, slope the subgrade and other site features so that surface water flows away from the site structures. Structure roof drains (if any) should be piped away to proper storm drainage systems. Diversion ditches should be used to keep surface water from accumulating at or near site structures. For excavations during construction, most free water could likely be removed via sump pumps and open channel flow (ditches) at or near the source of seepage. If normal dewatering measures prove insufficient due to shallow water conditions, CSI should be retained to provide recommendations on the issue.

Daylighting wet zones for drainage or the use of french/rock drains may be prudent or cost effective methods of de-watering wet areas of the site. Pumping with long-flexible hoses day-lighted hundreds of feet away or other types of sumping could also be utilized if necessary. CSI should be retained to observe all excavations in locations of springs or other water-bearing features.

11 FOUNDATIONS

Based on our discussions about the project, we believe that shallow spread foundations (continuous, isolated, or combinations thereof) bearing on existing fill or new fill will be used for this project. If there are any changes in the project criteria or building location, CSI should be allowed to review the recommendations to determine if any modifications are required. **As previously stated in this report, this is a high risk option. CSI will not be responsible for poor performance due to construction over old fill**.

11A SHALLOW SPREAD FOUNDATIONS ON SOIL

Shallow spread footings may be sized using a **maximum allowable bearing pressure of 1,500 pounds per square foot (psf)**. Foundations should bear on the existing fill material or new fill. We also recommend using inverted “T” footings (i.e.- concrete foundation and stem wall). This recommended bearing pressure is lower than normal due to the presence of the existing fill material which is being left in-place beneath the building foundations.

If rock is encountered within 2 feet of the design bottom of foundation (BOF) elevation (possible depending upon selected grades), then the rock should be undercut to at least 2 feet below the design BOF. The undercut area should then be backfilled with compacted soil fill or sand. The use of DGA (dense graded aggregate) or No. 57 crushed stone as backfill material is not recommended.

A detailed settlement analysis was beyond the scope of this exploration. **It is not possible to accurately determine foundation settlement when the existing fill is left in-place**, we recommend that the structure be designed for a total settlement of 1 inch and differential settlements of ½ inch between columns or along continuous footing distances of 30 feet or less.

Additional design considerations for spread foundations bearing directly (or indirectly) on old fills are outlined as follows:

- Design all footings with a minimum 24 inches width;
- Do not use turned-down slabs or thickened slab sections to support load bearing walls;
- All footing bottoms (interior and exterior) should bear at least 36 inches below finished exterior grading (due to the fat clays encountered on-site);
- Include control joints at liberal intervals in the walls of structures to help accommodate differential foundation movements.

11B SHALLOW FOUNDATIONS ON SOIL - CONSTRUCTION NOTES

Any soils can lose strength if they become wet, so we recommend the foundation subgrades be protected from exposure to water. For foundations construction, we also recommend the following procedures.

- For soils that will remain exposed overnight or for an extended period of time, place a "lean" concrete mudmat over the bearing areas. The concrete should be at least 4 inches thick. Flowable fill concrete or low-strength concrete is suitable for this cover, as conditions allow.
- Disturbed soil should be removed prior to foundation concrete placement.
- Foundation bearing conditions should be benched level.
- Areas loosened by excavation operations should be recompacted prior to reinforcing steel placement.

- Loose soil, debris, and excess surface water should be removed from the bearing surface prior to concrete placement.
- Retain a CSI geotechnical engineer to observe all foundation excavations and provide recommendations for treatment of any unsuitable conditions encountered.

12 SEISMIC SITE CLASSIFICATION

The latest edition of the Kentucky Building Code (KBC) was reviewed to determine the Site Seismic Classification. Based on our review of geologic data, our experience and subsurface conditions encountered and the use of soil bearing foundations, we recommend a Seismic **SITE CLASS "B"** for foundation design purposes.

A detailed geotechnical earthquake engineering analysis was not performed since it was beyond the scope of our authorized work. However, based on a review of published literature and our experience with similar subsurface conditions, we believe the potential for slope instability, liquefaction, and surface rupture due to faulting or lateral spreading resulting from earthquake motions is low. However, this potential could be elevated during wet periods of the year unless adequate drainage is provided.

13 CONCRETE SLABS-ON-GRADE

As previously stated, the existing fill will remain in-place beneath the proposed floor slabs. **As previously stated in this report, this is a high risk option. CSI will not be responsible for poor performance due to construction over old fill**. As a result, we can provide recommendations to reduce the likelihood of settlement of the floor slab, but not eliminate it.

Based on the depth to rock in our borings, rock is not expected to be encountered beneath the project floor slab. If rock is encountered within 1 foot of the slab subgrade elevation, we recommend that the rock be undercut at least 1 foot below slab subgrade elevation and the excavation be backfilled with compacted soil up to the design slab subgrade elevation to provide a "cushion".

The following features are recommended as part of the floor slab construction:

- Increase the floor slab thickness;
- Utilize a stronger flexural strength concrete to resist possible differential settlement. Incorporate reinforcing steel (not welded wire fabric) in the floor slab design as a means of providing increased flexural resistance;
- Provide isolation joints between the slab and columns and along footing supported walls. Do not use a turned-down slab or thickened slab sections to support load bearing walls;
- Adequate joint patterns (ACI and ICC guidelines) should be used to permit slab movement due to normal soil settlement, normal subgrade disturbance and material expansion/contraction;
- Place a minimum of 4 inches of clean, compacted gravel or crushed stone beneath the slab to provide a working base. The actual thickness of the gravel layer should be based on design requirements;

- Keep the crushed stone or gravel moist, but not wet, immediately prior to slab concrete placement to minimize curling of the slab due to differential curing conditions between the top and bottom of the slab;
- Retain CSI to review the actual subgrade conditions prior to slab construction and make recommendations for any unsuitable conditions encountered.

Note: Slab subgrade conditions are also considered earthwork areas and the recommendations contained in the Earthwork section of the report. See Section 8 of this report for specific details.

14 NOTES ON REPORT AND RECOMMENDATIONS

We recommend that this complete report be provided to the various design team members, the contractors and the project Owner. Potential contractors should be informed of this report in the "Instructions to Bidders" section of the bid documents. A geotechnical exploration, such as the one we performed, uses widely spaced borings to attempt to model the subsurface conditions at the site. Because no exploration contains complete data or a complete model, there is always a possibility that conditions between borings will be different from those at specific boring locations. Thus, it is possible that some subsurface conditions will not be as anticipated by the project team or contractor. If this report is included or referenced in the actual contract documents, **it shall be explicitly understood that this report is for informational purposes only**. CSI shall not be responsible for the opinions of, or conclusions drawn by, others.

It has been our experience that the construction process often disturbs soil conditions and this process, no matter how much experience we use to anticipate construction methodology, is not completely predictable. Therefore, changes or modifications to our recommendations are likely needed due to these possible variances. Experienced CSI geotechnical personnel should be used to observe and document the construction procedures and the conditions encountered. Unanticipated conditions and inadequate procedures should be reported to the design team along with timely recommendations to solve the problems created. We recommend that the Owner retain CSI to provide this service based upon our familiarity with the project, the subsurface conditions and the intent of our recommendations.

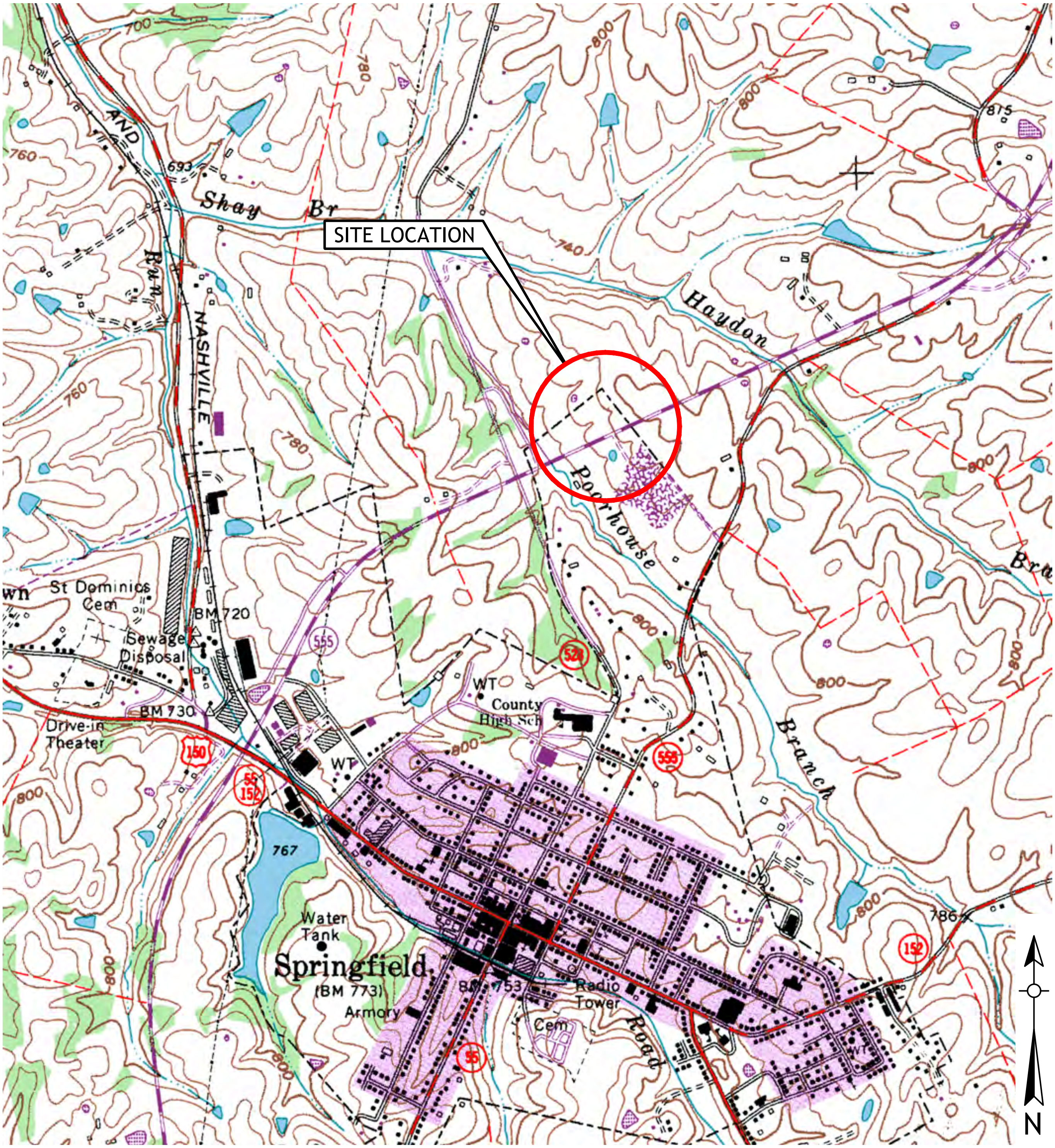
This report is based on the supplied project information, the subsurface conditions observed at the time of the report, and our experience with similar conditions. As such, it cannot be applied to other project sites, types, or combinations thereof. If the Project Information section in this report contains incorrect information or if additional information is available, you should convey the correct or additional information to us and retain us to review our recommendations. Our recommendations may then require modification.

No section or portion of this report (including Appendix information) can be used as a stand alone article to make distinct changes or assumptions. The entire report and Appendix should be used together as one resource.

While this report deals with samples of subsurface materials and some comments on water conditions at the site, no assessment of site environmental conditions or the presence of contaminants were performed.

We wish to remind you that our exploration services include storing the soil and rock core samples collected and making them available for inspection for 30 days. The soil and rock core samples are then discarded unless you request otherwise. Please inform us if you wish to keep any of the obtained samples.

APPENDIX



Site Location Plan adapted from USGS Springfeild, KY Topographic Quadrangle map (dated 1972, Revised 1979), with further adaptation by CSI personnel.

FOR ILLUSTRATION PURPOSES ONLY

Consulting Services Incorporated of Kentucky
858 Contract Street
Lexington, Kentucky 40505
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SITE LOCATION PLAN

DMA-Springfield
Springfield, Kentucky

Project No: LX220202	Drawn By: HH
Date: 12/8/2022	Checked By: CG
Scale: Not To Scale	Drawing No: SLP - 1

This drawing is being furnished for this specific project only. Any party accepting this document does so in confidence and agrees that it shall not be duplicated in whole or in part, nor disclosed to others without the consent of Consulting Services Incorporated of Kentucky.

Boring Location Plan adapted from provided aerial imagery with further adaptation by CSI personnel.

LEGEND	
● B-XXX	BORING LOCATIONS

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858 Contract Street
Lexington, Kentucky 40505
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www.csikentucky.com

BORING LOCATION PLAN

DMA-Springfield
Springfield, Kentucky

Project No: LX220202

Date: 12/8/2022

Scale: Not To Scale

Drawn By: HH

Checked By: BH

Drawing No: BLP - 1

Consulting Services Incorporated
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Geotechnical Boring Information Sheet

Sample Type Symbols	
Splitspoon (SPT)	☒
Shelby Tube	■
Grab	✋
Rock Core	◧
Auger Cuttings	▮

Surface Symbols	
Topsoil	⁂
Asphalt	■
Concrete	░
Lean Clay	▨
Fat Clay	▨
Glacial Till	▨
Sandy Clay	▨
Silt	▥
Elastic Silt	▥
Lean Clay to Fat Clay	▨
Gravelly Clay	▨
Sandy Silt	▥
Gravelly Silt	▥
Sand	░
Gravel	○
Fill	▩
Limestone	▦
Sandstone	▤
Shale/Siltstone	▤
Weathered Rock	▥

Samples Strength Descriptors	
Cohesive Soils:	**N**
Very Soft	0-1
Soft	2-4
Firm	5-8
Stiff	9-15
Very Stiff	16-30
Hard	31+
Non-cohesive Soils:	
Very Loose	0-4
Loose	5-10
Firm	11-20
Very Firm	21-30
Dense	30-50
Very Dense	51+

Definitions

SPT-"Splitspoon" or standard penetration test. Blow counts are number of drops required for a 140 lb hammer dropping 30 inches to drive the sampler 6 inches.

N-value is the addition of the last two intervals of the 18-inch sample.

Shelby tubes are often called "undisturbed samples". They are directly pushed into the ground, twisted, allowed to rest for a small period of time and then pulled out of the ground. Tops and bottoms are cleaned and then sealed.

Sample classification is done in general accordance with ASTM D2487 and 2488 using the Unified Soil Classification System (USCS) as a general guide.

Soil moisture descriptions are based on the recovered sample observations. The descriptors are dry, slightly moist, moist, very moist and wet. These are typically based on relative estimates of the moisture condition of a visual estimation of the soils optimum moisture content (EOMC). Dry is almost in a "dusty" condition usually 6 or more percent below EOMC. Slightly moist is from about 6 to 2 percent below EOMC at a point at which the soil color does not readily change with the addition of water. Moist is usually 2 percent below to 2 percent above EOMC and the point at which the soil will tend to begin forming "balls" under some pressure in the hand. Very moist is usually from about 2 percent to 6 percent above EOMC and also the point at which it's often considered "muddy". Wet soil is usually 6 or more percent above EOMC and often contains free water or the soil is in a saturated state.

Silt or Clay is defined at material finer than a standard #200 US sieve (<0.075mm) Sand is defined as material between the size of #200 sieve up to #4 sieve. Gravel is from #4 size sieve material to 3". Cobbles are from 3" to 12". Boulders are over 12".

Rock hardness is classified as follows:

Very Soft:	Easily broken by hand pressure
Soft:	Ends can be broken by hand pressure; easily broken with hammer
Medium:	Ends easily broken with hammer; middle requires moderate blow
Hard:	Ends require moderate hammer blow; middle requires several blows
Very Hard:	Many blows with a hammer required to break core

Rock Quality Designation (RQD) is defined as total combined length of 4" or longer pieces of core divided by the total core run length; defined in percentage.

Water or cave-in observed in borings is at completion of drilling each boring unless otherwise noted.

Strata lengths shown on borings represents a rough estimate. Transition may be more abrupt or gradual. Soil borings are representative of that estimated location at that time and are based on recovered samples. Conditions may be different between borings and between sample intervals. Boring information is not to be considered stand alone but should be taken in context with comments and information in the geotechnical report and the means by which the borings are logged, sampled and drilled.

BORING LOG

Consulting Services Incorporated
858 Contract Street
Lexington, Kentucky 40505
Phone: 859.309.6021
Fax: 888.792.3121

BORING: B-101

Project Number: LX220202
Name: DMA Springfield Cold Storage Building
Client: Finance and Administration Cabinet
Location: Springfeild, Kentucky
Logged By: C. Gibbs

Weather: Sunny, 40's
*Elevation (ft): 761.0
Date Started: 11/21/22
Date Completed: 11/21/22
Checked By: B. Bishop, PE

Contractor: CSI
Drill Rig: B-57
Method: SFA
Hole Size (in): 4

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
			TOPSOIL - 2 inches									
760		▨	FILL - sampled as VERY STIFF to HARD, orange and brown clay, with trace roots, with black oxide nodules, with rock fragments, damp	3-8-19 (27)	14							Dry upon completion of soil augering
	2	▨		13-18-19 (37)	11							
758		▨										
	4	▨										
756		▨		11-14-20 (34)	13	13.9						
	6	▨										
754		▨		8-24-24 (48)	16	13.9						
	8	▨										
			Auger Refusal at 8.2 feet									
752												
	10											
750												
	12											
748												

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

Left Photo: Photo of Approximate Boring Location
Right Photo: Photo of Boring

BORING LOG

Consulting Services Incorporated
858 Contract Street
Lexington, Kentucky 40505
Phone: 859.309.6021
Fax: 888.792.3121

BORING: B-101A

Project Number: LX220202	Weather: Sunny, 40's	Contractor: CSI
Name: DMA Springfield Cold Storage Building	*Elevation (ft): 761.0	Drill Rig: B-57
Client: Finance and Administration Cabinet	Date Started: 11/21/22	Method: SFA
Location: Springfeild, Kentucky	Date Completed: 11/21/22	Hole Size (in): 4
Logged By: C. Gibbs	Checked By: B. Bishop, PE	

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
			Offset from boring B-101 to confirm relatively shallow auger refusal depth									Dry upon completion of soil augering
760												
	2											
758												
	4											
756												
	6											
754												
	8		Auger Refusal at 2.0 feet									
752												
	10											
750												
	12											
748												

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

Left Photo: Photo of Approximate Boring Location
Right Photo: Photo of Boring

BORING LOG

Consulting Services Incorporated
858 Contract Street
Lexington, Kentucky 40505
Phone: 859.309.6021
Fax: 888.792.3121

BORING: **B-102**

Project Number: LX220202
Name: DMA Springfield Cold Storage Building
Client: Finance and Administration Cabinet
Location: Springfeild, Kentucky
Logged By: C. Gibbs

Weather: Sunny, 40's
*Elevation (ft): 764.0
Date Started: 11/21/22
Date Completed: 11/21/22
Checked By: B. Bishop, PE

Contractor: CSI
Drill Rig: B-57
Method: SFA
Hole Size (in): 4

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
			TOPSOIL - 1 inch									
760			FILL - sampled as VERY STIFF to HARD, brown clay, with rock fragments, damp	4-7-15 (22)	13							Dry upon completion of soil augering
758	2			15-13-17 (30)	15	9.6						
756	4			12-19-22 (41)	15	10.2						
754	6 8			9-16-31 (47)	17	12.5						
752 750 748	10 12		Auger Refusal at 8.2 feet Begin Coring at 8.2 feet LIMESTONE - MEDIUM to HARD, light to medium, gray, medium grained, with interbedded shale, with vugs		46							REC (%) - 77 RQD (%) - 8 No core water loss observed
			Coring Terminated at 13.2 feet									

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

Left Photo: Photo of Approximate Boring Location
Right Photo: Photo of Boring

BORING LOG

Consulting Services Incorporated
858 Contract Street
Lexington, Kentucky 40505
Phone: 859.309.6021
Fax: 888.792.3121

BORING: B-103

Project Number: LX220202	Weather: Sunny, 40's	Contractor: CSI
Name: DMA Springfield Cold Storage Building	*Elevation (ft): 761.4	Drill Rig: B-57
Client: Finance and Administration Cabinet	Date Started: 11/21/22	Method: SFA
Location: Springfeild, Kentucky	Date Completed: 11/21/22	Hole Size (in): 4
Logged By: C. Gibbs	Checked By: B. Bishop, PE	

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
			GRAVEL - 3 inches									
764			POSSIBLE FILL - sampled as STIFF to FIRM, orangish brown clay, with black oxide nodules, with trace roots, moist to wet	8-8-4 (12)	15							Dry upon completion of soil augering
762	2			3-5-5 (10)	18	29.8						
760	4			3-4-4 (8)	18	33.6						
758	6			3-3-4 (7)	16	30.9						
756	8		Auger Refusal at 8.5 feet									
754	10											
752	12											

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

Left Photo: Photo of Approximate Boring Location
Right Photo: Photo of Boring

BORING LOG

BORING: B-103A

Consulting Services Incorporated
858 Contract Street
Lexington, Kentucky 40505
Phone: 859.309.6021
Fax: 888.792.3121

Project Number: LX220202
Name: DMA Springfield Cold Storage Building
Client: Finance and Administration Cabinet
Location: Springfeild, Kentucky
Logged By: C. Gibbs

Weather: Sunny, 40's
*Elevation (ft): 761.4
Date Started: 11/21/22
Date Completed: 11/21/22
Checked By: B. Bishop, PE

Contractor: CSI
Drill Rig: B-57
Method: SFA
Hole Size (in): 4

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
764			Offset from boring B-103 to obtain relatively undisturbed sample									Dry upon completion of soil augering
762	2		FAT CLAY (CH) - orangish-brown, with black oxide nodules, wet		13	30.1	62	29	33	86		
760	4		Boring Terminated at 4.0 feet									
758	6											
756	8											
754	10											
752	12											

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

Left Photo: Photo of Approximate Boring Location
Right Photo: Photo of Boring

FIELD TESTING PROCEDURES

Field Operations: The general field procedures employed by CSI are summarized in ASTM D 420 which is entitled "Investigating and Sampling Soils and Rocks for Engineering Purposes." This recommended practice lists recognized methods for determining soil and rock distribution and ground water conditions. These methods include geophysical and in situ methods as well as borings.

Borings are drilled to obtain subsurface samples using one of several alternate techniques depending upon the subsurface conditions. These techniques are:

a. Continuous 2-1/2 or 3-1/4 inch I.D. hollow stem augers;

b. Wash borings using roller cone or drag bits (mud or water);

c. Continuous flight augers (ASTM D 1425).

These drilling methods are not capable of penetrating through material designated as "refusal materials." Refusal, thus indicated, may result from hard cemented soil, soft weathered rock, coarse gravel or boulders, thin rock seams, or the upper surface of sound continuous rock. Core drilling procedures are required to determine the character and continuity of refusal materials.

The subsurface conditions encountered during drilling are reported on a field test boring record by the chief driller. The record contains information concerning the boring method, samples attempted and recovered, indications of the presence of various materials such as coarse gravel, cobbles, etc., and observations between samples. Therefore, these boring records contain both factual and interpretive information. The field boring records are on file in our office.

The soil and rock samples plus the field boring records are reviewed by a geotechnical engineer. The engineer classifies the soils in general accordance with the procedures outlined in ASTM D 2488 and prepares the final boring records, which are the basis for all evaluations and recommendations.

The final boring records represent our interpretation of the contents of the field records based on the results of the engineering examinations and tests of the field samples. These records depict subsurface conditions at the specific locations and at the particular time when drilled. Soil conditions at other locations may differ from conditions occurring at these boring locations. Also, the passage of time may result in a change in the subsurface soil and ground water conditions at these boring locations. The lines designating the interface between soil or refusal materials on the records and on profiles represent approximate boundaries. The transition between materials may be gradual. The final boring records are included with this report.

The detailed data collection methods using during this study are discussed on the following pages.

Soil Test Borings: Soil test borings were made at the site at locations shown on the attached Boring Plan. Soil sampling and penetration testing were performed in accordance with ASTM D 1586.

The borings were made by mechanically twisting a hollow stem steel auger into the soil. At regular intervals, the drilling tools were removed and soil samples obtained with a standard 1.4 inch I.D., 2 inch O.D., split tube sampler. The sampler was first seated 6 inches to penetrate any loose cuttings, then driven an additional foot with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot was recorded and is designated the "penetration resistance". The penetration resistance, when properly evaluated, is an index to the soil strength and foundation supporting capability.

Representative portions of the soil samples, thus obtained, were placed in glass jars and transported to the laboratory. In the laboratory, the samples were examined to verify the driller's field classifications. Test Boring Records are attached which graphically show the soil descriptions and penetration resistances.

Core Drilling: Refusal materials are materials that cannot be penetrated with the soil drilling methods employed. Refusal, thus indicated, may result from hard cemented soil, soft weathered rock, coarse gravel or boulders, thin rock seams or the upper surface of sound continuous rock. Core drilling procedures are required to determine the character and continuity of refusal materials.

Prior to coring, casing is set in the drilled hole through the overburden soils, if necessary, to keep the hole from caving. Refusal materials are then cored according to ASTM D 2113 using a diamond-studded bit fastened to the end of a hollow double tube core barrel. This device is rotated at high speeds, and the cuttings are brought to the surface by circulating water. Core samples of the material penetrated are protected and retained in the swivel-mounted inner tube. Upon completion of each drill run, the core barrel is brought to the surface, the core recovered is measured, the samples are removed and the core is placed in boxes for storage.

The core samples are returned to our laboratory where the refusal material is identified and the percent core recovery and rock quality designation is determined by a soils engineer or geologist. The percent core recovery is the ratio of the sample length obtained to the depth drilled, expressed as a percent. The rock quality designation (RQD) is obtained by summing up the length of core recovered, including only the pieces of core which are four inches or longer, and dividing by the total length drilled. The percent core recovery and RQD are related to soundness and continuity of the refusal material. Refusal material descriptions, recoveries, and RQDs are shown on the "Test Boring Records".

Hand Auger Borings and Dynamic Cone Penetration Testing: Hand auger borings are performed manually by CSI field personnel. This consists of manually twisting hand auger tools into the subsurface and extracting “grab” or baggie samples at intervals determined by the project engineer. At the sample intervals, dynamic cone penetration (DCP) testing is performed. This testing involves the manual raising and dropping of a 20-pound hammer, 18 inches. This “driver” head drives a solid-13⁄4 inch diameter cone into the ground. DCP “counts” are the number of drops it takes for the hammer to drive three 13⁄4 inch increments, recorded as X-Y-Z values.

Test Pits: Test pits are excavated by the equipment available, often a backhoe or trackhoe. The dimensions of the test pits are based on the equipment used and the power capacity of the equipment. Samples are taken from the spoils of typical buckets of the excavator and sealed in jars or “Ziploc” baggies. Dynamic Cone Penetration or hand probe testing is often performed in the upper few feet as OSHA standards allow. Refusal is deemed as the lack of advancement of the equipment with reasonable to full machine effort.

Water Level Readings: Water table readings are normally taken in conjunction with borings and are recorded on the "Test Boring Records". These readings indicate the approximate location of the hydrostatic water table at the time of our field investigation. Where impervious soils are encountered (clayey soils) the amount of water seepage into the boring is small, and it is generally not possible to establish the location of the hydrostatic water table through water level readings. The ground water table may also be dependent upon the amount of precipitation at the site during a particular period of time. Fluctuations in the water table should be expected with variations in precipitation, surface run-off, evaporation and other factors.

The time of boring water level reported on the boring records is determined by field crews as the drilling tools are advanced. The time of boring water level is detected by changes in the drilling rate, soil samples obtained, etc. Additional water table readings are generally obtained at least 24 hours after the borings are completed. The time lag of at least 24 hours is used to permit stabilization of the ground water table, which has been disrupted by the drilling operations. The readings are taken by dropping a weighted line down the boring or using an electrical probe to detect the water level surface.

Occasionally the borings will cave-in, preventing water level readings from being obtained or trapping drilling water above the caved-in zone. The cave-in depth is also measured and recorded on the boring records.

LABORATORY TESTING PROCEDURES

Soil Classification: Soil classifications provide a general guide to the engineering properties of various soil types and enable the engineer to apply past experience to current problems. In our investigations, samples obtained during drilling operations are examined in our laboratory and visually classified by an engineer. The soils are classified according to consistency (based on number of blows from standard penetration tests), color and texture. These classification descriptions are included on our "Test Boring Records."

The classification system discussed above is primarily qualitative and for detailed soil classification two laboratory tests are necessary: grain size tests and plasticity tests. Using these test results the soil can be classified according to the AASHTO or Unified Classification Systems (ASTM D 2487). Each of these classification systems and the in-place physical soil properties provides an index for estimating the soil's behavior. The soil classification and physical properties obtained are presented in this report.

Rock Classification: Rock classifications provide a general guide to the engineering properties of various rock types and enable the engineer to apply past experience to current situations. In our explorations, rock core samples obtained during drilling operations are examined in our laboratory and visually classified by an engineer. The rock cores are classified according to relative hardness and RQD (see Guide to Rock Classification Terminology), color, and texture. These classification descriptions are included on our Test Boring Records.

Atterberg Limits: Portions of the samples are taken for Atterberg Limits testing to determine the plasticity characteristics of the soil. The plasticity index (PI) is the range of moisture content over which the soil deforms as a plastic material. It is bracketed by the liquid limit (LL) and the plastic limit (PL). The liquid limit is the moisture content at which the soil becomes sufficiently "wet" to flow as a heavy viscous fluid. The plastic limit is the lowest moisture content at which the soil is sufficiently plastic to be manually rolled into tiny threads. The liquid limit and plastic limit are determined in accordance with ASTM D 4318.

Moisture Content: The Moisture Content is determined according to ASTM D 2216.

Percent Finer Than 200 Sieve: Selected samples of soils are washed through a number 200 sieve to determine the percentage of material less than 0.074 mm in diameter.

Rock Strength Tests: To obtain strength data for rock materials encountered, unconfined compression tests are performed on selected samples. In the unconfined compression test, a cylindrical portion of the rock core is subjected to increasing axial load until it fails. The pressure required to produce failure is recorded, corrected for the length to diameter ratio of the core and reported.

Compaction Tests: Compaction tests are run on representative soil samples to determine the dry density obtained by a uniform compactive effort at varying moisture contents. The results of the test are used to determine the moisture content and unit weight desired in the field for similar soils. Proper field compaction is necessary to decrease future settlements, increase the shear strength of the soil and decrease the permeability of the soil.

The two most commonly used compaction tests are the Standard Proctor test and the Modified Proctor test. They are performed in accordance with ASTM D 698 and D 1557, respectively. Generally, the Standard Proctor compaction test is run on samples from building or parking areas where small compaction equipment is anticipated. The Modified compaction test is generally performed for heavy structures, highways, and other areas where large compaction equipment is expected. In both tests a representative soil sample is placed in a mold and compacted with a compaction hammer. Both tests have three alternate methods.

Summary of Laboratory Results

Sheet 1 of 1

Borehole	Depth	Sample Type	Liquid Limit	Plastic Limit	Plasticity Index	Class-ification	Water Content (%)	Unconfined Compressive Strength (ksf)	Dry Density (pcf)	Wet Density (pcf)	Max. Dry Density (pcf)	Opt. Water Content (%)	CBR	Swell (%)	RQD	Percent Recovery	k (cm/sec)	% Finer #200
B-101	4.0	SS					13.9											
B-101	6.5	SS					13.9											
B-102	1.5	SS					9.6											
B-102	4.0	SS					10.2											
B-102	6.5	SS					12.5											
B-103	1.5	SS					29.8											
B-103	4.0	SS					33.6											
B-103	6.5	SS					30.9											
B-103A	2.0	UD	62	29	33		30.1											85.9

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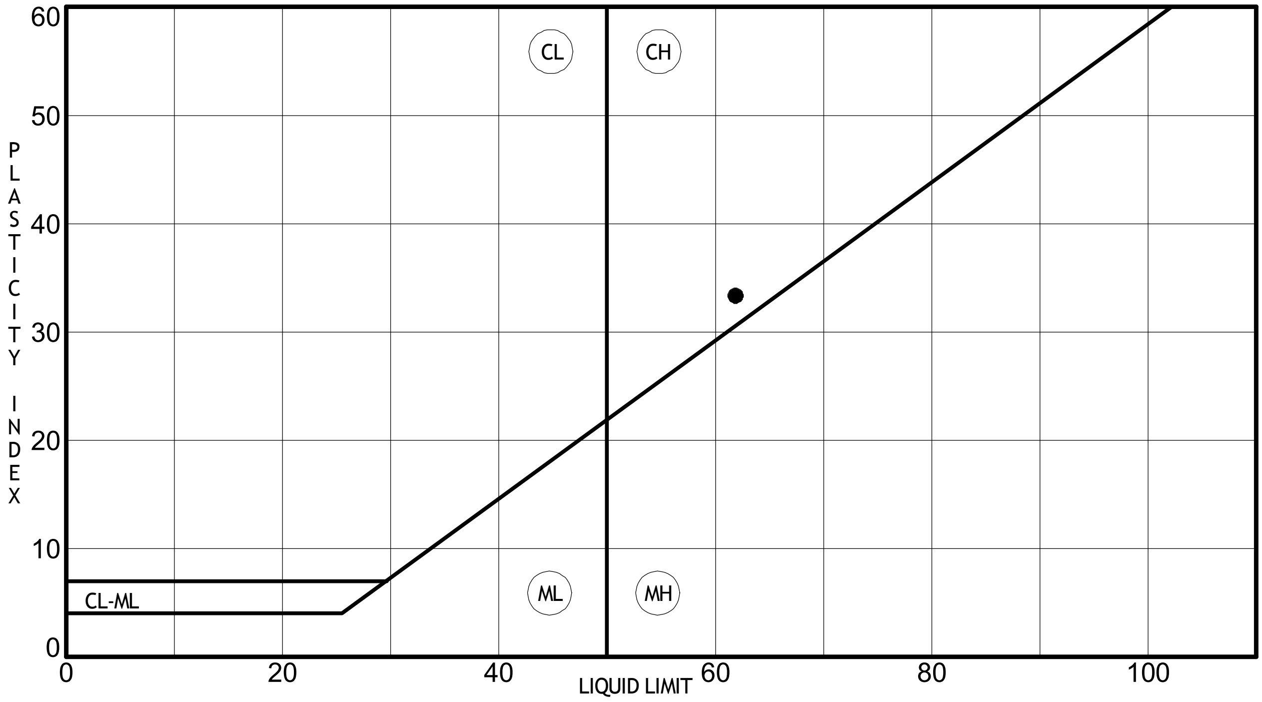
SS - Split Spoon Sample
GRAB - Bulk Grab Sample
k - Coefficient of Permeability
- See Attached test Results

PROJECT INFORMATION

Client: Finance and Administration Cabinet
Project Name: DMA Springfield Cold Storage Building
Project Number: LX220202
Project Location: Springfeild, Kentucky

Liquid and Plastic Limits Test Report



	Boring	Depth (ft)	LL	PL	PI	Water Content	% < #40	% < #200	USCS	Description
●	B-103A	2.0	62	29	33	30.1		85.9	CH	brown FAT CLAY

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PROJECT INFORMATION

Client: Finance and Administration Cabinet
Project Name: DMA Springfield Cold Storage Building
Project Number: LX220202
Project Location: Springfeild, Kentucky

Test	Method	Hammer Wt./ Fall	Mold Diam.	Run on Material Finer Than	No. of Layers	No. of Blows/ Layer
Standard D 698	A	5.5 lb./12”	4”	No. 4 sieve	3	25
	B	5.5 lb./12”	4”	3/8” sieve	3	25
	C	5.5 lb./12”	6”	3/4” sieve	3	56

Test	Method	Hammer Wt./ Fall	Mold Diam.	Run on Material Finer Than	No. of Layers	No. of Blows/ Layer
Modified D 15557	A	10 lb./18”	4”	No. 4 sieve	5	25
	B	10 lb./18”	4”	3/8” sieve	5	25
	C	10 lb./18”	6”	3/4” sieve	5	56

The moisture content and unit weight of each compacted sample is determined. Usually 4 to 5 such tests are run at different moisture contents. Test results are presented in the form of a dry unit weight versus moisture content curve. The compaction method used and any deviations from the recommended procedures are noted in this report.

<u>Laboratory California Bearing Ratio Tests:</u> The California Bearing Ratio, generally abbreviated to CBR, is a punching shear test and is a comparative measure of the shearing resistance of a soil. It provides data that is a semi-empirical index of the strength and deflection characteristics of a soil. The CBR is used with empirical curves to design pavement structures.

A laboratory CBR test is performed according to ASTM D 1883. The results of the compaction tests are utilized in compacting the test sample to the desired density and moisture content for the laboratory California Bearing Ratio test. A representative sample is compacted to a specified density at a specified moisture content. The test is performed on a 6-inch diameter, 4.58-inch-thick disc of compacted soil that is confined in a cylindrical steel mold. The sample is compacted in accordance with Method C of ASTM D 698 or D 1557.

CBR tests may be run on the compacted samples in either soaked or unsoaked conditions. During testing, a piston approximately 2 inches in diameter is forced into the soil sample at the rate of 0.05 inch per minute to a depth of 0.5 inch to determine the resistance to penetration. The CBR is the percentage of the load it takes to penetrate the soil to a 0.1 inch depth compared to the load it takes to penetrate a standard crushed stone to the same depth. Test results are typically shown graphically.

<u>Consolidation Tests:</u> Consolidation tests are conducted on representative soil samples to determine the change in height of the sample with increasing load. The results of these tests are used to estimate the settlement and time rate of settlement of structures constructed on similar soils. A consolidation test is performed according to ASTM D2435 on a single section of an undisturbed sample extruded from a sample tube. The sample is trimmed into a disc 2.5 inches in diameter and 0.75 inch thick. The disc is confined in a stainless steel ring and sandwiched between porous plates. It is then subjected to incrementally increasing vertical loads, and the resulting deformations are measured with a micrometer dial gauge. Void ratio are then calculated from these deformation readings. The test results are typically provided in tabular form or in the form of plots of void ratio versus applied stress (e-log p curves).

Organic Content: The Organic Content is determined according to ASTM D2974. The moisture content is first determined by drying portions of the sample at 105 degrees Celsius. The ash content is then determined by igniting the oven-dried sample from the moisture content determination in a muffle furnace at 440 degrees Celsius. The substance remaining after ignition is the ash. The organic content is expressed as a percentage by subtracting the percent ash from one hundred.

Direct Shear Tests: Direct shear tests are performed according to ASTM D3080 to determine the shear strength parameters of the soil. The specimen of soil is placed in a rigid box that is divided horizontally into two frames. The specimen is then confined under a vertical or normal stress and horizontal force is applied to fail the specimen along a horizontal plane at its mid-height.

Because drainage of the soil specimen cannot be easily controlled, undrained tests (i.e., UU and CU tests) are possible only on impervious soils and pore pressure measurements cannot be made. Drained tests (i.e., CD tests), however, are possible on all soil types. Since the drainage paths through the specimen are short and pore water pressures are dissipated fairly rapidly, the direct shear test is well suited to the CD test.

A minimum of three test specimens are required to establish the strength envelope of a soil. The soil parameters obtained are the cohesion and angle of internal friction.

Unconfined Compression Tests: The unconfined compression test is an unconsolidated-undrained triaxial shear test with no lateral confining pressure. This test is used to determine the shear strength of clayey soils. An unconfined compression test is performed according to ASTM D2166 on a single section of an undisturbed sample extruded from a sampling tube. The sample is trimmed to a length-to-diameter ratio of about 2 and placed in the testing device. Incrementally increasing vertical loads are applied until the sample fails. Test results are provided in the form of a stress-strain curve or a value representing the unconfined compressive strength of the sample.

Grain Size Tests: Grain Size Tests are performed to determine the soil classification and the grain size distribution. The soil samples are prepared for testing according to ASTM D421 (dry preparation) or ASTM D2217 (wet preparation). The grain size distribution of soils coarser than a number 200 sieve (0.074 mm opening) is determined by passing the samples through a standard set of nested sieves. Materials passing the number 200 sieve are suspended in water and the grain size distribution calculated from the measured settlement rate. These tests are conducted in accordance with ASTM D422.

Triaxial Shear Tests: Triaxial shear tests are used to determine the strength characteristics and friction angle of a given soil sample. Triaxial tests are also used to determine the elastic properties of the soil specimen. Triaxial shear tests are performed on several sections of a relatively undisturbed sample extruded from the sampling tube. The samples are trimmed into cylinders 1.4 to 2.8 inches in diameter and encased in rubber membranes. Each is then placed in a compression chamber and confined by all around water pressure. Samples are then subjected to additional axial and/or lateral loads, depending on the soil and the field conditions to be simulated. The test results are typically presented in tabular form or in the form of stress-strain curves and Mohr envelopes or p-q plots.

Three types of triaxial tests are normally performed. The most suitable type of triaxial test is determined by the loading conditions imposed on the soil in the field and the soil characteristics.

1. Consolidated-Undrained (designated as a CU or R Test).

2. Consolidated-Drained (designated as a CD or S Test).

3. Unconsolidated-Undrained (designated as a UU or Q Test).

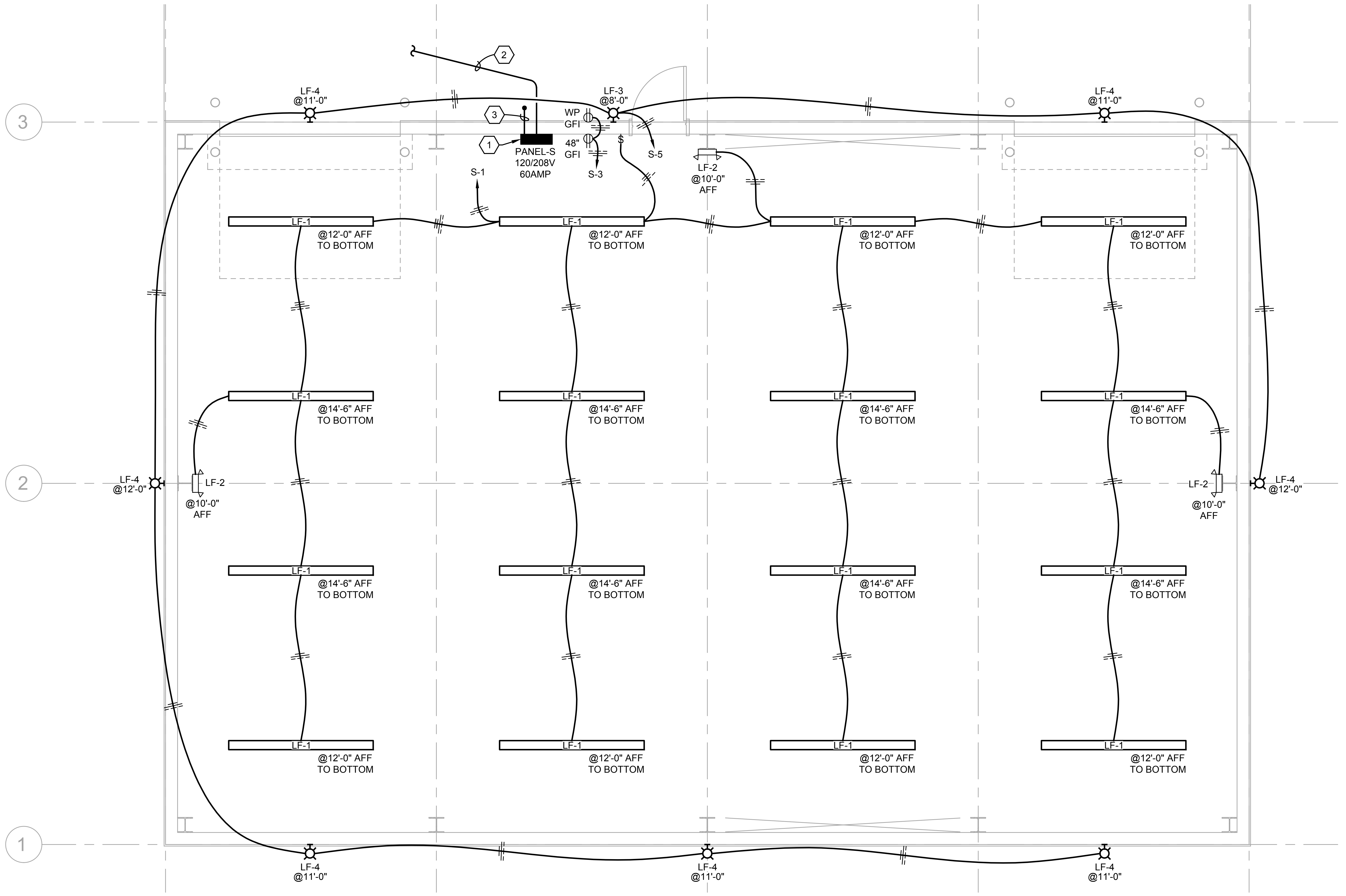
PANEL SCHEDULE: S
LOCATION: Storage Building
ENCLOSURE: PRL
MOUNTING: Surface
VOLTAGE: 120/208V; 3P,4W
MAINS AMPACITY: 100Amp
MAIN C.B. SIZE: 60AMP
TOTAL SPACES: 18

DESCRIPTION	VA	#P	BKR	FEEDER	NO	-A- VA	-B- VA	-C- VA	NO.	FEEDER	BKR	#P	VA	DESCRIPTION
Interior Lighting	1344	1	20A	2#12,1#12G.,3/4"C	1	1344	---------	---------	2		20A	1		Spare
Receptacles	360	1	20A	2#12,1#12G.,3/4"C	3	---------	360	---------	4		20A	1		Spare
Exterior Lighting	436	1	20A	2#12,1#12G.,3/4"C	5	---------	---------	436	6		20A	1		Spare
Spare		1	20A		7	0	---------	---------	8		20A	1		Spare
					9	---------	0	---------	10					
					11	---------	---------	0	12					
					13	0	---------	---------	14					
					15	---------	0	---------	16					
					17	---------	---------	0	18					
TOTAL VOLT-AMPERES PER PHASE						1344	360	436						
TOTAL AMPERES PER PHASE						11.2	3	3.6						

PANEL SHALL BE U.L. LISTED AS SERVICE ENTRANCE EQUIPMENT.

SHEET NOTES:

1. PROVIDE NEW PANELBOARD, REFER TO PANEL SCHEDULE THIS SHEET.
2. PROVIDE 4#4, 1#6 GND., 1 1/4" CONDUIT, REFER TO SHEET EU101 FOR CONTINUATION OF UNDERGROUND FEEDER.
3. PROVIDE 1#4, 3/4" CONDUIT FROM PANEL GROUND. PROVIDE GROUND ELECTRODE SYSTEM PER N.E.C.



ELECTRICAL FLOOR PLAN

SCALE: 1/4" = 1'-0"

0 2' 4' 8'

LIGHT FIXTURE SCHEDULE

TAG	MANUFACTURER AND MODEL	LAMPS	DESCRIPTION	VOLTAGE
LF-1	LITHONIA CSS-L96-ALO4-MVOLT-SWW3-ZACVH M100 H.E. WILLIAMS COOPER	LED UP TO 10,000 LUMENS	4'-0" LINEAR LUMINAIRE WITH STEEL CHANNEL AND COVER, HIGH-GLOSS WHITE POLYESTER PAINT, INJECTION MOLDED LENS AND ENDCAPS, WIDE DIFFUSE LENS, DIRECT CONTACT SURFACE MOUNTING FOR CEILINGS, MULTI-VOLT 0-10 DIMMING DRIVER WITH 10% DIMMING, LESS THAN 20% THD, 80 CRI , PAINT AFTER FABRICATION, 5 YEAR WARRANTY. UL LISTED. **LUMINAIRE SHALL BE SET TO 6,000 LUMENS (LOW) AND 4000K COLOR TEMPERATURE.**	MULTI-VOLT 120/277
LF-2	LITHONIA ELM6L UVOLT LTP SDRT H.E. WILLIAMS COOPER	LED 1,100 LUMENS	DUAL HEAD LED EMERGENCY FIXTURE WITH WHITE LOW PROFILE HOUSING, TWO ADJUSTABLE SPOT LED LAMP HEADS, 10 YEAR LED LIFE, DUAL VOLTAGE, LITHIUM IRON PHOSPHATE BATTERY, 90 MINUTE BACKUP, UL LISTED FOR CEILING AND WALL MOUNTING STANDARD, AND COMPLIANT WITH THE NFPA 101 LIFE SAFETY CODE.	MULTI-VOLT 120/277
LF-3	LITHONIA WDGE2LED-P2SW-40K-80CRI-VF-MVOLT-PIR1FC3V-XX H.E. WILLIAMS COOPER	LED 2,000 LUMENS TYPE VF DIST.	7" X 1.5" X 9" X 11.5" WEDGE SHAPE LED LUMINAIRE WITH SINGLE PIECE ALUMINUM HOUSING, ACRYLIC LENS WITH VISUAL COMFORT WIDE THROW, THERMOSET POWDER COAT FINISH, UNIVERSAL MOUNTING PLATE, LONG LIFE LEDS, HIGH EFFICIENCY DRIVER, 5 YEAR WARRANTY. UL LISTED. COLOR FROM STANDARD LISTING ON CUT SHEET SELECTED AT SHOP DRAWING PHASE OF PROJECT. **PROVIDE BI-LEVEL MOTION / AMBIENT SENSOR FOR 8'-15' MOUNTING HEIGHT, SENSOR SHALL BE ENABLED AT 1 FC, DIMMED STATE SHALL BE 30% OUTPUT AFTER 15 MINUTES.**	MULTI-VOLT 120/277
LF-4	LITHONIA WDGE3LED-P2-40K-80CRI-R4-MVOLT-PIR1FC3V-XX H.E. WILLIAMS COOPER	LED 8,700 LUMENS TYPE R4 DIST.	8" X 1.5" X 9" X 18" WEDGE SHAPE LED LUMINAIRE WITH SINGLE PIECE ALUMINUM HOUSING, ACRYLIC LENS WITH VISUAL COMFORT WIDE THROW, THERMOSET POWDER COAT FINISH, UNIVERSAL MOUNTING PLATE, LONG LIFE LEDS, HIGH EFFICIENCY DRIVER, 5 YEAR WARRANTY. UL LISTED. COLOR FROM STANDARD LISTING ON CUT SHEET SELECTED AT SHOP DRAWING PHASE OF PROJECT. **PROVIDE BI-LEVEL MOTION / AMBIENT SENSOR FOR 8'-15' MOUNTING HEIGHT, SENSOR SHALL BE ENABLED AT 1 FC, DIMMED STATE SHALL BE 30% OUTPUT AFTER 15 MINUTES.**	MULTI-VOLT 120/277

JOHN A. NEWMAN
16925

DRAWING INFORMATION	
A & E FILE NO.	2258
DRAWING DATE	03/22/2023
DRAWN BY	STAFF
CHECKED BY	JAN
PHASE	RTA
RTA DATE	03/24/2023

DMA SPRINGFIELD RC NON-HEATED STORAGE FACILITY

ELECTRICAL FLOOR PLAN

ACCOUNT NO.
095-CAR7-SP07-00

COMMONWEALTH OF KENTUCKY
FINANCE AND ADMINISTRATION CABINET
DEPARTMENT FOR FACILITIES AND SUPPORT SERVICES
DIVISION OF ENGINEERING AND CONTRACT ADMINISTRATION
FRANKFORT, KENTUCKY

DRAWING NO.
E101

N3D
NEWMAN • NIEMAN • DAUKAS
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AS BUILT DATE

DECA LOG #

REVISION HISTORY OF THIS DRAWING

	DESCRIPTION OF REVISIONS	DATE		DESCRIPTION OF REVISIONS	DATE
1			5		
2			6		
3			7		
4			8		

Mar 21, 2023 - 4:08pm By: David