ADDENDUM # 003

DATE ISSUED: *12/8/2023*

PROJECT INFORMATION

Project Name: *P22-HRBR-01 (EDA Madison Harbor Terminal Improvements)*

Bid Due Date: *1/3/2024@ 10am (Local Time)*

ADDENDUM INFORMATION

This Addendum addresses the following changes/additions/deletions for the above referenced project:

ITEM	DESCRIPTION
1.	Can you advise as to who the existing switchboard manufacture is on the attached one-line requiring multiple retrofit breakers per keyed note #2? The current switchboard manufacturer is square D QED-2 style switchboard. (refer to pages 2 and 3)
2.	In addition to the bore logs, can you please confirm this is the most recent Geotech report? Yes, most recent report is attached in addendum #3.
3.	The RFP references a Soils Report available upon request, could you please distribute this? Yes, Report is attached below in addendum #3.

A signed copy of this Addendum is to be included with the Bid Proposal indicating that Bidder has read and understood the modifications made to the Bidding Documents. Bidder shall also indicate this Addendum within Article 3.01.A of the 00410 - Bid Form.

BIDDER CERTIFICATION STATEMENT

I hereby attest that I have read and understood the changes listed in this Addendum for the above referenced Project and have submitted a Bid Proposal that reflects these changes.

Signature: ______________________ Date: ______________

Printed Name: ______________________

Title: ______________________

REQUEST FOR INFORMATION

Madison Harbor Grain

Date: 11-21-2023
RFI Number: 001 **REV Number:** 00
Cross Reference RFI Number:

From: Luke Kreamalmeyer	**To:** Jim Korthals
Company: ACP	**Company:** KOA
Phone:	**Phone:** 218-310-6679
Email: Lkreamalmeyer@americascentralport.com	**Email:** jim.korthals@krechojard.com
Subject: Electrical Bidding Question	**Location:**
References: E601	

Request:

Can you advise as to who the existing switchboard manufacture is on the attached one-line requiring multiple retrofit breakers per keyed note#2.

Originated by:	**Reviewed by:**

Response:

The Current Switchboard manufacturer is Square D QED-2 style switchboard

Response by: AW	**Date:** 11-29-23

Distribution:	☐ **Architect**	☐ **Electrical**	☐ **Owner**
	☐ **Structural**	☑ **Mechanical**	☐ **Other:**

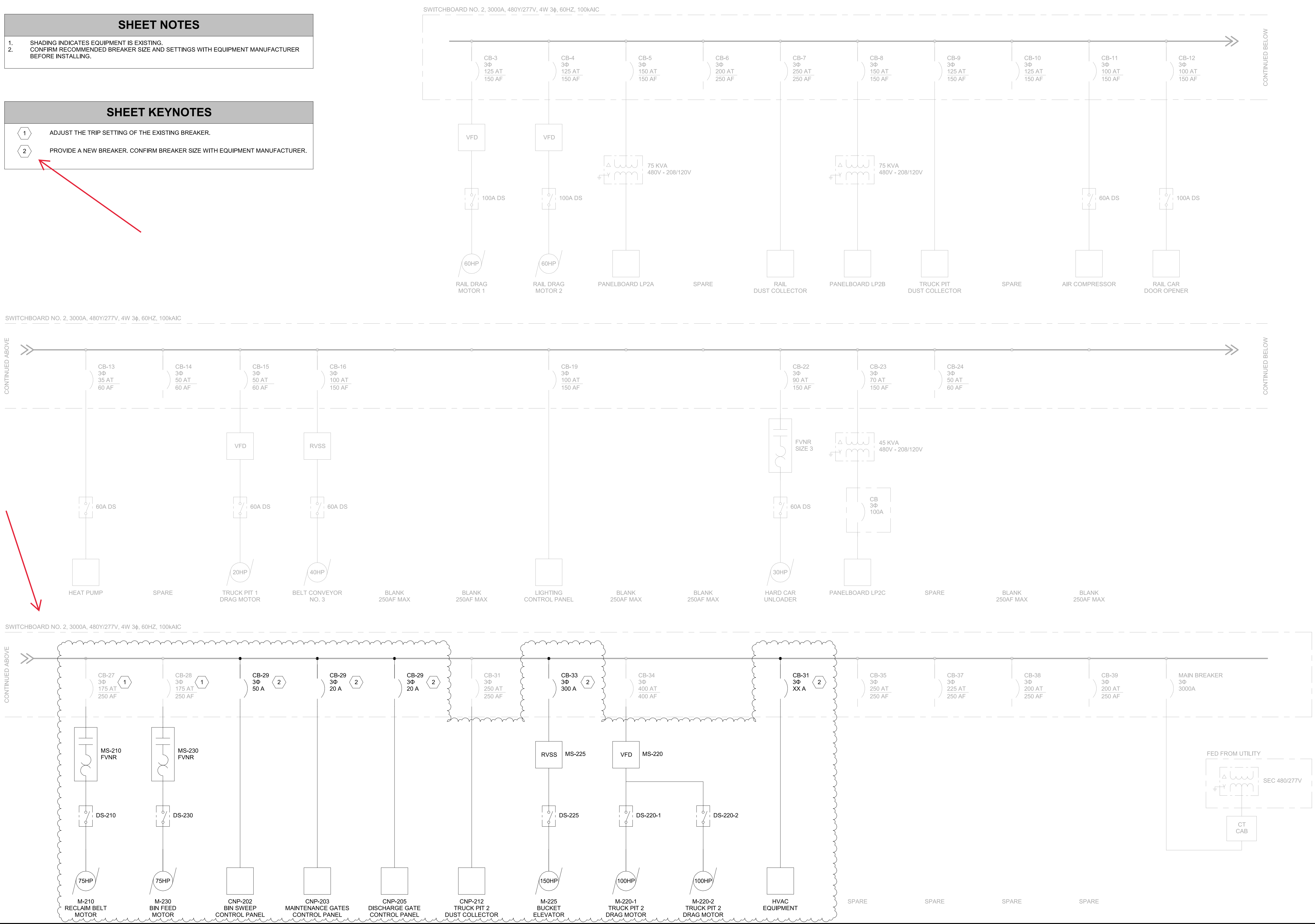
If the response provided with this RFI by the Owner or Owners Representative does not indicate that a Change Order request will be issued and the Contractor or Supplier has determined that the response constitutes a change to the requirements of the Contract Documents, the Contractor or Supplier must provide notice in accordance with the Contract requirements specifying the nature of the RFI changes. Failure to provide the required notice following the receipt of this RFI will result in rejection of the Contractor or Suppliers request to adjust for changes to the schedule or incurred costs resulting from this RFI.

SHEET NOTES

1. SHADING INDICATES EQUIPMENT IS EXISTING.
2. CONFIRM RECOMMENDED BREAKER SIZE AND SETTINGS WITH EQUIPMENT MANUFACTURER BEFORE INSTALLING.

SHEET KEYNOTES

1. ADJUST THE TRIP SETTING OF THE EXISTING BREAKER.
2. PROVIDE A NEW BREAKER. CONFIRM BREAKER SIZE WITH EQUIPMENT MANUFACTURER.



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LICENSED PROFESSIONAL ENGINEER
AUSTIN J. WALZ
062-074083
OF ILLINOIS

8-4-23

License Expires: 11/30/23

DATE:	REV:	DESCRIPTION:	DWN BY:	CKD BY:
08/04/23		ISSUED FOR CONSTRUCTION	SDP	AJW

AMERICA'S CENTRAL PORT
MADISON HARBOR TERMINAL
GRAIN HANDLING EXPANSION
MADISON, IL

ELECTRICAL ONE-LINE
SWITCHBOARD NO. 2

REV:
JOB No: 221087
SHEET:
E601

QUALITY TESTING
AND ENGINEERING, INC.

GEOTECHNICAL

ENVIRONMENTAL

CONSTRUCTION MATERIAL TESTING

CULTURAL RESOURCES

NATURAL RESOURCES

Subsurface Exploration and Geotechnical Recommendations

SOUTH HARBOR CONVEYOR
GRANITE CITY, ILLINOIS

August 2013

KORTE AND LUITJOHAN CONTRACTORS, INC.
General Contractor

THOUVENOT, WADE AND MOERCHEN, INC.
Civil Engineer/Structural Engineer

Project No. 13-0342-G

AASHTO R18
AASHTO Accredited

CORPORATE OFFICE: 803 WEST STATE STREET, O'FALLON, IL 62269 PHONE: 618-632-9900 FAX: 618-632-9922
REGIONAL OFFICE: 206 SOUTH LINN AVENUE, WENTZVILLE, MO 63385 PHONE: 636-332-1153 FAX: 636-332-5781
WWW.QTEINC.COM

QUALITY TESTING
AND ENGINEERING, INC.

August 19, 2013

Mr. John Whitworth
Korte and Luitjohan Contractors, Inc.
12052 Highland Road
Highland, Illinois 62249

RE: Geotechnical Exploration
South Harbor Conveyor
Granite City, Illinois
QTE No. 13-0342-G

Dear Mr. Whitworth:

Enclosed is our report titled *Subsurface Exploration and Geotechnical Recommendations – SOUTH HARBOR CONVEYOR – GRANITE CITY, ILLINOIS,* dated August 2013. The report provided herein should be read in its entirety for a full understanding of the report highlights provided below and other project recommendations. Highlights from the report include:

- Existing fill materials were encountered at two of the boring locations to a depth of approximately 3 feet below the ground surface. The results of the testing on the fill materials indicate they are relatively uniform in composition, cohesionless (and therefore not prone to shrinking and swelling), loose in density, and do not appear to contain deleterious materials. These soils, upon approval by QTE during construction, may be used to support new construction.

- Groundwater was encountered in all seven of the borings at depths of approximately 6 to 12 feet below the ground surface at the time of drilling. Problems with groundwater are not anticipated for the rail scale, truck scale, and new pavements. Constructing sump pits and pumping the groundwater may be required to control seepage into the rail pit both during construction and after the structure is put into service. Depending on the groundwater level at the time that the conveyor tower is constructed, it may also be necessary to pump groundwater in this area.

- Shallow foundations bearing on natural low plasticity soils or sands, approved existing fill, or new properly compacted structural fill or backfill placed as recommended herein will be appropriate for support of the proposed structures. For the loadout building, continuous wall footings and isolated column footings should be proportioned for a net allowable bearing pressure of 2,400 pounds per square foot (psf). For the conveyor tower, the spread footing may be designed for 4,500 psf.

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- ❖ Based on the anticipated structural loads, total post-construction settlement of the conveyor tower foundation should be on the order of ½ inch. Depending on the structural loads and footing sizes at the loadout building, total post-construction settlement of the footings should be on the order of ½ to 1 inch.

- ❖ Based on the expected traffic volumes and subgrade conditions, the recommended minimum rigid concrete pavement section consists of 10.5 inches of concrete and 4 inches of aggregate base course.

We appreciate the opportunity to be of service to you on this project. We should be employed to provide quality control testing for the project as recommended in the report. If you have any questions or comments at this time regarding the report or additional services, please call.

Respectfully submitted,

QUALITY TESTING AND ENGINEERING, INC.

Jennifer L. Delancey

Jennifer L. Delancey, P.E.
Geotechnical Engineer

Michael A. Widman, P.E.
President

JLD/MAW/hm

C: Mr. Paul Homann; Thouvenot, Wade and Moerchen, Inc.
Mr. Bill Stahlman; America's Central Port / Tri-City Regional Port District

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SOUTH HARBOR CONVEYOR
GRANITE CITY, ILLINOIS

1.0 INTRODUCTION

We were authorized by Mr. John Whitworth of Korte and Luitjohan Contractors, Inc. to conduct a subsurface exploration and to provide geotechnical recommendations for a conveyor system and other associated structures in Granite City, Illinois. The purpose of our exploration was to characterize and evaluate the subsurface conditions in order to develop geotechnical recommendations for the project and to prepare a formal report. The general scope of our study as outlined in our proposal dated July 10, 2013, addressed the following:

- Location and general description of natural soils and existing fill materials, if encountered.
- Evaluation of volume change potential of subgrade soils, and recommendations for mitigation of high plasticity soils, if necessary.
- Groundwater levels observed in the borings at the time of drilling, and the potential influence of groundwater on the design and construction of the project.
- Recommendations for foundation design, including feasible foundation types, bearing depths, allowable bearing pressures, and allowable friction values, as applicable.
- Anticipated settlement of shallow foundations, if recommended, based on general soil characteristics and laboratory consolidation tests, if performed.
- Seismic Site Class, mapped spectral accelerations at 0.2 second and 1.0 second (S_s and S_1), and Design Spectral Accelerations at 0.2 second and 1.0 second (S_{DS} and S_{D1}) according to the 2009 International Building Code (IBC).
- Recommendations for floor slab design of the loadout building, including modulus of subgrade reaction.
- Lateral earth pressures for the design of below-grade structures such as the rail pit.
- Site development recommendations and construction considerations.
- Suitability of on-site soils for use as structural fill.

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- Engineering criteria for placement of structural fill.
- Pavement subgrade considerations and designs for heavy duty rigid concrete pavement based on traffic loads and design criteria to be provided by others.
- Suggested construction monitoring program for foundation construction.

1.1 Site Description

The project site is located at the Tri-City Regional Port District in Granite City, Illinois. It is situated east of the Mississippi River, southwest of Bissell Street, and north of Merchant Avenue. A levee with the MCT Confluence Trail along the top traverses the site from northwest to southeast. The site is currently vacant and is vegetated with trees and grasses. The topography on the west side of the levee varies significantly, but the topography on the east side of the levee is relatively level.

1.2 Project Description

The project will consist of constructing several structures for a new grain conveyor system. The structures include a loadout building with a several pits, a rail scale, a truck scale, a conveyor tower, a belt conveyor supported by several isolated footings, and a possible crane pad. A heavy duty rigid concrete roadway is also planned for the project. Because drilling was not able to be performed between the river and the levee due to the high water level of the Mississippi River, recommendations for the structures located on the west side of the levee, including the belt conveyor and crane pad, are not included in this report.

According to the structural engineer, Thouvenot, Wade and Moerchen, Inc. (TWM), the depths of the pits in the loadout building will bear at depths varying from approximately 10 to 18 feet. We anticipate that the footings for the loadout building will bear just below the frost depth (2.5 feet). The foundation for the rail scale will bear at a depth of approximately 4 feet and the foundation for the truck scale will bear at a depth of approximately 2.5 feet. The conveyor tower will be supported on an isolated spread footing that will bear at a depth of approximately 2.5 feet. The maximum vertical load on the tower foundation will be approximately 110 kips. Structural loads have not been provided for the loadout building and pits, but we anticipate that column loads will not exceed 50 kips and wall loads will not exceed 4 kips per lineal foot. The location of the proposed construction is depicted on the Site Plan, Figure 1.

2.0 FIELD EXPLORATION AND LABORATORY TESTING

The field exploration phase of the project consisted of drilling seven test borings, designated B-1 through B-7, to a predetermined depths ranging from 10 to 40 feet. The borings were drilled by Midwest Drilling, Inc. on July 19 and 22, 2013. They were advanced with 4-inch outside diameter continuous flight augers mounted on an ATV drill rig. Mud rotary methods were used while drilling through sands below the groundwater level. Boring locations were established in the field by the project civil engineer, TWM. However, the driller offset B-1, B-2, and B-3 because the staked locations were not accessible to the drill rig. The approximate boring locations are shown on the Site Plan.

Field sampling and testing consisted of performing standard penetration tests (SPTs) with a split-spoon sampler at 2½-foot and 5-foot vertical intervals. The SPT provides approximate soil strength information and a disturbed sample for routine laboratory testing. Materials recovered with the split-spoon sampler were placed in sealed glass jars. Relatively undisturbed materials were recovered at five selected locations by pushing a 3-inch-diameter thin-walled sampling tube (Shelby tube) in lieu of the SPT. A bulk sample of auger cuttings from near-surface soils was collected from Boring B-6.

The samples were transported to our laboratory for classification and testing. We visually classified each cohesive soil sample and measured its moisture content. Approximations of the unconfined compressive strength of the cohesive SPT samples were determined by hand penetrometer. Natural density tests and unconfined compression tests were performed on one of the relatively undisturbed samples recovered in the Shelby tubes. These tests could not be performed on the other Shelby tube samples, which were comprised of primarily sands. A standard Proctor compaction test and a California Bearing Ratio (CBR) test were performed on the bulk sample. Field sampling information, groundwater readings taken by the driller at the time of drilling, and laboratory test results are presented on the Boring Logs, Appendix A. The results of the CBR test are included in Section 5.7.1 of this report and the results of the standard Proctor compaction test are included in Appendix B.

3.0 SUBSURFACE CONDITIONS

The following is a general description of the soils encountered at the seven boring locations. Detailed information regarding the soils encountered is presented on the Boring Logs. A Boring Log Legend is included to clarify the data presented.

3.1 Topsoil

Approximately 2 to 4 inches of topsoil was noted by the driller at all of the boring locations except B-4. Stripping of vegetation and root mass from areas to be developed will remove some of the topsoil layer. The stripped materials should be stockpiled for later placement in landscaped areas or removed from the site. In our opinion, topsoil remaining after stripping may be blended with other soil materials and used as site fill.

3.2 Fill Materials

In Borings B-2 and B-3, fill was encountered to a depth of approximately 3 feet below the ground surface. The fill was generally composed of fine sand. The SPT N-values of the fill materials were each 6 blows per foot (bpf). The moisture contents of the fill were 12 and 14 percent.

The results of the testing on the fill materials indicate they are relatively uniform in composition, cohesionless (and therefore not prone to shrinking and swelling), loose in density, and do not appear to contain deleterious materials. These soils, upon approval by QTE during construction, may be used to support new construction. However, because the fill is loose, we recommend that the subgrade be proofrolled and observed for rutting prior to placing additional fill or beginning construction in these areas.

3.3 Natural Soils

Beneath the topsoil, existing fill, or ground surface, natural soils generally consisted of interlayered sands and silty clays. The majority of the soils were fine or medium sands with varying amounts of clay and occasionally gravel. These soils extended to the boring termination depths. In general, the density of the sands increased with depth.

The silty clay soils exhibited SPT N-values ranging from 4 to 7 bpf, approximate unconfined compressive strengths as measured with a hand penetrometer ranging from 0.5 to 3.0 kips per square foot (ksf), and moisture contents ranging from 13 to 32 percent. The Shelby tube sample in B-3 exhibited a dry density of 93.1 pounds per cubic foot (pcf) and an unconfined compressive strength of 0.7 ksf. The tests indicate these soils are generally medium stiff in consistency.

The sands exhibited N-values ranging from 3 to 31 bpf and moisture contents ranging from 5 to 37 percent. The results indicate the sands vary from very loose to dense and some layers may consolidate under applied loads or liquefy from vibratory earthquake loadings if saturated.

3.4 Volume Change Potential

The majority of the soils encountered in the borings, and likely to be encountered during construction, are cohesionless or low plasticity in nature and possess little potential for volume change with changes in the soil moisture content. No site-wide special precautions related to volume change potential are required during construction where these soils are exposed in footings or as the subgrade material for slabs, pavements, or other surface improvements.

3.5 Groundwater

Groundwater was encountered at depths of approximately 6 to 12 feet below the ground surface in all of the borings at the time of drilling. These levels may be higher if measured after a longer period of time or during wetter periods of the year, particularly in the early spring months, when the Mississippi River is generally at higher levels. Problems with groundwater are not anticipated for the rail scale, truck scale, and new pavements. Constructing sump pits and pumping the groundwater may be required to control seepage into the rail pit both during construction and after the structure is put into service. Depending on the groundwater level at the time that the conveyor tower is constructed, it may also be necessary to pump groundwater in this area.

4.0 GEOTECHNICAL DESIGN CONSIDERATIONS

Newly placed fill and backfill should be of materials approved and monitored during placement by QTE. The following design recommendations assume the site has been prepared in accordance with the recommendations presented in subsequent sections of this report.

4.1 Shallow Foundations

Shallow foundations will be appropriate for support of the proposed structures. Foundations should bear on natural low plasticity soils or sands, approved existing fill, or new properly compacted structural fill or backfill placed in compliance with the recommendations presented herein. For the loadout building, continuous wall footings and isolated column footings should be proportioned for a net allowable bearing pressure of 2,400 pounds per square foot (psf). For the conveyor tower, the spread footing may be designed for 4,500 psf. Continuous wall footings should be at least 22 inches in width, and isolated column footings 30 inches in minimum dimension for bearing capacity considerations.

Exterior footings should be provided with a minimum of 30 inches of cover for frost considerations. Interior footings in heated areas of buildings may be placed at a nominal depth below the floor slabs.

We recommend the foundation walls be reinforced with at least three No. 4 bars, continuous, top and bottom. The foundation wall reinforcement will assist in bridging any soft, disturbed areas or "hard" spots in the footing subgrade. The structural design of the foundation walls may require heavier reinforcement. The final designs by the project architect and/or structural engineer may supersede these general recommendations.

Based on the anticipated structural loads, total post-construction settlement of the conveyor tower foundation should be on the order of ½ inch. This settlement should occur in a relatively uniform manner across the foundation. Depending on the structural loads and footing sizes at the loadout building, total post-construction settlement of the footings should be on the order of ½ to 1 inch. This settlement should occur in a relatively uniform manner across the building footprint. Maximum differential settlement at each structure should be approximately half of the total settlement. Most of the settlement should occur during construction as the structural loads are applied to the subgrade.

4.2 Seismic Considerations

We evaluated the seismic recommendations using the 2009 International Building Code (IBC). Although the Site Class is based on the upper 100 feet of the site profile, the borings for this project were drilled to a maximum depth of 40 feet and bedrock was not encountered. Per Table 1613.5.2 of the 2009 IBC and based on our experience in the area, we recommend that the project be designed using Site Class D.

According to ground motion maps prepared by the USGS and data obtained from the 2009 IBC, the maximum considered earthquake spectral response accelerations at short periods (S_s) and at a one-second period (S_1) are 0.563 g and 0.164 g, respectively. The Design Spectral Acceleration at 0.2 second (S_{DS}) is 0.506 g, and the Design Spectral Acceleration at 1.0 second (S_{D1}) is 0.234 g.

4.3 Floor Slabs

The recommendations provided below are intended as minimum requirements and are not intended to supersede the structural engineering design of the floor slabs.

QTE should observe and approve the subgrade immediately prior to placement of the floor slabs. Tests may be required to verify proper compaction of the subgrade materials if they are disturbed after initial placement and testing. For a low plasticity soil subgrade, a modulus of subgrade reaction of 200 pounds per cubic inch (pci) may be used for slab design. This value may be increased to 300 pci if lime-modified soils are used or 350 pci if granular materials are used. In order to achieve the above values, the subgrade, rock base, and backfill materials must be placed and compacted as recommended herein.

The floor slabs should be supported on a minimum 4-inch-thick layer of compacted crushed stone. The crushed stone will help distribute concentrated loads and equalize moisture conditions beneath the slabs. It may be desirable to place a 6-mil polyethylene moisture barrier beneath the floor slabs to prevent the transfer of capillary moisture to the slab. Without careful attention to curing of the concrete slabs, however, the polyethylene sheet can cause excessive shrinkage cracking and "curling". We suggest the applicable recommendations provided in the standards of the American Concrete Institute be followed for curing the concrete floor slab.

We suggest floor slabs not be structurally connected to the foundation walls and column pads. Isolation joints should be used at any place where a slab meets a wall or an independent column support. Careful attention should be given to the control joint spacing intervals which will likely be dictated by the design thickness of the slabs. Such joints permit slight movement of the independent elements and help prevent random cracking that might otherwise be caused by restraint of shrinkage, slight rotations, heave, or settlement. If the floor slabs must be structurally tied or connected to the foundations, slotted nut-type inserts should be considered for the fasteners. This type fastener will allow minor vertical movement yet provide lateral resistance.

4.4 Below-Grade and Retaining Walls

Below-grade walls for the rail pit must or other below-grade structures be designed to withstand lateral earth pressures exerted by the backfill. The walls should also be designed to withstand hydrostatic pressures, upward slopes behind walls, and a uniform horizontal load of one-half of adjacent surface loads, if any. For below-grade walls that are restrained and not free to deflect laterally, an at-rest earth pressure condition is assumed to develop. For retaining walls that allow lateral deflection, if any, an active earth pressure condition is assumed to develop. Active and at-rest earth pressures for cohesive and granular (crushed rock or sand) backfill materials are presented in the following table. "Drained" conditions apply when the backfill material is either consistently above the groundwater level or if it is properly drained so it will not become saturated.

	Cohesive Soil (drained)	**Cohesive Soil (undrained)**	**Granular Material (drained)**	**Granular Material (undrained)**
Active Equivalent Earth Pressure (pcf)	40	20	30	15
At-rest Equivalent Earth Pressure (pcf)	60	30	50	25

Resistance to sliding may be calculated using a coefficient of friction of 0.35 for the contact between the base of concrete footings and the sandy subgrade soils. In addition, a uniform passive pressure of 300 pounds per square foot (psf) per foot of depth may be used for undisturbed soils against the base of the footings if above the groundwater table or 150 psf per foot of depth if below the groundwater table. We recommend that backfill against the walls be assumed to provide no resistance to lateral movement.

The walls should be temporarily braced during backfilling. If structural design requires tying the tops of exposed below-grade walls into the adjoining floor slabs, the bracing should remain in place until the slabs are poured. Recommendations for wall backfill are provided later in this report.

4.5 Foundation Subdrains

We recommend the installation of an exterior foundation subdrain system to intercept groundwater that might otherwise infiltrate the zones beneath the footings and floor slabs and to reduce the development of hydrostatic pressures behind the below grade walls of the rail pit. The subdrains should consist of 4-inch diameter, perforated plastic pipe laid with the holes down and surrounded with a select filter stone material consisting of ½- to 1-inch clean crushed stone. This stone should be isolated from the surrounding subgrade with a single layer of synthetic filter material such as Supac 4NP, Mirafi 140N, or similar. The perimeter subdrains should be placed at the base of footing elevation and drained by gravity to daylight or connected to an interior sump where positive drainage by gravity cannot be achieved.

4.6 Site Drainage and Grading

Positive site drainage should be provided to reduce infiltration of surface water into the backfill of the foundation walls and beneath the floor slabs. All grades should be sloped away from structures. Roof and surface drainage should be collected and diverted through underground or aboveground non-perforated pipe to discharge away from the foundation wall backfill. Particular attention should be given to drainage in landscaped areas if proposed adjacent to any structures. The subgrade in paved areas should be sloped to collection points or trenches.

5.0 CONSTRUCTION RECOMMENDATIONS AND CONSIDERATIONS

The geotechnical aspects of the proposed construction will involve site preparation, grading the building pad and paved areas, placement of foundations, floor slab construction, and pavement construction. QTE should be involved in these construction activities.

5.1 Site Preparation

Site stripping will consist of removing any grass or weed growth together with its root mass. Excessively organic soils were not observed at the boring locations; however, if such materials are encountered, they should be stripped and stockpiled for later use in landscaped areas. After removal of vegetation and completion of any required additional stripping, the subgrade in areas to receive fill should be scarified and recompacted to a dry density of at least 95 percent of the material's maximum dry density as determined by the standard Proctor compaction test (ASTM D 698). Exposed soils in proposed cut areas should be observed by personnel of QTE and identified as acceptable or not acceptable for placement as structural fill in the building areas.

5.2 Fill Materials and Compaction

A clean, low plasticity, cohesive borrow material may be used as site fill. Typically, these soils are classified by ASTM D 2487 as CL, ML, or CL/ML, and have a liquid limit of less than 45. QTE should observe, test, and approve soils used as structural fill. Existing fill on site may be reused as structural fill upon approval by QTE. If fill materials are imported, they should be approved at their origin before being transported to the site. Low plasticity, cohesive fill should be placed in 8- to 12-inch loose lifts and compacted to a dry density of at least 95 percent of the material's standard Proctor maximum dry density. In general, the moisture content of the fill should be within 5 percent of optimum. Tests should be performed on each lift of fill and on every other lift of backfill to ensure compliance with the compaction requirements.

In the cut areas, the natural sandy and silty soils may tend to "pump" under the trafficking of equipment, and some difficulty with equipment mobility should be anticipated. Special attention should be give to the removal of the last 2 to 3 feet of cut from any "pumping" areas to avoid disturbances to the natural soils that will support roadway or building construction. Spreading lime in the excavations to dry the materials and allow excavating to the desired depths may be necessary.

If construction occurs during wet weather, the existing subgrade and fill materials may require chemical modification to reduce natural moisture contents and achieve compaction. An incorporation rate of 2 to 3 percent "Code L" should suffice for moisture control. The incorporation rates are based on dry weight of materials. Incorporation of lime in each lift of fill requires achieving a uniform blend of the materials by use of large mechanized equipment or "gators". Use of farm discs is not considered acceptable for blending lime based on prior experience with such equipment.

The natural soil moisture contents encountered at the time of drilling indicate that some of the on-site materials may need to be spread and dried in order to obtain proper compaction. These materials dry readily during favorable weather periods from May through October. The use of a disc for drying or the use of a "gator" to incorporate lime may be required to facilitate compaction of soils with high moisture contents. QTE should monitor blending procedures and test for proper compaction of the treated fill materials.

Well-graded granular materials classified as SP, SW, GP or GW may by preferable for structural fill and backfill and may be cost effective if the importation of fill materials is required. Granular materials will provide an excellent working surface for construction of buildings, will not be adversely affected by inclement weather, and can generally be compacted more readily. We suggest using ¾-inch to 2-inch-minus gradation crushed limestone, placed and compacted in the same manner and to the same criteria as recommended above for low plasticity soil.

5.3 Floor Slab Subgrade Considerations

The soil subgrade may be subjected to construction traffic and exposure to weather for an extended period prior to pouring the concrete slab. It is essential, therefore, to compact the subgrade to a dry density of at least 95 percent of the standard Proctor maximum dry density immediately prior to placing the slab.

During an extended period of hot and/or dry weather, an effort should be made to prevent exposed floor slab subgrades from drying out. Precautions might include spreading a thin layer of limestone screenings over the subgrade to prevent direct exposure to the air and sunlight. Significant construction problems may also be incurred if floor slab construction takes place in the wetter portions of the year, November through April. Special measures may be required to facilitate construction during these periods. These measures may include, but are not limited to, addition of lime to the subgrade soils for drying purposes, or the removal of soft, spongy soils, and their replacement with rock. QTE should test the soil subgrade to verify proper compaction before rock is placed.

5.4 Wall Backfill and Compaction

The backfill for below grade walls should consist of low plasticity soils or granular material. We suggest using granular material to provide improved drainage and to reduce lateral pressures on walls. If soil backfill is used, however, we recommend placement in 8-inch loose lifts and mechanically compacting to at least 92 percent of the standard Proctor maximum dry density. The compaction requirement should be increased to 95 percent where the backfill is to support the adjacent first floor slabs, walks, or pavements.

We advise performing field density tests on at least every other lift to monitor compliance with this standard.

Granular backfill should consist of ¾- to 1-inch-minus crushed limestone, placed in the same manner and to the same degree of compaction as described above. As an alternate, ½- to 1-inch-clean crushed limestone may be placed as backfill, though typically not recommended. If clean rock is used, it should be placed in no more than 2-foot-thick lifts and tamped or tracked to achieve adequate densification. Because of the potential risk of migration of soil fines into the clean rock, a synthetic filter fabric should be placed between the soil face of the excavation and the clean rock backfill.

5.5 Foundation Excavations

Each footing excavation should terminate in firm bearing materials. We should observe the initial footing excavations to establish acceptable criteria for footing placement. Footing excavations should not be left open longer than necessary to reduce drying of the soils in the exposed excavations.

The base of all excavations should be clean, dry, and free of loose or uncompacted fill. The excavations should be protected from extreme temperatures, precipitation, and construction disturbances. To minimize the possibility of disturbance of the foundation materials, we recommend the concrete be placed the same day the excavation is made.

5.6 Excavation Safety Considerations

During the excavation of this project, it may be necessary to slope or temporarily shore walls of open excavations to prevent collapse and sloughing of the soils. In Federal Register, Volume 54, No. 209 October 1989, the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, Part 1926, Subpart P." This document was issued to increase the safety of workers in excavations. It is mandated that all excavations, whether they are utility trenches, basement excavations, or footing excavations, be constructed in accordance with OSHA guidelines.

5.7 Pavements

5.7.1 Design Criteria

Design pavement thicknesses were calculated for heavy duty rigid concrete. According to Mr. Bill Stahlman with America's Central Port, the pavement will experience approximately 250 to 300 semi-tractor trailer passes per day. Therefore, the maximum number of 300 was used in the pavement design.

The semi tractor-trailers were specified with one axle of an 12-kip load on a single axle group, plus two axles of a 34-kip load on a tandem axle group. According to the "AASHTO Guide for Design of Pavement Structures" (1993), the number of vehicles was used to calculate the 18-kip equivalent single axle load (ESAL). Using the computer software "WinPAS", which is based on this guide, along with other design parameters including those in the following table, the required minimum rigid (Portland cement) concrete pavement section was determined.

Design Parameter	Rigid Concrete Value
Design Life (years)	20
Growth (percent)	0
Reliability (percent)	90
Standard Deviation	0.35
Initial Serviceability	4.5
Terminal Serviceability	2.25
Soil Resilient Modulus (psi)	3,012.5
Drainage Coefficient	1.0

Based on the results of the California Bearing Ratio (CBR) tests, which are included in the following table, a value of 1.9 was used for the subgrade soils.

California Bearing Ratio (CBR) Test Results

Boring	Sample Depth (ft)	Initial Density (pcf)	Initial Moisture (%)	Final Moisture (%)			CBR Values	
				Top	Middle	Bottom	Unsoaked	Soaked
B-6	1-5	107.1	14	21	17	21	2.7	1.9

5.7.2 Portland Cement Concrete

Based on the expected traffic volumes and subgrade conditions, the recommended minimum rigid concrete pavement section consists of 10.5 inches of concrete and 4 inches of aggregate base course. It should be noted that WinPAS requires a base course thickness in the range of 4 to 12 inches. Typically, varying the base course thickness only changes the minimum concrete thickness by less than half an inch.

The design is based on a minimum 28-day compressive strength of 4,000 psi for the concrete. It is assumed that dowels for load transfer will be installed at the pavement joints and that there is no edge support. Portland cement mix design and slump requirements should be in accordance with IDOT standards. Steel mesh reinforcement, if needed, and joint spacings should be determined by a qualified civil or structural engineer.

The primary purposes of an aggregate base course are to provide a working surface during construction, a uniform bearing surface for the concrete pavement, and drainage beneath the pavement to reduce the potential for damaging freeze-thaw effects. The detailed design should provide a means for gravity drainage of water that might collect in low areas of the base course.

5.7.3 Pavement Subgrade Considerations

For a subgrade consisting of low plasticity soils or granular materials, we recommend the subgrade materials be compacted to a dry density of at least 95 percent of the standard Proctor maximum dry density. Tests should be performed to verify compliance with compaction requirements.

Before placing the base course, the subgrade should be proofrolled to determine if any localized soft areas have developed. Proofrolling consists of oriented passes of a heavily-loaded rubber-tired vehicle such as a dump truck. Proofrolling is an economical means of locating soft soils that contribute to the deterioration of pavements. If the subgrade soils "pump" under the trafficking of the construction equipment, the soils should be allowed to aerate and be recompacted before final grading and placement of the pavement section.

The granular base course for the pavement section should be compacted to 95 percent of the above criterion. Tests should be performed to verify compliance with this requirement. The base course and the concrete pavement section should be monitored for proper thickness and tested for compaction during placement rather than by coring after placement. Verification by coring after placement does not allow for corrective measures during construction if project specifications are not being met. Positive drainage of the base course should be provided at low points in the parking areas and drive lanes by placing weep holes in storm drainage structures, which will likely be required at these locations.

6.0 CONSTRUCTION MONITORING PROGRAM

The following section details suggestions for a construction monitoring program. This summary of services is recommended to provide quality assurance in assessing design assumptions and to document earth-related construction procedures for compliance with plans, specifications, and good engineering practice. We suggest that Quality Testing and Engineering, Inc. perform the following project related services:

- ❖ Review plans to assess the suitability and the proper application of the geotechnical recommendations provided herein.

- ❖ Observe site preparation, determine the suitability of exposed subgrade soils, and determine if materials in cut portions of the site are suitable for use as structural fill.

- ❖ Evaluate proposed borrow materials. One standard Proctor test and Atterberg limits tests should be performed on each material at the start of grading, and then one per week or whenever materials appear to change.

- ❖ Monitor fill placement during site development. Moisture control testing and compaction testing is typically performed by a qualified soil technician at a rate of one test per lift per 20,000 square feet. The same interval would apply during preparation of the pavement subgrade and the compacted rock base.

- ❖ Observe footing excavations prior to the installation of rebar to determine if conditions are suitable. The observation is normally done daily while on site performing other construction related services.

- ❖ Monitor placement of reinforcing steel and concrete in footings, slabs, walls, and pavements where applicable. Steel placement is typically observed prior to a concrete pour to allow for corrections, if required. The American Concrete Institute and the Portland Cement Association recommend minimum concrete sampling to consist of 4 cylinders with slump, temperature, and air content testing to be performed once daily for each class of concrete and once for every 100 to 150 cubic yards of each class of concrete placed per day. Batch plant inspections can be performed as requested or as required by job specifications.

- ❖ Monitor pavement subgrade preparation and subsequent construction. The Illinois Department of Transportation (IDOT) Design Manual for Road and Bridge Construction recommends minimum testing on asphaltic material consist of one density test for every ½ mile of paving lane for 3-inch thick lifts or less, and one density test for every ¼ mile of paving lane for greater than 3-inch thick lifts. Batch plant inspections can be performed as requested or as required by job specifications.

7.0 LIMITATIONS OF REPORT

The recommendations provided herein are for the exclusive use of Korte and Luitjohan Contractors, Inc. Our recommendations are based on the information obtained at seven borings, on our understanding of the project scope as described herein, and on regionally accepted practice. No other warranty is expressed or implied. We should be contacted if there are changes in the scope of the project as reported herein, if conditions encountered are not consistent with those described, or if our present understanding of the project is incorrect.

In addition, we should be provided with a set of final plans as soon as they are available for review to determine the applicability of our recommendations. Construction specifications also merit our review to ensure proper interpretation of this report. Failure to provide these documents for review may nullify some or all of the recommendations provided herein.

The final part of our geotechnical service should consist of observation and materials testing during construction, to observe that conditions actually encountered are consistent with those described in this report and to assess the appropriateness of the analyses and the recommendations contained herein. QTE cannot assume responsibility or liability for the adequacy of its recommendations without being retained to observe construction.

FIGURE

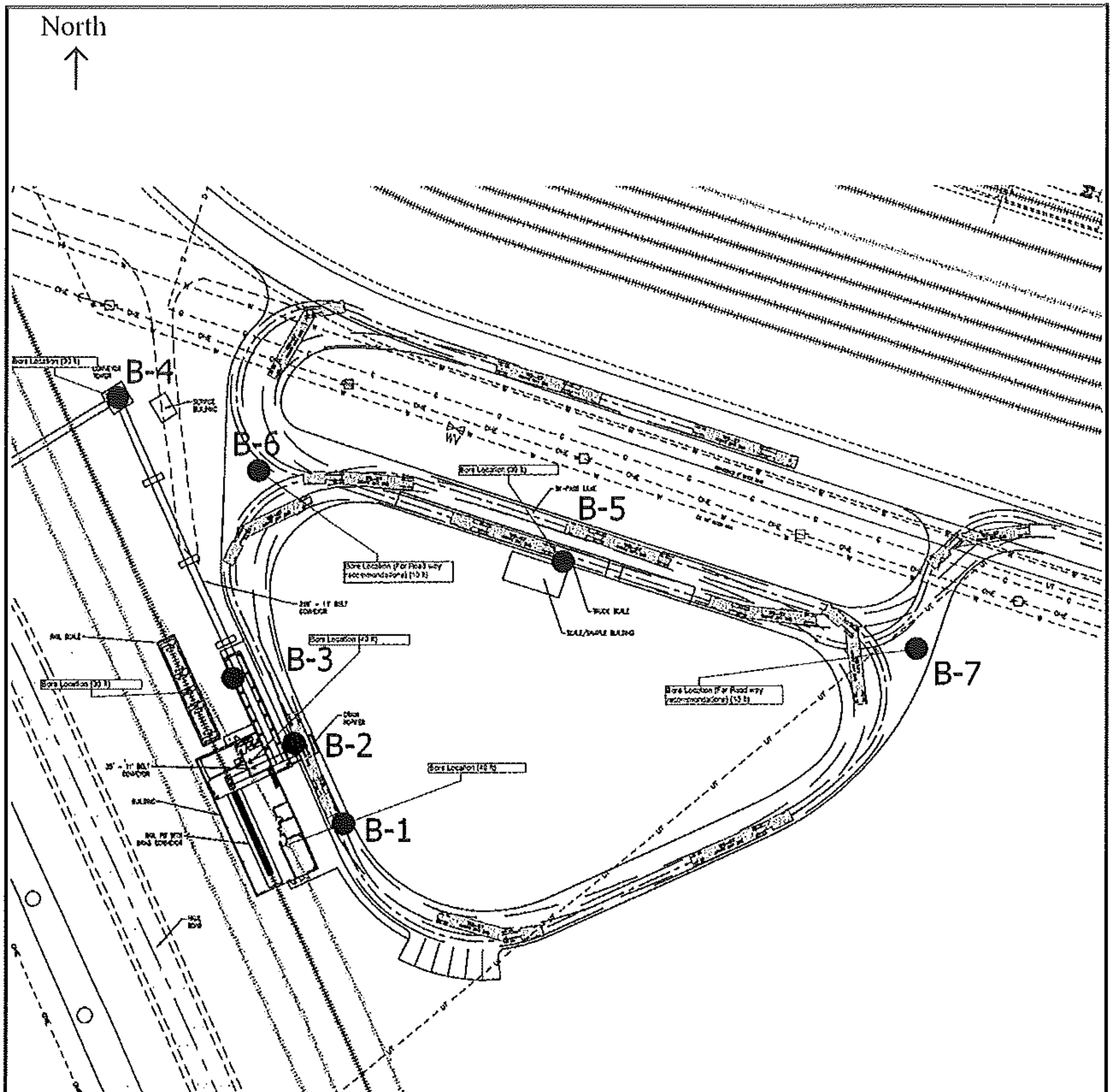

Figure 1

Approximate Boring Location

Scale: Not to Scale

QUALITY TESTING AND ENGINEERING, INC.

803 W. State Street, O'Fallon, Illinois 62269

South Harbor Conveyor

Granite City, Illinois

Site Plan

August 2013 QTE No. 13-0342-G

APPENDIX A

BORING LOG LEGEND AND NOMENCLATURE

Items shown in Boring Logs refer to the following: Where shown in parentheses, sampling and testing were performed in general accordance with applicable ASTM standard methods or practices.

1. **Depth** - Depth below ground surface feet.

2. **Sample** - Types designated by letters.

   SS - Split-spoon sample, disturbed, obtained by driving 2-inch O.D. split-spoon sampler ASTM D 1586.

   ST - Thin-walled tube sample, undisturbed, obtained by penetration of a 3-inch diameter tube ASTM D 1587.

   AS - Auger samples, disturbed, taken from cuttings.

   NX - Rock core recovered by NX-sized coring bit.

   Recovery - Recovery is expressed as a ratio of the length recovered to the total length pushed, driven, or cored inches, e.g. - 9/12.

   Blows - Numbers indicate blows per 6 inches of sampler penetration when driven by a 140-pound hammer falling freely 30 inches ASTM D 1586. When number of blows reaches 50 without 6 inches of sampler penetration, the result is shown as a ratio of 50 to the actual penetration, e.g. 50/2 inches.

3. **Description** - Description according to the Unified Soil Classification: Description indicates soil constituents, and other classification characteristics ASTM D 2488. Delineations of strata represent approximate boundaries between soil types and the transition may be gradual. The delineations shown on the Boring Logs were used for analytical purposes only. The information should not be used as a basis for design and/or construction cost estimates without realizing that there can be variation from the conditions shown.

   GW - Water level observation.

4. **Laboratory test results**

   - Natural moisture content in percent ASTM D 2216.
   - Dry density of sample tested in pounds per cubic foot (pcf).
   - Unconfined compressive strength ASTM D 2166 in kips per square foot (ksf).
   - Liquid limit ASTM D 4318 in percent.
   - Plastic limit ASTM D 4318 in percent.

BORING LOG

PROJECT	South Harbor Conveyor	**BORING NO.**	B-1
LOCATION	Granite City, Illinois	**SHEET**	1 **OF** 2
DRILLER	Midwest Drilling Inc.	**PROJECT NO.**	13-0342
SURFACE ELEVATION	**DRILLING METHOD** 4" CFA & Mud Rotary	**DATE DRILLED**	7/22/13

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
0					Topsoil 2" Brown low plastic SILTY CLAY, some sand		CL	1						0
	1	SS		2 2 2					23		3.0			
3					Brown fine SAND		SP							3
	2	SS		2 3 4					26		- -			
					Brown low plastic SILTY CLAY, some sand		CL							
6														6
	3	SS		2 2 4					27		1.0			
					Brown fine SAND, some clay		SP-SC							
9	4	SS		5 5 7					23		- -			9
12														12
								2						
	5	SS		0 1 3					27		- -			
15														15
	6	SS		3 5 7					25		- -			
					Brown fine SAND		SP							
18														18
	7	SS		5 6 7					31		- -			

Continued on Sheet 2 of 2

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
11 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

1) Boring moved approximately 44 feet east.
2) No recovery in shelby tube

BORING LOG

PROJECT South Harbor Conveyor | BORING NO. B-1
LOCATION Granite City, Illinois | SHEET 2 OF 2
DRILLER Midwest Drilling Inc. | PROJECT NO. 13-0342
SURFACE ELEVATION | DRILLING METHOD 4" CFA & Mud Rotary | DATE DRILLED 7/22/13

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
21					Brown medium SAND		SP							21
	8	SS		4 7 7					18		--			
24	9	SS		5 7 8					16		--			24
27					Brown fine SAND, trace gravel		SP							27
	10	SS		10 12 15					16		--			
30														30
					Gray medium SAND		SP							
33														33
	11	SS		5 7 11					19		--			
36														36
39	12	SS		9 14 17					13		--			39
					Boring terminated at 40 feet.									

WATER LEVEL:

_____ NONE OBSERVED WHILE DRILLING
11 FT WHILE DRILLING
_____ FT ____ HRS AFTER DRILLING
_____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor | BORING NO. B-2
LOCATION Granite City, Illinois | SHEET 1 OF 2
DRILLER Midwest Drilling Inc. | PROJECT NO. 13-0342
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA & Mud Rotary | DATE DRILLED 7/22/13

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	RECOVERY (IN/IN)	BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
0					Topsoil 4"			1						0
					FILL - Brown fine SAND, trace clay		FILL							
	1	SS		3 3 3					14		- -			
3					Brown low plastic SILTY CLAY, some sand		CL							3
	2	SS		2 2 2					20		- -			
					Brown fine SAND, some clay		SP-SC		5		- -			
6	3	ST	15/24						18		- -			6
									13		- -			
9	4	ST	10/24											9
12					Brown fine SAND		SP							12
	5	SS		4 6 6					26		- -			
15														15
	6	SS		4 5 7					31		- -			
18					Brown fine SAND, some clay		SP-SC							18
	7	SS		5 6 7					27		- -			

Continued on Sheet 2 of 2

WATER LEVEL:
______ NONE OBSERVED WHILE DRILLING
11 FT WHILE DRILLING
______ FT ____ HRS AFTER DRILLING
______ FT ____ HRS AFTER DRILLING

REMARKS:
1) Boring moved approximately 37 feet east.

BORING LOG

PROJECT South Harbor Conveyor | BORING NO. B-2
LOCATION Granite City, Illinois | SHEET 2 OF 2
DRILLER Midwest Drilling Inc. | PROJECT NO. 13-0342
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA & Mud Rotary | DATE DRILLED 7/22/13

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
					Brown medium SAND		SP							
21	8	SS		4 6 6					26		- -			21
24	9	SS		5 5 7					15		- -			24
27														27
					Brown medium SAND, trace gravel		SP							
30	10	SS		10 15 16					14		- -			30
					Gray medium SAND, trace gravel		SP							
33	11	SS		7 9 12					18		- -			33
36														36
39	12	SS		8 13 15					20		- -			39
					Boring terminated at 40 feet.									

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
11 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor | BORING NO. B-3
LOCATION Granite City, Illinois | SHEET 1 OF 2
DRILLER Midwest Drilling Inc. | PROJECT NO. 13-0342
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA & Mud Rotary | DATE DRILLED 7/22/13

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	RECOVERY (IN/IN)	BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
0					Topsoil 4"			1						0
					FILL - Brown fine SAND		FILL							
	1	SS		2 3 3					12		- -			
3					Brown low plastic SILTY CLAY, some sand		CL	2	22	93.1	0.7			3
	2	ST	15/24		Brown fine SAND, some clay		SP-SC		16		- -			
6					Brown low plastic SILTY CLAY, trace sand		CL							6
	3	SS		2 2 4	Brown fine SAND, some clay		SP-SC		30		1.0			
9	4	SS		5 4 7					11		- -			9
12					Brown fine SAND		SP							12
	5	SS		4 5 5					31		- -			
15														15
					Brown fine SAND, some clay		SP-SC							
18														18
	6	SS		5 6 7					26		- -			

Continued on Sheet 2 of 2

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
12 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

1) Boring moved approximately 31 feet east.
2) Unconfined compressive strength test performed.

BORING LOG

PROJECT South Harbor Conveyor | BORING NO. B-3
LOCATION Granite City, Illinois | SHEET 2 OF 2
DRILLER Midwest Drilling Inc. | PROJECT NO. 13-0342
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA & Mud Rotary | DATE DRILLED 7/22/13

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
21														21
					Brown medium SAND		SP							
24	7	SS		6 7 7					15		- -			24
27														27
	8	SS		8 9 11					20		- -			
30					Boring terminated at 30 feet.									30
33														33
36														36
39														39

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
12 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor
LOCATION Granite City, Illinois
DRILLER Midwest Drilling Inc.
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA & Mud Rotary

BORING NO. B-4
SHEET 1 OF 2
PROJECT NO. 13-0342
DATE DRILLED 7/19/13

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	RECOVERY (IN/IN)	BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
0					Brown fine SAND, trace clay		SP-SC							0
	1	ST	15/24						12		- -			
3					Brown and gray low plastic SILTY CLAY, trace sand		CL							3
	2	SS		1 2 2					29		3.0			
6					Brown and gray low plastic SILTY CLAY, some sand		CL							6
	3	SS		2 2 2					30		0.5			
					Brown fine SAND, some clay		SP-SC							
9	4	SS		4 5 8					21		- -			9
12														12
	5	SS		3 4 5					27		- -			
15														15
					Brown fine SAND		SP							
18														18
	6	SS		6 10 8					21		- -			

Continued on Sheet 2 of 2

WATER LEVEL:

_____ NONE OBSERVED WHILE DRILLING
10 FT WHILE DRILLING
_____ FT ____ HRS AFTER DRILLING
_____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor | BORING NO. B-4
LOCATION Granite City, Illinois | SHEET 2 OF 2
DRILLER Midwest Drilling Inc. | PROJECT NO. 13-0342
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA & Mud Rotary | DATE DRILLED 7/19/13

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
21														21
					Brown medium SAND		SP							
24	7	SS		6 8 9					19		--			24
27														27
					Brown medium SAND, trace gravel		SP							
	8	SS		8 10 10					16		--			
30					Boring terminated at 30 feet.									30
33														33
36														36
39														39

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
10 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT: South Harbor Conveyor | BORING NO.: B-5
LOCATION: Granite City, Illinois | SHEET: 1 OF 2
DRILLER: Midwest Drilling Inc. | PROJECT NO.: 13-0342
SURFACE ELEVATION: ______ | DRILLING METHOD: 4" CFA & Mud Rotary | DATE DRILLED: 7/22/13

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
0					Topsoil 2"									0
					Brown low plastic SILTY CLAY		CL							
	1	SS		3 3 3					21		8.0			
					Gray and brown fine SAND, some clay		SP-SC							
3														3
	2	SS		2 2 3					32		0.5			
					Brown fine SAND		SP							
6														6
	3	SS		2 1 2					32		- -			
					Brown fine SAND, some clay		SP-SC							
9	4	ST	17/24						23		- -			9
12														12
	5	SS		3 4 6					25		- -			
15														15
					Brown medium SAND		SP							
18														18
	6	SS		4 5 9					23		- -			

Continued on Sheet 2 of 2

WATER LEVEL:

_____ NONE OBSERVED WHILE DRILLING
6.5 FT WHILE DRILLING
_____ FT ____ HRS AFTER DRILLING
_____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor
LOCATION Granite City, Illinois
DRILLER Midwest Drilling Inc.
SURFACE ELEVATION
DRILLING METHOD 4" CFA & Mud Rotary

BORING NO. B-5
SHEET 2 OF 2
PROJECT NO. 13-0342
DATE DRILLED 7/22/13

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
21														21
24	7	SS		5 7 8					19		--			24
27					Gray and brown medium SAND		SP							27
	8	SS		5 10 14					18		--			
30					Boring terminated at 30 feet.									30
33														33
36														36
39														39

WATER LEVEL:

_____ NONE OBSERVED WHILE DRILLING
6.5 FT WHILE DRILLING
_____ FT ____ HRS AFTER DRILLING
_____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor
LOCATION Granite City, Illinois
DRILLER Midwest Drilling Inc.
SURFACE ELEVATION
DRILLING METHOD 4" CFA

BORING NO. B-6
SHEET 1 OF 1
PROJECT NO. 13-0342
DATE DRILLED 7/22/13

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
0					Topsoil 3"		SC							0
					Brown low plastic SILTY CLAY		CL							
	1	SS		3 2 2					13		- -			
3					Brown fine SAND, some clay		SP-SC							3
	2	SS		2 2 2					5		- -			
					Brown low plastic SILTY CLAY, some sand		CL							
6	3	SS		1 1 3					20		0.5			6
					Brown fine SAND, some clay		SP-SC							
9	4	SS		2 1 2					37		- -			9
					Boring terminated at 10 feet.									
12														12
15														15
18														18

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
8 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor
LOCATION Granite City, Illinois
DRILLER Midwest Drilling Inc.
SURFACE ELEVATION ______
DRILLING METHOD 4" CFA

BORING NO. B-7
SHEET 1 OF 1
PROJECT NO. 13-0342
DATE DRILLED 7/22/13

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
0					Topsoil 3"									0
	1	SS		2 2 2	Brown fine SAND, some clay		SP-SC		19		3.0			
3	2	SS		2 3 3	Brown high plastic CLAY		CH		32		3.0			3
6	3	SS		2 3 4	Brown and gray low plastic SILTY CLAY, some sand		CL		24		--			6
9	4	SS		3 3 4	Brown fine SAND, some clay		SP-SC		29		--			9
					Boring terminated at 10 feet.									
12														12
15														15
18														18

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
6 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

APPENDIX B

COMPACTION TEST REPORT

Curve No.: 1

Project No.: 13-0342 **Date:** 7/16/13

Project: South Harbor Conveyor

Location: B-6

Elev./Depth: 1-5 **Sample No.** 1

Remarks:

MATERIAL DESCRIPTION

Description: Brown SANDY CLAY

Classifications - **USCS:** SC **AASHTO:**

Nat. Moist. = **Sp.G. =**

Liquid Limit = **Plasticity Index =**

% > No.4 = % **% < No.200 =**

TEST RESULTS
Maximum dry density = 108.0 pcf
Optimum moisture = 15.2 %

Test specification:
ASTM D 698-10 Method A Standard

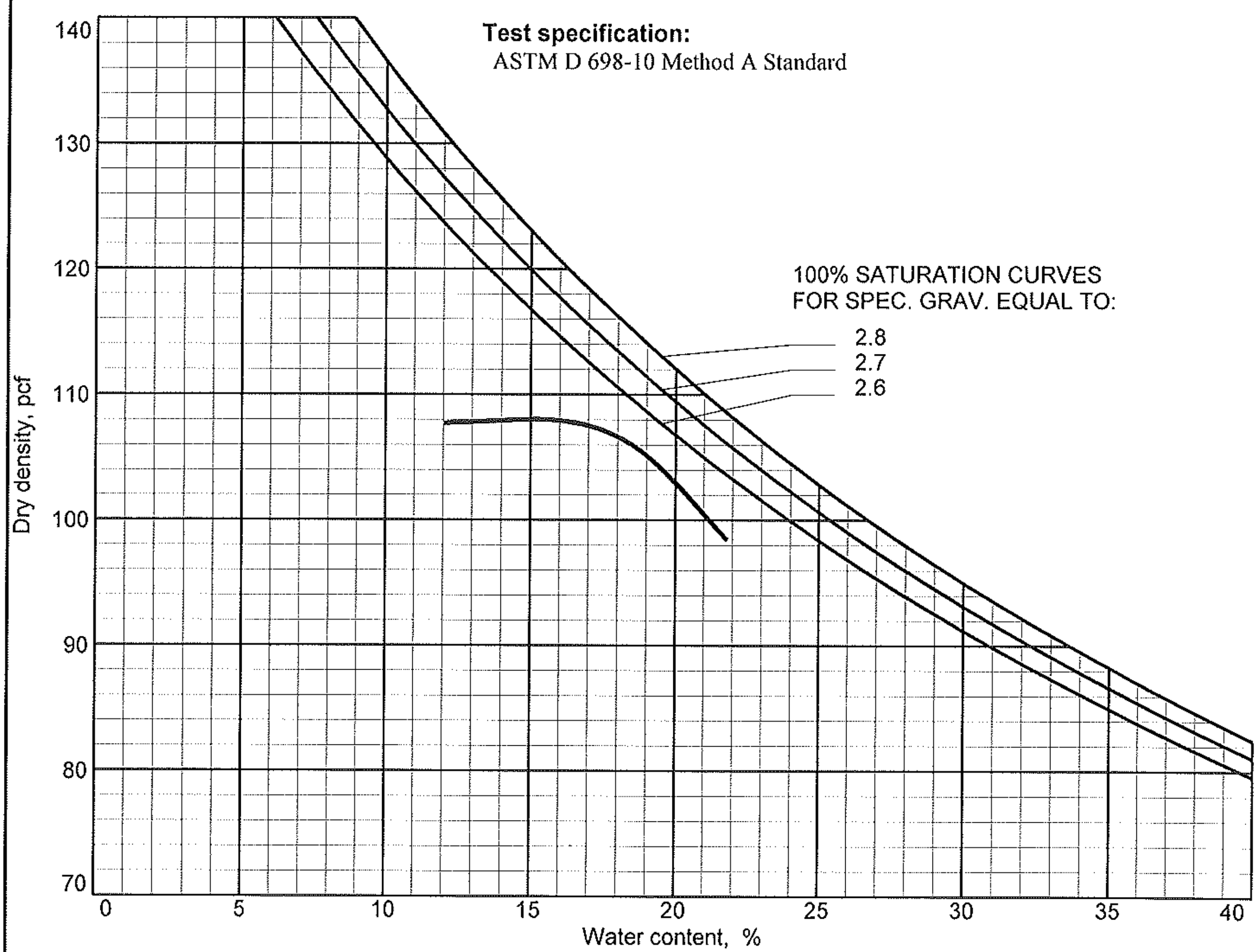

Plate 1

QUALITY TESTING AND ENGINEERING, INC.

GEOTECHNICAL

ENVIRONMENTAL

CONSTRUCTION MATERIAL TESTING

CULTURAL RESOURCES

NATURAL RESOURCES

Subsurface Exploration
and
Geotechnical Recommendations

SOUTH HARBOR CONVEYOR
GRANITE CITY, ILLINOIS

January 2014

KORTE AND LUITJOHAN CONTRACTORS, INC.
General Contractor

THOUVENOT, WADE AND MOERCHEN, INC.
Civil Engineer/Structural Engineer

Project No. 13-0342-G

AASHTO R18
AASHTO Accredited

CORPORATE OFFICE: 803 WEST STATE STREET, O'FALLON, IL 62269 PHONE: 618-632-9900 FAX: 618-632-9922

REGIONAL OFFICE: 206 SOUTH LINN AVENUE, WENTZVILLE, MO 63385 PHONE: 636-332-1153 FAX: 636-332-5781

WWW.QTEINC.COM

QUALITY TESTING AND ENGINEERING, INC.

GEOTECHNICAL
ENVIRONMENTAL
CONSTRUCTION MATERIAL TESTING
CULTURAL RESOURCES
NATURAL RESOURCES

January 15, 2014

Mr. John Whitworth
Korte and Luitjohan Contractors, Inc.
12052 Highland Road
Highland, Illinois 62249

RE: Geotechnical Exploration – Second Phase
South Harbor Conveyor
Granite City, Illinois
QTE No. 13-0342-G

Dear Mr. Whitworth:

Enclosed is our report titled *Subsurface Exploration and Geotechnical Recommendations – SOUTH HARBOR CONVEYOR – GRANITE CITY, ILLINOIS,* dated January 2014. The report provided herein should be read in its entirety for a full understanding of the report highlights provided below and other project recommendations. Highlights from the report include:

- Existing fill materials were encountered at four of the boring locations to depths ranging from approximately 4 to 17 feet below the ground surface. The results of the testing on the fill materials indicate they are either low plasticity or cohesionless (and therefore not prone to shrinking and swelling), medium in density, and do not appear to contain deleterious materials. These soils, upon approval by QTE during construction, may be used to support new construction.

- Groundwater was encountered at depths of approximately 21 to 33 feet below the ground surface in Borings B-8, B-9, B-11, and B-12 at the time of drilling. The driller did not record the groundwater elevation at B-10, but it is probably close to the elevation in B-11. Problems with groundwater are not anticipated during construction.

- Shallow foundations bearing on natural low plasticity soils or sands, approved existing fill, or new properly compacted structural fill or backfill placed as recommended herein may be used to support the towers. The foundations for Towers D, E, and F should be proportioned for a long-term net allowable bearing pressure of 7,000 pounds per square foot (psf) and a short-term net allowable bearing pressure of 9,300 psf. The foundations for Towers G, H, J, and K should be proportioned for a long-term net allowable bearing pressure of 2,500 psf and a short-term net allowable bearing pressure of 3,300 psf.

- Based on the anticipated vertical gross pressure of 1,000 psf and footing size of 20 feet by 20 feet, total long-term settlement of each tower foundation should be on the order of 0.3 to 0.6 inch.

We appreciate the opportunity to be of service to you on this project. We should be employed to provide quality control testing for the project as recommended in the report. If you have any questions or comments at this time regarding the report or additional services, please call.

Respectfully submitted,

QUALITY TESTING AND ENGINEERING, INC.

Jennifer L. Delancey

Jennifer L. Delancey, P.E.
Geotechnical Engineer

Michael A. Widman, P.E.
President

JLD/MAW/hm

C: Mr. Paul Homann; Thouvenot, Wade and Moerchen, Inc.
Mr. Bill Stahlman; America's Central Port / Tri-City Regional Port District

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Subsurface Exploration
and
Geotechnical Recommendations

SOUTH HARBOR CONVEYOR
GRANITE CITY, ILLINOIS

1.0 INTRODUCTION

We were authorized by Mr. John Whitworth of Korte and Luitjohan Contractors, Inc. to conduct a subsurface exploration and to provide geotechnical recommendations for a conveyor system and other associated structures in Granite City, Illinois. The purpose of our exploration was to characterize and evaluate the subsurface conditions in order to develop geotechnical recommendations for the project and to prepare a formal report. The general scope of our study as outlined in our proposal dated November 13, 2013, addressed the following:

- Location and general description of natural soils and existing fill materials, if encountered.
- Evaluation of volume change potential of subgrade soils and recommendations for mitigation of high plasticity soils, if necessary.
- Groundwater levels observed in the borings at the time of drilling, and the potential influence of groundwater on the design and construction of the project.
- Recommendations for foundation design, including feasible foundation types, bearing depths, net allowable bearing pressures (short term and long term), and allowable friction values, as applicable.
- Anticipated settlement of shallow foundations, if recommended, based on general soil characteristics.

1.1 Site Description

The project site is located at the Tri-City Regional Port District in Granite City, Illinois. It is situated east of the Mississippi River, southwest of Bissell Street, and north of Merchant Avenue. A levee with the MCT Confluence Trail along the top traverses the site from northwest to southeast. The site is currently vacant and is vegetated with trees and grasses. The topography on the west side of the levee varies significantly, but the topography on the east side of the levee is relatively level.

1.2 Project Description

The project will feature construction of several structures for a new grain conveyor system. The location of the proposed construction is depicted on the Site Plan, Figure 1. The structures include a loadout building with a rail pit, a rail scale, a truck scale, a conveyor tower, a belt conveyor supported by several isolated footings, and a possible crane pad. A heavy duty rigid concrete roadway is also planned for the project.

The structures located on the west side of the levee, which are addressed in this report, include seven towers, designated Tower D through Tower K (excluding Tower I). Towers D, E, and F will likely be supported on isolated spread footings. Towers G, H, J, and K could be supported on either isolated spread footings or driven piles such as steel H-piles. Spread footings for the project will bear at a depth of approximately 3 feet and will have plan dimensions of approximately 20 feet by 20 feet. According to the structural engineer, Thouvenot, Wade and Moerchen, Inc. (TWM), the vertical gross pressure on spread footings will be approximately 1,000 pounds per square foot (psf).

2.0 FIELD EXPLORATION AND LABORATORY TESTING

The field exploration of this phase of the project consisted of drilling five test borings, designated B-8 through B-12, until auger refusal was encountered at depths ranging from 67 to 83 feet. The borings were drilled by Midwest Drilling, Inc. on November 26 and 28 and December 1, 2013. They were advanced with 4-inch outside diameter continuous flight augers mounted on an ATV drill rig. Mud rotary methods were used while drilling through sands below the groundwater level. Boring locations were established in the field by the project civil engineer, TWM. However, the driller reportedly offset B-10 approximately 15 feet up the hill. The approximate boring locations are shown on the Site Plan.

Field sampling and testing consisted of performing standard penetration tests (SPTs) with a split-spoon sampler at 5-foot vertical intervals. The SPT provides approximate soil strength information and a disturbed sample for routine laboratory testing. Materials recovered with the split-spoon sampler were placed in sealed glass jars.

The samples were transported to our laboratory for classification and testing. We visually classified each cohesive soil sample and measured its moisture content. Approximations of the unconfined compressive strength of the cohesive SPT samples were determined by hand penetrometer. Field sampling information, groundwater readings taken by the driller at the time of drilling, and laboratory test results are presented on the Boring Logs, Appendix A.

3.0 SUBSURFACE CONDITIONS

The following is a general description of the soils encountered at the five boring locations. Detailed information regarding the soils encountered is presented on the Boring Logs. A Boring Log Legend is included to clarify the data presented.

3.1 Fill Materials

In Borings B-9 through B-12, fill was encountered to depths ranging from approximately 4 to 17 feet below the ground surface. The upper 3 to 7 feet of fill was generally composed of fine sand. The lower fill was generally composed of low plasticity silty clay. The SPT N-values of the fill materials ranged from 9 to 18 blows per foot (bpf), the approximate unconfined compressive strengths as measured with a hand penetrometer ranged from 3.0 to 8.0 kips per square foot (ksf), and the moisture contents ranged from 11 to 24 percent.

The results of the testing on the fill materials indicate they are either low plasticity or cohesionless (and therefore not prone to shrinking and swelling), medium in density, and do not appear to contain deleterious materials. These soils, upon approval by QTE during construction, may be used to support new construction.

3.2 Natural Soils

Beneath the existing fill or ground surface, natural soils generally consisted of cohesive soils (clays and silty clays) to depths varying from approximately 12 to 29 feet. The underlying soils primarily consisted of sands with varying grain sizes until auger refusal was encountered. The deeper sands sometimes contained gravel. Approximately 1.5 to 2 feet of limestone fragments were encountered in B-8 and B-12 before auger refusal occurred.

The cohesive soils exhibited SPT N-values ranging from 4 to 10 bpf, approximate unconfined compressive strengths as measured with a hand penetrometer ranging from 1.0 to 5.0 ksf, and moisture contents ranging from 22 to 47 percent. The tests indicate these soils are generally medium stiff to stiff in consistency.

The sands exhibited N-values ranging from 4 to 50 bpf and moisture contents ranging from 4 to 28 percent. The results indicate the sands vary from very loose to dense and some layers may consolidate under applied loads or liquefy from vibratory earthquake loadings if saturated.

3.3 Volume Change Potential

The majority of the soils encountered in the borings, and likely to be encountered during construction, are cohesionless or low plasticity in nature and possess little potential for volume change with changes in the soil moisture content. No site-wide special precautions related to volume change potential are required during construction where these soils are exposed in footings or as the subgrade material for slabs, pavements, or other surface improvements.

3.4 Groundwater

Groundwater was encountered at depths of approximately 21 to 33 feet below the ground surface in Borings B-8, B-9, B-11, and B-12 at the time of drilling. The driller did not record the groundwater elevation at B-10, but it is probably close to the elevation in B-11. These levels may be higher if measured after a longer period of time or during wetter periods of the year, particularly in the early spring months, when the Mississippi River is generally at higher levels. Problems with groundwater are not anticipated during construction.

4.0 GEOTECHNICAL DESIGN CONSIDERATIONS

Newly placed fill and backfill should be of materials approved and monitored during placement by QTE. The following design recommendations assume the site has been prepared in accordance with the recommendations presented in subsequent sections of this report.

4.1 Shallow Foundations

We understand that isolated shallow foundations bearing at a depth of 3 feet will be used to support Towers D, E, and F. They may also be used to support Towers G, H, J, and K. Foundations should bear on natural low plasticity soils or sands, approved existing fill, or new properly compacted structural fill or backfill placed in compliance with the recommendations presented herein.

Borings B-12, B-11, and B-10 were drilled for Towers D, G, and H, respectively. Based on the subsurface conditions encountered in these borings, the foundations should be proportioned for a long-term net allowable bearing pressure of 7,000 pounds per square foot (psf). Borings were not drilled for Towers E and F, but we anticipate that the subsurface conditions are similar enough that this bearing pressure may be also used to design these towers. For temporary loading conditions such as wind and earthquake loads, a net allowable bearing pressure of 9,300 psf may be used.

Borings B-9 and B-8 were drilled for Towers J and K, respectively. Based on the subsurface conditions encountered in these borings, the foundations should be proportioned for a long-term net allowable bearing pressure of 2,500 psf. For temporary loading conditions such as wind and earthquake loads, a net allowable bearing pressure of 3,300 psf may be used.

Based on the anticipated vertical gross pressure of 1,000 psf and footing size of 20 feet by 20 feet, total long-term settlement of each tower foundation should be on the order of 0.3 to 0.6 inch. This settlement should occur in a relatively uniform manner across the foundation. Maximum differential settlement at each structure should be approximately half of the total settlement. Most of the settlement should occur during construction as the structural loads are applied to the subgrade.

4.2 Driven Piles

As an option, Towers G, H, J, and K may be supported on driven pile foundations. We understand that if piles are used, they will likely be steel H-piles. Depending on the pile size and spacing used, the piles might terminate in natural sands or they might end bear on bedrock. The estimated pile length can be calculated using the IDOT spreadsheet titled "Modified IDOT Static Method of Estimating Pile Length", modified October 18, 2011, and the information in the tables in Appendix B, which is based on the Boring Logs.

5.0 LIMITATIONS OF REPORT

The recommendations provided herein are for the exclusive use of Korte and Luitjohan Contractors, Inc. Our recommendations are based on the information obtained at five borings, on our understanding of the project scope as described herein, and on regionally accepted practice. No other warranty is expressed or implied. We should be contacted if there are changes in the scope of the project as reported herein, if conditions encountered are not consistent with those described, or if our present understanding of the project is incorrect.

In addition, we should be provided with a set of final plans as soon as they are available for review to determine the applicability of our recommendations. Construction specifications also merit our review to ensure proper interpretation of this report. Failure to provide these documents for review may nullify some or all of the recommendations provided herein.

The final part of our geotechnical service should consist of observation and materials testing during construction, to observe that conditions actually encountered are consistent with those described in this report and to assess the appropriateness of the analyses and the recommendations contained herein. QTE cannot assume responsibility or liability for the adequacy of its recommendations without being retained to observe construction.

FIGURE

North

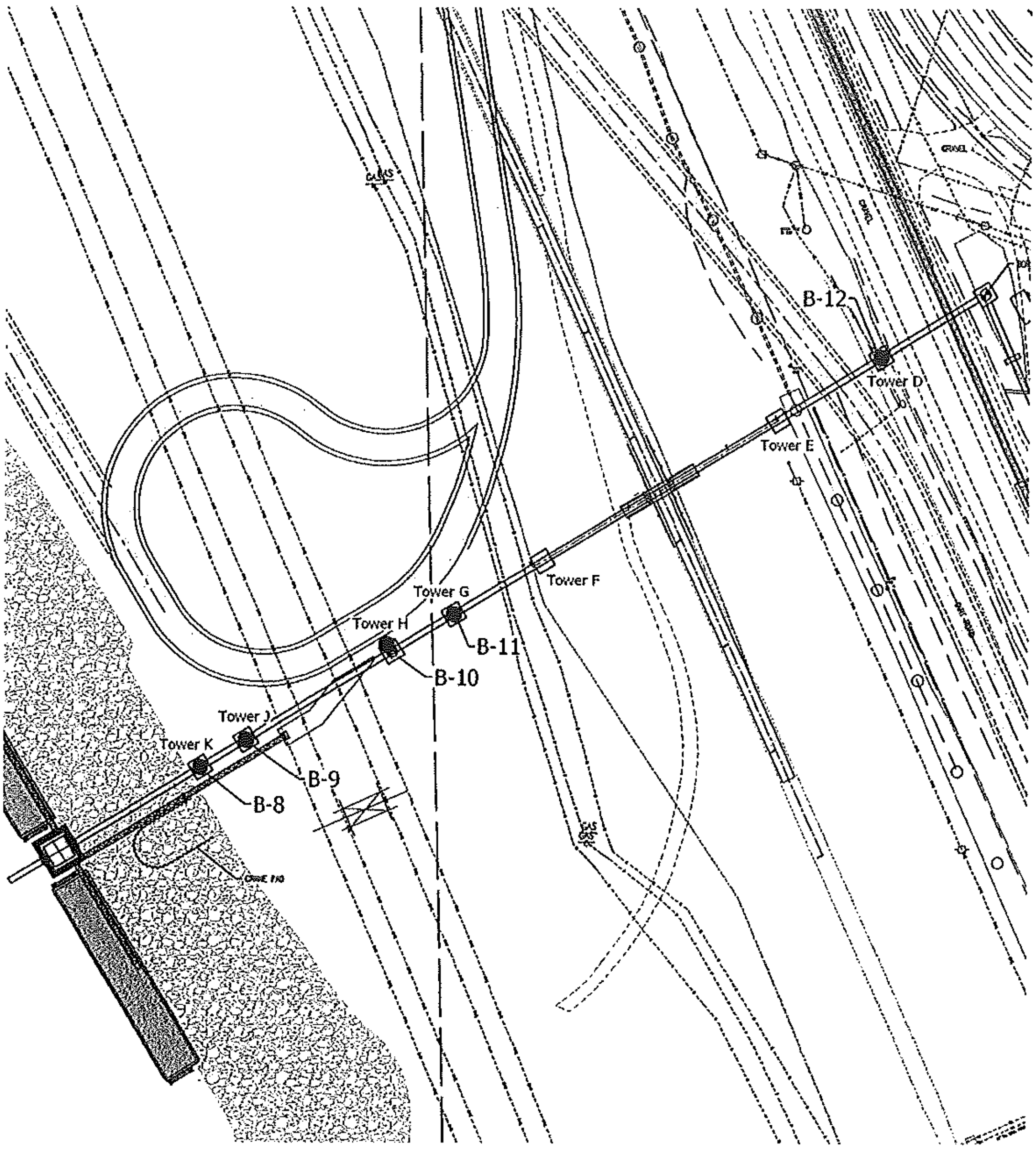

Figure 1

● Approximate Boring Location

Scale: Not to Scale

QUALITY TESTING AND ENGINEERING, INC.
803 W. State Street, O'Fallon, Illinois 62269

South Harbor Conveyor
Granite City, Illinois

Site Plan

January 2014 QTE No. 13-0342-G

APPENDIX A

BORING LOG LEGEND AND NOMENCLATURE

Items shown in Boring Logs refer to the following: Where shown in parentheses, sampling and testing were performed in general accordance with applicable ASTM standard methods or practices.

1. **Depth** - Depth below ground surface feet.

2. **Sample** - Types designated by letters.

   SS - Split-spoon sample, disturbed, obtained by driving 2-inch O.D. split-spoon sampler ASTM D 1586.

   ST - Thin-walled tube sample, undisturbed, obtained by penetration of a 3-inch diameter tube ASTM D 1587.

   AS - Auger samples, disturbed, taken from cuttings.

   NX - Rock core recovered by NX-sized coring bit.

   Recovery - Recovery is expressed as a ratio of the length recovered to the total length pushed, driven, or cored inches, e.g. - 9/12.

   Blows - Numbers indicate blows per 6 inches of sampler penetration when driven by a 140-pound hammer falling freely 30 inches ASTM D 1586. When number of blows reaches 50 without 6 inches of sampler penetration, the result is shown as a ratio of 50 to the actual penetration, e.g. 50/2 inches.

3. **Description** - Description according to the Unified Soil Classification: Description indicates soil constituents, and other classification characteristics ASTM D 2488. Delineations of strata represent approximate boundaries between soil types and the transition may be gradual. The delineations shown on the Boring Logs were used for analytical purposes only. The information should not be used as a basis for design and/or construction cost estimates without realizing that there can be variation from the conditions shown.

   GW - Water level observation.

4. **Laboratory test results**

   - Natural moisture content in percent ASTM D 2216.
   - Dry density of sample tested in pounds per cubic foot (pcf).
   - Unconfined compressive strength ASTM D 2166 in kips per square foot (ksf).
   - Liquid limit ASTM D 4318 in percent.
   - Plastic limit ASTM D 4318 in percent.

BORING LOG

PROJECT South Harbor Conveyor
LOCATION Granite City, Illinois
DRILLER Midwest Drilling Inc.
SURFACE ELEVATION ________ DRILLING METHOD 4" CFA

BORING NO. B-8
SHEET 1 OF 4
PROJECT NO. 13-0342
DATE DRILLED 11/26/13

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
0					Gray and brown high plastic CLAY		CH							0
3														3
	1	SS		2 2 3					40		2.0			
6														6
9	2	SS		2 2 2					33		2.0			9
12					Gray fine SAND, some clay		SP-SC							12
	3	SS		2 2 2					27		- -			
15														15
18														18
	4	SS		3 4 4					15		- -			

Continued on Sheet 2 of 4

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
23 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor | BORING NO. B-8
LOCATION Granite City, Illinois | SHEET 2 OF 4
DRILLER Midwest Drilling Inc. | PROJECT NO. 13-0342
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA | DATE DRILLED 11/26/13

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
21														21
					Gray medium SAND, trace clay		SP-SC							
24	5	SS		4 5 5					19		- -			24
27														27
	6	SS		8 10 13					17		- -			
30														30
					Gray fine SAND		SP							
33														33
	7	SS		9 10 12					26		- -			
36														36
39	8	SS		13 25 23					19		- -			39

Continued on Sheet 3 of 4

WATER LEVEL:

______ NONE OBSERVED WHILE DRILLING
23 FT WHILE DRILLING
______ FT ___ HRS AFTER DRILLING
______ FT ___ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor | BORING NO. B-8
LOCATION Granite City, Illinois | SHEET 3 OF 4
DRILLER Midwest Drilling Inc. | PROJECT NO. 13-0342
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA | DATE DRILLED 11/26/13

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
42														42
	9	SS		16 18 22					21		- -			
45														45
48														48
	10	SS		13 16 26					23		- -			
51														51
					Gray medium SAND, trace gravel		SP							
54	11	SS		11 17 22					19		- -			54
57														57
	12	SS		10 10 10					16		- -			
60														60

Continued on Sheet 4 of 4

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
23 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor — BORING NO. B-8

LOCATION Granite City, Illinois — SHEET 4 OF 4

DRILLER Midwest Drilling Inc. — PROJECT NO. 13-0342

SURFACE ELEVATION ______ DRILLING METHOD 4" CFA — DATE DRILLED 11/26/13

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
63														63
	13	SS		8 11 13					22		- -			
66					LIMESTONE fragments			1						66
	14	SS		50/5					10		- -			
					Refusal at 68 feet.									
69														69
72														72
75														75
78														78
81														81

WATER LEVEL:

_____ NONE OBSERVED WHILE DRILLING

23 FT WHILE DRILLING

_____ FT _____ HRS AFTER DRILLING

_____ FT _____ HRS AFTER DRILLING

REMARKS:

1) Driller's Observation

BORING LOG

PROJECT South Harbor Conveyor
LOCATION Granite City, Illinois
DRILLER Midwest Drilling Inc.
SURFACE ELEVATION ________ DRILLING METHOD 4" CFA

BORING NO. B-9
SHEET 1 OF 4
PROJECT NO. 13-0342
DATE DRILLED 11/28/13

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
0					FILL - Brown fine SAND		FILL							0
3														3
	1	SS		3 3 4	Brown and gray high plastic CLAY		CH		22		3.0			
6														6
					Gray and brown medium plastic SILTY CLAY		CL-CH							
9	2	SS		2 2 2					34		2.0			9
12					Gray low plastic SILTY CLAY		CL	1						12
	3	SS		4 4 6	Gray fine SAND		SP		26		- -			
15														15
18														18
	4	SS		3 3 8					26		- -			

Continued on Sheet 2 of 4

WATER LEVEL:
____ NONE OBSERVED WHILE DRILLING
22 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:
1) Driller's observation

BORING LOG

PROJECT South Harbor Conveyor | BORING NO. B-9
LOCATION Granite City, Illinois | SHEET 2 OF 4
DRILLER Midwest Drilling Inc. | PROJECT NO. 13-0342
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA | DATE DRILLED 11/28/13

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
21														21
24	5	SS		6 6 6					21		--			24
27					Gray medium SAND		SP							27
30	6	SS		7 13 10					23		--			30
33					Gray medium SAND, trace gravel		SP							33
	7	SS		8 9 11					17		--			
36														36
					Gray fine SAND		SP							
39	8	SS		5 9 14					24		--			39

Continued on Sheet 3 of 4

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
22 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor | BORING NO. B-9
LOCATION Granite City, Illinois | SHEET 3 OF 4
DRILLER Midwest Drilling Inc. | PROJECT NO. 13-0342
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA | DATE DRILLED 11/28/13

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
42														42
					Gray medium SAND		SP							
	9	SS		7 11 13					21		- -			
45														45
48														48
	10	SS		8 15 17					22		- -			
51														51
54	11	SS		11 13 16					20		- -			54
57														57
	12	SS		14 16 18					18		- -			
60														60

Continued on Sheet 4 of 4

WATER LEVEL:

_____ NONE OBSERVED WHILE DRILLING
22 FT WHILE DRILLING
_____ FT _____ HRS AFTER DRILLING
_____ FT _____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor | BORING NO. B-9
LOCATION Granite City, Illinois | SHEET 4 OF 4
DRILLER Midwest Drilling Inc. | PROJECT NO. 13-0342
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA | DATE DRILLED 11/28/13

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
					Gray coarse SAND, trace gravel		SP							
63														63
	13	SS		12 14 14					11		- -			
66														66
					Refusal at 67 feet.									
69														69
72														72
75														75
78														78
81														81

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
22 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT: South Harbor Conveyor
LOCATION: Granite City, Illinois
DRILLER: Midwest Drilling Inc.
SURFACE ELEVATION: ______
DRILLING METHOD: 4" CFA

BORING NO.: B-10
SHEET 1 OF 5
PROJECT NO.: 13-0342
DATE DRILLED: 12/01/13

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	RECOVERY (IN/IN)	BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
0					FILL - Gray fine SAND		FILL	1						0
3														3
	1	SS		4 5 5					11		- -			
6														6
					FILL - Brown low plastic SILTY CLAY, some sand		FILL							
9	2	SS		6 7 11					13		8.0			9
12					FILL - Brown low plastic SILTY CLAY		FILL							12
	3	SS		5 6 6					24		3.0			
15														15
					Gray high plastic CLAY		CH							
18														18
	4	SS		2 3 4					39		3.0			

Continued on Sheet 2 of 5

WATER LEVEL:

______ NONE OBSERVED WHILE DRILLING
______ FT WHILE DRILLING
______ FT ____ HRS AFTER DRILLING
______ FT ____ HRS AFTER DRILLING

REMARKS:

1) The driller offset the boring 15 feet north.

BORING LOG

PROJECT South Harbor Conveyor | BORING NO. B-10
LOCATION Granite City, Illinois | SHEET 2 OF 5
DRILLER Midwest Drilling Inc. | PROJECT NO. 13-0342
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA | DATE DRILLED 12/01/13

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	LABORATORY TEST RESULTS: MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
21														21
					Gray and brown high plastic CLAY		CH							
24	5	SS		3 4 5					40		- -			24
27					Brown fine SAND		SP							27
	6	SS		5 6 10					4		- -			
30														30
33														33
	7	SS		3 4 5					24		- -			
36														36
39	8	SS		4 7 8					19		- -			39

Continued on Sheet 3 of 5

WATER LEVEL:

_____ NONE OBSERVED WHILE DRILLING
_____ FT WHILE DRILLING
_____ FT ____ HRS AFTER DRILLING
_____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor | BORING NO. B-10
LOCATION Granite City, Illinois | SHEET 3 OF 5
DRILLER Midwest Drilling Inc. | PROJECT NO. 13-0342
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA | DATE DRILLED 12/01/13

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
42					Gray fine SAND		SP							42
	9	SS		7 9 10					24		--			
45														45
48														48
	10	SS		9 12 13					23		--			
51					Gray medium SAND		SP							51
54	11	SS		9 11 14					22		--			54
57					Gray fine SAND		SP							57
	12	SS		11 13 15					26		--			
60														60

Continued on Sheet 4 of 5

WATER LEVEL:

_____ NONE OBSERVED WHILE DRILLING
_____ FT WHILE DRILLING
_____ FT _____ HRS AFTER DRILLING
_____ FT _____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor | BORING NO. B-10
LOCATION Granite City, Illinois | SHEET 4 OF 5
DRILLER Midwest Drilling Inc. | PROJECT NO. 13-0342
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA | DATE DRILLED 12/01/13

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
					Gray medium SAND		SP							
63														63
	13	SS		12 13 15					21		- -			
66														66
69	14	SS		13 16 18					17		- -			69
72					Gray coarse SAND		SP							72
	15	SS		12 14 16					22		- -			
75														75
					Gray coarse SAND, some gravel		SP							
78														78
	16	SS		4 6 8					13		- -			
81														81

Continued on Sheet 5 of 5

WATER LEVEL:

_____ NONE OBSERVED WHILE DRILLING
_____ FT WHILE DRILLING
_____ FT _____ HRS AFTER DRILLING
_____ FT _____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor
LOCATION Granite City, Illinois
DRILLER Midwest Drilling Inc.
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA

BORING NO. B-10
SHEET 5 OF 5
PROJECT NO. 13-0342
DATE DRILLED 12/01/13

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
					Refusal at 82 feet.									
84														84
87														87
90														90
93														93
96														96
99														99
102														102

WATER LEVEL:
______ NONE OBSERVED WHILE DRILLING
______ FT WHILE DRILLING
______ FT ____ HRS AFTER DRILLING
______ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor | BORING NO. B-11
LOCATION Granite City, Illinois | SHEET 1 OF 5
DRILLER Midwest Drilling Inc. | PROJECT NO. 13-0342
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA | DATE DRILLED 12/01/13

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
0					FILL - Gray fine SAND		FILL							0
3														3
	1	SS		4 4 5					12		- -			
6														6
					FILL - Dark brown low plastic SILTY CLAY		FILL							
9	2	SS		4 4 6					18		3.0			9
12					Dark gray high plastic CLAY		CH							12
	3	SS		3 4 6					26		3.0			
15														15
18					Gray and brown high plastic CLAY		CH							18
	4	SS		3 3 3					43		5.0			

Continued on Sheet 2 of 5

WATER LEVEL:

___ NONE OBSERVED WHILE DRILLING
33 FT WHILE DRILLING
___ FT ___ HRS AFTER DRILLING
___ FT ___ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor
LOCATION Granite City, Illinois
DRILLER Midwest Drilling Inc.
SURFACE ELEVATION ________ DRILLING METHOD 4" CFA

BORING NO. B-11
SHEET 2 OF 5
PROJECT NO. 13-0342
DATE DRILLED 12/01/13

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
21														21
24	5	SS		2 3 3					37		3.0			24
27					Gray low plastic SILTY CLAY		CL							27
	6	SS		3 5 8	Brown fine SAND		SP		26		- -			
30														30
33														33
	7	SS		6 8 9					21		- -			
36														36
					Brown medium SAND		SP							
39	8	SS		8 8 12					20		- -			39

Continued on Sheet 3 of 5

WATER LEVEL:
____ NONE OBSERVED WHILE DRILLING
33 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor — BORING NO. B-11
LOCATION Granite City, Illinois — SHEET 3 OF 5
DRILLER Midwest Drilling Inc. — PROJECT NO. 13-0342
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA — DATE DRILLED 12/01/13

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
42														42
	9	SS		11 10 13					18		- -			
45														45
					Gray fine SAND		SP							
48														48
	10	SS		5 7 15					28		- -			
51					Gray medium SAND		SP							51
54	11	SS		9 10 12					20		- -			54
57														57
	12	SS		10 11 14					21		- -			
60														60

Continued on Sheet 4 of 5

WATER LEVEL:

_____ NONE OBSERVED WHILE DRILLING
33 FT WHILE DRILLING
_____ FT _____ HRS AFTER DRILLING
_____ FT _____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor | BORING NO. B-11
LOCATION Granite City, Illinois | SHEET 4 OF 5
DRILLER Midwest Drilling Inc. | PROJECT NO. 13-0342
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA | DATE DRILLED 12/01/13

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
					Gray medium SAND, trace gravel		SP							
63														63
	13	SS		13 21 24					22		- -			
66														66
69	14	SS		4 15 15					27		- -			69
72														72
	15	SS		9 13 15					18		- -			
75														75
					Gray coarse SAND, trace gravel		SP							
78														78
	16	SS		18 21 24					6		- -			
81														81

Continued on Sheet 5 of 5

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
33 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor
LOCATION Granite City, Illinois
DRILLER Midwest Drilling Inc.
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA

BORING NO. B-11
SHEET 5 OF 5
PROJECT NO. 13-0342
DATE DRILLED 12/01/13

DEPTH (FT)	SAMPLE				DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	LABORATORY TEST RESULTS					DEPTH (FT)
	NUMBER	TYPE	RECOVERY (IN/IN)	BLOWS (PER 6 IN)					MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	
					Refusal at 83 feet.									
84														84
87														87
90														90
93														93
96														96
99														99
102														102

WATER LEVEL:

_____ NONE OBSERVED WHILE DRILLING
33 FT WHILE DRILLING
_____ FT _____ HRS AFTER DRILLING
_____ FT _____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor | BORING NO. B-12
LOCATION Granite City, Illinois | SHEET 1 OF 4
DRILLER Midwest Drilling Inc. | PROJECT NO. 13-0342
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA | DATE DRILLED 11/26/13

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
0					FILL - Dark Brown low plastic CLAYEY SILT		FILL	1						0
					FILL - Brown medium SAND		FILL							
3														3
	1	SS		7 / 7 / 6					22		- -			
6														6
					Gray low plastic SILTY CLAY		CL							
9	2	SS		2 / 2 / 2					41		1.0			9
12					Gray and brown medium plastic SILTY CLAY		CL-CH							12
	3	SS		2 / 2 / 4					47		- -			
15														15
					Brown fine SAND		SP							
18														18
	4	SS		7 / 12 / 15					6		- -			

Continued on Sheet 2 of 4

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
21 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

1) Driller's observation

BORING LOG

PROJECT South Harbor Conveyor | BORING NO. B-12
LOCATION Granite City, Illinois | SHEET 2 OF 4
DRILLER Midwest Drilling Inc. | PROJECT NO. 13-0342
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA | DATE DRILLED 11/26/13

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
21					Brown fine SAND, trace gravel		SP							21
24	5	SS		3 4 7					20		--			24
27					Brown medium SAND, trace gravel		SP							27
30	6	SS		8 13 15					17		--			30
33	7	SS		6 11 14					18		--			33
36														36
					Gray medium SAND		SP							
39	8	SS		6 7 9					14		--			39

Continued on Sheet 3 of 4

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
21 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor — BORING NO. B-12
LOCATION Granite City, Illinois — SHEET 3 OF 4
DRILLER Midwest Drilling Inc. — PROJECT NO. 13-0342
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA — DATE DRILLED 11/26/13

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	RECOVERY (IN/IN)	BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
42														42
	9	SS		8 / 10 / 12					14		- -			
45														45
					Gray fine SAND		SP							
48														48
	10	SS		18 / 22 / 23					22		- -			
51														51
54	11	SS		13 / 24 / 26					19		- -			54
57														57
	12	SS		15 / 19 / 22					17		- -			
60														60

Continued on Sheet 4 of 4

WATER LEVEL:

_____ NONE OBSERVED WHILE DRILLING
21 FT WHILE DRILLING
_____ FT ___ HRS AFTER DRILLING
_____ FT ___ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor
LOCATION Granite City, Illinois
DRILLER Midwest Drilling Inc.
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA

BORING NO. B-12
SHEET 4 OF 4
PROJECT NO. 13-0342
DATE DRILLED 11/26/13

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
					Gray coarse SAND, trace gravel		SP							
63														63
	13	SS		10 13 17					7		- -			
66														66
69	14	SS		15 16 26					6		- -			69
72														72
	15	SS		14 17 32					6		- -			
75					Weathered LIMESTONE									75
					Refusal at 76 feet.									
78														78
81														81

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
21 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

APPENDIX B

Table 1. Information from B-8 (Tower K) for Estimating Pile Length

Layer Thickness (ft)	Unconfined Compressive Strength (tsf)	SPT N-value (bpf)	Granular or Rock Layer Description
7	1.0	–	–
5	1.0	–	–
5	–	4	Fine Sand
5	–	8	Fine Sand
5	–	10	Medium Sand
5	–	23	Medium Sand
5	–	22	Fine Sand
5	–	48	Fine Sand
5	–	40	Fine Sand
5	–	42	Fine Sand
5	–	39	Medium Sand
5	–	20	Medium Sand
4	–	24	Medium Sand
1 *	–	–	Limestone

* Continue adding 1-foot-thick layers of limestone to the end of the spreadsheet

Table 2. Information from B-9 (Tower J) for Estimating Pile Length

Layer Thickness (ft)	Unconfined Compressive Strength (tsf)	SPT N-value (bpf)	Granular or Rock Layer Description
4	–	–	Fine Sand
4	1.5	–	–
6	1.0	–	–
3	–	10	Fine Sand
5	–	11	Fine Sand
5	–	12	Fine Sand
5	–	23	Medium Sand
5	–	20	Medium Sand
5	–	23	Fine Sand
5	–	24	Medium Sand
5	–	32	Medium Sand
5	–	29	Medium Sand
5	–	34	Medium Sand
5	–	28	Clean Coarse Sand
1 *	–	–	Limestone

* Continue adding 1-foot-thick layers of limestone to the end of the spreadsheet

Table 3. Information from B-10 (Tower H) for Estimating Pile Length

Layer Thickness (ft)	Unconfined Compressive Strength (tsf)	SPT N-value (bpf)	Granular or Rock Layer Description
6	–	10	Fine Sand
6	4.0	18	–
5	1.5	–	–
5	1.5	–	–
5	0	–	–
5	–	16	Fine Sand
5	–	9	Fine Sand
5	–	15	Fine Sand
5	–	19	Fine Sand
5	–	25	Fine Sand
5	–	25	Medium Sand
5	–	28	Fine Sand
5	–	28	Medium Sand
5	–	34	Medium Sand
5	–	30	Clean Coarse Sand
5	–	14	Clean Coarse Sand
1 *	–	–	Limestone

* Continue adding 1-foot-thick layers of limestone to the end of the spreadsheet

Table 4. Information from B-11 (Tower G) for Estimating Pile Length

Layer Thickness (ft)	Unconfined Compressive Strength (tsf)	SPT N-value (bpf)	Granular or Rock Layer Description
7	–	9	Fine Sand
5	1.5		–
5	1.5	–	–
5	2.5	–	–
7	1.5	–	–
3	–	13	Fine Sand
5	–	17	Fine Sand
5	–	20	Medium Sand
5	–	23	Medium Sand
5	–	22	Fine Sand
5	–	22	Medium Sand
5	–	25	Medium Sand
5	–	45	Medium Sand
5	–	30	Medium Sand
5	–	28	Medium Sand
6	–	45	Clean Coarse Sand
1 *	–	–	Limestone

* Continue adding 1-foot-thick layers of limestone to the end of the spreadsheet

QUALITY TESTING AND ENGINEERING, INC.

GEOTECHNICAL

ENVIRONMENTAL

CONSTRUCTION MATERIAL TESTING

CULTURAL RESOURCES

NATURAL RESOURCES

Subsurface Exploration and Geotechnical Recommendations

SOUTH HARBOR CONVEYOR
GRANITE CITY, ILLINOIS

July 2014

KORTE AND LUITJOHAN CONTRACTORS, INC.
General Contractor

THOUVENOT, WADE AND MOERCHEN, INC.
Civil Engineer/Structural Engineer

Project No. 13-0342-G

AASHTO R18
AASHTO Accredited

CORPORATE OFFICE:	803 WEST STATE STREET, O'FALLON, IL 62269	PHONE: 618-632-9900	FAX: 618-632-9922
REGIONAL OFFICE:	206 SOUTH LINN AVENUE, WENTZVILLE, MO 63385	PHONE: 636-332-1153	FAX: 636-332-5781

WWW.QTEINC.COM

QUALITY TESTING AND ENGINEERING, INC.

GEOTECHNICAL
ENVIRONMENTAL
CONSTRUCTION MATERIAL TESTING
CULTURAL RESOURCES
NATURAL RESOURCES

July 16, 2014

Mr. John Whitworth
Korte and Luitjohan Contractors, Inc.
12052 Highland Road
Highland, Illinois 62249

RE: Geotechnical Exploration
South Harbor Conveyor – Third Phase
Granite City, Illinois
QTE No. 13-0342-G

Dear Mr. Whitworth:

Enclosed is our report titled *Subsurface Exploration and Geotechnical Recommendations – SOUTH HARBOR CONVEYOR – GRANITE CITY, ILLINOIS,* dated July 2014. The report provided herein should be read in its entirety for a full understanding of the report highlights provided below and other project recommendations. Highlights from the report include:

- Three borings were drilled for this phase of the project. One boring was drilled at Tower E to a depth of 25 feet. Two borings were drilled at the grain storage bins until auger refusal was encountered at a depth of 77 feet. Those two borings were then extended 10 feet into bedrock with an NX-sized rock core barrel.

- Groundwater was encountered in the borings at the grain storage bins at depths of approximately 13 and 17.5 feet below the ground surface at the time of drilling. Because the depth to groundwater is anticipated to be below the bottom of the foundations, problems with groundwater during construction are not anticipated.

- Shallow mat foundations bearing on natural soils or new properly compacted structural fill or backfill placed as recommended herein will be appropriate for support of the proposed grain storage bins. The foundations should be proportioned for a long-term net allowable bearing pressure of 2,200 pounds per square foot (psf) and a short-term net allowable bearing pressure of 2,900 psf.

- Based on the estimated vertical applied pressure of 3,500 psf and footing diameter of 52 feet, total long-term settlement of the mat foundations should be on the order of 1 inch.

CORPORATE OFFICE: 803 WEST STATE STREET, O'FALLON, IL 62269 PHONE: 618-632-9900 FAX: 618-632-9922
REGIONAL OFFICE: 206 SOUTH LINN AVENUE, WENTZVILLE, MO 63385 PHONE: 636-332-1153 FAX: 636-332-5781
WWW.QTEINC.COM

We appreciate the opportunity to be of service to you on this project. We should be employed to provide quality control testing for the project as recommended in the report. If you have any questions or comments at this time regarding the report or additional services, please call.

Respectfully submitted,

QUALITY TESTING AND ENGINEERING, INC.

Jennifer L. Delancey

Jennifer L. Delancey, P.E.
Geotechnical Engineer

Michael A. Widman, P.E.
President

JLD/MAW/hm

C: Mr. Paul Homann; Thouvenot, Wade and Moerchen, Inc.
Mr. Bill Stahlman; America's Central Port / Tri-City Regional Port District

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FIGURE

APPENDIX

Subsurface Exploration
and
Geotechnical Recommendations

SOUTH HARBOR CONVEYOR
GRANITE CITY, ILLINOIS

1.0 INTRODUCTION

We were authorized by Mr. John Whitworth of Korte and Luitjohan Contractors, Inc. to conduct a subsurface exploration and to provide geotechnical recommendations for a conveyor system and other associated structures in Granite City, Illinois. The purpose of our exploration was to characterize and evaluate the subsurface conditions in order to develop geotechnical recommendations for the project and to prepare a formal report. The general scope of our study as outlined in our proposal dated May 28, 2014, addressed the following:

- Location and general description of natural soils and existing fill materials, if encountered.
- Evaluation of volume change potential of subgrade soils and recommendations for mitigation of high plasticity soils, if necessary.
- Groundwater levels observed in the borings at the time of drilling, and the potential influence of groundwater on the design and construction of the project.
- Recommendations for foundation design of the grain storage bins, including feasible foundation types, bearing depths, net allowable bearing pressures (short term and long term), and allowable friction values, as applicable.
- Anticipated settlement of shallow mat foundations for the grain storage bins based on general soil characteristics and laboratory consolidation tests, if performed.
- Seismic Site Class, mapped spectral accelerations at 0.2 second and 1.0 second (S_s and S_1), and Design Spectral Accelerations at 0.2 second and 1.0 second (S_{DS} and S_{D1}) according to the 2009 International Building Code (IBC).
- Recommendations for floor slab design, including modulus of subgrade reaction.
- Excavation safety considerations.
- Site development recommendations and construction considerations.
- Suitability of on-site soils for use as structural fill.
- Engineering criteria for placement of structural fill.

1.1 Project Description

The project will feature construction of several structures for a new grain conveyor system. QTE previously prepared geotechnical reports for this project dated August 19, 2013 and January 15, 2014. The scope of the initial phase of the project included the structures located on the landward (east) side of the levee. The scope of the second phase included the structures located on the west side of the levee. The scope of the third phase will include two 100,000-bushel bins for grain storage on site. Two additional bins may be constructed in the future. The location of the proposed construction is depicted on the Site Plan, Figure 1. The grain storage bins will have a diameter of approximately 48 feet and a height of approximately 92 feet. A bucket elevator and conveyor system are also needed for loading and unloading the bins. According to the structural engineer, Thouvenot, Wade and Moerchen, Inc. (TWM), the bins will likely be supported on mat foundations with a diameter of 52 feet and will bear at a depth of approximately 3 feet. Based on an estimated applied pressure of 3,500 pounds per square foot, the vertical load on the bins will be approximately 7,430 kips.

2.0 FIELD EXPLORATION AND LABORATORY TESTING

The field exploration of this phase of the project consisted of drilling three test borings, designated B-13 through B-15. Borings B-14 and B-15 were drilled at the grain storage bins until auger refusal was encountered at a depth of 77 feet. The borings were then extended 10 feet into bedrock with an NX-sized rock core barrel. Boring B-13 was drilled at Tower E to a depth of to a depth of 25 feet, when potentially hazardous vapors were encountered. It was then backfilled with grout per U.S. Army Corps of Engineers specifications. The borings were drilled by Midwest Drilling, Inc. on June 11 and 12, 2014. They were advanced with 4-inch outside diameter continuous flight augers mounted on an ATV drill rig. Mud rotary methods were used when drilling below the groundwater table. Boring locations were established in the field and surface elevations determined by the project surveyor, TWM. The approximate boring locations are shown on the Site Plan.

Field sampling and testing consisted of performing standard penetration tests (SPTs) with a split-spoon sampler at 5-foot vertical intervals. The SPT provides approximate soil strength information and a disturbed sample for routine laboratory testing. Materials recovered with the split-spoon sampler were placed in sealed glass jars. Relatively undisturbed materials were recovered at four selected locations by pushing a 3-inch-diameter thin-walled sampling tube (Shelby tube) in lieu of the SPT.

The samples were transported to our laboratory for classification and testing. We visually classified each cohesive soil sample and measured its moisture content. Approximations of the unconfined compressive strength of the cohesive SPT samples were determined by hand penetrometer. Natural density tests and unconfined compression tests were performed on the relatively undisturbed samples recovered in the Shelby tubes. Field sampling information, groundwater readings taken by the driller at the time of drilling, and laboratory test results are presented on the Boring Logs, Appendix A.

3.0 SUBSURFACE CONDITIONS

The following is a general description of the soils encountered at the three boring locations. Detailed information regarding the soils encountered is presented on the Boring Logs. A Boring Log Legend is included to clarify the data presented.

3.1 Topsoil

Approximately 4 inches of topsoil was noted by the driller at Boring B-14. Stripping of vegetation and root mass from areas to be developed will remove some of the topsoil layer. The stripped materials should be stockpiled for later placement in landscaped areas or removed from the site. In our opinion, topsoil remaining after stripping may be blended with other soil materials and used as site fill.

3.2 Fill Materials

In Boring B-13, which was located at Tower E, fill was encountered to a depth of approximately 17 feet below the ground surface. The fill was generally composed of fine sand and low plasticity silty clay with some sand. The SPT N-values of the fill materials ranged from 6 to 14 blows per foot (bpf). The moisture content of the fill varied from 4 to 33 percent. The apparent unconfined compressive strength of the silty clay fill as measured with a hand penetrometer on a disturbed split-spoon sample was approximately 2.0 kips per square foot (ksf).

3.3 Natural Soils

Beneath the existing fill in B-13, natural soils generally consisted of fine sand to the boring termination depth of 25 feet. Beneath the topsoil in B-14, natural soils consisted of fine sand to a depth of approximately 1.5 feet and high plasticity clay to a depth of approximately 6 feet. These soils were underlain by clayey sand, fine sand, and medium sand to a depth of approximately 74 feet. Weathered rock was present between the depths of 74 and 77 feet before auger refusal on limestone was encountered. Beneath the ground surface in B-15, natural soils consisted of clayey sand to a depth of approximately 3 feet and low plasticity silty clay with some sand to a depth of approximately 8 feet. These soils were underlain by clayey sand, fine sand, and medium sand to a depth of approximately 73.5 feet. Weathered rock was present between the depths of 73.5 and 77 feet before auger refusal on limestone was encountered.

The high plasticity clay and low plasticity silty clay exhibited moisture contents of 25 and 30 percent. Two Shelby tube samples were taken in these soils. These samples exhibited dry densities of 90.5 and 96.6 pounds per cubic foot (pcf) and unconfined compressive strengths of 1.0 and 1.8 ksf. The tests indicate these soils are generally medium stiff in consistency.

The clayey sands exhibited an N-value of 10 bpf and moisture contents of 29 and 32 percent. The results indicate the sands are generally medium dense.

The fine and medium sands exhibited N-values ranging from 4 to 44 bpf and moisture contents ranging from 3 to 37 percent. The results indicate the sands range from loose to dense.

3.4 Bedrock

After auger refusal occurred in Boring B-14 and B-15, 10 feet of rock coring was performed with an NX-sized core barrel. The materials encountered consisted of gray limestone. The recoveries of the core runs were 98 and 95 percent. The Rock Quality Designations (RQDs) were 65 and 60 percent. Based on these RQDs, the bedrock is considered fair quality.

3.5 Volume Change Potential

The high plasticity clay soils encountered in B-14 between the depths of approximately 1.5 and 6 feet may possess a high potential for volume change. However, the weight of the grain storage bins will likely counteract any swell pressure produced by these soils.

The remainder of the soils encountered in the borings, and likely to be encountered during construction, are low plasticity or cohesionless in nature and possess little potential for volume change with changes in the soil moisture content. No site-wide special precautions related to volume change potential are required during construction where these soils are exposed in foundations or as the subgrade material for other surface improvements.

3.6 Groundwater

Groundwater was encountered at depths of approximately 13 and 17.5 feet below the ground surface in the borings located at the grain storage bins at the time of drilling. These levels may be higher if measured after a longer period of time or during wetter periods of the year, particularly in the early spring months. Because the depth to groundwater is anticipated to be below the bottom of the foundations, problems with groundwater during construction are not anticipated. Although not pertinent to this project, groundwater was also observed during drilling and at the completion of drilling in Boring B-13.

4.0 GEOTECHNICAL DESIGN CONSIDERATIONS

Newly placed fill and backfill should be of materials approved and monitored during placement by QTE. The following design recommendations assume the site has been prepared in accordance with the recommendations presented in subsequent sections of this report.

4.1 Mat Foundations

The proposed grain storage bins may be supported by shallow mat foundations that bear on natural soils or properly compacted new structural fill or backfill placed in compliance with the recommendations presented herein. The mat foundations should be proportioned for a long-term net allowable bearing pressure of 2,200 psf. For temporary loading conditions such as wind and earthquake loads, a net allowable bearing pressure of 2,900 psf may be used. It is recommended that a lateral load analysis be performed with the following design parameters:

Component	Recommended Value
Sliding resistance along base	0.30 times dead load
Sliding resistance along sides	250 psf times area of sides parallel to force
Uplift resistance	250 psf times area of all sides
Passive resistance on opposite face perpendicular to force	250 psf uniform passive pressure

Based on the estimated vertical applied pressure of 3,500 psf and footing diameter of 52 feet, total long-term settlement of the mat foundations should be on the order of 1 inch. This settlement should occur in a relatively uniform manner over the footprint of the structure. Maximum differential settlement across the foundation should be approximately half of the total settlement. Most of the settlement should occur during construction as the structural loads are applied to the subgrade.

4.2 Seismic Considerations

We evaluated the seismic recommendations using the 2009 International Building Code (IBC). Per Table 1613.5.2 of the 2009 IBC and based on our experience in the area, we recommend that the project be designed using Site Class D.

According to ground motion maps prepared by the USGS and data obtained from the 2009 IBC, the maximum considered earthquake spectral response accelerations at short periods (S_s) and at a one-second period (S_1) are 0.563 g and 0.164 g, respectively. The Design Spectral Acceleration at 0.2 second (S_{DS}) is 0.507 g, and the Design Spectral Acceleration at 1.0 second (S_{D1}) is 0.235 g.

4.3 Floor Slabs

The recommendations provided below are intended as minimum requirements and are not intended to supersede the structural engineering design of the floor slabs.

QTE should observe and approve the subgrade immediately prior to placement of the floor slabs. Tests may be required to verify proper compaction of the subgrade materials if they are disturbed after initial placement and testing. For a low plasticity soil subgrade, a modulus of subgrade reaction of 200 pounds per cubic inch (pci) may be used for slab design. This value may be increased to 300 pci if lime-modified soils are used, or 350 pci if granular materials are used. In order to achieve the above values, the subgrade, rock base, and backfill materials must be placed and compacted as recommended herein.

The floor slabs should be supported on a minimum 4-inch-thick layer of compacted crushed stone. The crushed stone will help distribute concentrated loads and equalize moisture conditions beneath the slabs. It may be desirable to place a 6-mil polyethylene moisture barrier beneath the floor slabs to prevent the transfer of capillary moisture to the slab. Without careful attention to curing of the concrete slabs, however, the polyethylene sheet can cause excessive shrinkage cracking and "curling". We suggest the applicable recommendations provided in the standards of the American Concrete Institute be followed for curing the concrete floor slab.

We suggest floor slabs not be structurally connected to the foundation walls and column pads. Isolation joints should be used at any place where a slab meets a wall or an independent column support. Careful attention should be given to the control joint spacing intervals which will likely be dictated by the design thickness of the slabs. Such joints permit slight movement of the independent elements and help prevent random cracking that might otherwise be caused by restraint of shrinkage, slight rotations, heave, or settlement. If the floor slabs must be structurally tied or connected to the foundations, slotted nut-type inserts should be considered for the fasteners. This type fastener will allow minor vertical movement yet provide lateral resistance.

5.0 CONSTRUCTION RECOMMENDATIONS AND CONSIDERATIONS

The geotechnical aspects of the proposed construction will involve site preparation, grading the construction areas, placement of foundations, floor slab construction, and construction of other site features. QTE should be involved in these construction activities.

5.1 Site Preparation

Site stripping will consist of removing any grass or weed growth together with its root mass. Organic soils were not observed at the boring locations; however, if such materials are encountered, they should be stripped and stockpiled for later use in landscaped areas. After removal of vegetation and completion of any required additional stripping, the subgrade in areas to receive fill should be scarified and recompacted to a dry density of at least 95 percent of the material's maximum dry density as determined by the standard Proctor compaction test (ASTM D 698). Exposed soils in proposed cut areas should be observed by personnel of QTE and identified as acceptable or not acceptable for placement as structural fill in the building areas.

5.2 Fill Materials and Compaction

A clean, low plasticity, cohesive borrow material may be used as site fill. Typically, these soils are classified by ASTM D 2487 as CL, ML, or CL/ML, and have a liquid limit of less than 45. QTE should observe, test, and approve soils used as structural fill. If fill materials are imported, they should be approved at their origin before being transported to the site. Cohesive structural fill materials placed beneath foundations and floor slabs or behind walls should consist of either low plasticity soils or chemically-modified high plasticity soils. Untreated high plasticity soils should not be used as structural fill. High plasticity soils excavated from the building areas should be placed outside of building or parking areas, if possible. If used as fill in the parking areas, lime modification should be considered. Fill materials should be placed and compacted according to the following criteria:

Fill Material	Loose Lift Thickness	Moisture Content	Minimum Dry Density (based on Standard Proctor Maximum Dry Density)
Low plasticity soils	8 to 12 inches	Within 5 percent above or below optimum	95 percent
Chemically-modified high plasticity soils	8 inches or less	4 to 6 percent above optimum	95 percent
Untreated high plasticity soils	8 to 12 inches	2 to 4 percent above optimum	92 percent

Tests should be performed on each lift of fill and on every other lift of backfill to ensure compliance with the compaction requirements.

The natural sandy soils on this site may tend to "pump" under the trafficking of equipment, and some difficulty with equipment mobility should be anticipated. Special attention should be give to the removal of the last 2 to 3 feet of cut from any "pumping" areas to avoid disturbances to the natural soils that will support roadway or building construction. Spreading lime in the excavations to dry the materials and allow excavating to the desired depths may be necessary.

Some of the excavated materials may consist of high plasticity clay soils that will require chemical modification if used as structural fill. "Code L" lime or quicklime is generally blended with the clay soils to lower their natural moisture content, liquid limit (LL), and plasticity index (PI). Cohesive soil fill materials placed within 3 feet of the base of concrete floor slabs should possess a PI less than 20 at the time of placement. Treated materials used to backfill foundation walls, footing overexcavations, or utility trenches should meet this requirement. The minimum recommended chemical incorporation rate used with on-site soils should be 4 to 6 percent "Code L" or equivalent, which roughly corresponds to 3 to 4 percent quicklime.

If construction occurs during wet weather, the existing subgrade and fill materials may require chemical modification to reduce natural moisture contents and achieve compaction. An incorporation rate of 2 to 3 percent "Code L" should suffice for moisture control. The incorporation rates are based on dry weight of materials. Incorporation of lime in each lift of fill requires achieving a uniform blend of the materials by use of large mechanized equipment or "gators". Use of farm discs is not considered acceptable for blending lime based on prior experience with such equipment.

The natural soil moisture contents encountered at the time of drilling indicate that some of the on-site materials may need to be spread and dried in order to obtain proper compaction. These materials dry readily during favorable weather periods from May through October. The use of a disc for drying or the use of a "gator" to incorporate lime may be required to facilitate compaction of soils with high moisture contents. QTE should monitor blending procedures and test for proper compaction of the treated fill materials.

Well-graded granular materials classified as SP, SW, GP or GW may by preferable for structural fill and backfill and may be cost effective if the importation of fill materials is required. Granular materials will provide an excellent working surface for construction of buildings, will not be adversely affected by inclement weather, and can generally be compacted more readily. We suggest using ¾-inch to 2-inch-minus gradation crushed limestone, placed and compacted in the same manner and to the same criteria as recommended above for low plasticity soil.

5.3 Floor Slab Subgrade Considerations

The floor slab subgrade may be subjected to construction traffic and exposure to weather for an extended period prior to pouring the concrete slab. It is essential, therefore, to compact the subgrade to a dry density of at least 95 percent of the standard Proctor maximum dry density immediately prior to placing the slab. This recommendation applies to both cut and fill areas.

During an extended period of hot and/or dry weather, an effort should be made to prevent exposed floor slab subgrades from drying out. Precautions might include spreading a thin layer of limestone screenings over the subgrade to prevent direct exposure to the air and sunlight. Significant construction problems may also be incurred if floor slab construction takes place in the wetter portions of the year, November through April. Special measures may be required to facilitate construction during these periods. These measures may include, but are not limited to, addition of lime to the subgrade soils for drying purposes, or the removal of soft, spongy soils, and their replacement with rock. QTE should test the soil subgrade to verify proper compaction before rock is placed.

5.4 Foundation Excavations

Each foundation excavation should terminate in firm bearing materials. We should observe the excavations to establish acceptable criteria for foundation placement. Foundation excavations should not be left open longer than necessary to reduce drying of the soils in the exposed excavations.

The base of all excavations should be clean, dry, and free of loose or uncompacted fill. The excavations should be protected from extreme temperatures, precipitation, and construction disturbances. To minimize the possibility of disturbance of the foundation materials, we recommend the concrete be placed the same day the excavation is made.

5.5 Excavation Safety Considerations

During the excavation of this project, it may be necessary to slope or temporarily shore walls of open excavations to prevent collapse and sloughing of the soils. In Federal Register, Volume 54, No. 209 October 1989, the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, Part 1926, Subpart P." This document was issued to increase the safety of workers in excavations. It is mandated that all excavations, whether they are utility trenches, basement excavations, or footing excavations, be constructed in accordance with OSHA guidelines.

Based the subsurface conditions encountered in the borings, we recommend that the soils be classified as "Type C" according to the OSHA guidelines. Therefore, the maximum allowable slope for excavations less than 20 feet deep is 1½ Horizontal to 1 Vertical (34 degrees). Slopes or benches for excavations greater than 20 feet deep, which are unlikely for the grain storage bins, shall be designed by a registered Professional Engineer.

6.0 LIMITATIONS OF REPORT

The recommendations provided herein are for the exclusive use of Korte and Luitjohan Contractors, Inc. Our recommendations are based on the information obtained at three borings, on our understanding of the project scope as described herein, and on regionally accepted practice. No other warranty is expressed or implied. We should be contacted if there are changes in the scope of the project as reported herein, if conditions encountered are not consistent with those described, or if our present understanding of the project is incorrect.

In addition, we should be provided with a set of final plans as soon as they are available for review to determine the applicability of our recommendations. Construction specifications also merit our review to ensure proper interpretation of this report. Failure to provide these documents for review may nullify some or all of the recommendations provided herein.

The final part of our geotechnical service should consist of observation and materials testing during construction to observe that conditions actually encountered are consistent with those described in this report and to assess the appropriateness of the analyses and the recommendations contained herein. QTE cannot assume responsibility or liability for the adequacy of its recommendations without being retained to observe construction.

FIGURE

North ↑

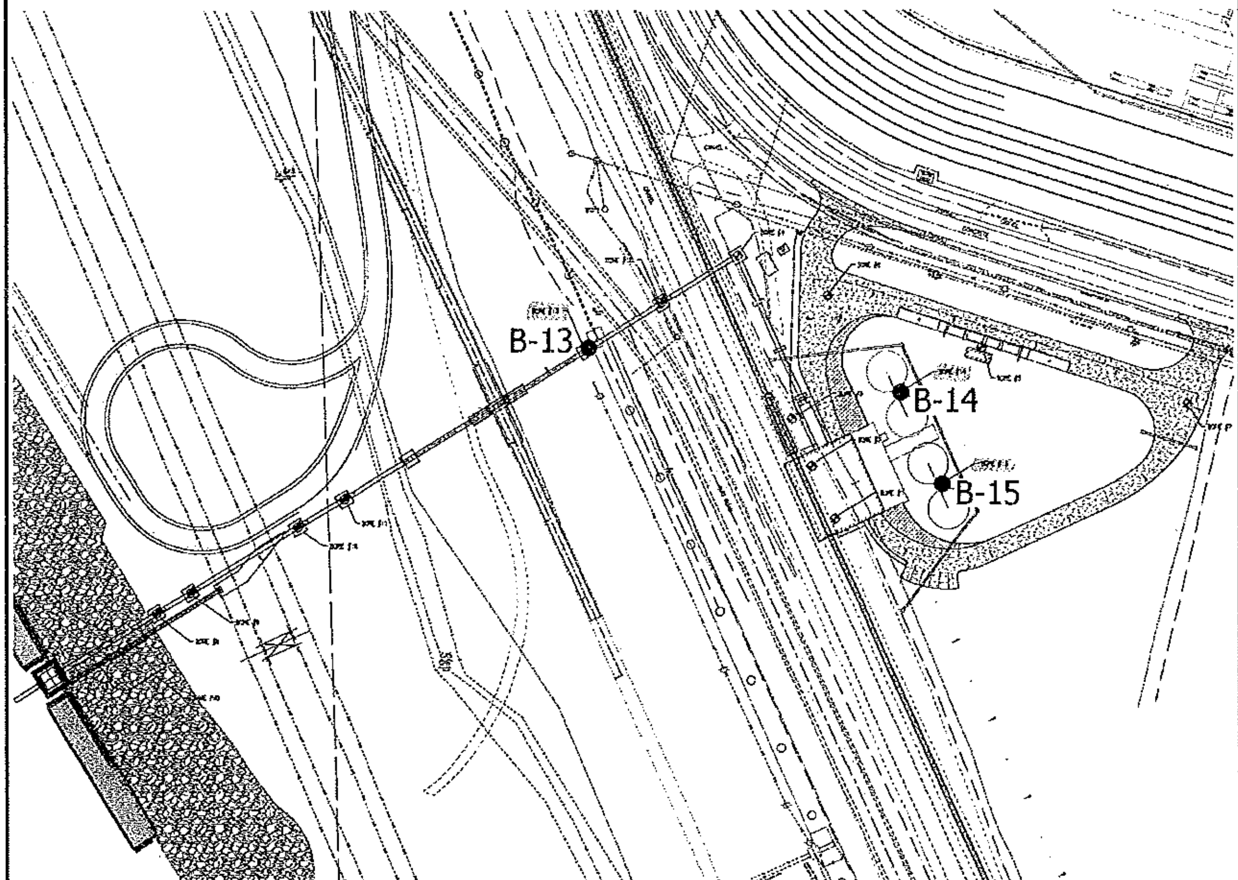

Figure 1

● Approximate Boring Location

Scale: Not to Scale

QUALITY TESTING AND ENGINEERING, INC.

803 W. State Street, O'Fallon, Illinois 62269

South Harbor Conveyor

Granite City, Illinois

Site Plan

July 2014 QTE No. 13-0342-G

APPENDIX A

QUALITY TESTING AND ENGINEERING, INC.

BORING LOG LEGEND AND NOMENCLATURE

Items shown in Boring Logs refer to the following: Where shown in parentheses, sampling and testing were performed in general accordance with applicable ASTM standard methods or practices.

1. **Depth** - Depth below ground surface feet.

2. **Sample** - Types designated by letters.

   SS - Split-spoon sample, disturbed, obtained by driving 2-inch O.D. split-spoon sampler ASTM D 1586.

   ST - Thin-walled tube sample, undisturbed, obtained by penetration of a 3-inch diameter tube ASTM D 1587.

   AS - Auger samples, disturbed, taken from cuttings.

   NX - Rock core recovered by NX-sized coring bit.

   Recovery - Recovery is expressed as a ratio of the length recovered to the total length pushed, driven, or cored inches, e.g. - 9/12.

   Blows - Numbers indicate blows per 6 inches of sampler penetration when driven by a 140-pound hammer falling freely 30 inches ASTM D 1586. When number of blows reaches 50 without 6 inches of sampler penetration, the result is shown as a ratio of 50 to the actual penetration, e.g. 50/2 inches.

3. **Description** - Description according to the Unified Soil Classification: Description indicates soil constituents, and other classification characteristics ASTM D 2488. Delineations of strata represent approximate boundaries between soil types and the transition may be gradual. The delineations shown on the Boring Logs were used for analytical purposes only. The information should not be used as a basis for design and/or construction cost estimates without realizing that there can be variation from the conditions shown.

   GW - Water level observation.

4. **Laboratory test results**

   - Natural moisture content in percent ASTM D 2216.
   - Dry density of sample tested in pounds per cubic foot (pcf).
   - Unconfined compressive strength ASTM D 2166 in kips per square foot (ksf).
   - Liquid limit ASTM D 4318 in percent.
   - Plastic limit ASTM D 4318 in percent.

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BORING LOG

PROJECT South Harbor Conveyor | BORING NO. B-13
LOCATION Granite City, Illinois | SHEET 1 OF 2
DRILLER Midwest Drilling Inc. | PROJECT NO. 13-0342
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA | DATE DRILLED 6/13/14

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
0					FILL - Brown fine SAND		FILL							0
3														3
	1	SS		5 6 8					4		- -			
6														6
					FILL - Brown and gray fine SAND		FILL							
9	2	SS		4 4 2					27		- -			9
12					FILL - Gray low plastic SILTY CLAY, some sand		FILL							12
	3	SS		2 2 4					33		2.0			
15														15
					Gray fine SAND, some clay		SP-SC							
18														18
	4	SS		2 2 2					37		0.5			

Continued on Sheet 2 of 2

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
22 FT WHILE DRILLING
9 FT 0 HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor
LOCATION Granite City, Illinois
DRILLER Midwest Drilling Inc.
SURFACE ELEVATION ________ DRILLING METHOD 4" CFA

BORING NO. B-13
SHEET 2 OF 2
PROJECT NO. 13-0342
DATE DRILLED 6/13/14

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
21					Brown fine SAND		SP							21
24	5	SS		3 5 7					26		- -			24
					Boring terminated at 25 feet.									
27														27
30														30
33														33
36														36
39														39

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
22 FT WHILE DRILLING
9 FT 0 HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor | BORING NO. B-14
LOCATION Granite City, Illinois | SHEET 1 OF 5
DRILLER Midwest Drilling Inc. | PROJECT NO. 13-0342
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA/mud rotary | DATE DRILLED 6/12/14

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
0					Topsoil 4"									0
					Brown fine SAND		SP							
					Gray high plastic CLAY		CH							
	1	ST	19/24					1	25	96.6	1.8			
3														3
6					Gray CLAYEY SAND		SC							6
	2	ST	18/24						32		1.0			
					Brown fine SAND		SP		4		- -			
9														9
12														12
	3	SS		5 / 6 / 11					25		- -			
15														15
18														18
					Brown medium SAND		SP							
	4	SS		3 / 6 / 6					15		- -			

Continued on Sheet 2 of 5

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
13 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:
1) Unconfined compressive strength test performed.

BORING LOG

PROJECT South Harbor Conveyor
BORING NO. B-14
LOCATION Granite City, Illinois
SHEET 2 **OF** 5
DRILLER Midwest Drilling Inc.
PROJECT NO. 13-0342
SURFACE ELEVATION ______ **DRILLING METHOD** 4" CFA/mud rotary
DATE DRILLED 6/12/14

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
21														21
					Brown medium SAND, trace gravel		SP							
24	5	SS		4 7 9					17		--			24
27					Brown fine SAND, trace organics		SP							27
	6	SS		4 4 3					15		--			
30														30
					Brown medium SAND		SP							
33														33
	7	SS		8 11 13					16		--			
36														36
39	8	SS		7 12 15					14		--			39

Continued on Sheet 3 of 5

WATER LEVEL:

- ____ NONE OBSERVED WHILE DRILLING
- 13 FT WHILE DRILLING
- ____ FT ____ HRS AFTER DRILLING
- ____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor | BORING NO. B-14
LOCATION Granite City, Illinois | SHEET 3 OF 5
DRILLER Midwest Drilling Inc. | PROJECT NO. 13-0342
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA/mud rotary | DATE DRILLED 6/12/14

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
42														42
					Gray fine SAND		SP							
	9	SS		11 13 22					22		--			
45														45
					Gray fine SAND, trace organics		SP							
48														48
	10	SS		5 8 9					30		--			
51														51
					Gray fine SAND		SP							
54	11	SS		9 11 18					24		--			54
57														57
	12	SS		7 13 14					25		--			
60														60

Continued on Sheet 4 of 5

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
13 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor
LOCATION Granite City, Illinois
DRILLER Midwest Drilling Inc.
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA/mud rotary

BORING NO. B-14
SHEET 4 OF 5
PROJECT NO. 13-0342
DATE DRILLED 6/12/14

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
63														63
	13	SS		18 22 20	Brown medium SAND		SP		14		--			
66					Brown medium SAND, trace organics		SP							66
69	14	SS		9 16 18					17		--			69
72														72
	15	SS		7 10 50/1"	Weathered rock									
75														75
					Gray LIMESTONE									
78														78
81														81

Continued on Sheet 5 of 5

WATER LEVEL:

___ NONE OBSERVED WHILE DRILLING
13 FT WHILE DRILLING
___ FT ___ HRS AFTER DRILLING
___ FT ___ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor | BORING NO. B-14
LOCATION Granite City, Illinois | SHEET 5 OF 5
DRILLER Midwest Drilling Inc. | PROJECT NO. 13-0342
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA/mud rotary | DATE DRILLED 6/12/14

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
	16	NX	117/120											
84					RQD= 65%									84
87					Boring terminated at 87 feet.									87
90														90
93														93
96														96
99														99
102														102

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
13 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor | BORING NO. B-15
LOCATION Granite City, Illinois | SHEET 1 OF 5
DRILLER Midwest Drilling Inc. | PROJECT NO. 13-0342
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA/mud rotary | DATE DRILLED 6/12/14

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
0					Brown CLAYEY SAND		SC							0
3					Gray low plastic SILTY CLAY, some sand		CL							3
	1	ST	20/24					1	30	90.5	1.0			
									4		--			
6														6
					Brown and gray fine SAND		SP							
9	2	ST	18/24						3		--			9
12														12
					Brown CLAYEY SAND		SC							
	3	SS		3 4 6					29		--			
15														15
					Brown fine SAND		SP							
18														18
	4	SS		4 4 5					23		--			

Continued on Sheet 2 of 5

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
17.5 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:
1) Unconfined compressive strength test performed.

BORING LOG

PROJECT South Harbor Conveyor
LOCATION Granite City, Illinois
DRILLER Midwest Drilling Inc.
SURFACE ELEVATION
DRILLING METHOD 4" CFA/mud rotary

BORING NO. B-15
SHEET 2 OF 5
PROJECT NO. 13-0342
DATE DRILLED 6/12/14

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
21														21
					Brown fine SAND, trace organics		SP							
24	5	SS		7 7 7					33		--			24
27					Brown medium SAND		SP							27
	6	SS		11 14 13					18		--			
30														30
33														33
	7	SS		9 11 12					14		--			
36														36
39	8	SS		7 9 11					20		--			39

Continued on Sheet 3 of 5

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
17.5 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor | BORING NO. B-15
LOCATION Granite City, Illinois | SHEET 3 OF 5
DRILLER Midwest Drilling Inc. | PROJECT NO. 13-0342
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA/mud rotary | DATE DRILLED 6/12/14

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
42					Brown and gray medium SAND		SP							42
	9	SS		8 9 12					13		--			
45														45
					Gray fine SAND		SP							
48														48
	10	SS		6 9 11					21		--			
51														51
54	11	SS		8 8 11					28		--			54
57					Gray medium SAND		SP							57
	12	SS		9 10 13					17		--			
60														60

Continued on Sheet 4 of 5

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
17.5 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor | BORING NO. B-15
LOCATION Granite City, Illinois | SHEET 4 OF 5
DRILLER Midwest Drilling Inc. | PROJECT NO. 13-0342
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA/mud rotary | DATE DRILLED 6/12/14

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
63														63
	13	SS		9 12 13					18		--			
66														66
69	14	SS		9 12 15					18		--			69
72														72
	15	SS		50/ 1"	Weathered rock									
75														75
					Gray LIMESTONE									
78														78
81														81

Continued on Sheet 5 of 5

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
17.5 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor
LOCATION Granite City, Illinois
DRILLER Midwest Drilling Inc.
SURFACE ELEVATION
DRILLING METHOD 4" CFA/mud rotary

BORING NO. B-15
SHEET 5 OF 5
PROJECT NO. 13-0342
DATE DRILLED 6/12/14

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
	16	NX	114/120											
84					RQD= 60%									84
87					Boring terminated at 87 feet.									87
90														90
93														93
96														96
99														99
102														102

WATER LEVEL:

_____ NONE OBSERVED WHILE DRILLING
17.5 FT WHILE DRILLING
_____ FT _____ HRS AFTER DRILLING
_____ FT _____ HRS AFTER DRILLING

REMARKS:

QUALITY TESTING AND ENGINEERING, INC.

COPY

GEOTECHNICAL

ENVIRONMENTAL

CONSTRUCTION MATERIAL TESTING

CULTURAL RESOURCES

NATURAL RESOURCES

Subsurface Exploration and Geotechnical Recommendations

SOUTH HARBOR CONVEYOR
GRANITE CITY, ILLINOIS

July 2014

KORTE AND LUITJOHAN CONTRACTORS, INC.
General Contractor

THOUVENOT, WADE AND MOERCHEN, INC.
Civil Engineer/Structural Engineer

Project No. 13-0342-G

AASHTO R18
AASHTO Accredited

QUALITY TESTING AND ENGINEERING, INC.

GEOTECHNICAL

ENVIRONMENTAL

CONSTRUCTION MATERIAL TESTING

CULTURAL RESOURCES

NATURAL RESOURCES

July 16, 2014

Mr. John Whitworth
Korte and Luitjohan Contractors, Inc.
12052 Highland Road
Highland, Illinois 62249

RE: Geotechnical Exploration
South Harbor Conveyor – Third Phase
Granite City, Illinois
QTE No. 13-0342-G

Dear Mr. Whitworth:

Enclosed is our report titled *Subsurface Exploration and Geotechnical Recommendations – SOUTH HARBOR CONVEYOR – GRANITE CITY, ILLINOIS,* dated July 2014. The report provided herein should be read in its entirety for a full understanding of the report highlights provided below and other project recommendations. Highlights from the report include:

- Three borings were drilled for this phase of the project. One boring was drilled at Tower E to a depth of 25 feet. Two borings were drilled at the grain storage bins until auger refusal was encountered at a depth of 77 feet. Those two borings were then extended 10 feet into bedrock with an NX-sized rock core barrel.

- Groundwater was encountered in the borings at the grain storage bins at depths of approximately 13 and 17.5 feet below the ground surface at the time of drilling. Because the depth to groundwater is anticipated to be below the bottom of the foundations, problems with groundwater during construction are not anticipated.

- Shallow mat foundations bearing on natural soils or new properly compacted structural fill or backfill placed as recommended herein will be appropriate for support of the proposed grain storage bins. The foundations should be proportioned for a long-term net allowable bearing pressure of 2,200 pounds per square foot (psf) and a short-term net allowable bearing pressure of 2,900 psf.

- Based on the estimated vertical applied pressure of 3,500 psf and footing diameter of 52 feet, total long-term settlement of the mat foundations should be on the order of 1 inch.

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We appreciate the opportunity to be of service to you on this project. We should be employed to provide quality control testing for the project as recommended in the report. If you have any questions or comments at this time regarding the report or additional services, please call.

Respectfully submitted,

QUALITY TESTING AND ENGINEERING, INC.

Jennifer L. Delancey

Jennifer L. Delancey, P.E.
Geotechnical Engineer

Michael A. Widman, P.E.
President

JLD/MAW/hm

C: Mr. Paul Homann; Thouvenot, Wade and Moerchen, Inc.
Mr. Bill Stahlman; America's Central Port / Tri-City Regional Port District

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Subsurface Exploration
and
Geotechnical Recommendations

SOUTH HARBOR CONVEYOR
GRANITE CITY, ILLINOIS

1.0 INTRODUCTION

We were authorized by Mr. John Whitworth of Korte and Luitjohan Contractors, Inc. to conduct a subsurface exploration and to provide geotechnical recommendations for a conveyor system and other associated structures in Granite City, Illinois. The purpose of our exploration was to characterize and evaluate the subsurface conditions in order to develop geotechnical recommendations for the project and to prepare a formal report. The general scope of our study as outlined in our proposal dated May 28, 2014, addressed the following:

- ❖ Location and general description of natural soils and existing fill materials, if encountered.
- ❖ Evaluation of volume change potential of subgrade soils and recommendations for mitigation of high plasticity soils, if necessary.
- ❖ Groundwater levels observed in the borings at the time of drilling, and the potential influence of groundwater on the design and construction of the project.
- ❖ Recommendations for foundation design of the grain storage bins, including feasible foundation types, bearing depths, net allowable bearing pressures (short term and long term), and allowable friction values, as applicable.
- ❖ Anticipated settlement of shallow mat foundations for the grain storage bins based on general soil characteristics and laboratory consolidation tests, if performed.
- ❖ Seismic Site Class, mapped spectral accelerations at 0.2 second and 1.0 second (S_s and S_1), and Design Spectral Accelerations at 0.2 second and 1.0 second (S_{DS} and S_{D1}) according to the 2009 International Building Code (IBC).
- ❖ Recommendations for floor slab design, including modulus of subgrade reaction.
- ❖ Excavation safety considerations.
- ❖ Site development recommendations and construction considerations.
- ❖ Suitability of on-site soils for use as structural fill.
- ❖ Engineering criteria for placement of structural fill.

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1.1 Project Description

The project will feature construction of several structures for a new grain conveyor system. QTE previously prepared geotechnical reports for this project dated August 19, 2013 and January 15, 2014. The scope of the initial phase of the project included the structures located on the landward (east) side of the levee. The scope of the second phase included the structures located on the west side of the levee. The scope of the third phase will include two 100,000-bushel bins for grain storage on site. Two additional bins may be constructed in the future. The location of the proposed construction is depicted on the Site Plan, Figure 1. The grain storage bins will have a diameter of approximately 48 feet and a height of approximately 92 feet. A bucket elevator and conveyor system are also needed for loading and unloading the bins. According to the structural engineer, Thouvenot, Wade and Moerchen, Inc. (TWM), the bins will likely be supported on mat foundations with a diameter of 52 feet and will bear at a depth of approximately 3 feet. Based on an estimated applied pressure of 3,500 pounds per square foot, the vertical load on the bins will be approximately 7,430 kips.

2.0 FIELD EXPLORATION AND LABORATORY TESTING

The field exploration of this phase of the project consisted of drilling three test borings, designated B-13 through B-15. Borings B-14 and B-15 were drilled at the grain storage bins until auger refusal was encountered at a depth of 77 feet. The borings were then extended 10 feet into bedrock with an NX-sized rock core barrel. Boring B-13 was drilled at Tower E to a depth of to a depth of 25 feet, when potentially hazardous vapors were encountered. It was then backfilled with grout per U.S. Army Corps of Engineers specifications. The borings were drilled by Midwest Drilling, Inc. on June 11 and 12, 2014. They were advanced with 4-inch outside diameter continuous flight augers mounted on an ATV drill rig. Mud rotary methods were used when drilling below the groundwater table. Boring locations were established in the field and surface elevations determined by the project surveyor, TWM. The approximate boring locations are shown on the Site Plan.

Field sampling and testing consisted of performing standard penetration tests (SPTs) with a split-spoon sampler at 5-foot vertical intervals. The SPT provides approximate soil strength information and a disturbed sample for routine laboratory testing. Materials recovered with the split-spoon sampler were placed in sealed glass jars. Relatively undisturbed materials were recovered at four selected locations by pushing a 3-inch-diameter thin-walled sampling tube (Shelby tube) in lieu of the SPT.

The samples were transported to our laboratory for classification and testing. We visually classified each cohesive soil sample and measured its moisture content. Approximations of the unconfined compressive strength of the cohesive SPT samples were determined by hand penetrometer. Natural density tests and unconfined compression tests were performed on the relatively undisturbed samples recovered in the Shelby tubes. Field sampling information, groundwater readings taken by the driller at the time of drilling, and laboratory test results are presented on the Boring Logs, Appendix A.

3.0 SUBSURFACE CONDITIONS

The following is a general description of the soils encountered at the three boring locations. Detailed information regarding the soils encountered is presented on the Boring Logs. A Boring Log Legend is included to clarify the data presented.

3.1 Topsoil

Approximately 4 inches of topsoil was noted by the driller at Boring B-14. Stripping of vegetation and root mass from areas to be developed will remove some of the topsoil layer. The stripped materials should be stockpiled for later placement in landscaped areas or removed from the site. In our opinion, topsoil remaining after stripping may be blended with other soil materials and used as site fill.

3.2 Fill Materials

In Boring B-13, which was located at Tower E, fill was encountered to a depth of approximately 17 feet below the ground surface. The fill was generally composed of fine sand and low plasticity silty clay with some sand. The SPT N-values of the fill materials ranged from 6 to 14 blows per foot (bpf). The moisture content of the fill varied from 4 to 33 percent. The apparent unconfined compressive strength of the silty clay fill as measured with a hand penetrometer on a disturbed split-spoon sample was approximately 2.0 kips per square foot (ksf).

3.3 Natural Soils

Beneath the existing fill in B-13, natural soils generally consisted of fine sand to the boring termination depth of 25 feet. Beneath the topsoil in B-14, natural soils consisted of fine sand to a depth of approximately 1.5 feet and high plasticity clay to a depth of approximately 6 feet. These soils were underlain by clayey sand, fine sand, and medium sand to a depth of approximately 74 feet. Weathered rock was present between the depths of 74 and 77 feet before auger refusal on limestone was encountered. Beneath the ground surface in B-15, natural soils consisted of clayey sand to a depth of approximately 3 feet and low plasticity silty clay with some sand to a depth of approximately 8 feet. These soils were underlain by clayey sand, fine sand, and medium sand to a depth of approximately 73.5 feet. Weathered rock was present between the depths of 73.5 and 77 feet before auger refusal on limestone was encountered.

The high plasticity clay and low plasticity silty clay exhibited moisture contents of 25 and 30 percent. Two Shelby tube samples were taken in these soils. These samples exhibited dry densities of 90.5 and 96.6 pounds per cubic foot (pcf) and unconfined compressive strengths of 1.0 and 1.8 ksf. The tests indicate these soils are generally medium stiff in consistency.

The clayey sands exhibited an N-value of 10 bpf and moisture contents of 29 and 32 percent. The results indicate the sands are generally medium dense.

The fine and medium sands exhibited N-values ranging from 4 to 44 bpf and moisture contents ranging from 3 to 37 percent. The results indicate the sands range from loose to dense.

3.4 Bedrock

After auger refusal occurred in Boring B-14 and B-15, 10 feet of rock coring was performed with an NX-sized core barrel. The materials encountered consisted of gray limestone. The recoveries of the core runs were 98 and 95 percent. The Rock Quality Designations (RQDs) were 65 and 60 percent. Based on these RQDs, the bedrock is considered fair quality.

3.5 Volume Change Potential

The high plasticity clay soils encountered in B-14 between the depths of approximately 1.5 and 6 feet may possess a high potential for volume change. However, the weight of the grain storage bins will likely counteract any swell pressure produced by these soils.

The remainder of the soils encountered in the borings, and likely to be encountered during construction, are low plasticity or cohesionless in nature and possess little potential for volume change with changes in the soil moisture content. No site-wide special precautions related to volume change potential are required during construction where these soils are exposed in foundations or as the subgrade material for other surface improvements.

3.6 Groundwater

Groundwater was encountered at depths of approximately 13 and 17.5 feet below the ground surface in the borings located at the grain storage bins at the time of drilling. These levels may be higher if measured after a longer period of time or during wetter periods of the year, particularly in the early spring months. Because the depth to groundwater is anticipated to be below the bottom of the foundations, problems with groundwater during construction are not anticipated. Although not pertinent to this project, groundwater was also observed during drilling and at the completion of drilling in Boring B-13.

4.0 GEOTECHNICAL DESIGN CONSIDERATIONS

Newly placed fill and backfill should be of materials approved and monitored during placement by QTE. The following design recommendations assume the site has been prepared in accordance with the recommendations presented in subsequent sections of this report.

4.1 Mat Foundations

The proposed grain storage bins may be supported by shallow mat foundations that bear on natural soils or properly compacted new structural fill or backfill placed in compliance with the recommendations presented herein. The mat foundations should be proportioned for a long-term net allowable bearing pressure of 2,200 psf. For temporary loading conditions such as wind and earthquake loads, a net allowable bearing pressure of 2,900 psf may be used. It is recommended that a lateral load analysis be performed with the following design parameters:

Component	Recommended Value
Sliding resistance along base	0.30 times dead load
Sliding resistance along sides	250 psf times area of sides parallel to force
Uplift resistance	250 psf times area of all sides
Passive resistance on opposite face perpendicular to force	250 psf uniform passive pressure

Based on the estimated vertical applied pressure of 3,500 psf and footing diameter of 52 feet, total long-term settlement of the mat foundations should be on the order of 1 inch. This settlement should occur in a relatively uniform manner over the footprint of the structure. Maximum differential settlement across the foundation should be approximately half of the total settlement. Most of the settlement should occur during construction as the structural loads are applied to the subgrade.

4.2 Seismic Considerations

We evaluated the seismic recommendations using the 2009 International Building Code (IBC). Per Table 1613.5.2 of the 2009 IBC and based on our experience in the area, we recommend that the project be designed using Site Class D.

According to ground motion maps prepared by the USGS and data obtained from the 2009 IBC, the maximum considered earthquake spectral response accelerations at short periods (S_s) and at a one-second period (S_1) are 0.563 g and 0.164 g, respectively. The Design Spectral Acceleration at 0.2 second (S_{DS}) is 0.507 g, and the Design Spectral Acceleration at 1.0 second (S_{D1}) is 0.235 g.

4.3 Floor Slabs

The recommendations provided below are intended as minimum requirements and are not intended to supersede the structural engineering design of the floor slabs.

QTE should observe and approve the subgrade immediately prior to placement of the floor slabs. Tests may be required to verify proper compaction of the subgrade materials if they are disturbed after initial placement and testing. For a low plasticity soil subgrade, a modulus of subgrade reaction of 200 pounds per cubic inch (pci) may be used for slab design. This value may be increased to 300 pci if lime-modified soils are used, or 350 pci if granular materials are used. In order to achieve the above values, the subgrade, rock base, and backfill materials must be placed and compacted as recommended herein.

The floor slabs should be supported on a minimum 4-inch-thick layer of compacted crushed stone. The crushed stone will help distribute concentrated loads and equalize moisture conditions beneath the slabs. It may be desirable to place a 6-mil polyethylene moisture barrier beneath the floor slabs to prevent the transfer of capillary moisture to the slab. Without careful attention to curing of the concrete slabs, however, the polyethylene sheet can cause excessive shrinkage cracking and "curling". We suggest the applicable recommendations provided in the standards of the American Concrete Institute be followed for curing the concrete floor slab.

We suggest floor slabs not be structurally connected to the foundation walls and column pads. Isolation joints should be used at any place where a slab meets a wall or an independent column support. Careful attention should be given to the control joint spacing intervals which will likely be dictated by the design thickness of the slabs. Such joints permit slight movement of the independent elements and help prevent random cracking that might otherwise be caused by restraint of shrinkage, slight rotations, heave, or settlement. If the floor slabs must be structurally tied or connected to the foundations, slotted nut-type inserts should be considered for the fasteners. This type fastener will allow minor vertical movement yet provide lateral resistance.

5.0 CONSTRUCTION RECOMMENDATIONS AND CONSIDERATIONS

The geotechnical aspects of the proposed construction will involve site preparation, grading the construction areas, placement of foundations, floor slab construction, and construction of other site features. QTE should be involved in these construction activities.

5.1 Site Preparation

Site stripping will consist of removing any grass or weed growth together with its root mass. Organic soils were not observed at the boring locations; however, if such materials are encountered, they should be stripped and stockpiled for later use in landscaped areas. After removal of vegetation and completion of any required additional stripping, the subgrade in areas to receive fill should be scarified and recompacted to a dry density of at least 95 percent of the material's maximum dry density as determined by the standard Proctor compaction test (ASTM D 698). Exposed soils in proposed cut areas should be observed by personnel of QTE and identified as acceptable or not acceptable for placement as structural fill in the building areas.

5.2 Fill Materials and Compaction

A clean, low plasticity, cohesive borrow material may be used as site fill. Typically, these soils are classified by ASTM D 2487 as CL, ML, or CL/ML, and have a liquid limit of less than 45. QTE should observe, test, and approve soils used as structural fill. If fill materials are imported, they should be approved at their origin before being transported to the site. Cohesive structural fill materials placed beneath foundations and floor slabs or behind walls should consist of either low plasticity soils or chemically-modified high plasticity soils. Untreated high plasticity soils should not be used as structural fill. High plasticity soils excavated from the building areas should be placed outside of building or parking areas, if possible. If used as fill in the parking areas, lime modification should be considered. Fill materials should be placed and compacted according to the following criteria:

Fill Material	Loose Lift Thickness	Moisture Content	Minimum Dry Density (based on Standard Proctor Maximum Dry Density)
Low plasticity soils	8 to 12 inches	Within 5 percent above or below optimum	95 percent
Chemically-modified high plasticity soils	8 inches or less	4 to 6 percent above optimum	95 percent
Untreated high plasticity soils	8 to 12 inches	2 to 4 percent above optimum	92 percent

Tests should be performed on each lift of fill and on every other lift of backfill to ensure compliance with the compaction requirements.

The natural sandy soils on this site may tend to "pump" under the trafficking of equipment, and some difficulty with equipment mobility should be anticipated. Special attention should be give to the removal of the last 2 to 3 feet of cut from any "pumping" areas to avoid disturbances to the natural soils that will support roadway or building construction. Spreading lime in the excavations to dry the materials and allow excavating to the desired depths may be necessary.

Some of the excavated materials may consist of high plasticity clay soils that will require chemical modification if used as structural fill. "Code L" lime or quicklime is generally blended with the clay soils to lower their natural moisture content, liquid limit (LL), and plasticity index (PI). Cohesive soil fill materials placed within 3 feet of the base of concrete floor slabs should possess a PI less than 20 at the time of placement. Treated materials used to backfill foundation walls, footing overexcavations, or utility trenches should meet this requirement. The minimum recommended chemical incorporation rate used with on-site soils should be 4 to 6 percent "Code L" or equivalent, which roughly corresponds to 3 to 4 percent quicklime.

If construction occurs during wet weather, the existing subgrade and fill materials may require chemical modification to reduce natural moisture contents and achieve compaction. An incorporation rate of 2 to 3 percent "Code L" should suffice for moisture control. The incorporation rates are based on dry weight of materials. Incorporation of lime in each lift of fill requires achieving a uniform blend of the materials by use of large mechanized equipment or "gators". Use of farm discs is not considered acceptable for blending lime based on prior experience with such equipment.

The natural soil moisture contents encountered at the time of drilling indicate that some of the on-site materials may need to be spread and dried in order to obtain proper compaction. These materials dry readily during favorable weather periods from May through October. The use of a disc for drying or the use of a "gator" to incorporate lime may be required to facilitate compaction of soils with high moisture contents. QTE should monitor blending procedures and test for proper compaction of the treated fill materials.

Well-graded granular materials classified as SP, SW, GP or GW may by preferable for structural fill and backfill and may be cost effective if the importation of fill materials is required. Granular materials will provide an excellent working surface for construction of buildings, will not be adversely affected by inclement weather, and can generally be compacted more readily. We suggest using ¾-inch to 2-inch-minus gradation crushed limestone, placed and compacted in the same manner and to the same criteria as recommended above for low plasticity soil.

5.3 Floor Slab Subgrade Considerations

The floor slab subgrade may be subjected to construction traffic and exposure to weather for an extended period prior to pouring the concrete slab. It is essential, therefore, to compact the subgrade to a dry density of at least 95 percent of the standard Proctor maximum dry density immediately prior to placing the slab. This recommendation applies to both cut and fill areas.

During an extended period of hot and/or dry weather, an effort should be made to prevent exposed floor slab subgrades from drying out. Precautions might include spreading a thin layer of limestone screenings over the subgrade to prevent direct exposure to the air and sunlight. Significant construction problems may also be incurred if floor slab construction takes place in the wetter portions of the year, November through April. Special measures may be required to facilitate construction during these periods. These measures may include, but are not limited to, addition of lime to the subgrade soils for drying purposes, or the removal of soft, spongy soils, and their replacement with rock. QTE should test the soil subgrade to verify proper compaction before rock is placed.

5.4 Foundation Excavations

Each foundation excavation should terminate in firm bearing materials. We should observe the excavations to establish acceptable criteria for foundation placement. Foundation excavations should not be left open longer than necessary to reduce drying of the soils in the exposed excavations.

The base of all excavations should be clean, dry, and free of loose or uncompacted fill. The excavations should be protected from extreme temperatures, precipitation, and construction disturbances. To minimize the possibility of disturbance of the foundation materials, we recommend the concrete be placed the same day the excavation is made.

5.5 Excavation Safety Considerations

During the excavation of this project, it may be necessary to slope or temporarily shore walls of open excavations to prevent collapse and sloughing of the soils. In Federal Register, Volume 54, No. 209 October 1989, the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, Part 1926, Subpart P." This document was issued to increase the safety of workers in excavations. It is mandated that all excavations, whether they are utility trenches, basement excavations, or footing excavations, be constructed in accordance with OSHA guidelines.

Based the subsurface conditions encountered in the borings, we recommend that the soils be classified as "Type C" according to the OSHA guidelines. Therefore, the maximum allowable slope for excavations less than 20 feet deep is 1½ Horizontal to 1 Vertical (34 degrees). Slopes or benches for excavations greater than 20 feet deep, which are unlikely for the grain storage bins, shall be designed by a registered Professional Engineer.

6.0 LIMITATIONS OF REPORT

The recommendations provided herein are for the exclusive use of Korte and Luitjohan Contractors, Inc. Our recommendations are based on the information obtained at three borings, on our understanding of the project scope as described herein, and on regionally accepted practice. No other warranty is expressed or implied. We should be contacted if there are changes in the scope of the project as reported herein, if conditions encountered are not consistent with those described, or if our present understanding of the project is incorrect.

In addition, we should be provided with a set of final plans as soon as they are available for review to determine the applicability of our recommendations. Construction specifications also merit our review to ensure proper interpretation of this report. Failure to provide these documents for review may nullify some or all of the recommendations provided herein.

The final part of our geotechnical service should consist of observation and materials testing during construction to observe that conditions actually encountered are consistent with those described in this report and to assess the appropriateness of the analyses and the recommendations contained herein. QTE cannot assume responsibility or liability for the adequacy of its recommendations without being retained to observe construction.

North

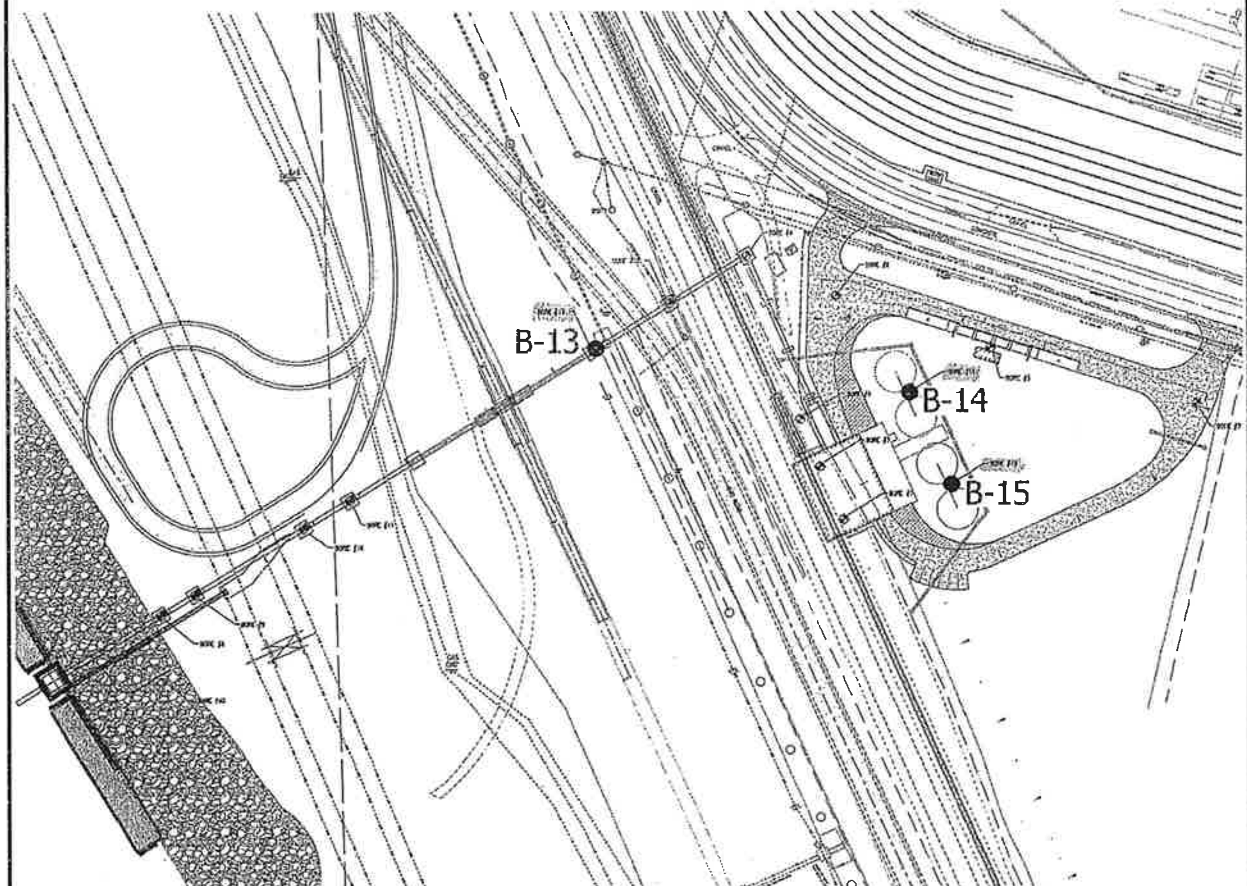

Figure 1

● Approximate Boring Location

Scale: Not to Scale

QUALITY TESTING AND ENGINEERING, INC.

803 W. State Street, O'Fallon, Illinois 62269

South Harbor Conveyor

Granite City, Illinois

Site Plan

July 2014 QTE No. 13-0342-G

QUALITY TESTING
AND ENGINEERING, INC.

BORING LOG LEGEND AND NOMENCLATURE

Items shown in Boring Logs refer to the following: Where shown in parentheses, sampling and testing were performed in general accordance with applicable ASTM standard methods or practices.

1. **Depth** - Depth below ground surface feet.

2. **Sample** - Types designated by letters.

   SS - Split-spoon sample, disturbed, obtained by driving 2-inch O.D. split-spoon sampler ASTM D 1586.

   ST - Thin-walled tube sample, undisturbed, obtained by penetration of a 3-inch diameter tube ASTM D 1587.

   AS - Auger samples, disturbed, taken from cuttings.

   NX - Rock core recovered by NX-sized coring bit.

   Recovery - Recovery is expressed as a ratio of the length recovered to the total length pushed, driven, or cored inches, e.g. - 9/12.

   Blows - Numbers indicate blows per 6 inches of sampler penetration when driven by a 140-pound hammer falling freely 30 inches ASTM D 1586. When number of blows reaches 50 without 6 inches of sampler penetration, the result is shown as a ratio of 50 to the actual penetration, e.g. 50/2 inches.

3. **Description** - Description according to the Unified Soil Classification: Description indicates soil constituents, and other classification characteristics ASTM D 2488. Delineations of strata represent approximate boundaries between soil types and the transition may be gradual. The delineations shown on the Boring Logs were used for analytical purposes only. The information should not be used as a basis for design and/or construction cost estimates without realizing that there can be variation from the conditions shown.

   GW - Water level observation.

4. **Laboratory test results**

   - Natural moisture content in percent ASTM D 2216.
   - Dry density of sample tested in pounds per cubic foot (pcf).
   - Unconfined compressive strength ASTM D 2166 in kips per square foot (ksf).
   - Liquid limit ASTM D 4318 in percent.
   - Plastic limit ASTM D 4318 in percent.

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BORING LOG

PROJECT South Harbor Conveyor
LOCATION Granite City, Illinois
DRILLER Midwest Drilling Inc.
SURFACE ELEVATION ______ **DRILLING METHOD** 4" CFA

BORING NO. B-13
SHEET 1 **OF** 2
PROJECT NO. 13-0342
DATE DRILLED 6/13/14

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
0					FILL - Brown fine SAND		FILL							0
3														3
	1	SS		5 6 8					4		--			
6														6
					FILL - Brown and gray fine SAND		FILL							
9	2	SS		4 4 2					27		--			9
12					FILL - Gray low plastic SILTY CLAY, some sand		FILL							12
	3	SS		2 2 4					33		2.0			
15														15
					Gray fine SAND, some clay		SP-SC							
18														18
	4	SS		2 2 2					37		0.5			

Continued on Sheet 2 of 2

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
22 FT WHILE DRILLING
9 FT 0 HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor
LOCATION Granite City, Illinois
DRILLER Midwest Drilling Inc.
SURFACE ELEVATION ______ **DRILLING METHOD** 4" CFA

BORING NO. B-13
SHEET 2 **OF** 2
PROJECT NO. 13-0342
DATE DRILLED 6/13/14

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
21					Brown fine SAND		SP							21
24	5	SS		3 5 7					26		--			24
					Boring terminated at 25 feet.									
27														27
30														30
33														33
36														36
39														39

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
22 FT WHILE DRILLING
9 FT 0 HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor
LOCATION Granite City, Illinois
DRILLER Midwest Drilling Inc.
SURFACE ELEVATION ______ **DRILLING METHOD** 4" CFA/mud rotary

BORING NO. B-14
SHEET 1 **OF** 5
PROJECT NO. 13-0342
DATE DRILLED 6/12/14

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
0					Topsoil 4"									0
					Brown fine SAND		SP							
					Gray high plastic CLAY		CH							
	1	ST	19/24					1	25	96.6	1.8			
3														3
6					Gray CLAYEY SAND		SC							6
	2	ST	18/24						32		1.0			
					Brown fine SAND		SP		4		--			
9														9
12														12
	3	SS		5 / 6 / 11					25		--			
15														15
18					Brown medium SAND		SP							18
	4	SS		3 / 6 / 6					15		--			

Continued on Sheet 2 of 5

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
13 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:
1) Unconfined compressive strength test performed.

BORING LOG

PROJECT South Harbor Conveyor
LOCATION Granite City, Illinois
DRILLER Midwest Drilling Inc.
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA/mud rotary

BORING NO. B-14
SHEET 2 OF 5
PROJECT NO. 13-0342
DATE DRILLED 6/12/14

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
21														21
					Brown medium SAND, trace gravel		SP							
24	5	SS		4 7 9					17		--			24
27					Brown fine SAND, trace organics		SP							27
	6	SS		4 4 3					15		--			
30														30
					Brown medium SAND		SP							
33														33
	7	SS		8 11 13					16		--			
36														36
39	8	SS		7 12 15					14		--			39

Continued on Sheet 3 of 5

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
13 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor
LOCATION Granite City, Illinois
DRILLER Midwest Drilling Inc.
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA/mud rotary

BORING NO. B-14
SHEET 3 OF 5
PROJECT NO. 13-0342
DATE DRILLED 6/12/14

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	RECOVERY (IN/IN)	BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
42														42
					Gray fine SAND		SP							
45	9	SS		11 13 22					22		--			45
					Gray fine SAND, trace organics		SP							
48	10	SS		5 8 9					30		--			48
51					Gray fine SAND		SP							51
54	11	SS		9 11 18					24		--			54
57														57
60	12	SS		7 13 14					25		--			60

Continued on Sheet 4 of 5

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
13 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor
LOCATION Granite City, Illinois
DRILLER Midwest Drilling Inc.
SURFACE ELEVATION ______
DRILLING METHOD 4" CFA/mud rotary

BORING NO. B-14
SHEET 4 **OF** 5
PROJECT NO. 13-0342
DATE DRILLED 6/12/14

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
63														63
	13	SS		18 22 20	Brown medium SAND		SP		14		--			
66					Brown medium SAND, trace organics		SP							66
69	14	SS		9 16 18					17		--			69
72														72
	15	SS		7 10 50/1"	Weathered rock									
75														75
					Gray LIMESTONE									
78														78
81														81

Continued on Sheet 5 of 5

WATER LEVEL:

_____ NONE OBSERVED WHILE DRILLING
13 FT WHILE DRILLING
_____ FT _____ HRS AFTER DRILLING
_____ FT _____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor
LOCATION Granite City, Illinois
DRILLER Midwest Drilling Inc.
SURFACE ELEVATION
DRILLING METHOD 4" CFA/mud rotary

BORING NO. B-14
SHEET 5 OF 5
PROJECT NO. 13-0342
DATE DRILLED 6/12/14

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
	16	NX	117/120											
84					RQD= 65%									84
87					Boring terminated at 87 feet.									87
90														90
93														93
96														96
99														99
102														102

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
13 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor
LOCATION Granite City, Illinois
DRILLER Midwest Drilling Inc.
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA/mud rotary

BORING NO. B-15
SHEET 2 OF 5
PROJECT NO. 13-0342
DATE DRILLED 6/12/14

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
21														21
					Brown fine SAND, trace organics		SP							
24	5	SS		7 7 7					33		--			24
27					Brown medium SAND		SP							27
	6	SS		11 14 13					18		--			
30														30
33														33
	7	SS		9 11 12					14		--			
36														36
39	8	SS		7 9 11					20		--			39

Continued on Sheet 3 of 5

WATER LEVEL:

_____ NONE OBSERVED WHILE DRILLING
17.5 FT WHILE DRILLING
_____ FT ___ HRS AFTER DRILLING
_____ FT ___ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor
LOCATION Granite City, Illinois
DRILLER Midwest Drilling Inc.
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA/mud rotary

BORING NO. B-15
SHEET 3 OF 5
PROJECT NO. 13-0342
DATE DRILLED 6/12/14

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
42					Brown and gray medium SAND		SP							42
	9	SS		8 9 12					13		--			
45														45
					Gray fine SAND		SP							
48														48
	10	SS		6 9 11					21		--			
51														51
54	11	SS		8 8 11					28		--			54
57					Gray medium SAND		SP							57
	12	SS		9 10 13					17		--			
60														60

Continued on Sheet 4 of 5

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
17.5 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor
LOCATION Granite City, Illinois
DRILLER Midwest Drilling Inc.
SURFACE ELEVATION ______
DRILLING METHOD 4" CFA/mud rotary

BORING NO. B-15
SHEET 4 **OF** 5
PROJECT NO. 13-0342
DATE DRILLED 6/12/14

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
63														63
	13	SS		9 12 13					18		--			
66														66
69	14	SS		9 12 15					18		--			69
72														72
	15	SS		50/ 1"	Weathered rock									
75														75
					Gray LIMESTONE									
78														78
81														81

Continued on Sheet 5 of 5

WATER LEVEL:

______ NONE OBSERVED WHILE DRILLING
17.5 FT WHILE DRILLING
______ FT ____ HRS AFTER DRILLING
______ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor
LOCATION Granite City, Illinois
DRILLER Midwest Drilling Inc.
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA/mud rotary

BORING NO. B-15
SHEET 5 OF 5
PROJECT NO. 13-0342
DATE DRILLED 6/12/14

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
	16	NX	114/120											
84					RQD= 60%									84
87					Boring terminated at 87 feet.									87
90														90
93														93
96														96
99														99
102														102

WATER LEVEL:

_____ NONE OBSERVED WHILE DRILLING
17.5 FT WHILE DRILLING
_____ FT _____ HRS AFTER DRILLING
_____ FT _____ HRS AFTER DRILLING

REMARKS:

QUALITY TESTING AND ENGINEERING, INC.

BORING LOG LEGEND AND NOMENCLATURE

Items shown in Boring Logs refer to the following: Where shown in parentheses, sampling and testing were performed in general accordance with applicable ASTM standard methods or practices.

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2. **Sample** - Types designated by letters.

   SS - Split-spoon sample, disturbed, obtained by driving 2-inch O.D. split-spoon sampler ASTM D 1586.

   ST - Thin-walled tube sample, undisturbed, obtained by penetration of a 3-inch diameter tube ASTM D 1587.

   AS - Auger samples, disturbed, taken from cuttings.

   NX - Rock core recovered by NX-sized coring bit.

   Recovery - Recovery is expressed as a ratio of the length recovered to the total length pushed, driven, or cored inches, e.g. - 9/12.

   Blows - Numbers indicate blows per 6 inches of sampler penetration when driven by a 140-pound hammer falling freely 30 inches ASTM D 1586. When number of blows reaches 50 without 6 inches of sampler penetration, the result is shown as a ratio of 50 to the actual penetration, e.g. 50/2 inches.

3. **Description** - Description according to the Unified Soil Classification: Description indicates soil constituents, and other classification characteristics ASTM D 2488. Delineations of strata represent approximate boundaries between soil types and the transition may be gradual. The delineations shown on the Boring Logs were used for analytical purposes only. The information should not be used as a basis for design and/or construction cost estimates without realizing that there can be variation from the conditions shown.

   GW - Water level observation.

4. **Laboratory test results**

   - Natural moisture content in percent ASTM D 2216.
   - Dry density of sample tested in pounds per cubic foot (pcf).
   - Unconfined compressive strength ASTM D 2166 in kips per square foot (ksf).
   - Liquid limit ASTM D 4318 in percent.
   - Plastic limit ASTM D 4318 in percent.

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Regional Office: 206 South Linn Avenue, Wentzville, MO 63385 phone: 636-332-1153 fax: 636-332-5781
WWW.QTEINC.COM

BORING LOG

PROJECT South Harbor Conveyor
LOCATION Granite City, Illinois
DRILLER Midwest Drilling Inc.
SURFACE ELEVATION ____ DRILLING METHOD 4" CFA

BORING NO. B-13
SHEET 1 OF 2
PROJECT NO. 13-0342
DATE DRILLED 6/13/14

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
0					FILL - Brown fine SAND		FILL							0
3														3
	1	SS		5 6 8					4		--			
6														6
					FILL - Brown and gray fine SAND		FILL							
9	2	SS		4 4 2					27		--			9
12					FILL - Gray low plastic SILTY CLAY, some sand		FILL							12
	3	SS		2 2 4					33		2.0			
15														15
					Gray fine SAND, some clay		SP-SC							
18														18
	4	SS		2 2 2					37		0.5			

Continued on Sheet 2 of 2

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
22 FT WHILE DRILLING
9 FT 0 HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor
LOCATION Granite City, Illinois
DRILLER Midwest Drilling Inc.
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA

BORING NO. B-13
SHEET 2 OF 2
PROJECT NO. 13-0342
DATE DRILLED 6/13/14

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
21					Brown fine SAND		SP							21
24	5	SS		3 5 7					26		--			24
					Boring terminated at 25 feet.									
27														27
30														30
33														33
36														36
39														39

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
22 FT WHILE DRILLING
9 FT 0 HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT: South Harbor Conveyor
LOCATION: Granite City, Illinois
DRILLER: Midwest Drilling Inc.
SURFACE ELEVATION:
DRILLING METHOD: 4" CFA/mud rotary

BORING NO.: B-14
SHEET: 1 OF 5
PROJECT NO.: 13-0342
DATE DRILLED: 6/12/14

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
0					Topsoil 4"									0
					Brown fine SAND		SP							
					Gray high plastic CLAY		CH							
	1	ST	19/24					1	25	96.6	1.8			
3														3
6					Gray CLAYEY SAND		SC							6
	2	ST	18/24						32		1.0			
					Brown fine SAND		SP		4		--			
9														9
12														12
	3	SS		5 6 11					25		--			
15														15
18														18
					Brown medium SAND		SP							
	4	SS		3 6 6					15		--			

Continued on Sheet 2 of 5

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
13 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:
1) Unconfined compressive strength test performed.

BORING LOG

PROJECT	South Harbor Conveyor	**BORING NO.**	B-14
LOCATION	Granite City, Illinois	**SHEET**	2 **OF** 5
DRILLER	Midwest Drilling Inc.	**PROJECT NO.**	13-0342
SURFACE ELEVATION		**DATE DRILLED**	6/12/14
DRILLING METHOD	4" CFA/mud rotary		

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
21														21
					Brown medium SAND, trace gravel		SP							
24	5	SS		4 7 9					17		--			24
27					Brown fine SAND, trace organics		SP							27
	6	SS		4 4 3					15		--			
30														30
					Brown medium SAND		SP							
33														33
	7	SS		8 11 13					16		--			
36														36
39	8	SS		7 12 15					14		--			39

Continued on Sheet 3 of 5

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
13 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor
LOCATION Granite City, Illinois
DRILLER Midwest Drilling Inc.
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA/mud rotary

BORING NO. B-14
SHEET 3 OF 5
PROJECT NO. 13-0342
DATE DRILLED 6/12/14

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
42														42
					Gray fine SAND		SP							
	9	SS		11 13 22					22		--			
45														45
					Gray fine SAND, trace organics		SP							
48														48
	10	SS		5 8 9					30		--			
51														51
					Gray fine SAND		SP							
54	11	SS		9 11 18					24		--			54
57														57
	12	SS		7 13 14					25		--			
60														60

Continued on Sheet 4 of 5

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
13 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor
LOCATION Granite City, Illinois
DRILLER Midwest Drilling Inc.
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA/mud rotary

BORING NO. B-14
SHEET 4 OF 5
PROJECT NO. 13-0342
DATE DRILLED 6/12/14

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	LABORATORY TEST RESULTS: MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
63					Brown medium SAND		SP							63
	13	SS		18 22 20					14		--			
66					Brown medium SAND, trace organics		SP							66
69	14	SS		9 16 18					17		--			69
72														72
	15	SS		7 10 50/1"	Weathered rock									
75														75
					Gray LIMESTONE									
78														78
81														81

Continued on Sheet 5 of 5

WATER LEVEL:

_____ NONE OBSERVED WHILE DRILLING
13 FT WHILE DRILLING
_____ FT _____ HRS AFTER DRILLING
_____ FT _____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor
LOCATION Granite City, Illinois
DRILLER Midwest Drilling Inc.
SURFACE ELEVATION ______
DRILLING METHOD 4" CFA/mud rotary

BORING NO. B-14
SHEET 5 **OF** 5
PROJECT NO. 13-0342
DATE DRILLED 6/12/14

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
	16	NX	117/120											
84					RQD= 65%									84
87					Boring terminated at 87 feet.									87
90														90
93														93
96														96
99														99
102														102

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
13 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT	South Harbor Conveyor	**BORING NO.**	B-15
LOCATION	Granite City, Illinois	**SHEET**	1 **OF** 5
DRILLER	Midwest Drilling Inc.	**PROJECT NO.**	13-0342
SURFACE ELEVATION		**DATE DRILLED**	6/12/14

DRILLING METHOD 4" CFA/mud rotary

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
0					Brown CLAYEY SAND		SC							0
3					Gray low plastic SILTY CLAY, some sand		CL							3
	1	ST	20/24					1	30 4	90.5	1.0 --			
6														6
					Brown and gray fine SAND		SP							
9	2	ST	18/24						3		--			9
12														12
					Brown CLAYEY SAND		SC							
	3	SS		3-4-6					29		--			
15														15
					Brown fine SAND		SP							
18														18
	4	SS		4-4-5					23		--			

Continued on Sheet 2 of 5

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
17.5 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:
1) Unconfined compressive strength test performed.

BORING LOG

PROJECT South Harbor Conveyor | BORING NO. B-15
LOCATION Granite City, Illinois | SHEET 2 OF 5
DRILLER Midwest Drilling Inc. | PROJECT NO. 13-0342
SURFACE ELEVATION ______ DRILLING METHOD 4" CFA/mud rotary | DATE DRILLED 6/12/14

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
21														21
					Brown fine SAND, trace organics		SP							
24	5	SS		7 7 7					33		--			24
27					Brown medium SAND		SP							27
	6	SS		11 14 13					18		--			
30														30
33														33
	7	SS		9 11 12					14		--			
36														36
39	8	SS		7 9 11					20		--			39

Continued on Sheet 3 of 5

WATER LEVEL:

______ NONE OBSERVED WHILE DRILLING
17.5 FT WHILE DRILLING
______ FT ___ HRS AFTER DRILLING
______ FT ___ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT: South Harbor Conveyor
LOCATION: Granite City, Illinois
DRILLER: Midwest Drilling Inc.
SURFACE ELEVATION: ___
DRILLING METHOD: 4" CFA/mud rotary

BORING NO.: B-15

PROJECT NO.: 13-0342
DATE DRILLED: 6/12/14

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
42					Brown and gray medium SAND		SP							42
	9	SS		8 9 12					13		--			
45														45
					Gray fine SAND		SP							
48														48
	10	SS		6 9 11					21		--			
51														51
54	11	SS		8 8 11					28		--			54
57					Gray medium SAND		SP							57
	12	SS		9 10 13					17		--			
60														60

Continued on Sheet 4 of 5

WATER LEVEL:

___ NONE OBSERVED WHILE DRILLING
17.5 FT WHILE DRILLING
___ FT ___ HRS AFTER DRILLING
___ FT ___ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor
LOCATION Granite City, Illinois
DRILLER Midwest Drilling Inc.
SURFACE ELEVATION
DRILLING METHOD 4" CFA/mud rotary

BORING NO. B-15
SHEET 4 OF 5
PROJECT NO. 13-0342
DATE DRILLED 6/12/14

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
63														63
	13	SS		9 12 13					18		--			
66														66
69	14	SS		9 12 15					18		--			69
72														72
	15	SS		50/ 1"	Weathered rock									
75														75
					Gray LIMESTONE									
78														78
81														81

Continued on Sheet 5 of 5

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
17.5 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS:

BORING LOG

PROJECT South Harbor Conveyor | BORING NO. B-15
LOCATION Granite City, Illinois | SHEET 5 OF 5
DRILLER Midwest Drilling Inc. | PROJECT NO. 13-0342
SURFACE ELEVATION ______ | DRILLING METHOD 4" CFA/mud rotary | DATE DRILLED 6/12/14

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (IN/IN)	SAMPLE BLOWS (PER 6 IN)	DESCRIPTION	GRAPHIC	UNIFIED SOIL CLASSIFICATION	SEE REMARK NO.	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)	LIQUID LIMIT	PLASTIC LIMIT	DEPTH (FT)
	16	NX	114/120											
84					RQD= 60%									84
87					Boring terminated at 87 feet.									87
90														90
93														93
96														96
99														99
102														102

WATER LEVEL:

____ NONE OBSERVED WHILE DRILLING
17.5 FT WHILE DRILLING
____ FT ____ HRS AFTER DRILLING
____ FT ____ HRS AFTER DRILLING

REMARKS: