DAS Iowa Department of Administrative Services
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DCI GROUP
DESIGN + CONSTRUCTION INTEGRATION

Addendum #02 for Design RFP 0919335096

Project Name: IVH Fox Retaining Wall Storm Repairs

RFQ #:0919335096

Date: 2/14/2019

Acknowledge receipt of this Addendum on the proposal response. Failure to do so may subject firm to disqualification.

Proposals Due **February 22nd, 2019 at 2:00 PM**

Addendum #2:

- Cover Page – Table of Contents and Clarifications (1 page)
- Pre-Proposal Meeting Minutes and Sign In Sheet (4 pages)
- Exhibit A: Existing Fox Retaining Wall Project Manual (9 pages)
- Exhibit B: Existing 2008 Soil Borings Report (36 pages)
- Exhibit C: Site photos https://dcigroupia.box.com/v/FoxWallPhotos

1) Clarifications:
    a) Please contact Steve Oberbroekling to schedule additional site visits.

End of Addendum #2

February 13, 2019 at 1:00 PM

Owner/DAS/CM Team Introductions:
Iowa Veterans Home – David Haines, Brad VanBaale
Iowa Department of Administrative Services (DAS) – Brad Tonyan
Construction Manager – DCI Group – Garrett Arganbright
DAS Purchasing Agent – Steve Oberbroeckling

General Project Description/Overview:

1. The scope of this project is as follows:
    a. Design, bidding, and construction administration services for repair of the existing retaining wall that failed.
    b. Investigation and evaluation into conditions that may have led to the failure of the existing retaining wall.
    c. The State of Iowa shall hold the option to negotiate at a later date additional future design services for work related to the Fox Retaining Wall.

Bid Package Process:

PROPOSALS DUE: **February 22nd, 2019 at 2:00 PM**

MAKE SURE IT IS SUBMITTED TO DAS AS THE REQUEST FOR PROPOSALS READS

1. Proposal Process
    a. Ensure all sections of 4.2 Proposal Content are included in proposal.
    b. Proposal shall include a Not-to-Exceed estimate for reimbursable expenses.
    c. Review Section 5.2 and ensure each of the criteria for evaluation are met.
    d. All questions after this meeting and prior to February 18th, to be submitted to Steve Oberbroeckling at steve.oberbroeckling@iowa.gov. Do not contact DAS or DCI Group directly for questions or clarifications.
2. Schedule

a.	Pre-Proposal Meeting On-Site:	February 13th, 2019 at 1:00 PM
b.	Questions Due:	February 18th, 2019 at 2:00 PM
c.	Last Addendum Issued By:	February 20th, 2019 at 2:00 PM
d.	Proposals Due:	February 22nd, 2019 at 2:00 PM
e.	Selection of Designer, Issue NOI:	March 4th, 2019
f.	Execution of Contract	March 15th, 2019
g.	Design:	March 18th, 2019 – May 3rd, 2019
h.	Contractor Bidding:	May 6th, 2019 – May 24th, 2019
i.	Construction:	June 2019 – September 2019

Scope of Work Overview:

1. Administrative
    a. Construction Manager (DCI Group) has been engaged for this Project to serve as advisor to the Owner and to provide assistance in administrating the Contract for Design between Owner and the Designer according to separate contract between Owner and Construction Manager.
        (a) Agreement between the Owner and Designer will be a modified ConsensusDoc 803.

   b. The Designer shall use the State of Iowa's Construction Management Software, EADOC, throughout duration of the project.
   c. Designer shall acknowledge that all documents are copyright to the State of Iowa and need to be turned over in their native computer format.

2. Design & Construction Requirements
   a. Existing PDF drawings will be provided to the successful design firm. Accuracy of drawings shall be verified by the design firm.
   b. Provide all disciplines necessary for complete design of the project.
   c. If deemed necessary, the designer shall provide minor drawing work to assist the Construction Manager in the development of a hazardous material bid package.
   d. Designer shall provide detailed input of design schedule to Construction Manager for overall incorporation into master schedule.
   e. Designer shall be responsible to upload all drawings and specifications for the project to EADOC. Drawings uploaded should include both a copy of the entire drawing set (as one file) and then a copy of each individual drawing sheet (as its own file). Specifications, should be uploaded per volume (as its own file) as well as per specification section (as its own file).
   f. Designer shall assist Construction Manager in the evaluation of long lead times.
   g. Designer shall assist Owner and Construction Manager in obtaining bids from qualified contractors.
   h. Designer shall include sufficient site visits and meetings to complete design work.
   i. Designer shall satisfy all Federal, State, and Local codes including plan submission for Fire Marshal and Building Code review or exemption. The Design Professional will coordinate and be the main contact to life safety, energy, and all other applicable codes. All applicable fees with the departments will be covered by the Design Professional.
   j. Designer shall provide electronic documents, supplemental instructions, and proposal requests in PDF and CAD.
   k. Design review will be conducted at 100% design development and 95% construction documents. Review will be conducted with DAS Owner Representative, Construction Manager, and Facility Representative.
   l. Designer shall include any and all survey work required for completion of project.
   m. Designer will be required to provide Cost Opinions at 100% DD and 100% CDs before documents are issued to the Public as required by the State of Iowa's ConsensusDoc contract and Iowa Code.
   n. Final submission of contract documents to include drawings and specifications for bidding. Designer to develop a complete set of specifications except for Division 00 which will be provided by DCI Group to incorporation into the designer specification book. The designers' specifications shall include all Technical Specifications. DCI Group will distribute the Division 00 documents for incorporation into the Designer's specifications.
   o. Include bid alternates as determined during course of design and bid package development.
   p. Field Observation reports shall be submitted to DCI Group for each site inspection within five (5) days of the site visit.
   q. As part of design and construction, the designer shall, at a minimum, attend ten (10) site visits as follows: one (1) kick-off meeting, one (1) 100% design development document review meeting, one (1) 95% construction document review meeting, one (1) pre-bid meeting, one (1) construction kick-off meeting, two (2) construction reviews, one (1) substantial completion/punch list development, one (1) punch list approval, and one (1) one-year warranty correction period visit. This total does not include visits for review and documentation of existing conditions which shall be as-needed to accomplish design work.
   r. Maintain an as-built set of drawings and specifications for all design modifications. Up-to-date full sheets to be issued electronically to address all Architectural Supplemental Instructions and RFIs as feasible.

s. Designer shall provide any information necessary to obtain utility rebates for the replacement units, where applicable.

3. Close-Out Requirements
    a. Provide Construction As-Builts drawings and specifications of all design modifications, including ASIs, PRs, COs and RFIs in both CAD and PDF formats.
    b. Review and approval of close-out documentation.
    c. Development and verification of punch list document with assistance from Construction Manager.
    d. Provide inspection and date for substantial completion along with Construction Manager.
    e. Approve Substantial and Final Completions via EADOC.

The Department requests the fee proposal from the respondents to this RFP be broken down as follows. These breakdown prices will be used as the schedule of values for billing purposes.

- Schematic Design Documents
- Design Development Documents
- Construction Documents
- Bidding or Negotiation Assistance
- Construction Phase
- Reimbursable Costs

4. Open Discussion:
    a. Existing drawings will be posted to EADOC and available to the selected design firm
    b. The existing retaining wall was built in 2010. The section failed in November 2018.
    c. Soil borings were completed in 2008 by Team Services. The full report will be available to the selected design firm in EADOC.
        i. Boring B-8, B-9 and B-10 are in the same area as the retaining wall and will be provided via addendum.

DCI GROUP
DESIGN + CONSTRUCTION INTEGRATION

Project Name: 9093.00 IVH Fox Retaining Wall

Meeting Purpose: Pre-Proposal Meeting

Date: February 13th, 2019 at 1:00 PM

Attendees

Name	Company	Phone Number	E-Mail Address
GARRETT ARGANBRIGHT	DCI GROUP	641-757-9791	GARRETT A @ DCI GROUP - IA . COM
Brad Tonyan	DAS	515-360-7718	bradtonyan@iowa.gov
Kyle Lawson	Shive-Hattery	515-223-8104	Klawson @ shive-hattery.com
Bradley Van Baale	IVH	641-750-0039	bradley.vanbaale@ivh.state.ia.us
DAVID HAINES	IVH	641-750-6022	DAVID.HAINES@IVH.STATE.IA.US
Matt Drummond	Allender Butzke Engineers	515-252-1885	drummond@abengineers.com
BRIAN EWALT	Great Lakes Engineering	309-524-5710	bmuzingoewalt@gleng.net

SECTION 02833

RETAINING WALLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Concrete segmental retaining wall units.

B. Geosynthetic reinforcement.

C. Leveling pad base.

D. Drainage aggregate.

E. Reinforced Backfill.

F. Drainage pipe.

G. Pre-fabricated Drainage Composite.

H. Geotextile Filter.

I. Impervious Materials.

J. Construction Adhesive.

1.2 RELATED SECTIONS

A. Section 02300 - Earthwork.

1.3 REFERENCES

A. American Association of State Highway Transportation Officials (AASHTO):

1. AASHTO M288 Geotextile Specification for Highway Applications.
2. AASHTO Standard Specifications for Highway Bridges.

B. ASTM International (ASTM):

1. ASTM C 140 - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
2. ASTM C 1262 - Standard Test Method for Evaluating the Freeze-Thaw Durability of Manufactured Concrete Masonry Units and Related Concrete Units.
3. ASTM C 1372 - Standard Specification for Segmental Retaining Wall Units.
4. ASTM D 448 - Standard Classification for Sizes of Aggregate for Road and Bridge Construction.
5. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu ft) (600 kN-m/cu.m.).
6. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil In Place by the Sand Cone Method

7. ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu ft) (2700 kN-m/cu.m.).
8. ASTM D 2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
9. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth).
10. ASTM D 3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer pipe and Fittings.
11. ASTM D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
12. ASTM D 4491 - Standard Test Method for Water Permeability of Geotextiles by the Permittivity Method.
13. ASTM D 4595 - Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
14. ASTM D 4873 - Standard Guide for Identification, Storage and Handling of Geosynthetics.
15. ASTM D 5084 - Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.
16. ASTM D 5262 - Standard Test Method for Evaluating the Unconfined Tension Creep Behavior of Geosynthetics.
17. ASTM D 5321 - Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method.
18. ASTM D 5818 - Standard Practice for Obtaining Samples of Geosynthetics from a Test Section for Assessment of Installation Damage.
19. ASTM D 6637 - Standard Test Method for Determining Tensile Properties of Geogrids by the Single or Multi-Rib Tensile Method.
20. ASTM D 6638 - Standard Test Method for Determining Connection Strength Between Geosynthetic Reinforcement and Segmental Concrete Units.
21. ASTM D 6916 - Standard Test Method for Determining the Shear Strength Between Segmental Concrete Units.
22. ASTM D 6706 - Standard Test Method for Measuring Geosynthetic Pullout Resistance in Soil.
23. ASTM F 405 - Standard Specification for Corrugated Polyethylene (PE) Tubings and Fittings.
24. ASTM G 51 - Standard Test Method for Measuring pH of Soil for Use in Corrosion Testing.

C. Federal Highway Administration

1. Elias, V., Christopher, B., and Berg, R., "Mechanically Stabilized Earth Walls and Reinforced Soil Slopes Design and Construction Guidelines", Federal Highway Administration Report No. FHWA-NHI-00-043, March 2001.
2. Elias, V., Christopher, B., and Berg, R., "Corrosion/Degradation of Soil Reinforcements for Mechanically Stabilized Earth Walls and Reinforced Soil Slopes", Federal Highway Administration Report No. FHWA-NHI-00-044, March 2001.

D. National Concrete Masonry Association (NCMA)

1. NCMA Design Manual for Segmental Retaining Walls, Second Edition, Second Printing (1997).

1.4 DEFINITIONS

A. Concrete Segmental Retaining Wall (SRW) Units: Dry-stacked masonry units used as the retaining wall fascia.

B. Reinforced Backfill: Soil which is used as fill behind the SRW unit, and within the reinforced soil mass (if applicable).

C. Drainage Aggregate: Material used (if applicable) within, between, and directly behind the concrete retaining wall units.

D. Stabilized Aggregate: A formulated mix design of clean stone, cement, and water that creates a permeable homogeneous zone (mass). It is obtained by the elimination of fine aggregates (sand) from the normal concrete mix.

E. Geotextile Filter: Material used for separation and filtration of dissimilar soil types.

F. Foundation Soil: Soil mass supporting the leveling pad and reinforced soil zone of the retaining wall system.

G. Geosynthetic Reinforcement: Polymeric material designed specifically to reinforce the soil mass.

H. Pre-fabricated Drainage Composite: three-dimensional geosynthetic drainage medium encapsulated in a geotextile filter, used to transport water.

I. Impervious Materials: Clay soil or low permeability geosynthetic used to prevent water percolation into the drainage zone and reinforced backfill behind the wall.

J. Global Stability: The general mass movement of a soil reinforced segmental retaining wall structure and adjacent soil mass.

K. Project Geotechnical Engineer: A registered engineer who provides site observations, recommendations for foundation support, and verifies soil shear strength parameters.

1.5 SUBMITTALS

A. Submit under provisions of Section 01330.

B. Product Data: Material description and installation instructions for each manufactured product specified.

C. Shop Drawings: Retaining wall system design, including wall elevation views, geosynthetic reinforcement layout, pertinent details, and drainage provisions. The shop drawings shall be signed by a registered professional engineer licensed in the state of wall installation.

D. Design Calculations: Engineering design calculations prepared in accordance with the NCMA Design Manual for Segmental Retaining Walls, or the AASHTO Standard Specifications for Highway Bridges, Section 5.8 (whichever is applicable). Analysis of global stability must be addressed and incorporated into the shop drawings.

E. Samples:

1. Furnish one unit in the color and face pattern specified, if requested.
2. Furnish 12 inch square or larger piece of the geosynthetic reinforcement specified.

F. Test Reports: Independent laboratory reports stating moisture absorption and compressive strength properties of the concrete retaining wall units meet the Project Specifications when tested in accordance with ASTM C140, Sections 6, 8 and 9.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: All products listed in this section are to be installed by a single installer with a minimum of five (5) years demonstrated experience in installing products of the same type and scope as specified.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Concrete Retaining Wall Units and Accessories: Deliver, store, and handle materials in accordance with manufacturer's recommendations, in such a manner as to prevent damage. Check the materials upon delivery to assure that proper material has been received. Store above ground on wood pallets or blocking. Remove damaged or otherwise unsuitable material, when so determined, from the site.

1. Exposed faces of concrete wall units shall be free of chips, cracks, stains, and other imperfections detracting from their appearance, when viewed from a distance of 10 feet.
2. Prevent mud, wet cement, adhesives and similar materials that may harm appearance of units, from coming in contact with system components.

C. Geosynthetics (including geosynthetic reinforcement, geotextile filter, pre-fabricated drainage composite) shall be delivered, stored, and handled in accordance with ASTM D4873.

1.8 WARRANTY

A. At project closeout, provide to Owner or Owners Representative an executed copy of the manufacturer's standard limited warranty against manufacturing defect, outlining its terms, conditions, and exclusions from coverage.

1.9 EXTRA MATERIALS

A. Furnish Owner with 3 replacement units of each type (i.e. cap, different block types, etc) identical to those installed on the Project.

PART 2 PRODUCTS

2.1 STANDARD OF QUALITY: Keystone Century – 6"

A. Keystone Wall Systems, Inc. 4444 W. 78th St., Minneapolis, MN 55435; Tel: 800-747-8971; www.keystonewalls.com.

2.2 ADDITIONAL MANUFACTURERS

A. Versa-Lok Retaining Wall Systems, 6348 Highway 36, Suite 1; Oakdale, MN 55128; Tel: 800-770-4525; www.versa-lok.com

B. Anchor Wall Systems, Inc.: 5959 Baker Rd. Suite 390 ; Minnetonka, MN 55345-5973; Tel: 877-295-5415; www.anchorwall.com

C. Requests for substitutions will be considered in accordance with provisions of Section 01600. **However, the wall system provided must match the appearance, texture, style, and color of the existing retaining walls recently constructed as part of Phase 1 of the Iowa Veterans Home. An example of the existing retaining wall can be viewed at the Pavilion facility at the Iowa Veterans Home (coordinate with Owner).**

2.3 RELATED PRODUCTS

A. Geosynthetic Reinforcement: Polyester fiber geogrid or geotextile, HDPE or polypropylene woven geotextile, as shown on the Drawings or as required by wall designer. In case of conflict the more stringent requirement shall govern.

B. Leveling Pad Base:

1. Aggregate Base: Crushed stone or granular fill meeting the following gradation as determined in accordance with ASTM D448:

    a. Sieve: 1 inch - 100 percent passage.
    b. Sieve: No. 4 - 35 to 70 percent passage.
    c. Sieve: No. 40 - 10 to 35 percent passage.
    d. Sieve: No. 200 - 3 to 10 percent passage.
    e. Base Thickness: 6 inch (152mm) minimum compacted thickness.

2. Concrete Base: Nonreinforced lean concrete base.

    a. Compressive Strength: 3000 psi (minimum).
    b. Base Thickness: At least 2 inches (52mm).

C. Drainage Aggregate: Clean crushed stone or granular fill meeting the following gradation as determined in accordance with ASTM D448:

1. Sieve: 1 inch - 100 percent passage.
2. Sieve: 3/4 inch - 75 to 100 percent passage.
3. Sieve: No. 4 - 0 to 60 percent passage.
4. Sieve: No. 40 - 0 to 50 percent passage.
5. Sieve: No. 200 - 0 to 5 percent passage.

D. Backfill: Soil free of organics and debris and consisting of either GP, GW, SP, SW, or SM type, classified in accordance with ASTM D2487 and the USCS classification system.

1. Soils classified as SC, ML and CL are considered suitable soils for segmental retaining walls with a total height of less than 10 feet unless the Plasticity Index (PI) is 20 or more.
2. Maximum particle size for backfill is 4 inches.
3. Unsuitable soils are organic soils and those soils classified as CH, OH, MH, OL, or PT.

E. Impervious Material: Clayey soil or other similar material which will prevent percolation into the drainage zone behind the wall.

F. Drainage Pipe: Perforated or slotted PVC or corrugated HDPE pipe manufactured in accordance with D3034 and/or ASTM F405. The pipe may be covered with a geotextile filter fabric to function as a filter.

G. Construction Adhesive: Exterior grade adhesive as recommended by the retaining wall unit manufacturer.

PART 3 EXECUTION

3.1 PREPARATION

A. Examine the areas and conditions under which the retaining wall system is to be erected, and notify the Architect in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

B. Promptly notify the wall design engineer of site conditions which may affect wall performance, soil conditions observed other than those assumed, or other conditions that may require a reevaluation of the wall design.

C. Verify the location of existing structures and utilities prior to excavation. Coordinate wall construction with existing utility companies.

D. Ensure surrounding structures are protected from the effects of wall excavation.

E. Excavation support, if required, is the responsibility of the Contractor, including the stability of the excavation and its influence on adjacent properties and structures.

3.2 EXCAVATION

A. Excavate to the lines and grades shown on the Drawings or as specified by the retaining wall designer, in case of conflict the more stringent requirement shall govern. Over-excavation not approved by the Architect will not be paid for by the Owner. Replacement of these soils with compacted fill and/or wall system components will be required at the Contractor's expense. Use care in excavating to prevent disturbance of the base beyond the lines shown, or as specified by the wall designer.

3.3 FOUNDATION PREPARATION

A. Excavate foundation soil as required to place foundation below the frost depth (approximately 4') and to meet or exceed the wall designer requirements.

B. The contractor shall coordinate to have the geotechnical engineer examine foundation soil to ensure that the actual foundation soil strength meets or exceeds that indicated on the design plans submitted by the contractor. Remove soil not meeting the required strength. Oversize resulting space sufficiently from the front of the block to the back of the reinforcement, and backfill with suitable compacted backfill soils.

C. The contractor shall coordinate with the geotechnical engineer to determine if the foundation soils will require special treatment or correction to control total and differential settlement.

D. Fill over-excavated areas with suitable compacted backfill, as recommended by the geotechnical engineer.

3.4 BASE COURSE PREPARATION

A. Place base materials to the depths and widths shown on the design shop drawings. upon undisturbed soils, or foundation soils prepared as specified by wall designer.

    1. Where a reinforced footing is required by local code official (or wall design engineer), place footing below frost depth.

B. Compact aggregate base material to provide a level, hard surface on which to place the first course of units.

C. Prepare base materials to ensure complete contact with retaining wall units. Gaps are not allowed.

3.5 ERECTION

A. General: Erect units in accordance with manufacturer's instructions and recommendations, and wall design criteria.

B. The contractor is responsible for providing all temporary shoring, bracing, and/or sheet piling as may be necessary to safely and properly construct the proposed retaining walls. All temporary stabilization practices shall be done at the contractor's expense and shall be removed upon completion of the work unless otherwise approved by the Architect.

C. Contractor shall check units for level and alignment throughout construction. Contractor shall ensure that the same elevation at the top of each unit within each section of the base course is maintained.

D. Contractor shall ensure that foundation units are in full contact with natural or compacted soil base.

E. Contractor shall ensure that concrete wall units are placed side-by-side for full length of wall alignment. Gaps are not allowed between the foundation concrete wall units.

F. Cap the backfill and drainage aggregate zone with 12 inches (305mm) of impervious material.

G. Retaining walls shall be designed and constructed with a drainage media behind the wall and the associated drainage pipe necessary to direct water away from the wall. The drainage pipe shall be designed and constructed to provide gravity flow and shall be connected to storm sewer structures and/or pipe. Tie-ins to storm sewer pipe and/or structures shall be made using water-tight connections. When tying into concrete pipe or structures, the contractor shall utilize a coring device that will provide a round, uniform opening for the pipe. Connections to flexible pipe systems (where permitted) shall be made with pre-manufactured, gasketed fittings (i.e. wye, tee, etc).

H. The contractor shall ensure that each succeeding course places units in a random pattern.

I. Install geosynthetic reinforcement in accordance with geosynthetic manufacturer's recommendations and wall design requirements.

    1. The contractor shall ensure that the geosynthetic reinforcement is oriented with the highest strength axis perpendicular to the wall face.

2. Place geosynthetic reinforcement at the elevations and to the lengths required by the wall design.
3. Contractor shall ensure that the geosynthetic reinforcement is placed within one inch of the face of the concrete retaining wall units.
4. The contractor shall routinely ensure that the geosynthetic reinforcement is in tension and free from wrinkles prior to placement of the backfill soils. The geosynthetic reinforcement shall be hand-taut and secured in place with staples, stakes, or by hand-tensioning until the geosynthetic reinforcement is covered by sufficient backfill material to prevent movement of the reinforcement.
5. The geosynthetic reinforcements shall be continuous throughout their embedment lengths. Splices in the geosynthetic reinforcement strength direction are not allowed.
6. Do not operate tracked construction equipment directly on the geosynthetic reinforcement.
7. At least 6 inches (or more if required by wall designer) of compacted backfill soil is required prior to operation of tracked vehicles over the geosynthetic reinforcement.
8. The contractor is responsible for ensuring that wall is constructed in manner that does not result in the damage to the reinforcement, wall, or any existing or proposed improvement.

3.6 BACKFILL PLACEMENT

A. Place reinforced backfill, spread and compact in accordance with wall design and to eliminate slack in the reinforcement.

B. Compaction testing shall be performed in accordance with ASTM D1556 or ASTM D2922.

C. Contractor shall compact backfill in accordance with wall design requirements.

D. At the end of each day's operation, the contractor shall slope the last level of compacted backfill away from the interior (concealed) face of the wall to direct surface water runoff away from the wall face.

3.7 CAP UNIT INSTALLATION

A. Install cap unit in accordance will wall design requirements and manufacturer's installation requirements. In case of conflict the more stringent requirement shall govern.

3.8 SITE CONSTRUCTION TOLERANCES

A. Site Construction Tolerances:

1. Vertical Alignment: Plus or minus 1 1/2 inches (38mm) over any 10 foot (3048mm) distance, with a maximum differential of 3 inches (76mm) over the length of the wall.
2. Horizontal Location Control From Grading Plan
    a. Straight Lines: Plus or minus 1 1/2 inches (38mm) over any 10 foot (3048mm) distance.
    b. Corner and Radius Locations: Plus or minus 12 inches (305mm).
    c. Curves and Serpentine Radii: Plus or minus 2 feet (610mm).
3. Immediate Post Construction Wall Batter: Within 2 degrees of the design batter of the concrete retaining wall units, unless more stringent requirements is stipulated by wall design.
4. Bulging: Plus or minus 1 1/4 inches (32mm) over any 10 foot (3048mm) distance. , unless more stringent requirements is stipulated by wall design.

3.9 FIELD QUALITY CONTROL

A. Contractor is responsible for quality control of installation of system components.

B. The contractor, at their expense, will retain a qualified professional to perform quality assurance checks of the retaining wall work.

C. Contractor shall correct work which does not meet these specifications or the wall designer requirements. All repair work shall be done at the contractor's expense.

D. The contractor shall perform compaction testing of the reinforced backfill placed and compacted in the reinforced backfill zone.

   1. Testing Frequency:

      a. One test for every 2 vertical feet (610mm) of fill placed and compacted, for every 50 lineal feet (15.25 lm) of retaining wall, unless more testing is required or recommended by wall designer.
      b. Vary compaction test locations to cover the entire area of the reinforced soil zone, including the area compacted by the hand-operated compaction equipment.

3.10 ADJUSTING AND CLEANING

A. Replace damaged units with new units as the work progresses. All broken or otherwise damaged units shall be replaced at the contractor's expense.

B. Remove debris caused by construction and leave adjacent paved areas broom clean.

END OF SECTION

TEAM Services
Geotechnical and Construction Material Consultants

June 18, 2008

Iowa Department of Administrative Services - Purchasing
Hoover State Office Building, Level A
1305 E. Walnut Street
Des Moines, Iowa 50319-0105

Attn: Randall Stapp, Purchasing Agent III

Re: Subsurface Exploration
Iowa Veterans Home Master Plan Implementation – Phase I
Ia. DAS RFQ # 0208335106
Marshalltown, IA
TEAM No. 1-2209

Dear Mr. Stapp:

We have completed the subsurface exploration for the proposed Iowa Veterans Home Master Plan Implementation project in Marshalltown, Iowa. The accompanying geotechnical report presents the findings of the subsurface exploration and our recommendations concerning foundation design and construction for the proposed buildings and associated pavements.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service to you in any way, please do not hesitate to contact us.

Sincerely yours,

TEAM Services

M. Ujwala.
Ujwala Manchikanti
Staff Engineer

Isaac Drew, E.I.
Senior Staff Engineer

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed professional engineer under the laws of the State of Iowa.

ROBERT E. DOSS
12543

Robert E. Doss, P.E. Iowa License No. 12543 Date: 06/18/08
My license renewal date is December 31, 2008.
Pages covered by this seal: All

717 SE 6th Street • Des Moines, IA 50309 • ph.: 515-282-8818 • fx: 515-282-8741 • email: staff@teamsvcs.com
Des Moines • Ft. Dodge • Cedar Rapids • Mason City • Davenport • Spirit Lake

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GENERAL NOTES

PROJECT INFORMATION

Project information has been provided by you through a "Request for Quotation for Geotechnical Services" attached to an email sent to our office on May 27, 2008. Also included in the email were utility site maps, a boring plan, and DAS' general terms and conditions. The project will include construction of two new nursing care buildings with associated parking lots at Iowa Veterans Home in Marshalltown, Iowa. The buildings are proposed to be in the southeast and southwest areas of the campus. Each building will have a tunnel connection to existing buildings on the site. A minor portion of each proposed building will be below grade to accommodate the tunnel system between proposed and existing structures. The remainder of each building will be slab-on-grade. We have assumed cut and fill operations on the order of 1 to 2 feet. Structural loads were not provided to our office. We have assumed maximum column loads to be 100 kips and maximum continuous footing loads of 5 klf for analysis purposes.

SITE CONDITIONS

The project site is located northeast of the intersection of Independence Road and Summit Street in Marshalltown, Iowa. The site was a relatively rolling field, sloping downwards to the south with up to 15 feet of relief on the southwest building site and 11 feet on the southeast building site. The ground surface was able to support our ATV-mounted auger drill rig without difficulty.

FIELD EXPLORATION

A total of 10 borings were laid out in the proposed building and parking areas, as directed by DAS. Borings were located using a walking wheel and estimated right angles measured from the corners of the existing structures. The approximate boring locations are indicated on the Boring Plan in the Appendix. Ground surface elevations at the boring locations were determined by using the finished floor of the Molloy building as a benchmark with a provided elevation of 934.96 feet. The locations and elevations of the borings should be considered accurate only to the degree implied by the means and methods used to define them.

Our drilling equipment consisted of an ATV-mounted auger drill rig. The borings were made by mechanically twisting a continuous flight hollow stem steel auger into the soil. At assigned intervals, the center drive bit of the auger was removed and soil samples were obtained.

Representative samples were obtained using thin-walled tube and split-barrel sampling procedures in general accordance with ASTM Specifications D 1587 and D 1586, respectively. In the thin-walled tube sampling procedure, a thin-walled, seamless steel tube with a sharp cutting edge is pushed hydraulically into the ground to obtain relatively undisturbed samples of cohesive or moderately cohesive soils. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon is driven into the ground with a 140-pound hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the standard penetration resistance value. These values are indicated on the boring logs at the depths of occurrence. The samples were tagged for identification, sealed and returned to the laboratory for testing and classification.

Field vane shear tests were performed on the in-situ cohesive soils at selected depths in general accordance with ASTM D 2573. In this test, a tapered four-bladed vane is advanced into the undisturbed in-situ soils at the bottom of the bore hole and rotated from the ground surface to determine the torsional force required to cause a cylindrical surface to be sheared by the vane. This torsional force is then converted to the shear strength of the soil. The results of the field vane shear tests are presented on the boring logs at the depths at which the tests were performed.

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

LABORATORY TESTING

Based on the driller's field records and examination of the samples in the laboratory, a soil testing program was developed to collect more information about the soil conditions at the site. The following is a brief description of the specific tasks completed for this project.

Natural Moisture Content -- The natural moisture content of selected samples was determined in general accordance with ASTM D 2216. The moisture content of the soil is the ratio, expressed as a percentage, of the weight of water in a given mass of soil to the weight of the soil particles. The results are presented on the boring logs at the depths from which the samples were obtained.

Unit Weight -- In the laboratory, selected undisturbed samples of the site soils were measured and weighed to determine gross weight and volume of the samples. Where possible, the samples are placed in a template and trimmed at each end to fit the template. The moisture content of each specimen was then determined, and the dry unit weight was calculated. The results of these tests are also presented on the boring logs at the appropriate sample depths.

Unconfined Compressive Strength -- Selected cohesive soil samples obtained with 3-inch diameter Shelby tubes were tested in the laboratory to determine their unconfined compressive strength in general accordance with ASTM D 2166. In this procedure, sections of the Shelby tube samples were trimmed to fit into a 2.875 inch diameter by 5.70 inch high template and placed, without any confinement, in a triaxial load frame and tested for compressive strength with a controlled rate of strain. The peak stress on the samples, in psf, is reported on the boring logs at the depth from which the samples were obtained. A calibrated hand penetrometer was used to estimate the approximate unconfined compressive strength of the remaining samples. The calibrated hand penetrometer has been correlated with unconfined compression tests and provides a better estimate of soil consistency than visual examination alone.

Torvane Shear Test -- The Torvane test was performed on a precut flat soil sample surface with a calibrated, hand-held spring loaded dial device with thin flanges in a radial array which can be pressed into the soil sample. The vanes are pressed into the soil sample, and the dial face is twisted slowly until the vanes begin to shear the soil. This test gives a direct dial reading of soil shear strength when the sample fails. The test is especially useful for estimating the shear strength of soft cohesive soils. Torvane shear test results are noted on the boring logs at the depth of the samples tested.

As part of the testing program, the samples were classified in the laboratory based on visual observation, texture and plasticity. The descriptions of the soils indicated on the boring logs are in accordance with the enclosed *General Notes* and the *Unified Soil Classification System*. Estimated group symbols according to the *Unified Soil Classification System* are given on the boring logs. A brief description of this classification system is attached to this report.

SUBSURFACE CONDITIONS

Subsurface conditions encountered during this exploration are indicated on the individual boring logs. Based on the results of the borings, subsurface conditions on the project site can be generalized as follows.

At the ground surface of the borings, fill soil was encountered. These soils consisted of sandy silt, silty sand and sandy lean clay with varying amounts of organic matter. The fill extended to about 1 foot below existing grades.

Below the fill, buried topsoil was encountered in Borings 1, 4, 7 and 8. The topsoil consisted of sandy lean clay and sandy silt with trace amounts of organic matter. The topsoil extended to a depth of about 2 to 5½ feet below existing grades.

Beneath the buried topsoil and beneath the fill in rest of the borings, wind-deposited soils (loess and eolian sand) were encountered. The wind-deposited soils at the site consisted of silty sand, clayey sand, sandy silt, sandy lean clay, silt, fine to medium sand and fine sand. Loess soils include primarily silt sized particles but a lesser fraction of clay dominates the behavior of the materials. Loess soils are characterized in this region by relatively low in-situ density and high moisture contents. The consistency of the loess soils at the site varied significantly, ranging from very soft to stiff. The Eolian sands at the site were typically fine to medium sands and fine sands with very loose to medium dense consistency. The wind-deposited soils at the site extended to depths of about 15 to 30½ feet. Borings 1 through 3 and Borings 5 through 10 were terminated in wind-deposited soils.

Beneath the wind-deposited soils at Boring 4, sandy lean clay developed from ancient (Illinoian) glacial activity was encountered. These materials, which are usually called glacial tills, are typically stiff to very stiff. Soils derived from glacial till were deposited during the advance or retreat of continental glacial ice sheets which covered this area many thousands of years ago. The glacial till soils are more or less unsorted soil deposits consisting of a homogeneous mixture of sand, silt and clay, with the engineering properties of the soil being controlled by the clay fraction. Glacial till has usually been heavily preconsolidated by the glacial ice sheet from which it was derived. This preconsolidation compacts the soil and gives it superior properties for foundation support. The glacial till soil encountered at Boring 4 was medium stiff in consistency, and extended to the maximum depth explored of about 30½ feet below existing grade.

The above descriptions provide a general summary of the subsurface conditions encountered. The attached Test Boring Records contain detailed information recorded at each boring location. These Test Boring Records represent our interpretation of the field logs based on engineering examination of the field samples. The lines designating the interfaces between various strata represent approximate boundaries and the transition between strata may be gradual. Where strata changes occur between sample depths, the strata change elevation is typically estimated based on interpolation, and is approximate. Soil conditions will vary between boring locations.

GROUNDWATER CONDITIONS

The borings were monitored while drilling and after completion for the presence and level of groundwater. Water levels observed in the borings are noted on the boring logs. Groundwater was encountered in Borings 4 and 5, drilled in the building area, at about 14 to 29 feet below existing grade, during and after drilling operations. Extended water levels were recorded approximately 1 to 2 days after completing drilling operations. At this time, groundwater was encountered in Borings 2 through 5 at about 7½ to 27½ feet below existing grades. These water level observations provide an approximate indication of the groundwater conditions existing on the site at the time the borings were drilled.

Groundwater levels may fluctuate several feet with industrial, seasonal and rainfall variations and with changes in the water level in adjacent drainage features. Normally, the highest groundwater levels occur in late winter and spring, and the lowest levels occur in late summer and fall. Water levels at the site will be highly responsive to the water level in the adjacent Mississippi River.

CONCLUSIONS AND RECOMMENDATIONS

General

The near surface silt encountered at this site will become susceptible to disturbance during wet weather conditions. Care should be taken to prevent unnecessary disturbance of subgrade soils. Disturbed areas should be removed and replaced with new fill placed and compacted in accordance with the recommendations of this report. In order to minimize disturbance of the silt soils. measures should be taken to control groundwater infiltration in accordance with the **Construction Dewatering** section of this report.

The silty loess soils at the site often exhibited low consistencies with depth including some areas of very soft to soft soil. Where foundations extend into the loess soils, probing for soft soils becomes particularly crucial to determine if and where soft soils exist. Soft soils provide unsuitable bearing for shallow foundation and should be removed and replaced with structural fill which has been placed and compacted in accordance with the recommendations of this report.

Depending upon final grading, the areas surrounding Borings 5 and 6 (southern portion of southwest building) may require overexcavation. As an alternative to avoid these soft soil areas, consideration should be given to reorient the southwest Pod building so that the footprint would be in the more favorable soil conditions surrounding Borings 2 through 4.

Up to 15 feet of relief exists between boring elevations on this site. In general, settlement will result in the fill area, both within the fill and underlying soils. These potential settlements will increase as the height of the fill placed increases. TEAM Services should be retained once final grades have been determined in order to reanalyze areas that could be affected by deep fill.

Site Preparation

Structures which are demolished in the proposed building area should be removed entirely from the site along with their foundations and associated backfill material. Any underground utilities present in the existing building area which are to be abandoned should be removed along with their associated backfill material. Consideration should be given to rerouting existing utilities which will remain in service to locations outside the planned new building. so that they will be easily accessible for maintenance.

After stripping, the exposed grade should be inspected by the geotechnical engineer. Any unsuitable soils identified should be removed and replaced with suitable, compacted and tested engineered fill prepared in accordance with the recommendations of this report.

Fill and backfill placed for support of structures should consist of approved materials which are free of organic matter and debris. Bricks, rocks, or other solid pieces with a maximum dimension of 3 inches or larger should not be placed in the new fill, nor should organic material be used. Low-plasticity cohesive soil or granular soil should be used for fill. By our definition, low-plasticity cohesive soil would have a liquid limit less than 45 and a plasticity index less than 20. Most of the soils at the site appear to meet these criteria.

Fill should be placed and compacted in lifts of 12 inches or less in loose thickness and compacted to at least 95 percent of the material's standard Proctor maximum dry density (ASTM D 698) for cohesive soils and 98 percent for cohesionless soils. Fill should be placed at moisture content between 2 percent below and 4 percent above the material's optimum moisture content (also based on ASTM D 698) for cohesive soils and within 3 percent of the optimum moisture content for cohesionless soils. Sufficient density tests should be performed on each lift of fills to help verify the adequacy of the compaction levels obtained.

Upon completion of the filling operation, care should be taken to maintain the subgrade moisture content prior to construction of the footings and floor slab. If the subgrade should become desiccated, frozen or otherwise disturbed, the affected material should be removed or these materials should be scarified, moistened, recompacted and retested prior to floor slab placement. As a general guideline, fills which dry to a moisture content less than 2/3 of their optimum moisture content as determined by the Standard Proctor Test (ASTM D 698) in their upper 2 inches are candidates for reconditioning as described above.

Shallow Foundation Design

Based on the boring data and our experience with similar soils, the eolian sand and medium stiff silt and sandy silt encountered in the borings or newly placed, compacted and tested engineered fills extended to suitable natural soils in accordance with the recommendations of this report should provide adequate support for a system of shallow foundations, subject to the criteria and site preparation recommendations in this report. The southwest building may be designed on shallow foundations for a maximum net allowable bearing pressure of 1500 psf and southeast building may be designed for 2500 psf. The net bearing pressure is the pressure in excess of the minimum adjacent overburden pressure at the foundation level. These bearing capacities may be increased by 33% for the total foundation load, which considers transient forces such as wind.

Perimeter footings and footings beneath unheated areas should extend at least 48 inches below lowest adjacent finished grade for frost protection. Interior footings located in permanently frost-free environments should have at least 18 inches of protective embedment below lowest adjacent finished grade. Where construction may occur during the winter months, consideration should be given to lowering all footings to 48 inches below grade for frost protection. Isolated footings should have a minimum width of 24 inches, and continuous formed footings should have a minimum width of 16 inches. Trench footings are not recommended due to sands encountered on the site.

Where foundations are constructed adjacent to an existing structure's foundations, the proposed foundation bearing elevation should be the same as the existing structure's foundation bearing elevation. If unsuitable soils are present at this depth, then TEAM Services should be retained to develop recommendations to provide adequate foundation support without undermining the existing foundations. Movement joints should be provided between the new and existing structures. Where new foundations are placed next to existing foundations, the differential settlements will approach the maximum settlements experienced at the site. We estimate maximum settlements will be less than 1 inch.

Shallow Foundation Construction

The base of all foundation excavations should be free of water and loose soil prior to placing concrete. Foundations should be inspected by qualified personnel working under the supervision of a geotechnical engineer. Due to the presence of silts at the site, it is recommended that foundation inspection include field vane tests. Field vane tests are more accurate than the common hand penetrometer and dynamic cone penetrometer tests on these soils. Where loose, soft, organic, or otherwise unsuitable materials are encountered in the foundation excavations, the suspect materials should be removed and replaced with suitable compacted fill prepared in accordance with the recommendations of this report. Figure 1 shows a cross-sectional view of the overexcavation and backfill procedure.

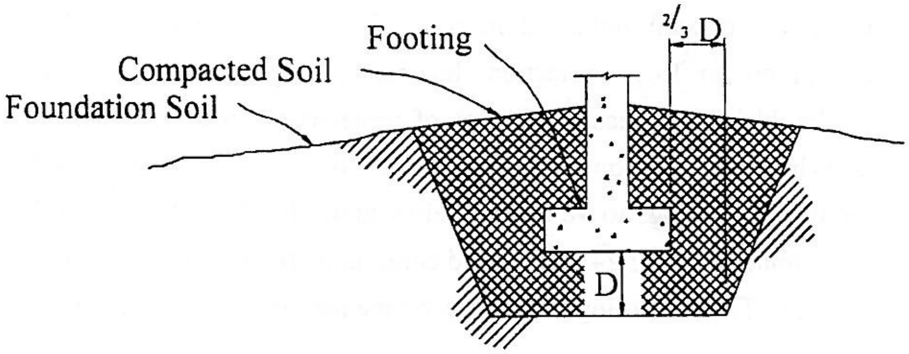


Figure 1

In general, the overexcavation is widened 2/3 foot on each side per foot of excavation that is below the foundation bearing elevation. The depth of overexcavation (shown as "D" in Figure 1) should be determined in consultation with the geotechnical engineer. Backfill materials should be suitable soil, prepared and compacted in accordance with the recommendations in the **Site Preparation** section of this report.

Soft loess soils exist in the building area and were encountered in Borings 5 and 6, drilled in the southern portion of the southwest building. Where these soils are present at or near the bottom of foundation excavations, overexcavation and replacement of these soils may be required.

The base of all foundation excavations should be free of water and loose soil prior to placing concrete. Concrete should be placed as soon as possible after excavating to minimize bearing soil disturbance. Should the soils at bearing level become excessively dry, saturated, or otherwise disturbed, the affected soil should be removed prior to placing concrete.

Floor Slabs

The recommendations provided in the **Site Preparation** section of this report are adequate for preparation of subgrade for building floor slabs. In order to allow successful use of a variety of floor systems, measures to control vapor transmission through the floor slab are recommended where moisture sensitive floor coverings are a possibility. This would include use of a vapor barrier/retarder with a minimum thickness of 10 mils placed between the floor slab and an underlying capillary barrier. The vapor barrier/retarder should be strong enough to resist puncturing of capillary barrier materials.

We recommend that the capillary barrier consist of a minimum 4-inch thick layer of relatively clean manufactured sand or crushed limestone having less than 5% passing the U.S. standard #200 sieve. Floor slabs in areas not subject to frost action may be designed with a modulus of subgrade reaction of 150 pci when subgrade soils and capillary barriers are constructed in accordance with the recommendations of this report.

Permanent Groundwater Control

For design purposes, the maximum groundwater level at the site should be considered to be near the ground surface elevation. A permanent groundwater control system which provides positive drainage for the below-grade walls and floor slabs is recommended to prevent development of hydrostatic pressures against the below grade building elements. If wall drains are not provided, then the design groundwater elevation should be considered equal to the ground surface.

Floor slabs which are placed below surrounding grade should be provided with a floor underdrain system to protect the floors from hydrostatic uplift forces. The underdrain system should consist of a minimum 6-inch layer of drainable material and trenches with subdrain pipes leading to an appropriate outfall. Beneath the floor slabs, crushed limestone with less than five percent passing the No. 200 sieve should be used. Trench drains should have free draining granular material with less than three percent passing the No. 200 sieve (crushed limestone - IDOT 4115 or pea gravel - IDOT 4131) and a minimum 4 inch perforated pipe.

The perforated pipe should be designed to collect water from the drainable material and should be sloped to drain to a reliable gravity outfall. The flow line elevation of these pipes should be at least 12 inches below the surface of the below grade floor slab. The perforations in the pipe should be sized to keep the drainable material out of the pipe. For the size of aggregates recommended, either 3/8-inch diameter perforations or 1/4-inch width slots should provide adequate performance. Where slots or perforations are concentrated on one side of the pipe, the pipe should be oriented with the perforations or slots on the bottom of the pipe. The radial thickness of drainable material around the pipes should not be less than 4 inches.

A perforated rigid plastic or metal drain line installed behind the base of walls extending below adjacent grade is recommended to prevent hydrostatic loading on the walls (and/or seepage into below grade building levels). The invert of a drain line around a below grade building area should be below the finished subgrade elevation of the interior floor. The drain line should be sloped to provide positive gravity drainage and should be surrounded by free-draining granular material graded to prevent the intrusion of fines, or an alternative free-draining granular material encapsulated with suitable filter fabric. At least a 2-foot wide section of free-draining granular fill should be used for backfill above the drain line and adjacent to the wall and should extend to within 2 feet of final grade. The granular backfill should be capped with 2 feet of compacted cohesive fill to minimize infiltration of surface water into the drain system. Figure 2 shows a typical wall drain.

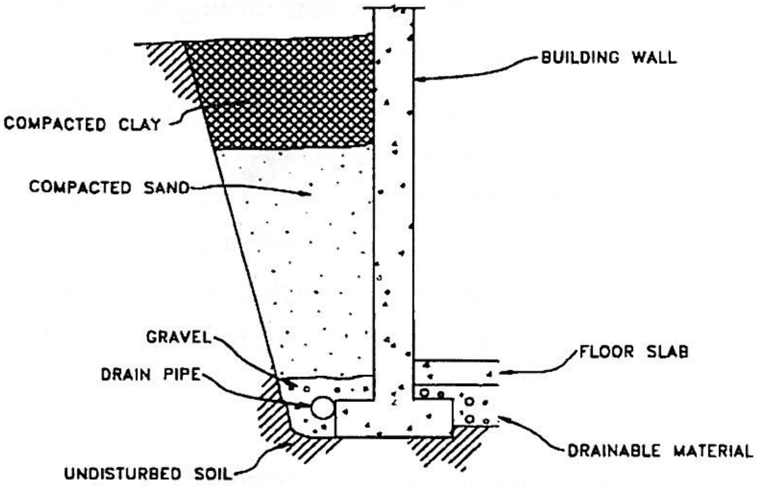


Figure 2.

Below grade walls which adjoin occupied areas should be protected with a moisture resistant barrier material on the outside of the wall. Care should be taken during wall backfilling operations to avoid damaging the moisture resistant material.

All drain lines should be directed to flow by gravity to a reliable, frost-free outfall if sufficient topographic relief is available at the site. A sump pit and pump should otherwise be constructed for the below grade facility. If such a system exists for the existing structure at the site, then it may be possible to route the drain lines into this system.

Lateral Earth Pressures

The project below-grade walls must be capable of resisting the lateral earth pressures that will be imposed on them. Customary design procedures for normal height residential walls may be followed where the height limitations associated with these designs are adhered to. For non-customary designs, the following recommendations may be used. Based on testing of reasonably similar soils on other projects. the following earth pressure coefficients are recommended. Walls which will be prevented from rotating, such as basement walls braced against the upper floor level, should be designed to resist the "at-rest" lateral earth pressure. The "at-rest" coefficient to be used in design will depend upon the type of backfill used. If soils similar to the silt soils encountered by the test borings are used for backfill behind walls, we recommend that an "at-rest" coefficient (Ko) of 0.7 be used. If more granular material such as compacted clean. washed sand is used as backfill, a lower "at-rest" coefficient of 0.45 could be used. In order for this coefficient to be used, the soil wedge within an angle of 45 degrees from the base of the wall to about 2 feet below the exterior grade should be excavated and replaced with compacted clean, washed sand.

Walls, such as exterior retaining walls. which are permitted to rotate at the top may be designed to resist "active" lateral earth pressure. Typically, a top rotation of about 1 inch per 10 feet height of wall is sufficient to develop active pressure conditions in soils similar to those encountered at the site. We recommend that an active earth pressure coefficient (Ka) of 0.5 be used for design of such walls if on-site silts are used for backfill. If a properly compacted clean, washed sand is used as backfill behind the wall within the active failure zone, a lower active earth pressure coefficient of 0.30 can be used.

The compacted mass unit weight of the backfill soil (which we estimate could reasonably be assumed as 110 pcf) should be used with the above earth pressure coefficients to calculate lateral earth pressures. Lateral pressure arising from surcharge loading, earthquake loading, and groundwater, should be added to the above soil earth pressures to determine the total lateral pressures which the walls must resist. In addition, transient loads imposed on the walls by construction equipment during backfilling should be taken into consideration during design and construction. Excessively heavy grading equipment (that could impose temporary excessive pressures or long-term excessive residual pressures against the constructed walls) should not be allowed within about 5 feet horizontally of the walls.

A coefficient of 0.3 could be reasonably assumed for evaluating ultimate frictional resistance to sliding at the foundation-soil contact. A passive earth pressure coefficient of 3 could be reasonably assumed for evaluating ultimate lateral resistance of the soil against the side of the foundation where this is a permissible condition. This passive earth pressure should be divided by a safety factor of at least 2 to limit the amount of lateral deformation required to mobilize the passive resistance.

Construction Dewatering

During construction activities, care should be taken to maintain positive drainage at the site. Based on the boring information, it appears possible that groundwater levels will rise to above the lowest construction grades. However, if groundwater level rises significantly during construction, excavation at the site will likely be performed in wet sands. It is possible that a "quick" condition may develop with attendant soil disturbance and loss of bearing capacity. This condition should be avoided by dewatering. Dewatering should be established at the site prior to excavation if groundwater is high. Enough time should be allowed for groundwater to be lowered a minimum of 3 feet below the planned excavation bottom prior to construction. Well points or dewatering trenches will be required to dewater the sandy soils at the site.

The silty and clayey soils at the site can be dewatered by constructing a series of dewatering trenches outside of the foundation excavations leading to sumps with pumps or to a free outfall. These dewatering trenches should extend to a minimum elevation of 3 feet below the foundation level and groundwater should be maintained 3 feet or deeper below the lowest foundation excavation level. Groundwater control should be maintained continuously until below grade construction is completed and backfilled sufficiently to withstand the forces which would be induced by the rise in groundwater levels when the dewatering system is turned off.

If groundwater control is lost during construction, disturbance of the upper few feet below grade is likely in the silt soils at the site. In these circumstances, it will be necessary to reestablish groundwater control and remove the disturbed soils. TEAM Services should be consulted regarding the extent of remedial action which is necessary.

Site Drainage

Positive site drainage should be maintained along the perimeter of structures. Final grades should be established to direct runoff away from building foundations. Down spouts, gutters, and roof drains should discharge away from building perimeters. Site grading should direct surface water away from excavations or completed foundations during construction and after site development is completed.

Site Classification for Earthquake Design

Based on the information from the boring logs and International Building Code, Site Class "D" should be used for seismic design of the proposed structures.

Pavements

Surface parking and entrance drives will be constructed at the project. Traffic is assumed to be primarily automobiles and buses. Subgrade soils should be prepared in accordance with the recommendations in the **Site Preparation** section of this report. We have used a California Bearing Ratio (CBR) value of about 3 for the pavement design. For rigid pavement design, this

CBR value would correspond to a modulus of subgrade reaction of about 35 pounds per cubic inch (pci) based on published correlations with soil type which considers the effects of frost.

The above design parameters assume at least 12 inches of suitable well-compacted low- plasticity material prepared in accordance with the recommendations in this report. This may entail undercutting and reworking soils near existing grade or in cut areas as well as moisture conditioning to achieve adequate compaction. Typical asphaltic cement concrete pavement sections are provided below.

	Light Duty (Auto Only)		Heavy Duty (Entrance & Drives)	
Asphalt	5½"	4½"	7"	6"
Class "A" Subbase	-	6"	-	6"
Compacted Subgrade	12"	12"	12"	12"

For Portland cement concrete, a minimum pavement thickness of 5 inches is recommended for automobile traffic only. The pavement thickness should be increased to a minimum of 6 inches in entrances and drives. Dumpster pad areas should have 7 inches of Portland cement concrete.

Asphaltic concrete mix designs and construction procedures should be in accordance with IDOT Specification No. 2303 with Class 1C compaction. Portland cement concrete should be designed to have a minimum modulus of rupture at 28 days of 550 pounds per square inch (psi) which is roughly equivalent to a compressive strength of 4,000 psi. The Portland cement concrete should also have an air entrainment in the range of 5 to 8 percent. Design and construction procedures for Portland cement concrete should be in accordance with IDOT Specification No. 2301, except that the concrete should be specified with minimum strength instead of with a prescription mix design.

Pavement subgrade preparation is especially critical where full-depth asphaltic concrete pavements are utilized due to the intense loadings on the subgrade from construction equipment.

Subgrades should be carefully proofrolled immediately prior to placement of asphaltic concrete with equipment such as a fully loaded, tandem axle dump truck. Areas that yield should be repaired by removal of the yielding soil and replacement with suitable fill placed, compacted, and tested in accordance with the recommendations in this report.

The above sections represent minimum design thicknesses, and periodic maintenance should be anticipated. Thicker pavement sections may be required if a high volume of traffic is anticipated, and pavement sections can be reviewed after final grades and traffic volume are known. Thicker pavement sections would also reduce maintenance and increase service life. Construction procedures involving placement, finishing, jointing, saw cutting, and weather protection can significantly impact pavement performance.

Pavements should be sloped to provide positive drainage of surface water. Water allowed to pond on or adjacent to the pavement could saturate the subgrade and contribute to premature pavement deterioration. Cracks which develop in the pavements should be sealed immediately. Periodic maintenance of any subdrains will also be required.

Pavement Subdrains and Drainable Base Course

Agencies and organizations in Iowa are increasingly constructing drained pavement sections to improve long-term performance and lower maintenance costs. Therefore, consideration may be given to a drained pavement section including a granular base connected to subdrains.

The granular base should be relatively free-draining meeting the requirements of IDOT Specification No. 4121 (Gradation No. 12) or IDOT Specification No. 4123 (Gradation No. 14). The granular base should be compacted in accordance with the recommendations presented previously in this report. The granular base should be at least 6 inches thick. The base material should be hydraulically connected to subdrains.

Subdrains should be placed at either side of the driveways or spaced about 30 to 60 feet on center in parking areas. In parking areas, the subdrains should be located so that the direction of the drains is perpendicular to the direction of the slopes. The subdrains should be placed approximately 48 inches below the bottom of the pavement section and sloped to drain to a reliable gravity outfall.

A 4-inch-diameter, perforated, high-density polyethylene (HDPE), corrugated pipe should be placed in 10-inch-wide trenches. The pipe should be centered horizontally within the trenches, and the perforations should be sized to prevent infiltration of fine grained soils. The trenches should be backfilled with gravel meeting the criteria of IDOT Specification No. 4131 (Gradation No. 29) or IDOT Spec No. 4115. Cleanouts should be provided on approximate 300 to 400 feet intervals to allow periodic flushing of the drain lines.

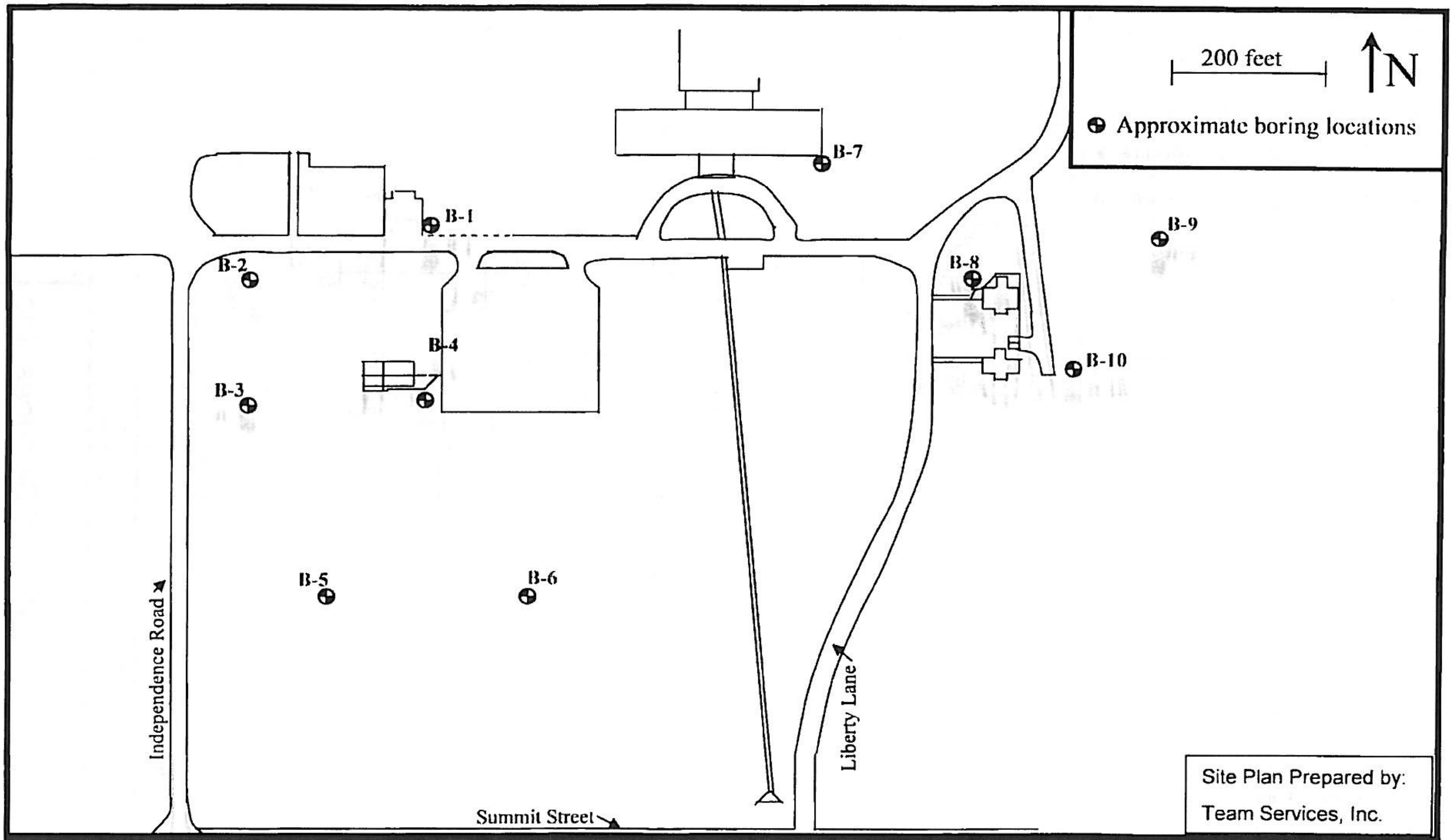
Where granular base and subdrains are utilized, the thickness of asphalt pavements can be reduced to account for increased subgrade support. With 6 inches of granular base as recommended above, asphaltic concrete pavement thicknesses may be reduced to 3½ inches for both light and medium automobile traffic, and to 5 inches for drive areas which will support service truck traffic. For Portland cement concrete pavements, the thickness of automobile only areas and driveways for service trucks may be designed with a thickness of 5 inches.

QUALIFICATION OF REPORT

Our evaluation of foundation support conditions has been based on our understanding of the site and project information and the data obtained in our exploration. The general subsurface conditions utilized in our foundation evaluation have been based on interpolation of subsurface data between the borings. In evaluating the boring data, we have examined previous correlations between soil properties and foundation bearing pressures observed in soil conditions similar to those at your site. The discovery of any site or subsurface conditions during construction which deviate from the data outlined in this exploration should be reported to us for our evaluation. The assessment of site environmental conditions or the presence of pollutants in the soil, rock, and groundwater of the site was beyond the scope of this exploration.

It is recommended that the geotechnical engineer be retained to review the plans and specifications so that comments can be provided regarding the interpretation and implementation of the geotechnical recommendations in the design and specifications. It is further recommended that the geotechnical engineer be retained for testing and observation during the foundation construction phase to help determine that the design requirements are fulfilled.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No other warranty is provided. In the event that any changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions of this report modified or verified in writing by the geotechnical engineer.



TEAM *Services*, Inc.

717 SE 6th Street
Des Moines, IA 50309

Iowa Veteran's Home Master Plan Implementation – Phase I

Marshalltown, IA

BORING PLAN

Project No. 1-2209

June 16, 2008

LOG OF BORING NO. 1

Page 1 of 1

OWNER	ARCHITECT/ENGINEER
SITE 1301 Summit Street Marshalltown, Iowa	PROJECT Iowa Veterans Home

Approx. Surface Elev.: 934.3 ft.

Depth	DESCRIPTION	Elev.
1.0	Fill -- Sandy SILT, trace organic matter, very dark grayish brown	933.3
2.0	Sandy lean CLAY, with sand seams, trace organic matter, very dark gray, very stiff (buried topsoil)	932.3
	Silty SAND, light olive brown, medium dense -- becomes loose @ about 5.5' -- becomes medium dense @ about 17'	
22.0	SILT, with sand, light olive brown and olive, medium stiff	912.3
27.0	Sandy SILT, trace ferrous staining, olive brown, stiff	907.3
30.5	Bottom of Boring	903.8

		SAMPLES				TESTS		
DEPTH (ft.)	USCS SYMBOL	NUMBER	TYPE	RECOVERY	SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF	UNCONFINED STRENGTH PSF
	ML	1	AS			21.5		
	CL	2	ST	4"		17.4		5500*
			HS					
5	SM	3	SS	18"	14	14.2		
	SM	4	SS	18"	6	15.4		
			HS					
10	SM	5	SS	18"	4	15.2		
			HS					
15	SM	6	SS	18"	6	15.8		
			HS					
20	SM	7	SS	18"	10	7.7		
			HS					
25	ML	8	SS	18"	7	25.5		
			HS					
30	ML	9	SS	18"	11	19.0		

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

Calibrated Hand Penetrometer*

WATER LEVEL OBSERVATIONS			
WL	▽ None	WD ▼ None	6-11-08
WL	None	AD	
WL			

TEAM Services, Inc.

BORING STARTED	6-10-08		
BORING COMPLETED	6-10-08		
RIG	ATV	FOREMAN	MG
APPROVED	RED	JOB #	1-2209

LOG OF BORING NO. 2

Page 1 of 1

OWNER	ARCHITECT/ENGINEER
SITE: 1301 Summit Street Marshalltown, Iowa	PROJECT: Iowa Veterans Home

Approx. Surface Elev.: 940.6 ft.

Depth (ft.)	DESCRIPTION	Elev.
1.0	Fill -- Silty SAND, trace organic matter, very dark grayish brown	939.6
3.5	Silty SAND, trace organic matter, olive brown, loose	937.1
5.5	Fine to coarse SAND, with silt, light olive brown, medium dense	935.1
8.5	Fine SAND, trace silt, light yellowish brown, medium dense	932.1
12.0	Silty SAND, light yellowish brown, loose	928.6
17.0	Clayey SAND, light olive brown, loose	▼ 923.6
22.0	Silty SAND, light olive brown, medium dense	918.6
25.0	SILT, with sand, light olive brown and olive, medium stiff	915.6
	Boring of Boring	

		SAMPLES				TESTS		
DEPTH (ft.)	USCS SYMBOL	NUMBER	TYPE	RECOVERY	SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF	UNCONFINED STRENGTH PSF
	SM	1	AS			10.8		
	SM	2	SS	15"	6	10.2		
			HS					
5	SP	3	SS	14"	11	11.5		
	SP	4	SS	15"	10	6.6		
			HS					
10	SM	5	SS	15"	9	13.0		
			HS					
	SC	6	SS	15"	8	21.3		
15			HS					
20	SM	7	SS	14"	15	16.4		
			HS					
25	ML	8	SS	14"	5	27.6		

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

Calibrated Hand Penetrometer*

WATER LEVEL OBSERVATIONS

WL	▽ None	WD	▼ 17'	6-11-08
WL	None	AD		
WL				

TEAM Services, Inc.

BORING STARTED	6-9-08		
BORING COMPLETED	6-9-08		
RIG	ATV	FOREMAN	MG
APPROVED	RED	JOB #	1-2209

LOG OF BORING NO. 3

Page 1 of 1

OWNER	ARCHITECT/ENGINEER
SITE 1301 Summit Street Marshalltown, Iowa	PROJECT Iowa Veterans Home

GRAPHIC LOG	DESCRIPTION Approx. Surface Elev.: 939.7 ft.	DEPTH (ft.)	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY	SAMPLES SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH PSF
▩	Fill -- Silty SAND, trace organic matter, very dark grayish brown and light olive brown 1.0 938.7		SM	1	AS			9.5		
░	Silty SAND, light olive brown, loose		SM	2	SS	14"	7	15.5		
░					HS					
░		5	SM	3	SS	17"	7	11.6		
░			SM	4	SS	16"	9	8.5		
░					HS					
░		10	SM	5	SS	15"	11	6.3		
░	12.0 927.7				HS					
▨	Sandy SILT, olive brown, medium stiff	15	ML	6	SS	18"	5	33.3		1000*
▨	-- light olive brown and olive @ about 17'				HS					
▨		20	ML	7	SS	15"	7	26.0		
▨	22.0 917.7				HS					
▥	SILT, trace sand, trace ferrous staining, light olive brown and gray. medium stiff 25.0 914.7	25	ML	8	SS	17"	7	27.5		
	Bottom of Boring									

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

Calibrated Hand Penetrometer*

WATER LEVEL OBSERVATIONS				
WL	∇ None	WD ▼ DCI 15' 6-11-08	BORING STARTED	6-9-08
WL	None	AD	BORING COMPLETED	6-9-08
WL			RIG ATV	FOREMAN MG
			APPROVED RED	JOB # 1-2209

TEAM Services, Inc.

LOG OF BORING NO. 4

Page 1 of 1

OWNER	ARCHITECT/ENGINEER
SITE 1301 Summit Street Marshalltown, Iowa	PROJECT Iowa Veterans Home

Approx. Surface Elev.: 933.6 ft.

Depth	DESCRIPTION	Elev.
1.0	Fill -- Sandy lean CLAY, trace organic matter, very dark grayish brown	932.6
3.0	Sandy lean CLAY, trace organic matter and sand seams, very dark grayish brown, very stiff (buried topsoil)	930.6
8.5	Silty SAND, light olive brown, loose	925.1
12.5	SILT, with sand, trace ferrous staining, olive brown, medium stiff	921.1
17.5	Silty SAND, light olive brown, medium dense	916.1
27.0	Sandy SILT, trace ferrous staining, light olive brown and gray, soft -- becomes medium stiff @ about 24'	906.6
30.5	Sandy lean CLAY, trace gravel and ferrous staining, light olive brown and gray, medium stiff ⊻ ⊻	903.1
	Bottom of Boring	

DEPTH (ft.)	USCS SYMBOL	SAMPLES NUMBER	TYPE	RECOVERY	SPT - N BLOWS / FT.	TESTS MOISTURE, %	DRY DENSITY PCF	UNCONFINED STRENGTH PSF	
	CL	1	AS			17.4			
	CL	2	ST	4"		15.6		4000*	
			HS						
5	SM	3	SS	18"	6	5.3			
	SM	4	SS	18"	6	6.9			
			HS						
10	ML	5	SS	18"	3	34.4			
			HS						V. Shear 1000 psf
15	SM	6	SS	18"	16	7.9			
			HS						
20	ML	7	SS	10"	4	27.6		1000*	
			HS						
25	ML	8	SS	12"	5	23.9		1000*	
			HS						
30	CL	9	SS	18"	7	20.8			

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

Calibrated Hand Penetrometer*

WATER LEVEL OBSERVATIONS

WL	⊻ 29	WD	⊻ 27.5'	6-11-08
WL	29'	AD		
WL				

TEAM Services, Inc.

BORING STARTED			6-10-08
BORING COMPLETED			6-10-08
RIG	ATV	FOREMAN	MG
APPROVED	RED	JOB #	1-2209

LOG OF BORING NO. 5

Page 1 of 1

OWNER	ARCHITECT/ENGINEER
SITE 1301 Summit Street Marshalltown, Iowa	PROJECT Iowa Veterans Home

GRAPHIC LOG	DESCRIPTION Approx. Surface Elev.: 931.7 ft.		DEPTH (ft.)	USCS SYMBOL	SAMPLES				TESTS			
					NUMBER	TYPE	RECOVERY	SPT - N BLOWS / FT.	MOISTURE, %	DRY DENSITY PCF	UNCONFINED STRENGTH PSF	
▦	Fill -- <u>Sandy SILT, trace organic matter,</u> very dark grayish brown			ML	1	AS			22.7			
	1.0	930.7										
▥	<u>SILT, with sand,</u> very dark grayish brown, medium stiff			ML	2	ST	10"		27.3	87	1000*	Torvane 400 psf
	-- becomes stiff @ about 3'					HS						V. Shear 1290 psf
	4.0	927.7										
▨	<u>Sandy SILT, trace ferrous staining, trace sand seams,</u> olive brown, stiff		5	ML	3	ST	6"		27.5	94	2500*	Torvane 1000 psf
	6.0	925.7										
░	<u>Silty SAND,</u> light olive brown, loose			SM	4	SS	15"	8	12.5			
	▼					HS						
	8.0	923.7										
▥	<u>SILT, with sand,</u> olive brown, soft			ML	5	SS	17"	3	31.3			
			10			HS						
	▽			ML	6	SS	14"	3	33.8			
	15.0	916.7	15									
	Bottom of Boring											

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

Calibrated Hand Penetrometer*

WATER LEVEL OBSERVATIONS						
WL	▽ 14'	WD	▼ 7.5'	6-11-08		
WL	14'	AD				
WL						

TEAM Services, Inc.

BORING STARTED	6-9-08		
BORING COMPLETED	6-9-08		
RIG	ATV	FOREMAN	MG
APPROVED	RED	JOB #	1-2209

LOG OF BORING NO. 6

Page 1 of 1

OWNER

ARCHITECT/ENGINEER

SITE 1301 Summit Street
Marshalltown, Iowa

PROJECT Iowa Veterans Home

GRAPHIC LOG	DESCRIPTION Approx. Surface Elev.: 924.7 ft.	DEPTH (ft.)	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY	SAMPLES SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH PSF	
	Fill -- Sandy lean CLAY, with organic matter, very dark grayish brown 1.0 923.7		CL	1	AS			28.2			
	Sandy lean CLAY, trace organic matter, olive brown, stiff 2.0 922.7		CL	2	ST	17"		24.3	91	2500*	Torvane 1000 psf
	Fine SAND, with silt, light olive brown 3.5 921.2		SP					7.6			
					HS						
	Silty SAND, light olive brown, loose 5.5 919.2	5	SM	3	SS	10"	5	14.4			
					HS						
	SILT, with sand, trace ferrous staining, olive brown, soft 7.0 917.7		ML	4	ST	19"		30.1	85	650	Torvane 300 psf
	Fine to medium SAND, with silt, light olive brown 8.5 916.2		SP					10.8			
					HS						
	SILT, with sand, olive brown, soft	10	ML	5	SS	14"	2	29.6			
					HS						
	-- trace ferrous staining, becomes medium stiff @ about 11.5' 15.0 909.7		ML	6	ST	20"		28.8	88	920 1500*	Torvane 400 psf
	Bottom of Boring	15									

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

Calibrated Hand Penetrometer*

WATER LEVEL OBSERVATIONS			
WL	⊻ None	WD ⊻ None	6-11-08
WL	None	AD	
WL			

TEAM Services, Inc.

BORING STARTED			6-9-08
BORING COMPLETED			6-9-08
RIG	ATV	FOREMAN	MG
APPROVED	RED	JOB #	1-2209

LOG OF BORING NO. 7

Page 1 of 1

OWNER

ARCHITECT/ENGINEER

SITE 1301 Summit Street
Marshalltown, Iowa

PROJECT Iowa Veterans Home

Approx. Surface Elev.: 930.2 ft.

Graphic Log Depth	Description	Elev.	Depth (ft.)	USCS Symbol	Samples: Number	Samples: Type	Samples: Recovery	Samples: SPT - N Blows / Ft.	Tests: Moisture, %	Tests: Dry Density PCF	Tests: Unconfined Strength PSF
1.0	Fill -- Sandy SILT, very dark grayish brown	929.2		ML	1	AS			13.8		
	Sandy SILT, trace organic matter, very dark grayish brown, soft (buried topsoil)			ML	2	SS	6"	2	15.5		
						HS					
5.5		924.7	5	ML	3	SS	8"	2	17.3		
	Silty SAND, light olive brown and dark gray, loose			SM	4	SS	18"	6	12.8		
						HS					
9.5	-- lean clay seam, olive brown @ about 9'	920.7	10	CL SP	5	SS	18"	16	11.9		
	Fine SAND, light olive brown, medium dense					HS					
12.5		917.7									
	Silty SAND, light olive brown, loose		15	SM	6	SS	18"	9	7.7		
						HS					
			20	SM	7	SS	18"	10	6.9		
						HS					
			25	SM	8	SS	18"	9	9.4		
						HS					
30.5		899.7	30	SM	9	SS	18"	6	6.8		
	Bottom of Boring										

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

Calibrated Hand Penetrometer*

WATER LEVEL OBSERVATIONS			
WL	▽ None	WD ▼ None	6-11-08
WL	None	AD	
WL			

TEAM Services, Inc.

BORING STARTED	6-10-08		
BORING COMPLETED	6-10-08		
RIG	ATV	FOREMAN	MG
APPROVED	RED	JOB #	1-2209

LOG OF BORING NO. 8

Page 1 of 1

OWNER	ARCHITECT/ENGINEER
SITE **1301 Summit Street** **Marshalltown, Iowa**	PROJECT **Iowa Veterans Home**

Approx. Surface Elev.: 928.5 ft.

Depth	DESCRIPTION	Elev.
1.0	Fill -- Silty SAND, trace organic matter, very dark gray	927.5
3.0	Silty SAND, trace organic matter, very dark gray, very soft (buried topsoil)	925.5
5.5	Sandy SILT, very dark grayish brown, very soft	923.0
8.5	Sandy SILT, olive brown, medium stiff	920.0
12.5	Fine SAND, with silt, light olive brown, loose	916.0
30.5	Silty SAND, light yellowish brown, loose -- becomes medium dense @ about 17.5' -- silt seam, olive brown @ about 29'	898.0
	Bottom of Boring	

DEPTH (ft.)	USCS SYMBOL	SAMPLES: NUMBER	TYPE	RECOVERY	SPT - N BLOWS / FT.	TESTS: MOISTURE, %	DRY DENSITY PCF	UNCONFINED STRENGTH PSF
	SP	1	AS			19.0		
	SP	2	SS	18"	2	14.4		
			HS					
5	ML	3	SS	18"	2	19.8		
	ML	4	SS	18"	5	17.7		
			HS					
10	SP	5	SS	18"	5	7.4		
			HS					
15	SM	6	SS	18"	10	1.6		
			HS					
20	SM	7	SS	18"	14	5.5		
			HS					
25	SM	8	SS	18"	15	10.0		
			HS					
30	ML SM	9	SS	18"	13	5.1		

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

Calibrated Hand Penetrometer*

WATER LEVEL OBSERVATIONS			
WL	▽ None	WD ▼ None	6-11-08
WL	None	AD	
WL			

TEAM Services, Inc.

BORING STARTED			**6-10-08**
BORING COMPLETED			**6-10-08**
RIG	**ATV**	FOREMAN	**MG**
APPROVED	**RED**	JOB #	**1-2209**

LOG OF BORING NO. 9

Page 1 of 1

OWNER	ARCHITECT/ENGINEER
SITE 1301 Summit Street Marshalltown, Iowa	PROJECT Iowa Veterans Home

DESCRIPTION Approx. Surface Elev.: 918.9 ft.	DEPTH (ft.)	USCS SYMBOL	SAMPLES NUMBER	TYPE	RECOVERY	SPT - N BLOWS / FT.	TESTS MOISTURE, %	DRY DENSITY PCF	UNCONFINED STRENGTH PSF
Fill -- Sandy SILT, trace organic matter, very dark gray 1.0 917.9		ML	1	AS			16.8		
Silty SAND, very dark grayish brown and light olive brown, loose		SM	2	SS	18"	5	7.4		
				HS					
color changes to light olive brown, becomes very loose @ about 3'		SM	3	SS	18"	4	5.6		
	5								
-- becomes loose @ about 5.5'				HS					
		SM	4	SS	18"	6	9.8		
				HS					
		SM	5	SS	18"	9	8.7		
	10								
				HS					
		SM	6	SS	18"	5	5.9		
15.5 903.4	15								
Bottom of Boring									

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

Calibrated Hand Penetrometer*

WATER LEVEL OBSERVATIONS			
WL	▽ None	WD ▼ None	6-11-08
WL	None	AD	
WL			

TEAM Services, Inc.

BORING STARTED	6-10-08		
BORING COMPLETED	6-10-08		
RIG	ATV	FOREMAN	MG
APPROVED	RED	JOB #	1-2209

LOG OF BORING NO. 10

Page 1 of 1

OWNER	ARCHITECT/ENGINEER
SITE 1301 Summit Street Marshalltown, Iowa	PROJECT Iowa Veterans Home

GRAPHIC LOG	DESCRIPTION Approx. Surface Elev.: 924.0 ft.	DEPTH (ft.)	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY	SAMPLES SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH PSF
▩	Fill -- Sandy SILT, very dark gray		ML	1	AS			8.0		
	1.0 923.0									
▒	Silty SAND, light olive brown, loose		SM	2	SS	18"	6	6.8		
					HS					
		5	SM	3	SS	18"	9	6.0		
					HS					
			SM	4	SS	18"	6	6.0		
					HS					
		10	SM	5	SS	18"	9	6.0		
					HS					
		15	SM	6	SS	18"	6	5.6		
	15.5 908.5									
	Bottom of Boring									

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

Calibrated Hand Penetrometer*

WATER LEVEL OBSERVATIONS			
WL	∇ None	WD ▼ None	6-11-08
WL	None	AD	
WL			

TEAM Services, Inc.

BORING STARTED	6-10-08		
BORING COMPLETED	6-10-08		
RIG	ATV	FOREMAN	MG
APPROVED	RED	JOB #	1-2209

UNIFIED SOIL CLASSIFICATION SYSTEM

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

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

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

[C] Gravels with 5 to 12% fines require dual symbols:

- GW-GM well-graded gravel with silt
- GW-GC well-graded gravel with clay
- GP-GM poorly graded gravel with silt
- GP-GC poorly graded gravel with clay

[D] Sands with 5 to 12% fines require dual symbols:

- SW-SM well-graded sand with silt
- SW-SC well-graded sand with clay
- SP-SM poorly graded sand with silt
- SP-SC poorly graded sand with clay

For classification of fine-grained soils and fine grained fraction of coarse-grained soils.

Equation of "A" Line:
Horizontal at PI = 4 to LL + 25.5.
then PI = 0.73 (LL-20)

[E]

$$Cu = D_{60}/D_{10} \qquad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

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

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

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

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

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

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

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

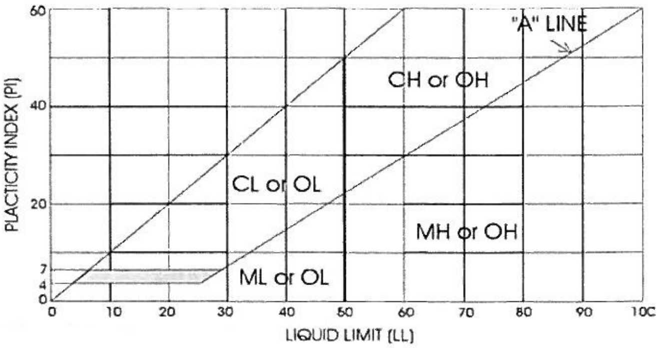
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

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

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

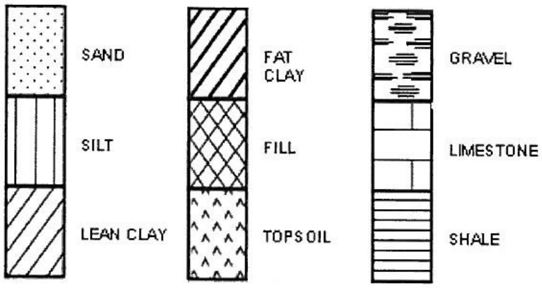
[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



GENERAL NOTES

SOIL and ROCK TYPES



DRILLING & SAMPLING SYMBOLS

SS	Split Spoon - 1 1/2" I.D., 2" O.D., unless otherwise noted
ST	Thin-Walled Tube - 3" O.D., unless otherwise noted
PA	Power Auger
HA	Hand Auger
DB	Diamond Bit - 4", N, B
AS	Auger Sample
HS	Hollow Stem Auger
WS	Wash Sample
RB	Rock Bit
BS	Bulk Sample
DC	Dutch Cone
WB	Wash Bore
AR	Air Rotary

CONSISTENCY OF FINE-GRAINED SOILS
(major portion passing No. 200 sieve)

Consistency	Unconfined Compressive Strength, Qu, psf	N-Blows/ft* (Approx. Correlation)
Very Soft	< 500	0 - 2
Soft	500 - 1,000	3 - 4
Medium	1,001 - 2,000	5 - 8
Stiff	2,001 - 4,000	9 - 15
Very Stiff	4,001 - 8,000	16 - 30
Hard	8,001 - 16,000	31 - 50
Very Hard	> -16,000	50 +

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Relative Density	N-Blows/ft. *
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	10 - 29
Dense	30 - 49
Very Dense	50 - 80
Extremely Dense	80 +

* Standard "N" Penetration Blows per foot of a 140 pound hammer falling 30 inches on a 2-inch OD split spoon, except where noted.

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) (of components also present in sample)	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) (of components also present in sample)	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

GRAIN SIZE TERMINOLOGY

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

WATER LEVELS:

WD = While Drilling AD = After Drilling

∇	Depth groundwater first encountered during drilling
▼	Groundwater level after 24 hours (unless otherwise noted, i.e. "AD" -- after drilling)

TERMS DESCRIBING SOIL STRUCTURE

Parting:	paper thin in size
Seam:	1/8" to 3" in thickness
Layer:	greater than 3" in thickness
Ferrous:	containing appreciable quantities of iron
Well-Graded:	having wide range in grain size and substantial amounts of all intermediate sizes.
Poorly-Graded:	predominately one grain size or having a range of sizes with some intermediate sizes missing.
Fissured:	containing shrinkage cracks, frequently filled with fine sand or silt, usually more or less vertical.
Interbedded:	composed of alternate layers of different soil types.
Laminated:	composed of thin layers of varying color and texture.
Slickensided:	having inclined planes of weakness that are slick and glossy in appearance.
NOTE:	Clays possessing slickensided or fissured structure may exhibit lower unconfined strength than indicated above. Consistency of such soil is interpreted using the unconfined strength along with pocket penetrometer results.