University of Nebraska Lincoln

FACILITIES PLANNING & CONSTRUCTION

ADDENDUM NO. 1

PROJECT NAME: **14th & R Street Parking Lot & Area Improvements**
UNL PROJECT NUMBER: **C903P255**

CONSULTANT: WLA Consulting, Inc.
ADDRESS: 1640 "L" Street, Suite D
Lincoln, NE 68508

DATE OF ISSUANCE: April 18, 2012
DATE OF BID OPENING: April 24, 2012

The bid documents dated March 30, 2012 for the above referenced project are amended by this addendum.

NOTICE: This Addendum is issued to all interested prospective bidders as an amendment to the project manual or other parts of the bidding (contract) documents for the above named project. Reference to this Addendum must be included in the Bid proposal. The information contained herein shall be fully incorporated into the contract documents as though originally included therein.

QUESTIONS AND MODIFICATIONS TO THE PROJECT MANUAL:

SECTION NO. – REFERENCE (LISTED IN ORDER)

MODIFICATIONS:

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

SECTION 00 21 13.01 – SCHEDULE OF VALUES

1. **DELETE** Section 00 21 13.01 – Schedule of Values in its entirety and **REPLACE** with the attached revised section.

DIVISION 31 – EARTHWORK

SECTION 31 10 00 – SITE CLEARING

1. **ADD** the following paragraph 3.7:

"3.7 RECYCLE OF MATERIALS

A. Trees:

1. Remove trees, shrubs and bushes not marked to remain and within the demolition boundaries.
2. Dispose of trees greater than 1 inch diameter in designated storage site for Owner's use. Owner will be responsible for chipping and mulching of the trees

3. Trees shall be cut into 6-foot or less lengths and de-limbed before being placed in storage site. Storage pile shall be constructed and maintained in an organized manner.
4. Contractor is responsible for removal of tree root ball."

APPENDIX B – GEOTECHNICAL ENGINEERING REPORT

APPENDIX B – Geotechnical Engineering Report

1. **ADD** the attached Geotechnical Engineering Report to Appendix B.

QUESTIONS:

1. Who is responsible for sidewalk and street closings?

   Response: Contractor is responsible for all sidewalk and street closings necessary to complete the work. Contractor is also responsible for obtaining permits as appropriate.

2. The bus stop on the east side of 14th Street appears to be in conflict with the new storm sewer?

   Response: Contractor shall attempt to avoid impacting the bus stop during installation of the storm sewer. If the bus stop does need to be temporarily relocated, Contractor shall coordinate with UNL and City of Lincoln.

3. Are the architectural feature light fixtures provided by UNL?

   Response: Contractor is responsible for providing all architectural feature lighting fixtures.

4. Is the Contractor responsible for material testing (i.e., soil, concrete, compaction, on-site, etc) or will this be handled by the Owner?

   Response: UNL is responsible for material testing.

5. Is the Contractor responsible for surveying and layout or will this be handled by the Owner?

   Response: Survey, layout and construction staking are the responsibility of the Contractor.

6. At the pre-bid, it was mentioned that UNL would handle all landscaping. However, in the Schedule of Values – Package 2, it has the line item of "landscaping". Is the Contractor responsible for landscaping in this section only?

   Response: UNL is responsible for all landscaping. The Schedule of Values has been revised and attached to this Addendum No. 1 per the modifications discussed above.

7. Is the Contractor responsible for salvaging road brick underlay or limestone curbing for the City of Lincoln?

   Response: Brick underlay does NOT need to be salvaged for the City of Lincoln. The brick underlay may be removed and disposed. The limestone curbing shall be salvaged for the City of Lincoln. Contractor is responsible for removing, protecting and stockpiling the limestone curbing. The City of Lincoln will pick up and transport the materials offsite. Contractor is responsible for coordinating with City of Lincoln for pick up.

STATEMENTS:

1. Contractor shall submit a Traffic Control Plan for approval.
2. Final grading for landscaped areas shall be 6-inches below grade shown.
3. The Contractor does NOT need to provide sleeves for parking meter installation. Instead, the Contractor will core drill the holes necessary for the parking meter installation. Contractor shall coordinate with UNL.
4. UNL will be completing all landscaping activities.
5. The last day to submit questions or comments prior to bid is April 19, 2012.
6. The parking lot surfacing activities shall be completed according to the following phasing:
   A. Southwest parking lot – functional surface (including paving, striping and lighting)
   B. Southeast parking lot – functional surface (including paving, striping and lighting)
   C. North parking lot
7. Contractor is responsible for construction staging. Staging areas shall be limited to the areas under construction. Contractor may coordinate with UNL rented at 19th & Y Street.

QUESTIONS AND MODIFICATIONS TO THE DRAWINGS:

DRAWING NO. – REFERENCE (LISTED IN ORDER)

MODIFICATIONS:

DRAWING NO. C4.2

1. **ADD** the attached Figure 1 – Retaining Wall Guardrail Detail

END OF ADDENDUM NO. 1

SCHEDULE OF VALUES

COMPANY NAME: _____ CONTACT: _____

ADDRESS: _____

PROJECT NAME: 14th & R Street Parking Lot & Area Improvements PROJECT NO. C903P255

Based on the Lump Sum Bid provided in Section 00 41 13 Bid Proposal Form, the project is divided into the following phases of work and statement of costs for each item:

Package 1 – Parking Areas

Pkg. 1 – Parking Areas - Work Phase Description	**Cost Value**
Mobilization / De-Mobilization	
Insurance / Bonding	
Southeast Parking Lot – Demolition & Site Clearing	
Southwest Parking Lot – Demolition & Site Clearing	
Southeast Parking Lot – Site Paving & Sidewalks	
Southwest Parking Lot – Site Paving & Sidewalks	
Southeast Parking Lot – Site Lighting Complete	
Southwest Parking Lot – Site Lighting Complete	
Storm Water NPDES BMP Elements	
Southeast Parking Lot – Retaining Wall	
Southwest Parking Lot – Striping Complete	
Southeast Parking Lot – Striping Complete	
Package 1 Subtotal	

Package 2 – Public Paving, Storm Sewer and Landscaping

Pkg. 2 – Public Paving, Storm Sewer & Landscaping Work Phase Description	Cost Value
Mobilization / De-Mobilization	
Insurance / Bonding	
Curb Bump Outs – Complete	
Storm Sewer – Complete	
North Driveway Entrance – Complete	
Storm Water NPDES BMP Elements	
Landscaping	N.I.C. – Completed by UNL
Package 2 Subtotal	

Package 3 – North Entry and North Architectural Features

Work Phase Description	Cost Value
Mobilization / De-Mobilization	
Insurance / Bonding	
North Gateway Identifier – Complete	
North Gateway Identifier – Electrical / Lighting Complete	
Storm Water NPDES BMP Elements	
Package 3 Subtotal	

Package 4 – South Architectural Features

Work Phase Description	Cost Value
Mobilization / De-Mobilization	
Insurance / Bonding	
Southeast Gateway Identifier – Complete	
Southwest Gateway Identifier – Complete	
Architectural Features – Electrical / Lighting Complete	
Storm Water NPDES BMP Elements	
Landscaping	N.I.C. – Completed by UNL
Package 4 Subtotal	
Total Project Package Cost	

END OF SECTION

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Geotechnical Engineering Report

Proposed New Parking Lot
14th and R Street
Lincoln, Nebraska

January 17, 2012
Terracon Project No. A3115050

Prepared for:
WLA Consulting, Inc.
Lincoln, Nebraska

Prepared by:
Terracon Consultants, Inc.
Lincoln, Nebraska

Offices Nationwide
Employee-Owned
Established in 1965
terracon.com
Terracon
Geotechnical ■ Environmental ■ Construction Materials ■ Facilities

January 17, 2012

WLA Consulting, Inc.
1640 L Street, Ste. D
Lincoln, Nebraska 68508

Attn: Mr. Darren Jack

Re: Geotechnical Engineering Report
Proposed New Parking Lot
14th and R Street
Lincoln, Nebraska
Terracon Project No. A3115050

Dear Mr. Jack:

Terracon Consultants, Inc. (Terracon) has completed a subsurface exploration for the referenced project. The accompanying geotechnical report presents the findings of the subsurface exploration and provides recommendations for the design and construction of the proposed parking lot and retaining wall. General earthwork recommendations are also included.

We appreciate the opportunity to provide the geotechnical consulting services for this project, and look forward to reviewing the plans and specifications as well as providing observation and testing services during construction. Please contact us if you have any questions regarding the attached report, or if we may be of further service.

Sincerely,

Terracon Consultants, Inc.

Gopala K. Allam, E.I.
Staff Geotechnical Engineer

Bradley A. Levich, P.E.
Principal

GKA/BAL:gka/leb

Copies to: Addressee (2 bound and 1 via e-mail)

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY

A geotechnical engineering report has been completed for the proposed new parking lot, located at 14th and R Street in Lincoln, Nebraska. Three borings were performed to provide geotechnical information. Laboratory tests and observations were then performed on the samples.

Based on the information obtained from our exploration and testing program, the site can be developed for the proposed project. Following are some significant geotechnical issues identified:

- Existing fill soils were encountered in the borings to depths of about 3 to 8 feet. Clay with various amounts of rubble was observed in the borings. Samples of the fill soils appeared to be moderately to poorly compacted. Fill soils in Boring B-2 consisted of fat clays. We recommend removal of fat clays and any rubble materials and provide at least 18 inches of newly compacted low plasticity cohesive fill beneath the pavements.

- Support of the proposed retaining wall on a spread footing foundation system extending through existing through existing fill soils bearing on suitable native soils appears feasible, with careful observation and testing in footing excavations and removal of any unsuitable materials observed.

- The on-site soils including existing fills except those identified as fat or lean to fat clays are typically appear suitable for reuse as low-plasticity cohesive fill. Some moisture conditioning will be required to facilitate compaction.

- Close monitoring of the construction operations discussed herein will be critical in achieving the design subgrade and foundation support. We therefore recommend that Terracon be retained to monitor this portion of the work.

This summary should be used in conjunction with the entire report for design purposes. It should be recognized that details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. The section titled **GENERAL COMMENTS** should be read for an understanding of the report limitations.

GEOTECHNICAL ENGINEERING REPORT
PROPOSED NEW PARKING LOT
14TH AND R STREET
LINCOLN, NEBRASKA

Terracon Project No. A3115050
January 17, 2012

1.0 INTRODUCTION

This report presents the results of our subsurface exploration for the proposed new parking lot, located at 14th and R Street in Lincoln, Nebraska. As requested, three borings were completed to depths of about 10 to 15 feet below existing grade, to obtain information on the subsurface conditions. The individual boring logs are included in Appendix A of this report. The approximate boring locations are shown on the Boring Location Plan, also included in Appendix A.

Our work was completed in general accordance with our proposal-agreement no. PA3110243 dated November 23, 2011.

The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- subsurface soil conditions
- groundwater conditions
- site stripping and preparation
- site grading and earthwork
- footing foundation design and construction
- lateral earth pressures
- pavement subgrade preparation
- pavement thickness

2.0 PROJECT INFORMATION

2.1 Site Location and Description

Item	Description
Location	The project will consist of the construction of a new parking lot located within existing parking lot on the east side of 14th Street and within the vacant lot and parking lot on the west side of the 14th Street, south of R Street, in Lincoln, Nebraska.
Existing improvements	We understand residences previously existed east of 14th street, and they have been removed. The remaining areas consist of active parking lots.

Item	Description
Existing topography	Topographic survey information was not available at the time of this report. Based on review of USGS quadrangle maps, the site appears relatively level.

2.2 Project Description

Item	Description
Pavement	We understand that the new parking lot will be constructed of Portland cement concrete pavement.
Grading	Less than 2 feet of cut or fill (assumed)
Retaining wall	Reinforced concrete retaining walls less than 3 feet in height are anticipated on the site.

Should any of the above information or assumptions be inconsistent with the planned construction or site development, please let us know so we may make appropriate modifications to this report.

3.0 SUBSURFACE CONDITIONS

3.1 Mapped Soil Units

Surface soils at the project site were mapped as part of the effort to develop the Lancaster County NRCS-USDA Soil Survey. According to this document, the soil association at this site is Crete-Aksarben complex. These soil series consists of very deep, moderately well drained soils formed in loess. These soil units have a moderate to high shrink-swell potential. The seasonal high water level in these series is noted as greater than about 6 feet below native grade.

The native soil profile may have been considerably altered by development associated with urbanization.

More information is provided in Soil Survey of Lancaster County, Nebraska.

3.2 Typical Profile

It should be noted that during the course of the field exploration, Boring B-1 was terminated due to auger refusal at a depth of about 3 feet. This boring was moved to a new location and redrilled as B-1A. Based on the results of the borings, subsurface conditions on the project site can be generalized as follows:

Description	Approximate Depth to Bottom of Stratum	Material	Consistency/ Density
Surface	N/A	Borings 1, 1A, and 3, 3, 4: Asphaltic cement concrete over limestone base Boring 2: Grass, shallow root zone	N/A
Stratum 1 (Fill)	Extended to depths of about 3 to 8 feet in Borings 1, 1A, 2, and 3	Lean Clay, Lean to Fat Clay, Fat Clay with varying amounts rubble	N/A
Stratum 2	Underlying Stratum 1 to 10-foot and 15-foot termination depths	Lean Clay, Sandy Lean Clay	Stiff to Very Stiff

Conditions encountered at each boring location are indicated on the individual boring logs. Additional information is presented on the boring logs in Appendix A. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in-situ, the transition between materials may be gradual.

Variations could occur between borings locations or across the site. Additional variations may be attributable to previous grading and construction.

3.3 Groundwater

The borings were monitored while drilling and shortly after completion for the presence and level of groundwater. Groundwater was not observed in the borings. At the time the borings were drilled, the groundwater table at the boring locations was apparently below the maximum drilling depth. However, fluctuations in the groundwater table can occur and perched water can develop over low permeability soil strata following periods of heavy or prolonged precipitation. This possibility should be considered when developing design and construction plans and specifications for the project. Long term monitoring in cased holes or piezometers would be necessary to accurately evaluate the potential range of groundwater conditions on the site.

4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

4.1 Geotechnical Considerations

4.1.1 Existing Structures and Existing Fill

Existing buildings and structures are present on the site, along with numerous subsurface utilities. We anticipate other structures may pre-dated the current structures. We recommend that the

structures be removed, along with footings and utilities in the area of the proposed parking lot and retaining wall.

Existing fill soils were encountered in the borings to depths of about 3 to 8 feet. Clay with various amounts of rubble was observed in the borings. Samples of the fill soils appeared to be moderately to poorly compacted. Terracon has not been provided records concerning previous grading or placement/compaction records associated with the existing fill. Any such records and/or test pits would aid our evaluations of the fill. Leaving existing fill in-place below new pavements presents a risk to the owner of premature pavement deterioration. Complete removal of the existing fill would be necessary to eliminate this risk. Fill soils in Boring B-2 consisted of fat clays. We recommend removal of fat clays and any rubble materials and providing at least 18 inches of newly compacted low plasticity cohesive fill beneath the pavements.

In areas of the proposed retaining walls, we recommend extending the footings to bear on the natural soils below the fill.

4.1.2 Construction Observation and Testing

Terracon should be retained during construction to observe the stripping, site preparation, removal of existing fill, removal of desiccated soil, removal of soft or unstable native soils, and subgrade preparation. We can assist in identifying low-density or unstable existing fill soils or low-strength native soils that should be undercut and removed, as well as identifying additional corrective measures that may become apparent during construction.

We should be retained to evaluate and perform laboratory tests on proposed fill materials to evaluate compliance with the project specifications. We can also review laboratory tests of proposed fill soils provided by suppliers and contractors. We should be retained to monitor fill placement, and to perform field density tests as each lift of fill is place in order to evaluate compliance with the design requirements. We should be retained to observe and test bearing soils exposed in footing foundation excavations, and to evaluate floor slab and pavement subgrades immediately prior to paving.

4.2 Site Preparation and Earthwork

4.2.1 Stripping and Preparation

Site preparation of the pavement areas and retaining wall areas, cut areas, and areas to receive fill should include the removal of existing foundations (to the extent feasible without undermining or reducing support of the existing building foundations), floor slabs, pavements, vegetation, organic topsoil, and any other material unsuitable for re-use as low-plasticity cohesive fill.

Foundations, foundation walls, floor slabs, utilities, retaining walls, existing pavements and other existing features should be removed from the proposed parking lot and retaining wall to the extent

feasible. This process should include removing poorly compacted existing fill and any organic topsoil buried by the existing fill. Utility lines should be re-routed outside of the retaining wall area. The actual removal depths and lateral extents should be evaluated and confirmed during construction. We recommend the bid documents contain base quantities for excavation, removal of debris, and unit prices for additional / reduced amounts of excavation and removal. Test pits can be performed at the onset of construction to help better define the depth, extent, and composition of existing fill.

Any existing fill soils should be removed below the retaining wall. The retaining wall area should be defined as their nominal dimensions plus 3 feet beyond on all sides. Any observed soft natural soils, or unstable soils should be removed and replaced.

We recommend the fat clays and existing fill soils be undercut and replaced to a depth of at least 18 inches with new low plasticity cohesive fill below exterior pavements. The soils at this overexcavation level should also be proofrolled in the presence of Terracon personnel. We recommend that site stripping, overexcavation, subgrade preparation, and compaction procedures extend at least 2 feet beyond the edges of the proposed pavements.

Proofrolling is recommended after stripping and overexcavation is completed. Proofrolling aids in providing a firm base for compaction of fill and delineating soft or poorly compacted fill that may exist below subgrade level. Unsuitable areas observed at this time should be improved by scarification and recompaction or by undercutting and replacement with structural fill. Proofrolling may be accomplished with a fully loaded, tandem-axle dump truck or other equipment providing an equivalent subgrade loading. A minimum gross weight of 25 tons is recommended for the proofrolling equipment.

4.2.2 Structural Fill Composition Requirements

We recommend the structural fill meet the following material composition requirements:

Fill Type [1]	USCS Classification	Acceptable Location for Placement
Low Plasticity Cohesive	CL (LL≤45 and 10≤PI≤25) [2]	Most locations and elevations, including below the segmental retaining walls and footing foundations, and for retaining wall backfill.
Free draining granular fill [3]	SC, SM, GC, GM	Free-draining backfill along the back edge of retaining walls.
On-Site Soils	CL	Suitable for use as Lean Clay fill if meeting the requirements of “Low Plasticity Cohesive” above. Lean to fat clays and fat clays are not suitable for use within 2 feet of pavements.

(continued from previous page)

1. Controlled, compacted fill should consist of approved materials that are free of organic matter, debris, and particles larger than 3 inches in maximum dimension. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the geotechnical engineer for evaluation.
2. LL = Liquid Limit, PI = Plasticity Index.
3. Well-graded, free-draining granular material used as drainage backfill adjacent to below-grade walls. A general gradation should be 100% passing the 1½-inch sieve, about 40 percent passing the No. 10 sieve, and less than 6 percent fines. Terracon can review proposed materials.

4.2.3 Structural Fill Compaction Requirements

Item	Description
Fill Lift Thickness [4]	9 inches or less in loose thickness
Compaction Requirements [1, 3]	
■ **Below footings, and upper 9 inches of pavement subgrade**	98% of the material's standard Proctor maximum dry density (ASTM D 698)
■ **All other locations**	95% of the material's standard Proctor maximum dry density (ASTM D 698)
Moisture Content – Cohesive Soil	Within the range of -1 to +3 percent of the optimum moisture content as determined by the standard Proctor test at the time of placement and compaction
Moisture Content – Granular Material [2]	Workable moisture levels

1. We recommend compacted fill be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.
2. Specifically, moisture levels should be maintained low enough to allow for satisfactory compaction to be achieved without the cohesionless fill material pumping when proofrolled or containing excess water (ponding).
3. Consideration can be given to compacting all fill below pavements to 95% during mass grading. Immediately prior to paving, we recommend the subgrade below exterior pavements be rough-graded as needed, proofrolled, and then compacted.
4. Thinner lifts may be required in excavations or confined areas.

4.2.4 Construction Grading and Drainage

Any areas of standing surface water should be drained as far in advance of construction as possible. Any saturated soils should be removed prior to placing fill or proceeding with construction.

The on-site soils will be sensitive to disturbance from construction activity and water seepage. If precipitation occurs immediately prior to or during construction, the near-surface clay soils could

increase in moisture content and become more susceptible to disturbance. Construction activity should be monitored, and should be curtailed if the construction activity is causing subgrade disturbance. A Terracon representative can help with monitoring and developing recommendations to avoid subgrade disturbance.

Surface water should not be allowed to pond on the site and soak into the soil during construction. Construction staging should provide drainage of surface water and precipitation away from the building and pavement areas. Any water that collects over or adjacent to construction areas should be promptly removed, along with any softened or disturbed soils. Surface water control in the form of sloping surfaces, drainage ditches and trenches, and sump pits and pumps will be important to avoid ponding and associated delays due to precipitation and seepage.

4.2.5 Construction Considerations

It is our experience that a saturated zone often develops immediately below existing pavements. The saturated zone forms when surface water infiltrates through cracks in the paving, and then is prevented from draining or evaporating by the paving. It is our experience that this saturated zone typically is not more than about 6 inches thick, but it may be necessary to scarify, dry, and recompact this layer where encountered.

Slippage can occur if fill is placed on slopes steeper than about 5 horizontal to 1 vertical (5H:1V). Therefore, we recommend that slopes steeper than about 5H:1V be flattened or benched prior to placing fill. We recommend this process consist of removing vegetation and sod, and then forming benches or horizontal steps wide enough to accommodate construction equipment, and separated by vertical risers less than 2 feet high.

Upon completion of filling and grading, care should be taken to maintain the subgrade moisture content prior to construction of retaining wall footings and pavements. Construction traffic over the completed subgrade should be avoided to the extent practical. Heavy or concentrated loads or numerous repetitions of lighter loads could cause subgrade disturbance / failure and should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. If the subgrade should become frozen, desiccated, saturated, or disturbed, the affected material should be removed or these materials should be scarified, moisture conditioned, and recompacted prior to floor slab and pavement construction.

As a minimum, all temporary excavations should be sloped or braced as required by Occupational Health and Safety Administration (OSHA) regulations to provide stability and safe working conditions. Temporary excavations will probably be required during grading operations. The grading contractor, by his contract, is usually responsible for designing and constructing stable, temporary excavations and should shore, slope or bench the sides of the excavations as required, to maintain stability of both the excavation sides and bottom. All excavations should comply with applicable local, state and federal safety regulations, including the current OSHA Excavation and Trench Safety Standards.

4.2.6 Landscaping and Grading Considerations

Poor site drainage and ponding of surface water can increase the potential for frost heave, swell, or settlement within the native or recompacted clay soils or clay fill. Excessive moisture can reduce the soil's bearing capacity and contribute to settlement and cracking. Finished grading slopes should promote drainage away from the existing building, retaining wall, and pavement areas to help prevent post-construction wetting of the bearing soils. Pavements or sidewalks installed adjacent to the building should slope away from the building at a grade of 2% or more.

Overwatering of grass or landscaping vegetation is a significant source of water, and should be avoided near the retaining walls, and pavements. Sprinkler heads should be adjusted to miss the retaining walls and pavements. Automated watering systems should be programmed to not run after natural rain events, and to not overwater. Any utility leaks should be promptly repaired.

4.3 Spread Footing Foundations

In our opinion, the proposed retaining wall can be supported by a shallow, spread footing foundation system extending through existing fill soils bearing on suitable native soils . We anticipate this may require some overexcavation and replacement or use of lean concrete. Design and installation recommendations for shallow foundations for the proposed building are presented in the following subsections.

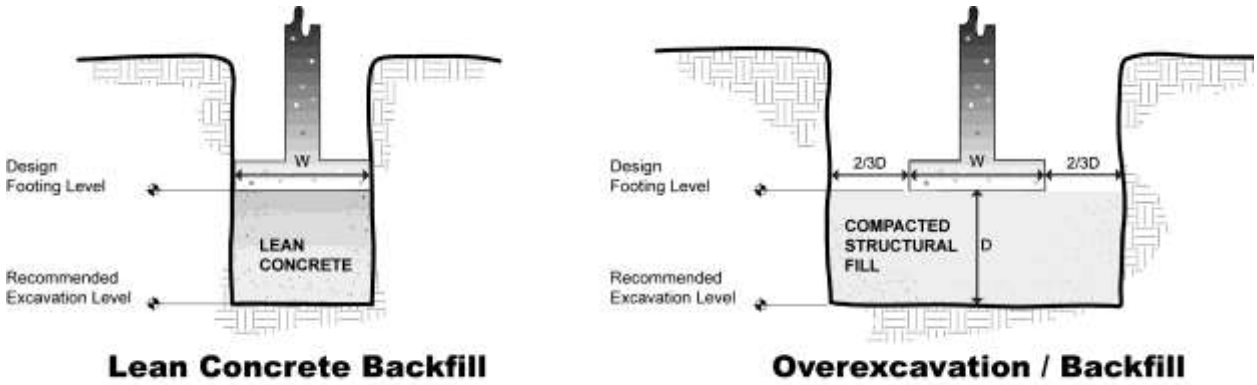
4.3.1 Design Recommendations

Description	Wall
Net allowable bearing pressure (soil) [1]	2,000 psf
Minimum dimensions	18 inches
Minimum embedment of perimeter footings and footings beneath unheated areas [2]	42 inches
Estimated total settlement [3]	<1 inch
Estimated differential settlement [3]	2/3 inch over 40 feet

1. The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Assumes any fill, disturbed soil, or soft soils, if encountered, will be undercut and replaced with lean concrete or engineered fill.
2. For frost protection and to reduce the effects of seasonal moisture variations in the subgrade soils. If construction extends into freezing weather, we recommend that either all footings extend to frost depth (as measured from adjacent grade at the time of construction) or that the foundations be protected from the elements by straw, frost blankets, or similar means.
3. The foundation settlement will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth of the footings, the thickness of compacted fill, and the quality of the earthwork operations. The above settlement estimates have assumed the, 2 feet for continuous footings, and relatively uniform loading.

4.3.2 Construction Considerations

Terracon should be retained to observe and test the bearing materials exposed in all foundation excavations. If unsuitable bearing materials are encountered in footing excavations, the excavations should be extended deeper to suitable materials. The footings could bear directly on these materials at the lower level or on lean concrete backfill placed in the excavations. The



NOTE: Excavations in sketches shown vertical for convenience. Excavations should be sloped as necessary for safety.

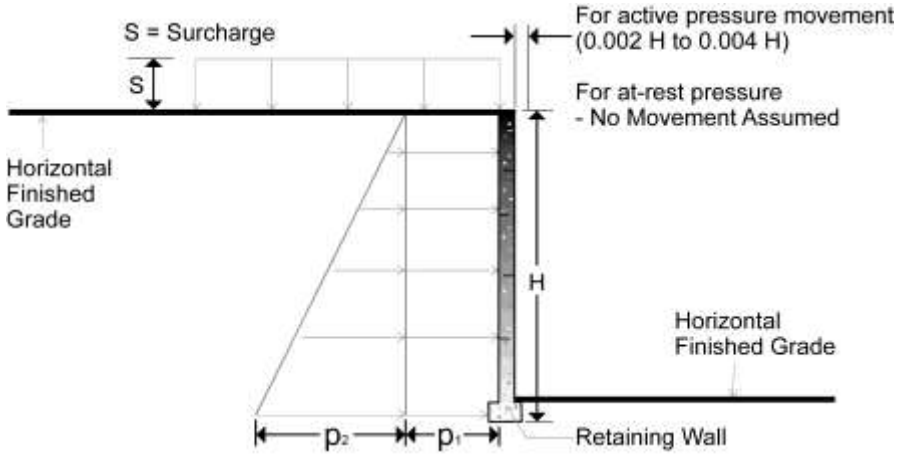
footings could also bear on approved, properly compacted backfill extending down to the suitable materials. Overexcavation for compacted backfill placement below footings should extend laterally at least 8 inches beyond the edges of the footings for each foot of overexcavation depth below footing base elevation. The overexcavation should then be backfilled up to the footing base elevation with engineered fill placed in lifts of 9-inches or less in loose thickness and compacted in accordance with recommendations provided in **Section 4.2**. Thinner lifts may be required in confined excavations, depending on fill material type and compaction equipment used. A schematic of the overexcavation and backfill procedure is shown on the adjacent figure (note that the sides of footing excavations should be sloped in accordance with governing regulations).

The clay soils encountered on this site are susceptible to disturbance from construction activities, particularly if the soils have high natural moisture contents or become wetted by surface water or seepage. Care should be taken during excavation and construction of footings to avoid disturbing the bearing soils. The base of all foundation excavations should be free of water and loose material prior to placement of concrete. Concrete should be placed within a few hours after excavating to reduce disturbance of the bearing materials. If the materials at bearing level become excessively dry, disturbed or saturated, the affected material should be removed prior to placing concrete. A 2- to 3-inch lean concrete “mud mat” could be placed in the base of the foundation excavations to reduce the potential for disturbance of bearing soils and provide a stable working surface for placement of reinforcing steel.

4.4 Lateral Earth Pressures

The lateral earth pressure recommendations given in this section are applicable to the design of rigid retaining walls subject to slight rotation, such as cantilever, or gravity type concrete walls. These recommendations are not applicable to the design of modular block - geogrid reinforced backfill walls (also termed MSE walls). Recommendations covering these types of wall systems are beyond the scope of services for this assignment. However, we would be pleased to develop a proposal for evaluation and design of such wall systems upon request.

Walls with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to those indicated in the following table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction and/or compaction and the strength of the materials being restrained. Two wall restraint conditions are shown. Active earth pressure is commonly used for design of free-standing cantilever retaining walls and assumes wall movement. The "at-rest" condition assumes no wall movement. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls.



EARTH PRESSURE COEFFICIENTS

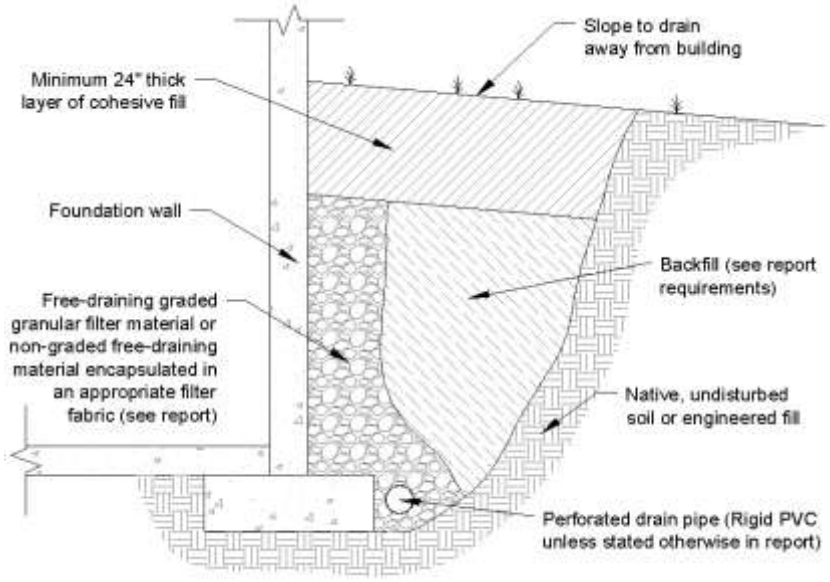
Earth Pressure Conditions	Coefficient For Backfill Type	Equivalent Fluid Density (Pcf)	Surcharge Pressure, P_1 (Psf)	Earth Pressure, P_2 (Psf)
Active (Ka)	Granular - 0.33	40	(0.33)S	(40)H
	Lean Clay - 0.39	47	(0.39)S	(47)H
At-Rest (Ko)	Granular - 0.46	55	(0.46)S	(55)H
	Lean Clay - 0.56	67	(0.56)S	(67)H
Passive (Kp)	Granular - 3.0	360	---	---
	Lean Clay - 2.4	288	---	---

Applicable conditions to the above include:

- For active earth pressure, wall must rotate about base, with top lateral movements of about 0.002 **H** to 0.004 **H**, where **H** is wall height
- For passive earth pressure to develop, wall must move horizontally to mobilize resistance.
- Uniform surcharge, where S is surcharge pressure
- In-situ soil backfill weight a maximum of 120 pcf
- Horizontal backfill, compacted between 95 and 98 percent of standard Proctor maximum dry density
- Loading from heavy compaction equipment not included
- No hydrostatic pressures acting on wall
- No dynamic loading
- No safety factor included in soil parameters
- Ignore passive pressure in frost zone

Backfill placed against structures should consist of granular soils or low plasticity cohesive soils. For the granular values to be valid, the granular backfill must extend out from the base of the wall at an angle of at least 45 and 60 degrees from vertical for the active and passive cases, respectively. To calculate the resistance to sliding, a value of 0.4 should be used as the ultimate coefficient of friction between the footing and the underlying soil.

We recommend a perimeter drain be installed at the foundation level to control the water level behind the wall. If this is not possible, then combined hydrostatic and lateral earth pressures should be calculated for lean clay backfill using an equivalent fluid weighing 90 and 100 pcf for active and at-rest conditions, respectively. For granular backfill, an equivalent fluid weighing 85 and 90 pcf should be used for active and at-rest, respectively. These pressures do not include the influence of surcharge, equipment or pavement loading, which should be added. Heavy equipment should not operate within a distance closer than the exposed height of retaining walls to prevent lateral pressures more than those provided.



4.5 Exterior Pavements

4.5.1 Design and Thickness Recommendations

Pavement subgrades should be prepared in accordance with the recommendations presented in section **4.2 Site Preparation and Earthwork**.

Typical construction in this area is not to place a granular base and subdrains below exterior pavements for projects of this type. Rather, the exterior pavements are supported directly on the cohesive subgrade soils or stabilized subgrade soils. If the project design results in a granular base and subdrains being installed below exterior pavements, Terracon should be retained to provide additional recommendations.

Following are our recommended minimum pavement sections:

Standard Duty Pavements: For parking areas subjected to low volumes of automobile traffic, a full-depth ACC section having a total thickness of at least 6 inches, or a PCC pavement section having a thickness of at least 5 inches, is recommended.

Heavy-Duty Pavements: Entry drives and driveways carrying weekly garbage truck traffic require increased pavement thicknesses. A minimum 7-inch thick ACC section, or a minimum 6-inch thick PCC section, is recommended in these areas.

Truck Pads: A minimum 7-inch thick PCC section is recommended as aprons for delivery truck parking or refuse pick-up areas.

Terracon has observed dishing in some parking lots surfaced with ACC. Dishing is usually observed in frequently-used parking stalls (such as near the front of the building), and occurs under the wheel footprint in these stalls. The use of higher grade asphaltic cement such as PG70-28, or surfacing these areas with PCC, is recommended. The dishing is exacerbated by factors such as irrigated islands or planter areas, sheet surface drainage to the front of the building, and placing the ACC directly on a compacted clay subgrade. The use of lower grade asphalt cement, such as PG64-22 is relatively common in this area and may be considered, but would provide lower reliability against rutting and creeping during warm weather.

Minimum surface course thicknesses of 2 inches in automobile areas and 3 inches in driveways are recommended for asphaltic cement concrete pavement sections. An ACC base course thickness of 4 inches is recommended.

We recommend that ACC pavement specifications reference Chapters 5 and 12 of the 2006 City of Lincoln Standard Specification. For ACC mix design, we recommend that type of SP4 Special be used for the surface and base mix; however, since the parking lot areas are subjected to slow-moving and static load conditions, PG70-28 asphalt cement is recommended for the surface course.

A Portland cement concrete mix design with a minimum 28-day modulus of rupture of 550 psi should be used for concrete pavements (ASTM C 78-84, Third Point Loading Method). This is roughly equivalent to a 28-day compressive strength of 4,000 psi. In addition, Portland cement concrete paving should contain about 5 to 7 percent entrained air, and should have a maximum water-cement ratio of about 0.45.

A formal pavement design has not been completed for this project. The above recommended pavement sections are typical minimum values and thicker pavement sections could be used to reduce maintenance and extend the expected service life of the pavements.

4.5.2 Construction Considerations

Construction traffic on the pavements was not considered in developing the recommended minimum pavement thicknesses. Construction traffic can cause significant damage to pavements, especially to partially-completed pavement sections (e.g., base course lifts). If the pavements will be subject to traffic by construction equipment/vehicles, the pavement thicknesses should be revised to consider the effects of the additional loading.

Construction scheduling often involves grading and paving by separate contractors and can involve a time lapse between the end of grading operations and the commencement of paving.

Disturbance, desiccation or wetting of the subgrade soils between grading and paving can result in deterioration of the previously completed subgrade. Immediately prior to paving, we recommend the subgrade below exterior pavements be rough-graded as needed, and then proofrolled.

4.5.3 Drainage and Maintenance Considerations

Reducing subgrade saturation is an important factor in maintaining the subgrade strength. Water allowed to pond on or next to pavements could saturate the subgrade and cause premature pavement deterioration. Positive surface drainage should be provided away from the edges of paved areas, and all pavements should be sloped to provide rapid surface drainage. Additional measures which would reduce the risk of subgrade saturation would include crowning of pavement subgrades to drain toward the edges rather than the center, and installing perimeter subsurface drains next to irrigated planters or other areas where surface water could pond.

Periodic maintenance will also extend the service life of the pavements and should include patching and repair of deteriorated areas, crack sealing, and surface sealing.

4.6 Exterior Slabs

The clay soils encountered in the borings are susceptible to frost heave. Our borings did not indicate a groundwater source for water close to the ground surface. Rather, it is our experience that surface water infiltration and utility leaks present the greatest risk of abnormal frost heave conditions. Therefore, with proper design, drainage and maintenance, we would expect typical performance for the Lincoln area. The risk of frost heave may be reduced by providing surface drainage away from the building and slabs.

If frost action needs to be eliminated in critical areas, then we recommend the use of structural slabs (e.g., as structural stoops in front of building doors). This is a common practice in Lincoln.

Placing non-frost-susceptible (granular) material in large areas under sidewalks and pavements, and installing a drain tile to collect any water in the granular fill and direct it to the storm drain system, would further control frost heave. However, it is our opinion that placing non-frost susceptible material in large areas under exterior pavements and sidewalks would be exceedingly expensive, and would also be an unusual design and construction procedure for Lincoln. We should be contacted to provide additional recommendations should consideration be given to placing non-frost-susceptible (granular) material in large areas.

5.0 GENERAL COMMENTS

Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project.

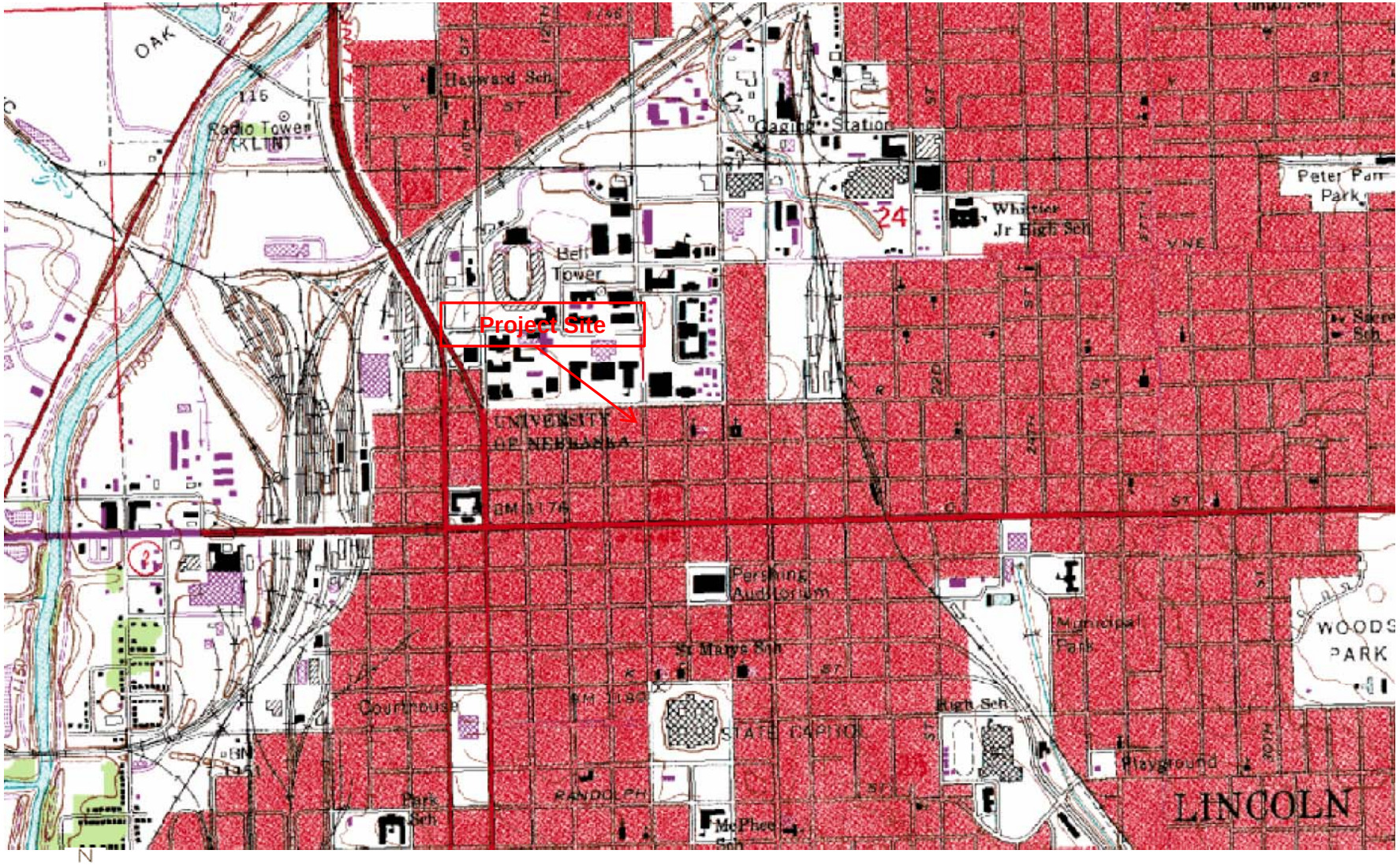
The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the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

Support of pavements above existing fill soils is discussed in this report. However, even with the recommended construction testing services, there is an inherent risk for the owner that compressible fill or unsuitable material within or buried by the fill will not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill, but can be reduced by performing additional testing and evaluation.

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

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

APPENDIX A
FIELD EXPLORATION



N

THIS DIAGRAM IS FOR GENERAL LOCATION PURPOSES ONLY

Source: United States Geological Survey, 7.5-minute series map "Lincoln, Nebraska", 1980.

Project Manager: BAL	Project No. A3115050
Drawn by: GKA	Scale: N.T.S.
Checked by: BAL	File Name: A3115050VMAP
Approved by: BAL	Date: 1/13/2012

Terracon
Consulting Engineers & Scientists
3220 N. 20th Street, Suite 3 Lincoln, Nebraska 68521
PH. (402) 466-3911 FAX. (402) 466-0811

SITE LOCATION PLAN

PROPOSED NEW PARKING LOT
14TH AND R STREET
LINCOLN, NEBRASKA

Ex. No.

A-1

- Boring location (approx.)

Source: Lancaster county GIS website

THIS DIAGRAM IS FOR GENERAL LOCATION PURPOSES ONLY

Project Manager: BAL	Project No. A3115050
Drawn by: GKA	Scale: N.T.S.
Checked by: BAL	File Name: A3115050PLAN
Approved by: BAL	Date: 1/13/2012

Terracon
Consulting Engineers & Scientists
3220 N. 20th Street, Suite 3 Lincoln, Nebraska 68521
PH. (402) 466-3911 FAX. (402) 466-0811

BORING LOCATION PLAN

PROPOSED NEW PARKING LOT
14TH AND R STREET
LINCOLN, NEBRASKA

Ex. No. A-2

LOG OF BORING NO. B-1

CLIENT **WLA Consulting Inc.**

SITE **14th and R Street, Lincoln, NE**

PROJECT **Proposed Parking Lot**

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	Approx. Surface Elev.: 102.5 ft									
	4 inches of asphaltic cement concrete over 5 inches of limestone base				PA					
	(FILL) LEAN CLAY, trace sand, trace rubble			1	ST	7		23	99	6500*
	3	99.5								
	Yellowish brown									
	Driller's Note: auger refusal at about 3 feet									
	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
**CME Automatic Hammer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ N/E	WD	▼
WL	▼		▼
WL			

Terracon

BORING STARTED			12-21-11
BORING COMPLETED			12-21-11
RIG	96	FOREMAN	JM
APPROVED	GKA	JOB #	A3115050

BOREHOLE A3115050 LOGS.GPJ TERRACON.GDT 1/6/12

LOG OF BORING NO. B-1A

CLIENT **WLA Consulting Inc.**

SITE **14th and R Street, Lincoln, NE**

PROJECT **Proposed Parking Lot**

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	Approx. Surface Elev.: 102.5 ft									
	3 inches of asphaltic cement concrete over 6 inches of limestone base				PA					
	(FILL) LEAN CLAY, trace sand, trace brick fragments, trace gravel, Dark grayish brown			1	ST	4		24	94	7500*
				2	ST	3		21	94	9000+*
	5 97.5	5								
	(FILL) LEAN TO FAT CLAY, trace sand, Dark grayish brown			3	ST	4		24	97	9000+*
	8 94.5				PA					
	LEAN CLAY, trace sand, Yellowish brown, very stiff		CL	4	ST	5		17	96	6500*
	10 92.5	10								
	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
**CME Automatic Hammer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ N/E	WD	▼
WL	▼		▼
WL			

Terracon

BORING STARTED			12-21-11
BORING COMPLETED			12-21-11
RIG	96	FOREMAN	JM
APPROVED	GKA	JOB #	A3115050

BOREHOLE A3115050 LOGS.GPJ TERRACON.GDT 1/6/12

LOG OF BORING NO. B-2

CLIENT **WLA Consulting Inc.**

SITE **14th and R Street, Lincoln, NE**

PROJECT **Proposed Parking Lot**

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf	ATTERBERG LIMITS TEST RESULTS, %
	Approx. Surface Elev.: 101 ft										
	Grass, shallow root zone at surface				PA						
	(FILL) FAT CLAY, trace sand, trace gravel, trace roots			1	ST	6		19	104	9000+*	LL=50 PI=32
	3 Dark grayish brown 98										
	LEAN CLAY, trace sand, trace roots Yellowish brown, very stiff		CL	2	ST	17		17	81	5500*	
		5	CL	3	ST	10		16	87	6000*	
					PA						
			CL	4	ST	10		16	93	7500*	
	10 91	10									
	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
**CME Automatic Hammer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ N/E	WD	▼
WL	▼		▼
WL			

Terracon

BORING STARTED			12-21-11
BORING COMPLETED			12-21-11
RIG	96	FOREMAN	JM
APPROVED	GKA	JOB #	A3115050

BOREHOLE A3115050 LOGS.GPJ TERRACON.GDT 1/6/12

LOG OF BORING NO. B-3

CLIENT **WLA Consulting Inc.**

SITE **14th and R Street, Lincoln, NE**

PROJECT **Proposed Parking Lot**

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf	TESTS ATTERBERG LIMITS TEST RESULTS, %
	Approx. Surface Elev.: 103.5 ft										
	3 inches of asphaltic cement concrete over 6 inches of limestone base				PA						
	(FILL) LEAN CLAY, trace sand Mottled grayish brown			1	ST	8		25	92	6000*	LL=42 PI=21
	Grayish brown at about 3 feet			2	ST	12		26	94	5500*	
	5 / 98.5	5									
	(FILL) LEAN TO FAT CLAY, trace sand Mottled grayish brown			3	ST	4		22	100	6500*	
	8 / 95.5				PA						
	LEAN CLAY, trace sand Yellowish brown, very stiff		CL	4	ST	15		25	88	4500*	
		10			PA						
	13 / 90.5										
	SANDY LEAN CLAY Olive brown, stiff		CL	5	ST	16		20	105	3000*	
	15 / 88.5	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
**CME Automatic Hammer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ N/E	WD	▼
WL	▼		▼
WL			

Terracon

BORING STARTED			12-21-11
BORING COMPLETED			12-21-11
RIG	96	FOREMAN	JM
APPROVED	GKA	JOB #	A3115050

BOREHOLE A3115050 LOGS.GPJ TERRACON.GDT 1/6/12

Field Exploration Description

The drill crew staked the boring locations relative to existing physical features at the site. Distances were measured with a mechanical wheel or nylon tape and right angles for these measurements were estimated. The approximate boring locations are shown on the Boring Location Plan. The locations of the soil borings should be considered accurate only to the degree implied by the means and methods used to define them.

Ground surface elevations indicated on the boring logs are approximate and have been rounded to the nearest ½-foot. Boring elevations were measured relative to the north rim elevation of the manhole located approximately 65 feet southwest of Boring B-3. An arbitrary elevation of 100 feet was used for the elevation at the benchmark. The elevations of the soil borings should be considered accurate only to the degree implied by the means and methods used to define them.

The borings were advanced with a truck-mounted drilling rig utilizing continuous flight solid-stemmed augers to advance the boreholes. Representative samples were obtained using thin-walled tube sampling procedure. In the thin-walled tube sampling procedure, a thin-walled, 3-inch OD, 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. The samples were sealed and transported to the laboratory for testing and classification.

The drill crew prepared a field log for each boring. Each log included visual classifications of the materials encountered during drilling as well as the driller's interpretation of the subsurface conditions between samples. The 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.

APPENDIX B
LABORATORY TESTING

Laboratory Testing

Moisture content tests were performed on the samples. Density determinations were performed on most of the thin-walled tube samples, and unconfined compression tests were performed on some of the samples. The unconfined compressive strength of most of the samples was estimated with a hand penetrometer test. In addition, two Atterberg limits tests were performed on selected samples. The results of these laboratory tests are provided on the boring logs.

The samples were classified in the laboratory based on visual observation, texture and plasticity. Additional laboratory testing could be performed to more accurately classify the samples. The soil descriptions presented on the boring logs for native soils are in accordance with our enclosed General Notes and Unified Soil Classification System (USCS). The estimated group symbol for the USCS is also shown on the boring logs for native soils, and a brief description of the Unified System is included in this report.

APPENDIX C
SUPPORTING DOCUMENTS

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon - 1 3/8" I.D., 2" O.D., unless otherwise noted	HS:	Hollow Stem Auger
ST:	Thin-Walled Tube - 3" O.D., unless otherwise noted	PA:	Power Auger
RS:	Ring Sampler - 2.42" I.D., 3" O.D., unless otherwise noted	HA:	Hand Auger
DB:	Diamond Bit Coring – 1 7/8" I.D., NQ-2, unless otherwise noted	RB:	Rock Bit
BS:	Bulk Sample or Auger Sample	WB:	Wash Boring or Mud Rotary

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

WATER LEVEL MEASUREMENT SYMBOLS:

WL:	Water Level	WS:	While Sampling	N/E:	Not Encountered
WCI:	Wet Cave in	WD:	While Drilling	BCR:	Before Casing Removal
DCI:	Dry Cave in	AB:	After Boring	ACR:	After Casing Removal

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

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

CONSISTENCY OF FINE-GRAINED SOILS

Unconfined Compressive Strength, Qu, psf	Standard Penetration or N-value (SS) Blows/Ft.	Consistency
< 500	0 – 1	Very Soft
500 – 1,000	2 – 4	Soft
1,001 – 2,000	4 – 8	Medium Stiff
2,001 – 4,000	8 – 15	Stiff
4,001 – 8,000	15 – 30	Very Stiff
8,000+	> 30	Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS

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

RELATIVE PROPORTIONS OF SAND AND GRAVEL

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

GRAIN SIZE TERMINOLOGY

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

RELATIVE PROPORTIONS OF FINES

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

PLASTICITY DESCRIPTION

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

UNIFIED SOIL CLASSIFICATION SYSTEM

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

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

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

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

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

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

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

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

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

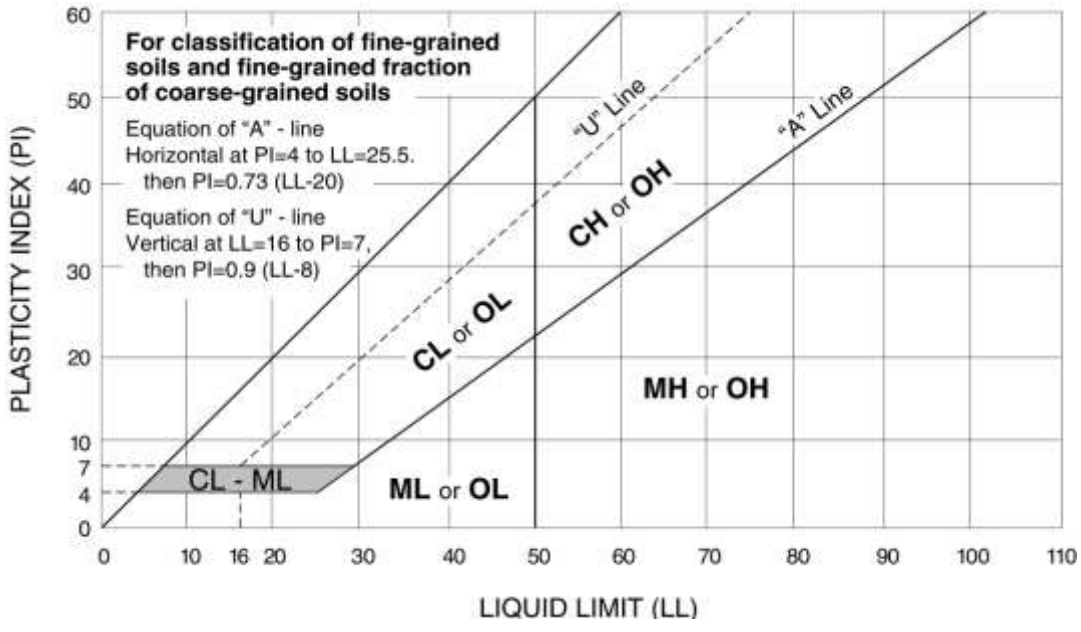
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

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

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

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

[Q] PI plots below "A" line.



References

Soil Survey of Lancaster County,, Nebraska; United States Department of Agriculture;
URL: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

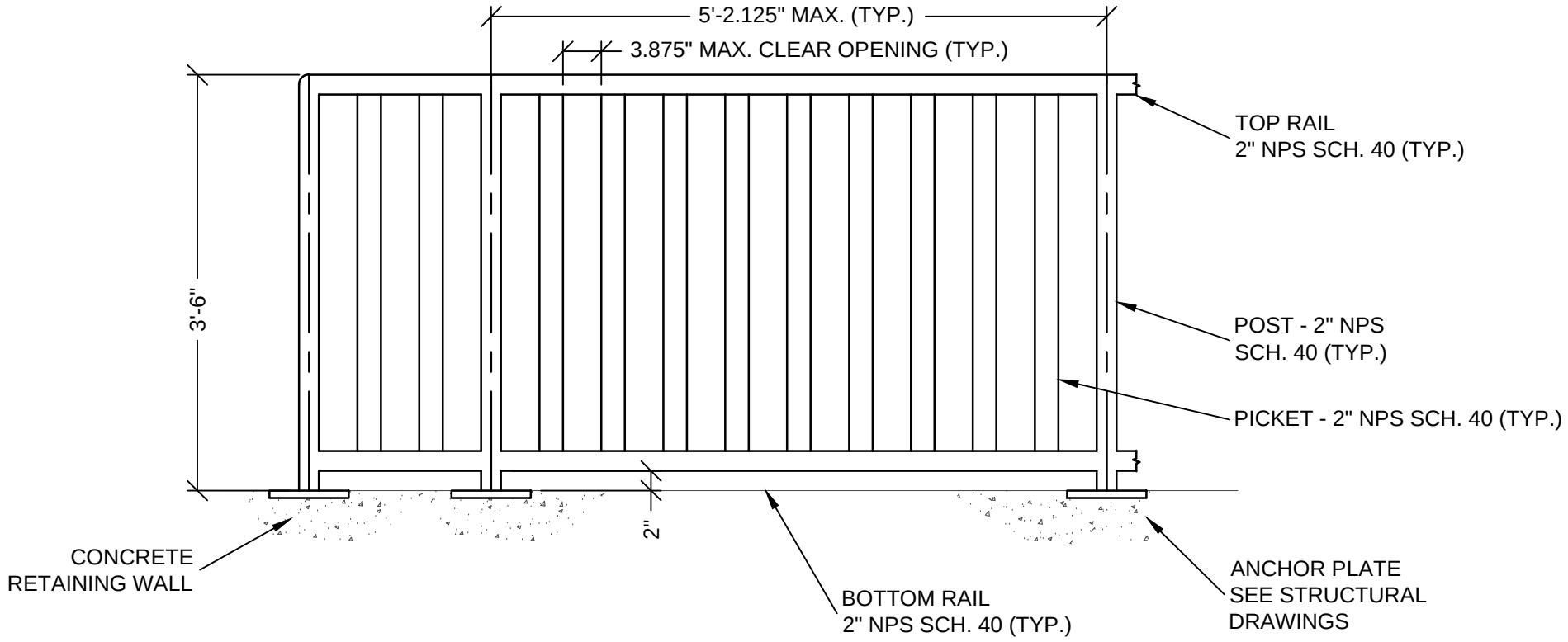
Soil Survey of Lancaster County, Nebraska; United States Department of Agriculture, Soils Conservation Service, 1980.

United States Geological Survey, 7.5-minute series quadrangle map "Lincoln, Nebraska," 1980.

Lancaster County GIS website, URL: http://ags.lincoln.ne.gov/gisviewer/

FENCE DETAILS:

1. MINIMUM FENCE HEIGHT IS 42-INCHES.
2. NO OPENING WITHIN GUARDRAIL THAT WILL ALLOW PASSAGE OF A 4-INCH SPHERE.
3. GALVANIZED STEEL MATERIALS.
4. CONTRACTOR SHALL SUBMIT MANUFACTURER SHOP DRAWINGS FOR APPROVAL.
5. CONTRACTOR MAY SUBMIT ALTERNATIVE GUARDRAIL FOR ENGINEER APPROVED EQUAL.



WLA Consulting, Inc.

FILE: AD1-FENCE

DATE: 04/16/2012
SCALE: 3/4" = 1'
PROJ. NO.: 117-007
DRAWN: DAJ
CHECKED: AJM
FIGURE 1

RETAINING WALL GUARDRAIL DETAIL
UNIVERSITY OF NEBRASKA - LINCOLN
14TH & R STREET PARKING LOT & AREA IMPROVEMENTS
LINCOLN, NEBRASKA