



MEMO

- Overnight
- Regular Mail
- Hand Delivery
- Other: E-mail

TO:	Cottonwood Creek HOA Attn: Mr. John Grose, Mr. Neal Ferry
FROM:	Tim Jensen, P.E. Edward Schnackenberg, P.E.
RE:	Cottonwood Creek Pavement Evaluation
DATE:	May 31, 2019
OLSSON PROJECT #:	019-0664

INTRODUCTION

This memorandum presents the results of the subsurface exploration and pavement evaluation of the private roads within The Estates of Cottonwood Creek development near Blair, Nebraska. The intent of this geotechnical exploration is to evaluate existing pavement and subsurface conditions and provide pavement and subgrade rehabilitation recommendations as necessary. This geotechnical exploration included the following:

- Site visits by a geotechnical engineer to review the existing pavement performance and site conditions.
- A review of existing geologic subsurface conditions.
- Completion of twenty-two (22) pavement cores and soil test soil borings to depths of about 2.5 feet below existing pavement surfaces.
- Laboratory testing of soil samples obtained during the field exploration.
- Completion of a geotechnical engineering evaluation using information obtained from our field observations, soil borings, laboratory test results, and available project information.
- Preparation of this memorandum presenting the results of our subsurface exploration, laboratory test results, engineering evaluations, and geotechnical design and construction recommendations.

This memorandum was prepared under the supervision of a Professional Engineer registered in the State of Nebraska with the firm of Olsson. The conclusions and recommendations contained herein are based on generally accepted, professional geotechnical engineering practices at the time of this report, within this geographic area.

SITE LOCATION AND PROJECT DESCRIPTION

The locations of specific soil/pavement borings and the approximate limits of the pavement sections evaluated during this exploration are identified on the Boring Location Map included as Appendix A of this report. To see how the subsurface conditions varied with actual pavement performance, soil borings were positioned in roadway areas visually considered to have minor, moderate, and heavy pavement deterioration or damage.

TEST BORINGS AND LABORATORY SUMMARY

A total of 22 pavement cores were completed at the locations identified on the Boring Location Map. At each location, a 4-inch OD, diamond tipped, hollow core barrel was advanced through the pavement which produced a pavement core sample which could be extracted for evaluation. A 3" OD undisturbed soil sample was collected through the core hole from directly below the pavement. Pavement cores and recovered soil samples were sealed and transported to our laboratory for visual observation and testing. At the conclusion of drilling operations, the borings were backfilled with auger cuttings, imported soil, or crushed aggregates and the pavement was patched and compacted with asphalt cold patch mix.

Olsson visually classified the soil samples in accordance with Unified Soils Classification System (USCS). The pavement cores were measured and photographed in our laboratory. Moisture content, density, and unconfined compressive strength tests were completed on select samples across the development.

Table 1 below outlines the pavement thickness and existing subgrade conditions at each core location. Olsson rated the quality of the pavement cores on a scale of 1 thru 4, with "1" considered to be "good quality", competent asphalt pavement (Figure 1) and "4" being considered to be "heavily deteriorated" asphalt pavement (Figure 2).

Figure 1



Example: Core score of 1

**Example: Core score of 4
(C-12)**

Figure 2



(C-19)

The subgrade soils consisted primarily of wind deposited lean clays (loess) which are common formations in this area of Nebraska. When paved roads are constructed, the subgrade soils are typically scarified to a specified depth, moisture conditioned, and compacted to a minimum design or construction requirement. When properly prepared and compacted, the in-situ subgrade density increases. Typical dry densities of native (undisturbed) loessal soils in this area range from lows of 80 to 85 pcf (pounds per cubic foot) to highs of 90 to 95 pcf. After proper moisture condition, preparation and compaction to 95% to 98% of the loessal soils maximum Standard proctor dry density, in situ dry densities will typically increase to between 100 and 106 pcf. Refer to the boring logs included with this memo for specific in situ soil descriptions and properties at each boring location. Groundwater was not observed in any of the shallow borings completed during this investigation.

Table 1: Pavement Core Summary and Subgrade Description

Boring	Core Thickness (in)	Core Rating	Subgrade Dry Unit Weight (pcf)	Unconfined Compressive Strength (tsf)	Subgrade Description
C1	6.5	1	106.5	NP	Lean clay (CL), stiff, moist, medium brown
C2	6.5	1	107.7	NP	Lean clay (CL), stiff, moist, yellowish brown
C3	6.0	2	108.5	1.9	Lean clay (CL), stiff, moist, grayish brown, trace iron staining
C4	6.0	3	110.9	NP	Lean clay (CL), stiff, moist, dark brown, trace iron staining
C5	6.0	2	109.4	1.2	Lean clay (CL), stiff, moist, grayish brown, trace carbon staining
C6	6.0	2	104.3	1.0	Lean clay (CL), stiff, moist, grayish brown
C7	6.0	2	107.7	1.9	Lean clay (CL), stiff, moist, grayish brown, trace iron staining
C8	6.0	1	108.2	NP	Lean clay (CL), stiff, moist, yellowish brown, trace iron staining
C9	6.0	2	98.8	NP	*Lean clay (CL), firm, very moist**, light brown, trace iron staining
C10	5.75	1	96.0	0.6	*Lean clay (CL), firm, very moist**, grayish brown, few iron staining
C11	5.0	1	103.6	NP	Lean clay (CL), stiff, moist, dark grayish brown, trace iron staining
C12	5.0	1	98.4	0.8	*Lean clay with gravel (CL), very stiff, moist, brown
C13	5.0	4	106.5	1.7	Lean clay (CL), stiff, moist, yellowish brown, trace iron staining
C14	6.0	1	105.7	NP	Lean clay (CL), stiff, moist, dark grayish brown, trace iron staining
C15	6.5	2	105.6	0.5	Lean clay (CL), firm, moist, grayish brown, trace iron staining
C16	6.5	1	107.7	1.4	Lean clay (CL), stiff, moist, yellowish brown, trace iron staining
C17	6.0	2	105.7	0.5	Lean clay (CL), firm, moist, grayish brown, trace sand
C18	6.5	1	105.4	0.8	Lean clay (CL), firm, moist, medium brown
C19	6.0	4	98.2	1.1	*Lean clay (CL), stiff, very moist**, yellowish brown
C20	5.0	2	108.6	NP	Lean clay (CL), stiff, moist, light grayish brown
C21	5.0	3	106.3	1.3	Lean clay (CL), stiff, moist, dark grayish brown, trace iron staining
C22	6.5	1	105.1	NP	Lean clay (CL), firm, moist, brown

*Subgrade appears to be mostly undisturbed native loess soils.

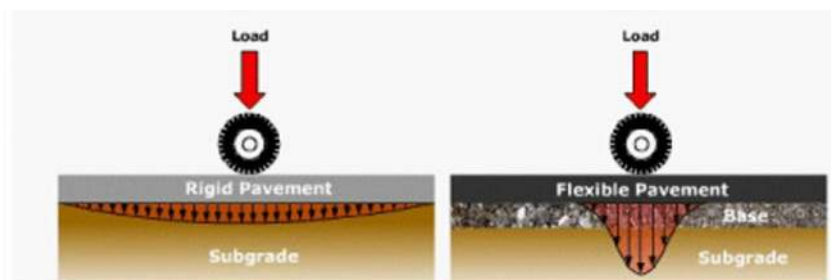
**Subgrade was documented to have moisture contents in excess of 25%

GEOTECHNICAL CONSIDERATIONS

During our initial April 18 site visit, Olsson engineers drove the entire neighborhood with Mr. Neil Ferry to discuss the existing road and pavement conditions and what may be contributing to areas of concern. Olsson's review of historical aerial photos indicate the roads within the development were constructed between 2005 and 2006 which indicates a current service life of 14 to 15 years. We understand home construction within the development started between 2006 and 2008. We understand the developer or the HOA has not had a regularly scheduled crack sealing or pavement maintenance program in effect over the years, but it appears some isolated pavement patching was completed near the entrance drives within the past 5 years (+/-).

The road pavements within this development were constructed on grade and are considered "full depth" pavements. Full depth pavements are common in this area of Nebraska. Although a free draining granular subbase layer below asphalt or concrete pavements can help better distribute the vehicle wheel load over the underlying subgrade and improve subgrade drainage when designed and constructed properly, it does add costs. When improperly designed or constructed, a granular subbase layer below pavements can actually reduce pavement life.

Asphalt is considered a flexible pavement while Portland cement concrete is considered a rigid pavement. Rigid pavements do a better job of distributing the wheel loads over larger areas due to the structural properties of the concrete pavement. Similar thicknesses of asphalt pavement will not provide the same level of load distribution and more load is applied to the underlying subgrade. Preparing and maintaining a competent subgrade is critical to long life and pavement performance. The figure below indicates how the vehicle load transfer varies between asphalt (flexible) and concrete (rigid) pavements.



A review of the laboratory test results indicated that only three of the 22 tested locations had in situ dry unit weights that could indicate inadequate subgrade preparation or possible subgrade disturbance over time. The lower in situ densities were identified in borings B-9, B-10, B-12, and B-19. Our opinion regarding the potential reasons or causes for the isolated areas of low subgrade unit weight is provided below.

Borings B-9 and B-10 appear to have been positioned near an original natural terrain ridgeline. Visually, the pavements in these areas appear to be performing quite well under existing site conditions. Even with the slightly lower subgrade unit weights, the drainage improvements in these areas are still producing an adequate pavement section.

2003 aerial

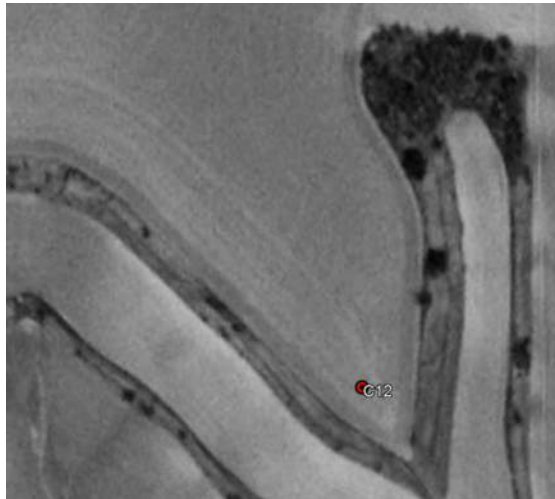


2018 aerial



Boring B-12 appears to have been located in an area behind a previous agricultural terrace. Areas behind terraces are known for collecting surface runoff, sediment, and overtime the soils can become softer and experience increases in moisture contents.

2003 aerial



2018 aerial



Boring B-19 was positioned in an area where the existing pavements were considered heavily deteriorated.



The existing asphalt pavements were documented to be between 5.0 and 6.5 inches thick. These thicknesses would be considered typical for standard duty pavements primarily exposed to lightweight vehicle traffic, few smaller delivery type trucks and occasional heavy trucks. These asphalt pavement thicknesses with no granular subbase would be considered unsuitable for supporting heavy truck traffic for any reasonable design life. We understand home construction within the development is nearing completion and the volume of heavy-duty truck traffic such as concrete trucks, dump trucks, tractor-trailers, delivery trucks, utility trucks, garbage trucks will continue to decline with time. This reduction in heavy duty traffic and loading will also extend the design life of future pavements.

The worst pavement deterioration, such as alligator cracking, within this development appears to be located near individual driveways where traffic concentrations are highest. The turning traffic also increases the lateral forces applied to the asphalt pavements which creates additional deterioration. For example, the cul-du-sacs are all generally showing signs of pavement showing especially in the outside tire paths.

Most of the pavement cracks observed were transverse, or perpendicular to the road surface. These cracks are typically associated with shrinkage of the asphalt surface due to low temperatures and the asphalt binder hardening over time. These cracks can be large and allow significant moisture infiltration to the underlying subgrade soils creating differential movement and a rough driving surface that continues to deteriorate as the pavement damage increases over time. In the photo below, the surface moisture that collects in the transverse cracks is flowing toward the edges of the roadway where the water flow is restricted by the clay subgrade contributing to the increased pavement deterioration with time. If not repaired, the damaged pavement and softened subgrade area will continue to grow.



PAVEMENT REHABILITATION CONSIDERATIONS:

Regardless of the extent of the roadway repairs considered by the HOA and what the annual budget will allow, it is recommended that a regularly scheduled asphalt maintenance program be considered that includes selective removal and replacement of damaged pavement sections, sealing and filling cracks as they occur, and applying surface seal coats as necessary to reduce future moisture infiltration. Seal coating will also improve the visual appearance of the road surface by providing a nice dark black finish to blend the original asphalt surfaces and pavement patches together. Applying a seal coat every year or every other year is common for regularly maintained asphalt pavements.

North Portion

The recovered pavement cores from Woodcrest Circle (C-3 through C-7) indicated excessive asphalt deterioration/delamination between the surface course and base course layers. Moisture is being trapped within the asphalt layers and the repetitive freeze/thaw action and traffic loading has accelerated the pavement deterioration. It should be noted that these cores were located in areas that did not yet have significant visible surface damage. Although these core locations were less disturbed at the surface, the asphalt quality below the surface has been compromised.

Since the existing roadway divides the natural side slope there is an increased potential for moisture from upgradient areas (east portions) to flow toward the west and southwest. Woodcrest Circle road may be restricting the westward movement of this moisture toward the creek. We recommend the roadside ditches be maintained at a minimum 5-foot width and kept free of sediment, silt, and debris to maintain adequate flow away from the road. After the drainage is improved, the HOA should consider completing isolated full depth pavement replacement where visible distress and pavement damage are most prevalent. Refer to the example photo below.



In general, Olsson observed about 15 (+/-) areas where isolated full depth pavement replacement or repairs should be considered. These pavement areas, near the south entrance, are primarily located around or near the existing transverse pavement cracks. We estimate about 250 linear feet of roadway would be applicable for this full depth pavement replacement. More information regarding full depth removal and replacement is provided later in this memo. Considering the fatigue that has been occurring below the pavement surface, between the south entrance and the intersection of Woodcrest Dr., an asphalt mill and overlay should be considered. We recommend a minimum milling and replacement depth of 2.5 inches be considered to remove the surface course, the disturbed asphalt layers, and to properly prepare the underlying surface for the new overlay. To provide a smooth uniform surface after the initial overlay is completed, a reduced mill and overlay thickness of 2.0 inches could be considered for the remaining roads within this development. After the initial milling operations are complete, the exposed asphalt surface should be inspected and reevaluated to determine if additional areas of deterioration or damage are observed and if additional removal and replacement may be necessary.

If a full mill and overlay of all roads within the development are not within the budget at this time, a surface seal coat should be applied at your earliest convenience to reduce future moisture infiltration and protect your current investment.

South Portion

Pavement cores C15, C17 and C19 indicated asphalt deterioration between the surface course and base courses. Core C16 was completed in a former patched area that appeared competent,

however it could be assumed that the area around C16 is exhibiting similar pavement conditions as the areas around cores C15 and C17. The recovered cores indicate moisture is becoming trapped within the asphalt pavement layers and the repetitive freeze/thaw action and traffic has increased the rate of pavement deterioration in these areas. It should be noted that these core locations were not all situated in areas of extensive pavement deterioration. Some cores were obtained from areas that appeared to be less disturbed at the surface, but the underlying asphalt quality had been compromised.

Considering the roadway at the base of natural side slope currently has a sag in it, there is an increased potential for moisture from upgradient areas to flow toward Cottonwood Creek Drive and Switchgrass Road near the entrance. In this area we also recommend the roadside ditches be graded and maintained at a minimum 5-foot depth and kept free of sediment, silt, and debris to provide suitable surface moisture flow away from the road. After the drainage is improved, the HOA should consider completing isolated full depth pavement replacement where visible distress and pavement damage are most prevalent.



In general, Olsson observed about 30 (+/-) areas where isolated full depth pavement replacement or repairs should be considered. These pavement areas are primarily located around or near the existing transverse pavement cracks. The pavements from the intersection of Cottonwood Creek Drive and Switchgrass Road extending north about 500 feet should be considered for an asphalt mill and overlay. We recommend a minimum milling and replacement depth of 2.5 inches be considered to remove the surface course, the disturbed asphalt layers, and to properly prepare the underlying surface for the new overlay. To provide a smooth uniform surface after the initial overlay is completed, a reduced mill and overlay thickness of 2.0 inches could be considered for the remaining roads within this development. After the initial milling operations are complete, the exposed asphalt surface should be inspected and reevaluated to determine if additional areas of deterioration or damage are observed and if additional removal and replacement may be necessary.

If a full mill and overlay of all roads within the development are not within the budget at this time, a surface seal coat should be applied at your earliest convenience to reduce future moisture infiltration and protect your current investment.

Typical Full Depth Removal and Replacement

Areas where the existing asphalt is experiencing excessive alligator cracking or significant distress, it is recommended the asphalt be completely removed exposing the underlying subgrade soils. The removal area should extend into areas of competent asphalt at least 3 feet beyond the limits of the damaged areas. The underlying soil subgrade should be scarified to a depth of 9 inches, moisture conditioned as necessary (dried or wetted), and recompact to a minimum 98% of the materials maximum dry density as determined by the Standard Proctor test (ASTM D698). The moisture content of the subgrade soils at the time of compaction should be maintained between -2 and +3 percent of the materials optimum.

Ditches and Drains

Improving drainage is the key to providing a quality roadway surface that will provide years of service. Wherever adjacent grades slope toward the road, the HOA should consider providing ditches or supplemental drains to intercept surface water flow and direct it away from the road. The need for drains is most critical where large slope areas drain toward the road, especially in

those areas with higher traffic concentrations or turns. Effectively intercepting and redirecting this surface moisture will also reduce future maintenance costs by maintaining stable subgrade conditions which will reduce future pavement failures or distress. In general, we recommend the base of ditches extend at least 2 feet below the edge of the roadway, be a minimum of 5 feet wide, and kept free of sediment, silt, and debris to maintain suitable flow. Considering the rolling hills within the development, maintaining positive drainage should not be difficult.

An alternative to an open ditch would be the use of a subsurface panel drain system such as the those from Multi-flow or ADS AdvanEdge. Website links for each are provided below. Although these panel drain systems have slightly higher product costs, they offer cost savings during installation, backfilling materials and labor, and schedule. We recommend having your contractors compare panel drain costs versus ditch grading and select the option which meets your schedule and budget requirements.

Multi-flow Drainage System

<http://www.multi-flow.com/Menu/products.html>

ADS AdvanEdge

<https://www.ads-pipe.com/products/pipes/advanedge-panel>

CONCLUSIONS

The conclusions and recommendations presented in this memo are based on the information available regarding the proposed pavement and grading improvements, the results obtained from our borings, laboratory testing program, and our experience with similar projects. The borings represent a very small statistical sampling of subsurface soils and it is possible that conditions may be encountered during construction that are substantially different from those indicated by the borings. In these instances, adjustments to design and construction may be necessary.

This geotechnical memo is based on the site plan and information provided to Olsson and our understanding of the project as noted in this report. Changes in the location or design of new pavements could significantly affect the conclusions and recommendations presented in this geotechnical memo. Olsson should be contacted in the event of such changes to determine if the recommendations of this report remain appropriate for the revised site design.

This report was prepared under the direction and supervision of a Professional Engineer registered in the State of Nebraska with the firm of Olsson. The conclusions and

recommendations contained herein are based on generally accepted, professional, geotechnical engineering practices at the time of this report, within this geographic area. No warranty, express or implied, is intended or made. This report has been prepared for the exclusive use of Cottonwood Creek HOA and their authorized representatives for specific application to the proposed project described herein.

Respectfully Submitted,
Olsson, Inc.




Patrick Deacon, E.I.
Assistant Engineer

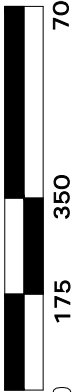



Tim Jensen, P.E.
Geotechnical Engineer

APPENDIX A
BORING LOCATION MAP



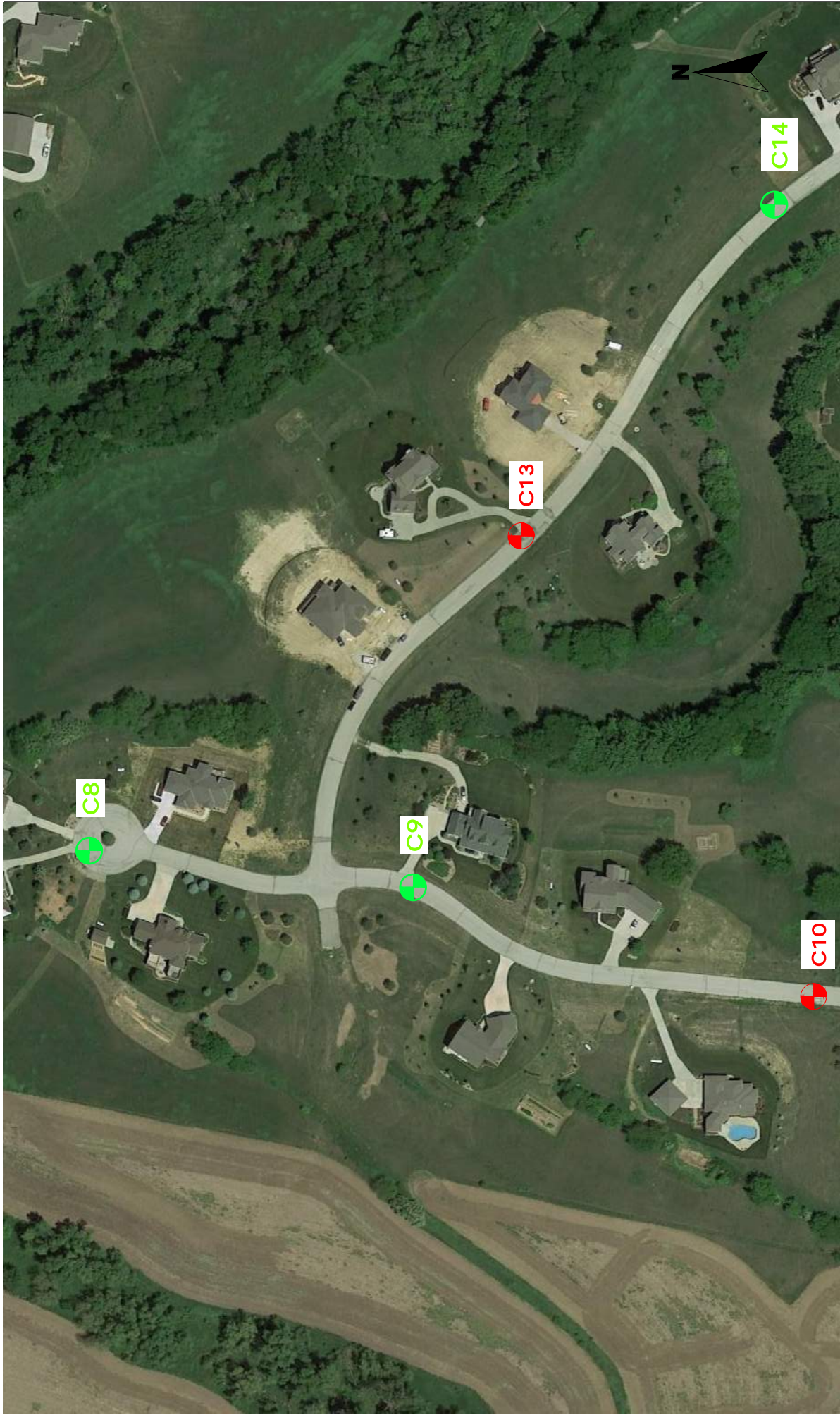
LEGEND  PRIMARY BORING LOCATION  SECONDARY BORING LOCATION	PROJECT:
	DRAWN BY: PCD DATE: 4/24/19

 <p>0 175 350 700 SCALE IN FEET</p>	BORING LOCATION MAP COTTONWOOD CREEK BLAIR, NEBRASKA
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11627 Virginia Plaza,
 Suite 103
 La Vista, NE 68128

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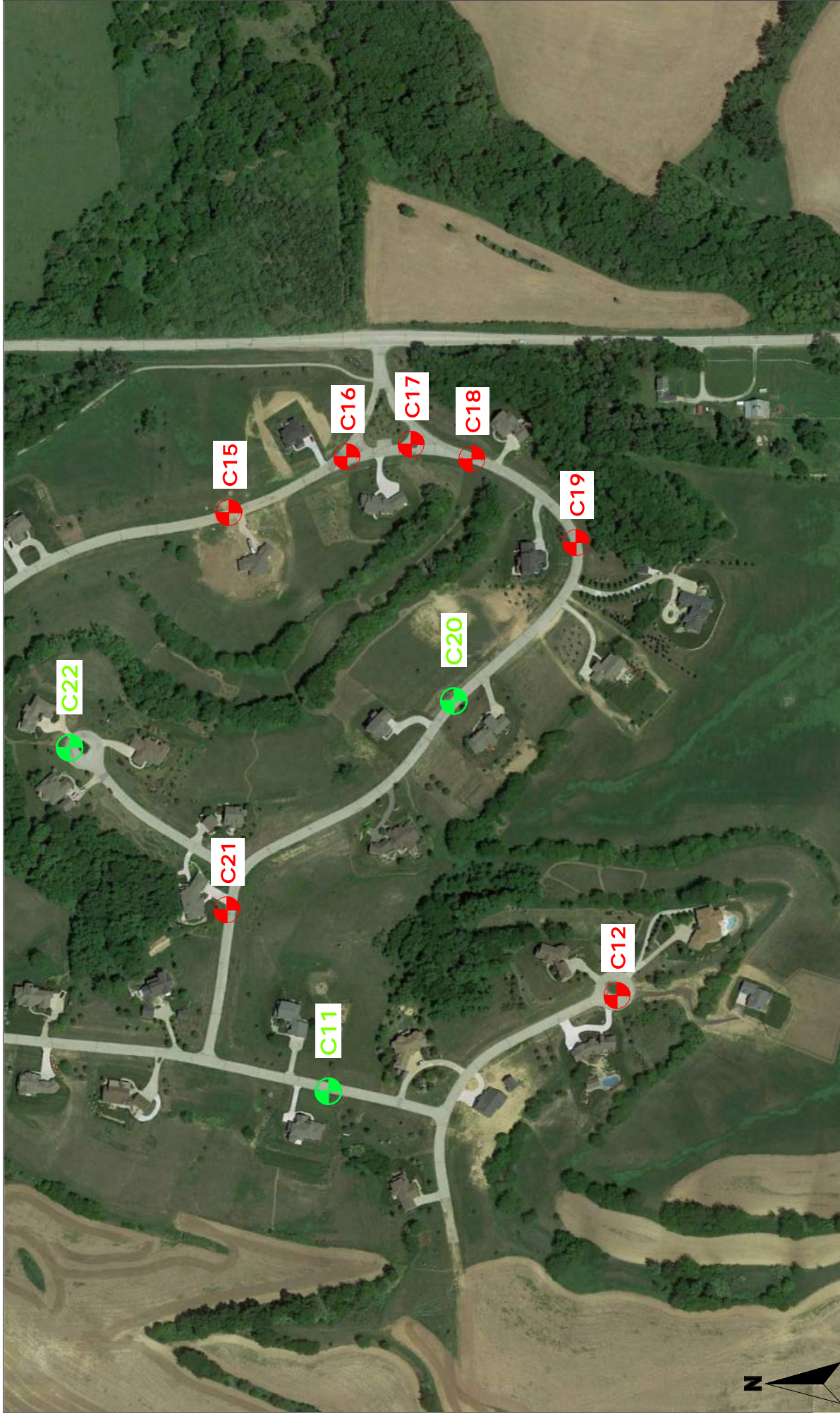


LEGEND	PRIMARY BORING LOCATION
	SECONDARY BORING LOCATION
PROJECT:	
DRAWN BY:	PCD
DATE:	4/24/19

<p>SCALE IN FEET</p>	<p>BORING LOCATION MAP COTTONWOOD CREEK BLAIR, NEBRASKA</p>
<p>11627 Virginia Plaza, Suite 103 La Vista, NE 68128</p>	

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LEGEND PRIMARY BORING LOCATION SECONDARY BORING LOCATION	PROJECT:
	DRAWN BY: PCD DATE: 4/24/19

 SCALE IN FEET	BORING LOCATION MAP COTTONWOOD CREEK BLAIR, NEBRASKA
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SYMBOLS AND NOMENCLATURE

DRILLING NOTES

DRILLING AND SAMPLING SYMBOLS

SS: Split-Spoon Sample (1.375" ID, 2.0" OD)	HSA: Hollow Stem Auger	NE: Not Encountered
U: Thin-Walled Tube Sample (3.0" OD)	CFA: Continuous Flight Auger	NP: Not Performed
CS: Continuous Sample	HA: Hand Auger	NA: Not Applicable
BS: Bulk Sample	CPT: Cone Penetration Test	% Rec: Percent of Recovery
MC: Modified California Sampler	WB: Wash Bore	WD: While Drilling
GB: Grab Sample	FT: Fish Tail Bit	IAD: Immediately After Drilling
SPT: Standard Penetration Test Blows per 6.0'	RB: Rock Bit	AD: After Drilling
		CI: Cave-In

DRILLING PROCEDURES

Soil samples designated as "U" samples on the boring logs were obtained in using Thin-Walled Tube Sampling techniques. Soil samples designated as "SS" samples were obtained during Penetration Test using a Split-Spoon Barrel sampler. The standard penetration resistance 'N' value is the number of blows of a 140 pound hammer falling 30 inches to drive the Split-Spoon sampler one foot. Soil samples designated as "MC" were obtained in using Thick-Walled, Ring-Lined, Split-Barrel Drive sampling techniques. Recovered samples were sealed in containers, labeled, and protected for transportation to the laboratory for testing.

WATER LEVEL MEASUREMENTS

Water levels indicated on the boring logs are levels measured in the borings at the times indicated. In relatively high permeable materials, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels is not possible with only short-term observations.

SOIL PROPERTIES & DESCRIPTIONS

Descriptions of the soils encountered in the soil test borings were prepared using Visual-Manual Procedures for Descriptions and Identification of Soils.

PARTICLE SIZE

Boulders	12 in. +	Coarse Sand	4.75mm-2.0mm	Silt	0.075mm-0.005mm
Cobbles	12 in.-3 in.	Medium Sand	2.0mm-0.425mm	Clay	<0.005mm
Gravel	3 in.-4.75mm	Fine Sand	0.425mm-0.075mm		

COHESIVE SOILS

<u>Consistency</u>	<u>Unconfined Compressive Strength (Qu) (tsf)</u>	
	Very Soft	<0.25
Soft	0.25 - 0.5	
Firm	0.5 - 1.0	
Stiff	1.0 - 2.0	
Very Stiff	2.0 - 4.0	
Hard	> 4.0	

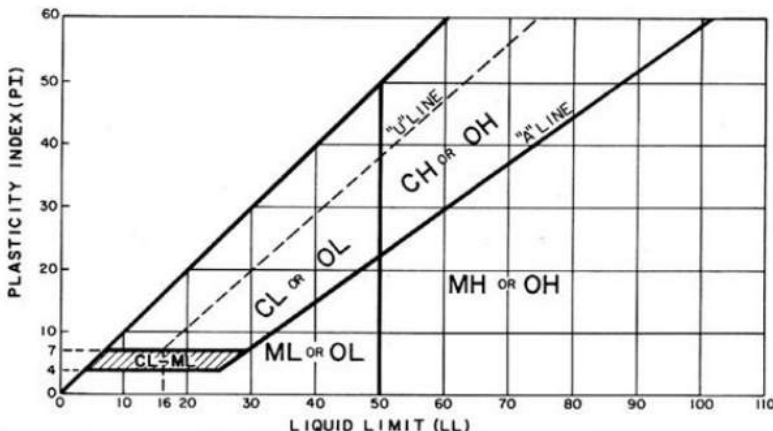
COHESIONLESS SOILS

<u>Relative Density</u>	<u>'N' Value</u>
Very Loose	0 - 3
Loose	4 - 9
Medium Dense	10 - 29
Dense	30 - 49
Very Dense	≥ 50

COMPONENT %

<u>Description</u>	<u>Percent (%)</u>
Trace	<5
Few	5 - 10
Little	15 - 25
Some	30 - 45
Mostly	50 - 100

PLASTICITY CHART



ROCK QUALITY DESIGNATION (RQD)

<u>Description</u>	<u>RQD (%)</u>
Very Poor	0 - 25
Poor	25 - 50
Fair	50 - 75
Good	75 - 90
Excellent	90 - 100



SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS		
			GRAPH	LETTER			
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES		
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES		
		GRAVELS WITH FINES		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES		
		(APPRECIABLE AMOUNT OF FINES)		GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES		
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES		
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES		
		SANDS WITH FINES		SM	SILTY SANDS, SAND - SILT MIXTURES		
		(APPRECIABLE AMOUNT OF FINES)		SC	CLAYEY SANDS, SAND - CLAY MIXTURES		
		FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50			ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
						CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY		
SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50				MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS		
				CH	INORGANIC CLAYS OF HIGH PLASTICITY		
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS			
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS		

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS



PROJECT NAME Cottonwood Creek Pavement Evaluation	CLIENT Cottonwood Creek HOA
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PROJECT NUMBER 019-0664	LOCATION Washington County, Nebraska
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ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/REMARKS
1230	APPROX. SURFACE ELEV. (ft):1230		0								
	ASPHALT		0.5'								
	FILL			1 C				20.0	106.5		
	Lean clay (CL), stiff, moist, medium brown		2.5'								

BASE OF BORING AT 2.5 FEET

WATER LEVEL OBSERVATIONS	OLSSON, INC. 11627 VIRGINIA PLAZA, STE 103 LA VISTA, NEBRASKA 68128	STARTED: 4/29/19	FINISHED: 4/29/19
WD Not Encountered		DRILL CO.: OLSSON	DRILL RIG: CME 45B
IAD Not Encountered		DRILLER: K. KEMPTON	LOGGED BY: T. KUJATH
AD Not Performed		METHOD: CONTINUOUS FLIGHT AUGER	



PROJECT NAME Cottonwood Creek Pavement Evaluation	CLIENT Cottonwood Creek HOA
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PROJECT NUMBER 019-0664	LOCATION Washington County, Nebraska
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ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/REMARKS
	<div style="background-color: black; width: 20px; height: 10px; display: inline-block; margin-right: 5px;"></div> Shelby Tube APPROX. SURFACE ELEV. (ft):1201		0								
1200	ASPHALT	0.5'									
	FILL <i>Lean clay (CL), stiff, moist, yellowish brown</i>	2.5'		1 C				21.2	107.7		

BASE OF BORING AT 2.5 FEET

WATER LEVEL OBSERVATIONS	OLSSON, INC. 11627 VIRGINIA PLAZA, STE 103 LA VISTA, NEBRASKA 68128	STARTED: 4/29/19	FINISHED: 4/29/19	
WD <input type="checkbox"/> Not Encountered		DRILL CO.: OLSSON	DRILL RIG: CME 45B	
IAD <input type="checkbox"/> Not Encountered		DRILLER: K. KEMPTON	LOGGED BY: T. KUJATH	
AD <input type="checkbox"/> Not Performed		METHOD: CONTINUOUS FLIGHT AUGER		



PROJECT NAME Cottonwood Creek Pavement Evaluation	CLIENT Cottonwood Creek HOA
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PROJECT NUMBER 019-0664	LOCATION Washington County, Nebraska
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ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	Shelby Tube										
	APPROX. SURFACE ELEV. (ft):1204		0								
	ASPHALT	0.5'									
	FILL	2.5'		1-C			1.9	19.5	108.5		
	Lean clay (CL), stiff, moist, grayish brown, trace iron staining										

BASE OF BORING AT 2.5 FEET

WATER LEVEL OBSERVATIONS	OLSSON, INC. 11627 VIRGINIA PLAZA, STE 103 LA VISTA, NEBRASKA 68128	STARTED: 4/26/19	FINISHED: 4/26/19
WD <input type="checkbox"/> Not Encountered		DRILL CO.: OLSSON	DRILL RIG: CME 45B
IAD <input type="checkbox"/> Not Encountered		DRILLER: D. HUMANN	LOGGED BY: T. KUJATH
AD <input type="checkbox"/> Not Performed		METHOD: CONTINUOUS FLIGHT AUGER	



PROJECT NAME Cottonwood Creek Pavement Evaluation	CLIENT Cottonwood Creek HOA
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PROJECT NUMBER 019-0664	LOCATION Washington County, Nebraska
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ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/REMARKS
	<div style="background-color: black; width: 20px; height: 10px; display: inline-block; margin-bottom: 5px;"></div> Shelby Tube APPROX. SURFACE ELEV. (ft):1197		0								
	ASPHALT		0.5'								
	FILL		2.5'	1-C				19.2	110.9		
1195	<i>Lean clay (CL), stiff, moist, dark brown, trace sand and iron staining</i>										

BASE OF BORING AT 2.5 FEET

WATER LEVEL OBSERVATIONS	OLSSON, INC. 11627 VIRGINIA PLAZA, STE 103 LA VISTA, NEBRASKA 68128	STARTED: 4/29/19	FINISHED: 4/29/19
WD <input type="checkbox"/> Not Performed		DRILL CO.: OLSSON	DRILL RIG: CME 45B
IAD <input type="checkbox"/> Not Performed		DRILLER: K. KEMPTON	LOGGED BY: T. KUJATH
AD <input type="checkbox"/> Not Performed		METHOD: CONTINUOUS FLIGHT AUGER	



PROJECT NAME Cottonwood Creek Pavement Evaluation	CLIENT Cottonwood Creek HOA
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PROJECT NUMBER 019-0664	LOCATION Washington County, Nebraska
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ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/REMARKS
1180	APPROX. SURFACE ELEV. (ft):1180		0								
	ASPHALT	0.5'									
	FILL <i>Lean clay (CL), stiff, moist, grayish brown, trace carbon staining</i>	2.5'		1-C			1.2	18.8	109.4		

BASE OF BORING AT 2.5 FEET

WATER LEVEL OBSERVATIONS	OLSSON, INC. 11627 VIRGINIA PLAZA, STE 103 LA VISTA, NEBRASKA 68128	STARTED:	4/26/19	FINISHED:	4/26/19
WD <input type="checkbox"/> Not Encountered		DRILL CO.:	OLSSON	DRILL RIG:	CME 45B
IAD <input type="checkbox"/> Not Encountered		DRILLER:	D. HUMANN	LOGGED BY:	T. KUJATH
AD <input type="checkbox"/> Not Performed		METHOD: CONTINUOUS FLIGHT AUGER			



PROJECT NAME Cottonwood Creek Pavement Evaluation	CLIENT Cottonwood Creek HOA
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PROJECT NUMBER 019-0664	LOCATION Washington County, Nebraska
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ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	<div style="background-color: black; width: 20px; height: 10px; display: inline-block; margin-bottom: 5px;"></div> Shelby Tube APPROX. SURFACE ELEV. (ft):1163		0								
	ASPHALT		0.5'								
	FILL <i>Lean clay (CL), stiff, moist, grayish brown</i>		2.5'	1-C			1.0	21.7	104.3		

BASE OF BORING AT 2.5 FEET

WATER LEVEL OBSERVATIONS	OLSSON, INC. 11627 VIRGINIA PLAZA, STE 103 LA VISTA, NEBRASKA 68128	STARTED: 4/26/19	FINISHED: 4/26/19
WD <input type="checkbox"/> Not Encountered		DRILL CO.: OLSSON	DRILL RIG: CME 45B
IAD <input type="checkbox"/> Not Encountered		DRILLER: D. HUMANN	LOGGED BY: T. KUJATH
AD <input type="checkbox"/> Not Performed		METHOD: CONTINUOUS FLIGHT AUGER	



PROJECT NAME Cottonwood Creek Pavement Evaluation	CLIENT Cottonwood Creek HOA
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PROJECT NUMBER 019-0664	LOCATION Washington County, Nebraska
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ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	Shelby Tube										
	APPROX. SURFACE ELEV. (ft):1169		0								
	ASPHALT	0.5'									
	FILL	2.5'		1-C			1.9	20.4	107.7		
	Lean clay (CL), stiff, moist, grayish brown, trace iron staining										

BASE OF BORING AT 2.5 FEET

WATER LEVEL OBSERVATIONS	OLSSON, INC. 11627 VIRGINIA PLAZA, STE 103 LA VISTA, NEBRASKA 68128	STARTED: 4/26/19	FINISHED: 4/26/19
WD <input type="checkbox"/> Not Encountered		DRILL CO.: OLSSON	DRILL RIG: CME 45B
IAD <input type="checkbox"/> Not Encountered		DRILLER: D. HUMANN	LOGGED BY: T. KUJATH
AD <input type="checkbox"/> Not Performed		METHOD: CONTINUOUS FLIGHT AUGER	



PROJECT NAME Cottonwood Creek Pavement Evaluation	CLIENT Cottonwood Creek HOA
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PROJECT NUMBER 019-0664	LOCATION Washington County, Nebraska
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ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	<div style="background-color: black; width: 20px; height: 10px; display: inline-block; margin-bottom: 5px;"></div> Shelby Tube APPROX. SURFACE ELEV. (ft):1223		0								
	ASPHALT		0.5'								
	FILL <i>Lean clay (CL), stiff, moist, yellowish brown, trace iron staining</i>		2.5'	1-C				20.3	108.2		

BASE OF BORING AT 2.5 FEET

WATER LEVEL OBSERVATIONS	OLSSON, INC. 11627 VIRGINIA PLAZA, STE 103 LA VISTA, NEBRASKA 68128	STARTED: 4/29/19	FINISHED: 4/29/19	
WD <input type="checkbox"/> Not Encountered		DRILL CO.: OLSSON	DRILL RIG: CME 45B	
IAD <input type="checkbox"/> Not Encountered		DRILLER: K. KEMPTON	LOGGED BY: T. KUJATH	
AD <input type="checkbox"/> Not Performed		METHOD: CONTINUOUS FLIGHT AUGER		



PROJECT NAME Cottonwood Creek Pavement Evaluation	CLIENT Cottonwood Creek HOA
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PROJECT NUMBER 019-0664	LOCATION Washington County, Nebraska
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ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	<div style="background-color: black; width: 20px; height: 10px; display: inline-block; margin-bottom: 5px;"></div> Shelby Tube APPROX. SURFACE ELEV. (ft):1242		0								
	ASPHALT		0.5'								
1240	PEORIA LOESS <i>Lean clay (CL), firm, very moist, light brown, trace iron staining</i>		2.5'	1-C				27.9	98.8		

BASE OF BORING AT 2.5 FEET

WATER LEVEL OBSERVATIONS	OLSSON, INC. 11627 VIRGINIA PLAZA, STE 103 LA VISTA, NEBRASKA 68128	STARTED: 4/29/19	FINISHED: 4/29/19	
WD <input type="checkbox"/> Not Encountered		DRILL CO.: OLSSON	DRILL RIG: CME 45B	
IAD <input type="checkbox"/> Not Encountered		DRILLER: K. KEMPTON	LOGGED BY: T. KUJATH	
AD <input type="checkbox"/> Not Performed		METHOD: CONTINUOUS FLIGHT AUGER		



PROJECT NAME Cottonwood Creek Pavement Evaluation	CLIENT Cottonwood Creek HOA
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PROJECT NUMBER 019-0664	LOCATION Washington County, Nebraska
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ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	<div style="background-color: black; width: 20px; height: 10px; display: inline-block; margin-bottom: 5px;"></div> Shelby Tube APPROX. SURFACE ELEV. (ft):1281		0								
1280	ASPHALT 0.5' PEORIA LOESS <i>Lean clay (CL), firm, very moist, grayish brown, few iron staining</i>			1-C			0.6	27.0	96.0		
	2.5'										

BASE OF BORING AT 2.5 FEET

WATER LEVEL OBSERVATIONS	OLSSON, INC. 11627 VIRGINIA PLAZA, STE 103 LA VISTA, NEBRASKA 68128	STARTED: 4/26/19	FINISHED: 4/26/19
WD <input type="checkbox"/> Not Performed		DRILL CO.: OLSSON	DRILL RIG: CME 45B
IAD <input type="checkbox"/> Not Performed		DRILLER: D. HUMANN	LOGGED BY: T. KUJATH
AD <input type="checkbox"/> Not Performed		METHOD: CONTINUOUS FLIGHT AUGER	



PROJECT NAME Cottonwood Creek Pavement Evaluation	CLIENT Cottonwood Creek HOA
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PROJECT NUMBER 019-0664	LOCATION Washington County, Nebraska
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ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/REMARKS
1305	APPROX. SURFACE ELEV. (ft):1305		0								
	ASPHALT		0.4'								
	FILL			1 C				23.2	103.6		
	Lean clay (CL), stiff, moist, dark grayish brown, trace iron staining		2.5'								

BASE OF BORING AT 2.5 FEET

WATER LEVEL OBSERVATIONS	OLSSON, INC. 11627 VIRGINIA PLAZA, STE 103 LA VISTA, NEBRASKA 68128	STARTED: 4/29/19	FINISHED: 4/29/19
WD Not Encountered		DRILL CO.: OLSSON	DRILL RIG: CME 45B
IAD Not Encountered		DRILLER: K. KEMPTON	LOGGED BY: T. KUJATH
AD Not Performed		METHOD: CONTINUOUS FLIGHT AUGER	



PROJECT NAME Cottonwood Creek Pavement Evaluation	CLIENT Cottonwood Creek HOA
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PROJECT NUMBER 019-0664	LOCATION Washington County, Nebraska
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ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	<div style="background-color: black; width: 20px; height: 10px; display: inline-block; margin-bottom: 5px;"></div> Shelby Tube APPROX. SURFACE ELEV. (ft):1287		0								
	ASPHALT		0.4'								
1285	PEORIA LOESS <i>Lean clay (CL), firm, moist, yellowish brown, trace iron staining</i>		2.5'	1 C			0.8	24.5	98.4		

BASE OF BORING AT 2.5 FEET

WATER LEVEL OBSERVATIONS	OLSSON, INC. 11627 VIRGINIA PLAZA, STE 103 LA VISTA, NEBRASKA 68128	STARTED: 4/26/19	FINISHED: 4/26/19
WD <input type="checkbox"/> Not Encountered		DRILL CO.: OLSSON	DRILL RIG: CME 45B
IAD <input type="checkbox"/> Not Encountered		DRILLER: D. HUMANN	LOGGED BY: T. KUJATH
AD <input type="checkbox"/> Not Performed		METHOD: CONTINUOUS FLIGHT AUGER	



PROJECT NAME Cottonwood Creek Pavement Evaluation	CLIENT Cottonwood Creek HOA
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PROJECT NUMBER 019-0664	LOCATION Washington County, Nebraska
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ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/REMARKS
	Shelby Tube										
	APPROX. SURFACE ELEV. (ft):1191		0								
1190	ASPHALT	0.4'									
	FILL	2.5'		1 U			1.7	22.3	106.5		
	Lean clay (CL), stiff, moist, yellowish brown, trace iron staining										

BASE OF BORING AT 2.5 FEET

WATER LEVEL OBSERVATIONS	OLSSON, INC. 11627 VIRGINIA PLAZA, STE 103 LA VISTA, NEBRASKA 68128	STARTED:	4/26/19	FINISHED:	4/26/19
WD <input type="checkbox"/> Not Encountered		DRILL CO.:	OLSSON	DRILL RIG:	CME 45B
IAD <input checked="" type="checkbox"/> Not Encountered		DRILLER:	D. HUMANN	LOGGED BY:	T. KUJATH
AD <input checked="" type="checkbox"/> Not Performed		METHOD: CONTINUOUS FLIGHT AUGER			



PROJECT NAME Cottonwood Creek Pavement Evaluation	CLIENT Cottonwood Creek HOA
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PROJECT NUMBER 019-0664	LOCATION Washington County, Nebraska
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ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	<div style="background-color: black; width: 20px; height: 10px; display: inline-block; margin-bottom: 5px;"></div> Shelby Tube APPROX. SURFACE ELEV. (ft):1186		0								
1185	ASPHALT FILL <i>Lean clay (CL), stiff, moist, dark grayish brown, trace iron staining</i>	<div style="background-color: black; width: 100%; height: 10px; margin-bottom: 5px;"></div> <div style="background-color: #cccccc; width: 100%; height: 10px; margin-bottom: 5px;"></div> <div style="background-color: #e0e0e0; width: 100%; height: 10px; margin-bottom: 5px;"></div> <div style="background-color: #f0f0f0; width: 100%; height: 10px; margin-bottom: 5px;"></div> <div style="background-color: #ffffff; width: 100%; height: 10px;"></div>	0.5'	1-C				21.4	105.7		
	BASE OF BORING AT 2.5 FEET										

WATER LEVEL OBSERVATIONS	OLSSON, INC. 11627 VIRGINIA PLAZA, STE 103 LA VISTA, NEBRASKA 68128	STARTED: 4/29/19	FINISHED: 4/29/19
WD <input type="checkbox"/> Not Performed		DRILL CO.: OLSSON	DRILL RIG: CME 45B
IAD <input type="checkbox"/> Not Performed		DRILLER: K. KEMPTON	LOGGED BY: T. KUJATH
AD <input type="checkbox"/> Not Performed		METHOD: CONTINUOUS FLIGHT AUGER	



PROJECT NAME Cottonwood Creek Pavement Evaluation	CLIENT Cottonwood Creek HOA
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PROJECT NUMBER 019-0664	LOCATION Washington County, Nebraska
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ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/REMARKS
	<div style="background-color:black; width:20px; height:15px; display:inline-block; margin-bottom:5px;"></div> Shelby Tube APPROX. SURFACE ELEV. (ft):1178		0								
	ASPHALT		0.5'								
	FILL <i>Lean clay (CL), firm, moist, grayish brown, trace iron staining</i>		2.5'	1 U			0.5	22.4	105.6		

BASE OF BORING AT 2.5 FEET

WATER LEVEL OBSERVATIONS	OLSSON, INC. 11627 VIRGINIA PLAZA, STE 103 LA VISTA, NEBRASKA 68128	STARTED:	4/26/19	FINISHED:	4/26/19
WD <input type="checkbox"/> Not Encountered		DRILL CO.:	OLSSON	DRILL RIG:	CME 45B
IAD <input checked="" type="checkbox"/> Not Encountered		DRILLER:	D. HUMANN	LOGGED BY:	T. KUJATH
AD <input checked="" type="checkbox"/> Not Performed		METHOD: CONTINUOUS FLIGHT AUGER			



PROJECT NAME Cottonwood Creek Pavement Evaluation	CLIENT Cottonwood Creek HOA
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PROJECT NUMBER 019-0664	LOCATION Washington County, Nebraska
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ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	<div style="background-color: black; width: 20px; height: 10px; display: inline-block; margin-bottom: 5px;"></div> Shelby Tube APPROX. SURFACE ELEV. (ft):1196		0								
1195	ASPHALT FILL <i>Lean clay (CL), stiff, moist, yellowish brown, trace iron staining</i>	<div style="background-color: black; width: 100%; height: 10px; margin-bottom: 5px;"></div> <div style="border: 1px solid black; width: 100%; height: 10px; background: repeating-linear-gradient(45deg, transparent, transparent 2px, black 2px, black 4px);"></div>	0.5'	1 U			1.4	21.3	107.7		
		<div style="border: 1px solid black; width: 100%; height: 10px; background: repeating-linear-gradient(45deg, transparent, transparent 2px, black 2px, black 4px);"></div>	2.5'								

BASE OF BORING AT 2.5 FEET

WATER LEVEL OBSERVATIONS	OLSSON, INC. 11627 VIRGINIA PLAZA, STE 103 LA VISTA, NEBRASKA 68128	STARTED: 4/26/19	FINISHED: 4/26/19	
WD <input type="checkbox"/> Not Encountered		DRILL CO.: OLSSON	DRILL RIG: CME 45B	
IAD <input type="checkbox"/> Not Encountered		DRILLER: D. HUMANN	LOGGED BY: T. KUJATH	
AD <input type="checkbox"/> Not Performed		METHOD: CONTINUOUS FLIGHT AUGER		



PROJECT NAME Cottonwood Creek Pavement Evaluation	CLIENT Cottonwood Creek HOA
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PROJECT NUMBER 019-0664	LOCATION Washington County, Nebraska
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ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/REMARKS
	Shelby Tube										
	APPROX. SURFACE ELEV. (ft):1208		0								
	ASPHALT	0.5'									
	FILL	2.5'		1-C			0.5	21.8	105.7		
	Lean clay (CL), firm, moist, grayish brown, trace sand										

BASE OF BORING AT 2.5 FEET

WATER LEVEL OBSERVATIONS	OLSSON, INC. 11627 VIRGINIA PLAZA, STE 103 LA VISTA, NEBRASKA 68128	STARTED: 4/26/19	FINISHED: 4/26/19
WD <input type="checkbox"/> Not Encountered		DRILL CO.: OLSSON	DRILL RIG: CME 45B
IAD <input checked="" type="checkbox"/> Not Encountered		DRILLER: D. HUMANN	LOGGED BY: T. KUJATH
AD <input checked="" type="checkbox"/> Not Performed		METHOD: CONTINUOUS FLIGHT AUGER	



PROJECT NAME Cottonwood Creek Pavement Evaluation	CLIENT Cottonwood Creek HOA
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PROJECT NUMBER 019-0664	LOCATION Washington County, Nebraska
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ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	<div style="background-color: black; width: 20px; height: 10px; display: inline-block; margin-bottom: 5px;"></div> Shelby Tube APPROX. SURFACE ELEV. (ft):1223		0								
	ASPHALT		0.5'								
	FILL <i>Lean clay (CL), firm, moist, medium brown</i>		2.5'	1 C			0.8	21.5	105.4		

BASE OF BORING AT 2.5 FEET

WATER LEVEL OBSERVATIONS	OLSSON, INC. 11627 VIRGINIA PLAZA, STE 103 LA VISTA, NEBRASKA 68128	STARTED: 4/26/19	FINISHED: 4/26/19
WD <input type="checkbox"/> Not Encountered		DRILL CO.: OLSSON	DRILL RIG: CME 45B
IAD <input type="checkbox"/> Not Encountered		DRILLER: D. HUMANN	LOGGED BY: T. KUJATH
AD <input type="checkbox"/> Not Performed		METHOD: CONTINUOUS FLIGHT AUGER	



PROJECT NAME Cottonwood Creek Pavement Evaluation	CLIENT Cottonwood Creek HOA
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PROJECT NUMBER 019-0664	LOCATION Washington County, Nebraska
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ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
1250	APPROX. SURFACE ELEV. (ft):1250		0								
	ASPHALT	0.5'									
	PEORIA LOESS	2.5'		1-C			1.1	26.8	98.2		
	<i>Lean clay (CL), stiff, very moist, yellowish brown</i>										

BASE OF BORING AT 2.5 FEET

WATER LEVEL OBSERVATIONS	OLSSON, INC. 11627 VIRGINIA PLAZA, STE 103 LA VISTA, NEBRASKA 68128	STARTED: 4/26/19	FINISHED: 4/26/19
WD <input type="checkbox"/> Not Encountered		DRILL CO.: OLSSON	DRILL RIG: CME 45B
IAD <input type="checkbox"/> Not Encountered		DRILLER: D. HUMANN	LOGGED BY: T. KUJATH
AD <input type="checkbox"/> Not Performed		METHOD: CONTINUOUS FLIGHT AUGER	



PROJECT NAME Cottonwood Creek Pavement Evaluation	CLIENT Cottonwood Creek HOA
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PROJECT NUMBER 019-0664	LOCATION Washington County, Nebraska
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ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
1260	<div style="border: 1px solid black; width: 20px; height: 10px; display: inline-block; margin-bottom: 5px;"></div> Shelby Tube APPROX. SURFACE ELEV. (ft):1260		0								
	ASPHALT 0.4' FILL <i>Lean clay (CL), stiff, moist, light grayish brown, trace calcium and iron staining</i>			1 C				20.5	108.6		
	BASE OF BORING AT 2.5 FEET										

WATER LEVEL OBSERVATIONS	OLSSON, INC. 11627 VIRGINIA PLAZA, STE 103 LA VISTA, NEBRASKA 68128	STARTED: 4/29/19	FINISHED: 4/29/19
WD <input type="checkbox"/> Not Encountered		DRILL CO.: OLSSON	DRILL RIG: CME 45B
IAD <input checked="" type="checkbox"/> Not Encountered		DRILLER: K. KEMPTON	LOGGED BY: T. KUJATH
AD <input checked="" type="checkbox"/> Not Performed		METHOD: CONTINUOUS FLIGHT AUGER	



PROJECT NAME Cottonwood Creek Pavement Evaluation	CLIENT Cottonwood Creek HOA
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PROJECT NUMBER 019-0664	LOCATION Washington County, Nebraska
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ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	<div style="background-color: black; width: 20px; height: 10px; display: inline-block; margin-right: 5px;"></div> Shelby Tube APPROX. SURFACE ELEV. (ft):1287		0								
	ASPHALT		0.4'								
	FILL										
1285	<i>Lean clay (CL), stiff, moist, dark grayish brown, trace iron staining</i>		2.5'	1 C			1.3	19.3	106.3		
BASE OF BORING AT 2.5 FEET											

WATER LEVEL OBSERVATIONS	OLSSON, INC. 11627 VIRGINIA PLAZA, STE 103 LA VISTA, NEBRASKA 68128	STARTED: 4/26/19	FINISHED: 4/26/19	
WD Not Encountered		DRILL CO.: OLSSON	DRILL RIG: CME 45B	
IAD Not Encountered		DRILLER: D. HUMANN	LOGGED BY: T. KUJATH	
AD Not Performed		METHOD: CONTINUOUS FLIGHT AUGER		



PROJECT NAME Cottonwood Creek Pavement Evaluation	CLIENT Cottonwood Creek HOA
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PROJECT NUMBER 019-0664	LOCATION Washington County, Nebraska
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ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	<div style="background-color: black; width: 20px; height: 10px; display: inline-block; margin-bottom: 5px;"></div> Shelby Tube APPROX. SURFACE ELEV. (ft):1247		0								
	ASPHALT		0.5'								
	FILL										
1245	<i>Lean clay (CL), firm, moist, brown</i>		2.5'	1-C				22.8	105.1		

BASE OF BORING AT 2.5 FEET

WATER LEVEL OBSERVATIONS	OLSSON, INC. 11627 VIRGINIA PLAZA, STE 103 LA VISTA, NEBRASKA 68128	STARTED: 4/29/19	FINISHED: 4/29/19	
WD Not Encountered		DRILL CO.: OLSSON	DRILL RIG: CME 45B	
IAD Not Encountered		DRILLER: K. KEMPTON	LOGGED BY: T. KUJATH	
AD Not Performed		METHOD: CONTINUOUS FLIGHT AUGER		

APPENDIX C

SUMMARY OF LABORATORY TEST RESULTS



PROJECT NAME: Cottonwood Creek Pavement Evaluation
PROJECT NUMBER: 019-0664

CLIENT: Cottonwood Creek HOA
PROJECT LOCATION: Washington County, Nebraska

BORING NUMBER	SAMPLE I.D.	SAMPLE DEPTH (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	VOID RATIO	SATURATION (%)	UNCONFINED STRENGTH (tsf)	STRAIN (%)	ATTERBERG LIMITS			USCS CLASS.
									LIQUID LIMIT	PLASTIC LIMIT	PLASTIC INDEX	
C1	U-1	0.5 - 2.5'	20.0	106.5	0.582	92.6						
C2	U-1	0.5 - 2.5'	21.2	107.7	0.564	100.0						
C3	U-1	0.5 - 2.5'	19.5	108.5	0.554	95.3	1.9	6.6				
C4	U-1	0.5 - 2.5'	19.2	110.9	0.520	99.8						
C5	U-1	0.5 - 2.5'	18.8	109.4	0.541	93.8	1.2	7.4				
C6	U-1	0.5 - 2.5'	21.7	104.3	0.616	95.0	1.0	3.5				
C7	U-1	0.5 - 2.5'	20.4	107.7	0.565	97.4	1.9	5.2				
C8	U-1	0.5 - 2.5'	20.3	108.2	0.558	98.3						
C9	U-1	0.5 - 2.5'	27.9	98.8	0.707	100.0						
C10	U-1	0.5 - 2.5'	27.0	96.0	0.756	96.3	0.6	2.7				
C11	U-1	0.4 - 2.4'	23.2	103.6	0.627	99.9						
C12	U-1	0.4 - 2.4'	24.5	98.4	0.712	92.9	0.8	5.0				
C13	U-1	0.4 - 2.4'	22.3	106.5	0.583	100.0	1.7	12.9				
C14	U-1	0.5 - 2.5'	21.4	105.7	0.594	97.4						
C15	U-1	0.5 - 2.5'	22.4	105.6	0.596	100.0	0.5	3.5				
C16	U-1	0.5 - 2.5'	21.3	107.7	0.565	100.0	1.4	3.2				
C17	U-1	0.5 - 2.5'	21.8	105.7	0.595	99.2	0.5	3.3				
C18	U-1	0.5 - 2.5'	21.5	105.4	0.599	96.8	0.8	3.0				
C19	U-1	0.5 - 2.5'	26.8	98.2	0.716	100.0	1.1	3.7				
C20	U-1	0.4 - 2.4'	20.5	108.6	0.553	100.0						
C21	U-1	0.4 - 2.4'	19.3	106.3	0.586	88.9	1.3	2.6				
C22	U-1	0.5 - 2.5'	22.8	105.1	0.604	100.0						

APPENDIX D

Photo Log

PHOTO LOG

Project Name: Cottonwood Creek Pavement Evaluation	Site Location: Near Blair, Nebraska	Project No: 019-0664
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Description: C-1



Description: C-2

PHOTO LOG

Project Name: Cottonwood Creek Pavement Evaluation	Site Location: Near Blair, Nebraska	Project No: 019-0664
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Description: C-3



Description: C-4

PHOTO LOG

Project Name: Cottonwood Creek Pavement Evaluation	Site Location: Near Blair, Nebraska	Project No: 019-0664
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Description: C-5



Description: C-6

PHOTO LOG

Project Name: Cottonwood Creek Pavement Evaluation	Site Location: Near Blair, Nebraska	Project No: 019-0664
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Description: C-7



Description: C-8

PHOTO LOG

Project Name: Cottonwood Creek Pavement Evaluation	Site Location: Near Blair, Nebraska	Project No: 019-0664
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Description: C-9



Description: C-10

PHOTO LOG

Project Name: Cottonwood Creek Pavement Evaluation	Site Location: Near Blair, Nebraska	Project No: 019-0664
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Description: C-11



Description: C-12

PHOTO LOG

Project Name: Cottonwood Creek Pavement Evaluation	Site Location: Near Blair, Nebraska	Project No: 019-0664
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Description: C-13



Description: C-14

PHOTO LOG

Project Name: Cottonwood Creek Pavement Evaluation	Site Location: Near Blair, Nebraska	Project No: 019-0664
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Description: C-15



Description: C-16

PHOTO LOG

Project Name: Cottonwood Creek Pavement Evaluation	Site Location: Near Blair, Nebraska	Project No: 019-0664
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Description: C-17



Description: C-18

PHOTO LOG

Project Name: Cottonwood Creek Pavement Evaluation	Site Location: Near Blair, Nebraska	Project No: 019-0664
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Description: C-19



Description: C-20

PHOTO LOG

Project Name:
Cottonwood Creek Pavement Evaluation

Site Location:
Near Blair, Nebraska

Project No:
019-0664



Description: C-21



Description: C-22