Geotechnical Engineering Report

N11 Roadway Alignment
Crownpoint, New Mexico
19-517-00054

Prepared for:

Wilson & Company, Inc., Engineers and Architects
4401 Masthead St. NE #150, Albuquerque, NM 87109

November 15, 2019

wood.

11/15/2019

Project No. 19-517-00054

Wilson & Company Inc., Engineers and Architects
4404 Masthead St. NE #150
Albuquerque, New Mexico 87109

Attention: Mr. Derek Meier, P.E.,

Subject: **Supplemental Pavement Design and Foundation Study**
N11 Roadway Alignment
Mariano Lake, New Mexico

Dear Mr. Derek Meier,

Wood Environment and Infrastructure Solutions, Inc. (Wood E&IS), is pleased to submit this report for the N11 Roadway Alignment Project. The purpose of our study was to provide supplementary data to complete available geotechnical resources in accordance with the Project Development and Design (PPDM) Manual of the US Department of Transportation Federal Highway Administration.

Our scope of work included review of available reports, field testing, laboratory testing, geotechnical engineering analyses, and report preparation. This report has been prepared for the exclusive use of Wilson & Company, and their consultants, for specific application to this project, in accordance with generally accepted geotechnical engineering practice.

We appreciate the opportunity to be of service on this project. If you have any questions regarding this report, or any aspects of the project, please feel free to contact our office.

Sincerely,

Wood Environment and Infrastructure Solutions, Inc.

Diego I. Garcia, E.I.T.
Staff Geotechnical Engineer

Reviewed by:

JACOB S. HAYS
NEW MEXICO
22904
11/15/19
PROFESSIONAL ENGINEER

Jacob S. Hays, P.E.
Senior Geotechnical Engineer

Geotechnical Engineering Report

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Summary

The following summary of project geotechnical considerations is presented for introductory purposes and should be used only in conjunction with the full text of this report.

Project Description: The Bureau of Indian Affairs previously contracted Kleinfelder West Inc. to complete the investigations for both the bridge and the pavement for the N11 Project. Kleinfelder West Inc. conducted the geotechnical investigation, collecting samples at four (4) different locations for the bridge and fifty-four (54) samples for the pavement. Different types of tests were run on these samples to provide their geotechnical engineering conclusions and designs. Those tests were: Gradation, Plasticity Index (Atterberg Limits), Chemical Resistivity, and Moisture Content. The Pavement design was completed by Kleinfelder West Inc. using assumed CBR values.

Exploratory Methods: Wood E&I's team was hired to submit a supplementary geotechnical report to characterize soil conditions and corrosion potential for pavement design and at the bridge site. To achieve this, a total of six (6) hollow-stem auger bore holes were drilled; five (5) to a depth of 5 feet and one (1) to a depth of 20 feet. Selected soil samples from the explorations were submitted for laboratory testing to determine index properties, CBR values, sulfate and soil resistivity tests to support initial pavement designs provided by Kleinfelder West Inc.

Soil Conditions: The soils at this site are for the most part fine grained soils (clays)with various amounts of sand.

Groundwater Conditions: At the time of drilling (August 19, 2019), none of our explorations encountered groundwater.

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1. INTRODUCTION

This report is submitted to supplement a geotechnical engineering study made by Kleinfelder West Inc. for the proposed N11 Project in Crownpoint, NM dated August 4th, 2018. The objectives of this study were to perform additional laboratory tests, such as CBR and corrosivity tests, to evaluate the physical properties of the subsoils for providing pavement design.

The flexible pavement section recommendations presented by Kleinfelder West Inc. for this project was based on estimated CBR values, and not on actual data retrieved from the field. In this report, we are presenting three (3) different flexible pavement section recommendations based on CBR values determined from soil samples and in accordance with "*The Guide for Design of Pavement Structures and 1998 Supplement, AASHTO, 1993*", and the Federal Highway Administration's (FHWA) Design Manual. It is our understanding that rigid (plain concrete) pavement was not a consideration for the pavement.

The conclusions and recommendations contained in this report are based on our understanding of the project, as derived from layout drawings, written information, and verbal information supplied to us. Consequently, if any significant changes are made to the currently proposed project, we may need to modify our conclusions and recommendations contained herein to reflect those changes.

2. PROPOSED CONSTRUCTION

We understand that the project calls for a new asphalt pavement and a new bridge structure on the southern portion of Route N11 on the Navajo Nation near Crownpoint, New Mexico. This report contains our geotechnical engineering observations and recommendations regarding the pavement sections of the project, as a supplementary geotechnical report to the original report submitted by Kleinfelder West Inc. in 2010.

3. INVESTIGATION

3.1. Subsurface Investigation

The subsurface investigation included drilling six (6) borings throughout the project alignment on N11, five (5) of the borings were drilled to a depth of 5 feet for the pavement borings and one (1) to a depth of 20 feet at the bridge location to adequately characterize support properties of surficial soils for the pavement design and soil corrosion potential at the bridge site. Borings were advanced with a hollow-stem auger, using a truck-mounted drill rig operated by an independent firm working under subcontract to Wood. Throughout the drilling operation, soil samples were obtained at 5-foot depth intervals by driving split-spoon samplers in accordance with the Standard Penetration Test procedure (ASTM:D-1586). Coring was not performed during our field exploration because no rock was encountered during boring. An experienced geotechnical engineer from our office was continuously observing the borings, log the subsurface conditions, collect representative soil samples, and transport all samples to our laboratory for further visual examination and testing. After drilling, each borehole was backfilled with remaining soil cuttings. Results of the field study are presented in Appendix A, which includes a brief description of drilling and sampling equipment and procedures, and logs of the test borings with coordinates describing their locations.

The specific number, locations, and depths of our explorations were selected by Wood E&I, in collaboration with Wilson & Company. The borings were field adjusted based on existing site features, under the constraints of surface access, underground utility locations, and budget considerations. Please refer to the site and exploration plan in appendix A for approximate locations of the borings.

It should be noted that the explorations performed and used for this report reveal subsurface conditions only at discrete locations along the project alignment and that actual conditions in other locations could vary. Furthermore, the nature and extent of these variations would not become evident until additional explorations are performed or until construction activities have begun. If significant variations are observed at that time, we may need to modify our conclusions and recommendations contained in this report to reflect the actual site conditions.

3.2. Laboratory Analysis

Laboratory testing, related to pavement design, was performed on selected samples. Soils testing included grain-size analysis, Atterberg Limits, soil classifications, CBR tests, pH, chloride content, sulfate content, and resistivity testing. The results of these tests are provided in Appendix B. The following sections highlight some properties used for analysis.

3.2.1. CBR Test Data

The site soils classify as AASHTO A-4, A-6, and A-7-6. FP-14 section 204 "Excavation and Embankment" requires density in the field to be compared against AASHTO T-99 "Standard Compaction Effort". As a result, CBR specimens were molded using AASHTO T-99. The CBR values shown below represent 95% compaction of AASHTO T-99 at optimum moisture content.

Four (4) California Bearing Ratio of Laboratory Compacted Soils (AASHTO T193-10) tests were performed on surface soils along the alignment. Results are presented in the table below:

Table 1. CBR Test Data

Sample Source	Penetration (inches)	Density at 95% of Max. Density (lb/ft^3)	Optimum Moisture (%)	California Bearing Ratio, CBR (%)
B-04 and C-02	0.1	106.4	13.0	2.8
B-03	0.1	108.3	12.5	4.2
B-05 and C-01	0.1	102.6	17.0	3.2

Based on the results of the study, the soils sampled for N11 showed a higher CBR value at B-01 and lower CBR values further north of the project. For our pavement design, we used a CBR value of 2.8. As previously described, samples collected on N11 were observed to be more fine-grained soils, ranging from lean clay to sandy clays. No granular material was encountered throughout the alignment profile in our exploration.

3.2.2. Soils Chemical Testing

Tests for pH (AASHTO T289), Chloride Content (AASHTO T291), Sulfate Content (AASHTO T290), and Resistivity testing (AASHTO T288) were conducted on strategically selected samples based on classification and location. The tests performed for this study were conducted as per The Federal Highway Administration's Geotechnical Technical Guidance Memo.

Table 2. Laboratory Test Results of Sulfates and Corrosivity

Boring	Soil Type	Sample Depth (ft)	pH (S.U.)	Chloride Content (ppm)	Sulfate Content (ppm)	Resistivity (Ohm-cm)
B-01	Clay with some sand	0'-5'	-	-	5085	-
B-03	Sandy Clay	0'-5'	-	-	98	-
B-04	Sandy Clay	0'-5'	-	-	193	-
C-01	Clay with some sand	0'-5'	-	-	1788	-
B-05	Clay with some sand	0'-5'	-	-	-	550
B-05	Clay with some sand	5'-6.5'	7.7	94	-	-
B-05	Clay with some sand	10'-11.5'	7.6	62	-	-
B-05	Clay with some sand	15'-16.5'	7.6	24	-	-
B-05	Clay with some sand	20'-21.5'	7.3	8	806	-

S.U. = Standard Unit; ppm = part per million

Laboratory test results indicate that the onsite soils at B-05 have an average pH of 7.6 and an average chloride content of 47; which decreases significantly with depth. For metals in soils and water, corrosion is typically a result of contact with soluble salts or an acidic (pH of 4.5 or less) environment. Very strong alkalinity soils (pH greater than 10) are also generally associated with significant corrosion rates. The pH test performed for the project does indicate high potential for corrosion.

A resistivity test was performed and determined to be 550 Ohm-cm. Per FHWA recommendations, the aggressiveness category for this result is "Very Corrosive." The value of 550 Ohm-cm may also be utilized for electrical engineering considerations for the site. Given this resistivity classification, it will be recommended to utilize a type V cement for concrete placements.

Samples of site soil was submitted for sulfate content to evaluate potential for lime treating onsite soils for fill and pavement design purposes. The highest result was 5085 ppm. Generally, the upper limit permitted for lime treating soils is 3,000 ppm. Given that the result is greater than the upper limit recommended, it appears that lime treatment of the site will require special considerations related to heave potential if lime or cement treatment is selected for this project. It will be recommended to allow lime/soil mixtures to "mellow" for a period of at least 48 hours prior to final fill placement as recommended FHWA/TX-06/0-4240-3 "Recommendations for Stabilization of High Sulfate in Soils."

4. SITE CONDITIONS & GEOTECHNICAL PROFILE

4.1. Site Conditions

The N11 roadway currently does not have any paved areas. Based on the field investigation, the existing roadway for NM 11 consists mostly of clay to sandy clay soils with some sand in the surficial layers (0' to 5').

4.2. Geotechnical Profile

As indicated by the exploratory borings, the soils along the alignment consist primarily of clay (CL) and sandy clay (CL). These soils were generally of medium plasticity. In most of the borings along the

alignment, some sand was encountered. All borings were advanced to their intended depth with no auger refusal.

4.3. Soil Moisture & Groundwater Conditions

Groundwater was not encountered in any of the borings. Measured soil moisture contents ranged from 6 percent to 18 percent with the majority above 9 percent.

5. ANALYSIS AND RECOMMENDATIONS

5.1. Traffic Analysis

An updated annual average daily traffic (ADT) report for N11 provided by the Navajo Division of Transportation (NDOT) was utilized to provide a new design pavement section based on actual CBR values obtained from laboratory testing of collected samples. This data showed an average daily traffic (ADT) value of 193 vehicles per day (vpd) in 2013, with projected ADT of 287 vpd for 2033. No percent trucks data was provided in this report; therefore, a truck percent value of 7% was estimated for the design based on NMDOT data from adjacent roads (US566). Per FHWA specs. section 11.2.1 required design inputs, a design period of 25 years was implemented with a growth factor of 2%, and a lane distribution of 60%. This determined a total of 143,379 ESALs.

5.2. Pavement Design Section

A new pavement sections are provided and presented below. This flexible pavement section was designed in accordance with the 1993 AASHTO Guide for Design of Pavement Structures. The same design parameters as those used by Kleinfelder West Inc. in their original report were incorporated in our flexible pavement sections design but using a composite CBR value of 3.6, a design reliability of 75%, an initial serviceability index (P_i) of 4.2 and a terminal serviceability index (P_t) 2.0. The design reliability was selected from the lower limit of AASHTO's recommended range for rural collectors and principal arterial functional classifications.

Table 3. Subgrade Design Resilient Modulus Values

Roadway Segment	CBR-value	Corollary Resilient Modulus
NDOT – N11	2.8	4,938 psi

Using the CBR-data, a Resilient Modulus (M_r) of 4,938 psi was shown for the natural untreated in-situ subgrade layer. It is our understanding that it is intended to chemically stabilize the in-situ soil with Roadbond EN-1 on the entire project length. A combined resilient modulus of 5,822 psi was obtained using the Berminster two-layer method and the kirk approximation for the design. From these input values and design ESALs shown in Section 5.1, the required pavement structural number (S_N) for the roadway section was calculated using the AASHTO design equation for flexible pavements. Pavement layer thicknesses were then calculated based on a structural layer coefficient of 0.44 for the HMA, 0.11

for the Aggregate Base Course, and 0.10 for the Chemically Stabilized Subgrade. The Chemically Stabilized Subgrade must have at least 100 psi (690 kPa) of 28-day unconfined compressive strength.

5.2.1. Pavement Structural Design

The following table presents the design weighted structural number, S_N, asphalt thickness, and resulting structural number for the pavement design utilizing onsite subgrade materials:

Table 4. Recommended Depth Pavement Section

Pavement Design	Required S_N	HMA Thickness (inches)	Crushed Aggregate Base Course (BC) Thickness (inches)	Chemically Stabilized Subgrade Thickness (inches)	Resulting S_N
N11	2.51	3.0	6.0	6.0	2.58

The pavement design sections listed above are based on chemical stabilization of the upper 6 inches of the onsite subgrade material. This treatment must increase the Modulus of Rupture of the subgrade material to at least 30,000 psi. This should be continuously checked on site during construction. One effective method to evaluate the quality of the subgrade material after treatment is through the Dynamic Cone Penetration (DCP) testing because it provides an indication of soil quality with depth. The DCP is utilized to measure the strength of the in-situ material based on the penetration rate. The DCP testing results can then be used to correlate laboratory CBR in the field expediently using penetration rate. Based on this correlation a DCP index of at least 0.20 inches/blow (5.1 mm/blow) must be achieved in the treated material to obtain the required CBR value of 47.

The site soils appear to be relatively uniform so it is not anticipated that import will be required to meet minimum CBR-value requirements if chemical stabilization is utilized on the entire project length. If for some reason fill is necessary for the roadway, it is recommended to import materials having a CBR-value greater than 47.

Table 5. Recommended Asphalt Lifts for the Selected Total HMA Thickness

Pavement Design	Total HMA Thickness	FHWA FP-401 Mix Design
N11	3.0"	1 layer @ 3.0" of ¾" NMSA

NMSA = Nominal Maximum Size Aggregate.

5.3. Pavement Construction Considerations

5.3.1. FHWA Specifications

If the project is to be governed by FHWA criteria, project construction and material specifications shall conform to Standard Specification of Roads and Bridges on Federal Highway Projects FP-14. At a minimum, the following sections and divisions should apply for the roadways:

- FP-14 Section 204. - Excavation and Embankment
- FP-14 Section 301. – Untreated Aggregate Courses
- FP-14 Division 400 Asphalt Pavements and Surface Treatments

It is our recommendation that the HMA have a nominal maximum aggregate size of ¾ inches. Additionally, we recommend a "D" Grading Designation (FP-14, Section 703) be specified for the aggregate basecourse.

The soils throughout the project area that will be encountered during earthwork operations can be excavated with normal earth moving equipment. Heavier equipment may be necessary if sandstone rock is to be excavated. Based on the data available, it appears that excavated soils in the potential borrow areas will be suitable for reuse as subgrade fill for meeting the criteria for R-value of 35.

6. CLOSURE

The conclusions and recommendations presented in this report are based, in part, on the explorations Wood E&I performed and used for this study; therefore, if variations in the subgrade conditions are observed at a later time, we may need to modify this report to reflect those changes.

We appreciate the opportunity to be of service on this project. If you have any questions regarding this report, or any aspects of the project, please feel free to contact our office.

References

AASHTO. 1993 "AASHTO Guide for Design of Pavement Structures." American Association of State Highway and Transportation Officials, Washington, D. C.

Federal Highway Administration (FHWA), 2007. Geotechnical Technical Guidance Manual. Federal Highway Administration, U.S. Department of Transportation. May 2007.

Federal Highway Administration (FHWA), 2014. Federal Lands Highway Project Development and Design Manual. Federal Highway Administration, U.S. Department of Transportation. December 2014.

Geotechnical Investigation And Foundation Recommendation Report Bia Route N11 Bia Project N11(1A) . 1,2&4 Near Crownpoint, New Mexico. Kleinfelder Project No. 105884.

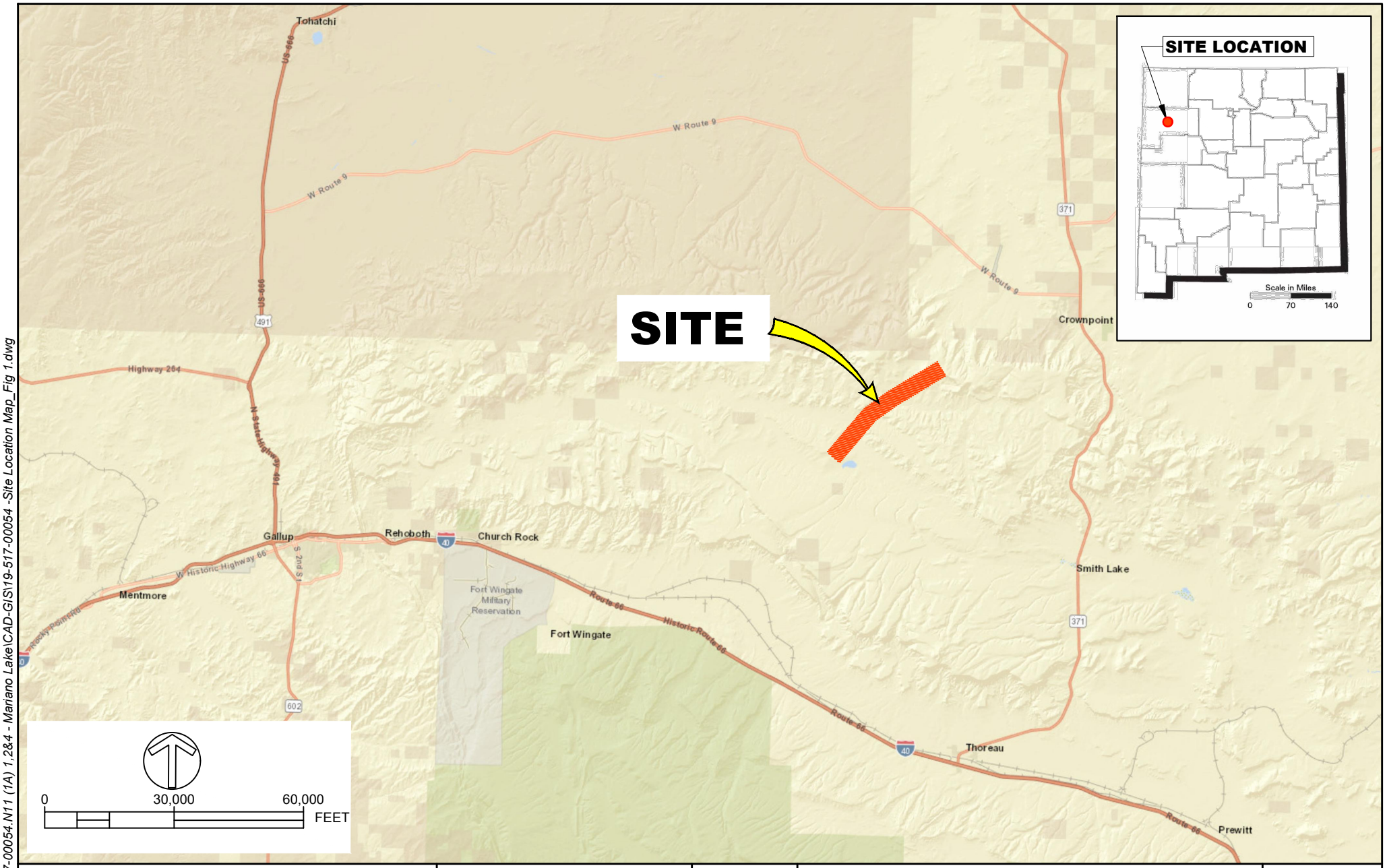
Portland Cement Association (PCA), 2011. Design and Control of Concrete Mixtures. Portland Cement Association 2011.

Federal Highway Administration (FHWA), 2009. Corrosion/Degradation of Soil Reinforcements for Mechanically Stabilized Earth Walls and Reinforced Soil Slopes. Federal Highway Administration, U.S. Department of Transportation. November 2009

Limitations

1. The work performed in the preparation of this report and the conclusions presented are subject to the following:
    a. The Standard Terms and Conditions which form a part of our Master Services Contract with Wilson & Company;
    b. The Scope of Services;
    c. Time and Budgetary limitations as described in our Contract; and
    d. The Limitations stated herein.
2. No other warranties or representations, either expressed or implied, are made as to the professional services provided under the terms of our Contract, or the conclusions presented.
3. The conclusions presented in this report were based, in part, on visual observations of the Site and subsurface explorations. Our conclusions cannot and are not extended to include those portions of the Site, which are not reasonably available, in Wood's opinion, for direct observation.
4. The Site history research included obtaining information from third parties. No attempt has been made to verify the accuracy of any information provided, unless specifically noted in our report.
5. Where testing was performed, it was carried out in accordance with the terms of our contract providing for testing. Other substances, or different quantities of substances testing for, may be present on-site and may be revealed by different or other testing not provided for in our contract.
6. Because of the limitations referred to above, different environmental conditions from those stated in our report may exist. Should such different conditions be encountered, Wood must be notified in order that it may determine if modifications to the conclusions in the report are necessary.
7. The utilization of Wood's services during the implementation of any remedial measures will allow Wood to observe compliance with the conclusions and recommendations contained in the report. Wood's involvement will also allow for changes to be made as necessary to suit field conditions as they are encountered.
8. This report is for the sole use of the party to whom it is addressed unless expressly stated otherwise in the report or contract. Any use which any third party makes of the report, in whole or the part, or any reliance thereon or decisions made based on any information or conclusions in the report is the sole responsibility of such third party. Wood accepts no responsibility whatsoever for damages or loss of any nature or kind suffered by any such third party as a result of actions taken or not taken or decisions made in reliance on the report or anything set out therein.
9. This report is not to be given over to any third party for any purpose whatsoever without the written permission of Wood.
10. Provided that the report is still reliable, and less than 12 months old, Wood will issue a third-party reliance letter to parties that the client identifies in writing, upon payment of the then current fee for such letters. All third parties relying on Wood's report, by such reliance agree to be bound by our proposal and Wood's standard reliance letter. Wood's standard reliance letter indicates that in no event shall Wood be liable for any damages, howsoever arising, relating to third-party reliance on Wood's report. No reliance by any party is permitted without such agreement.

FIGURES



P:\consulting\projects\19\19-517-00054.N11 (1A) 1,2&4 - Mariano Lake\CAD-GIS\19-517-00054 -Site Location Map_Fig 1.dwg

CLIENT:
Wilson & Company, Inc.

LEGEND

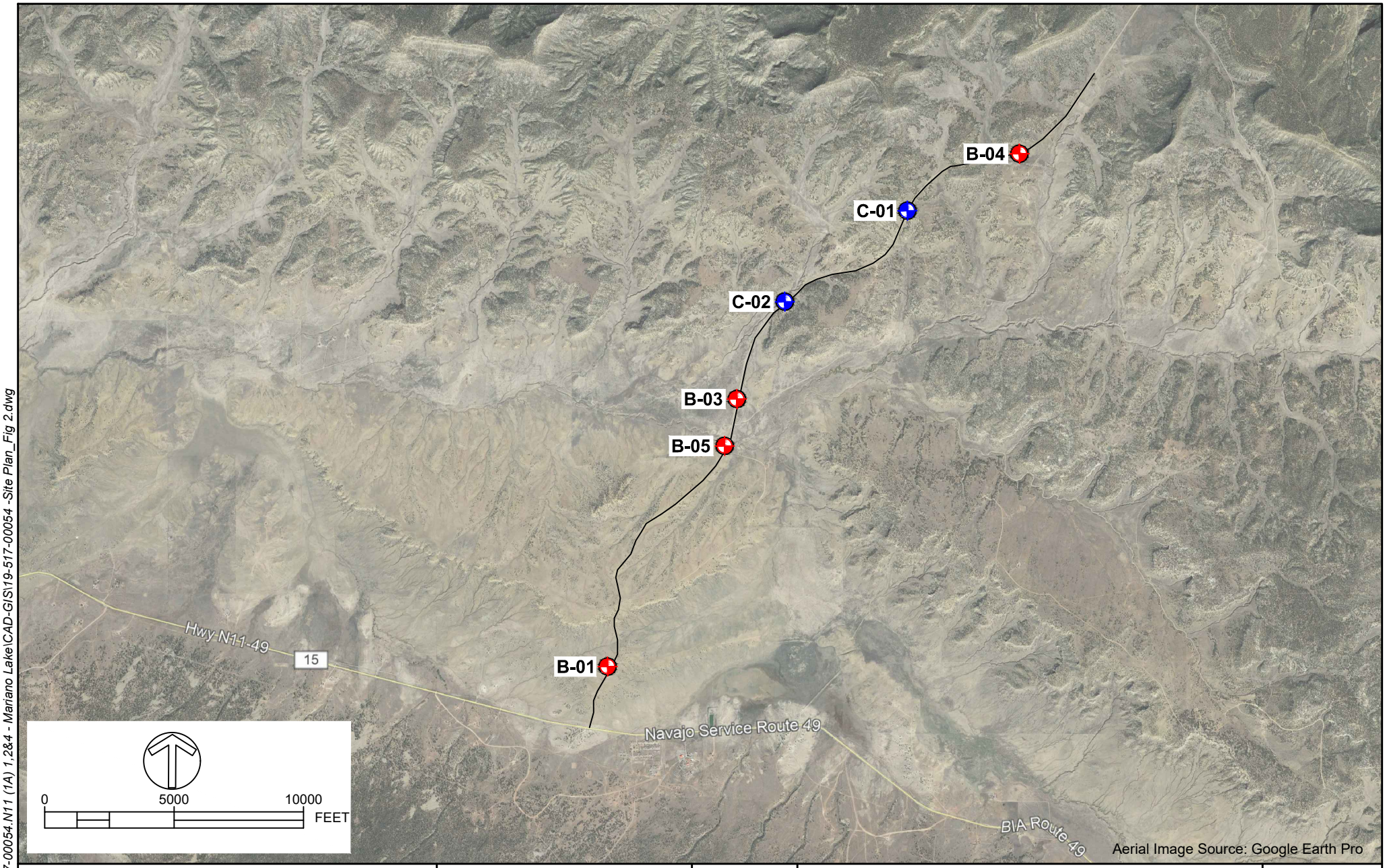
DWN BY: JT
CHK'D BY: DG
DATUM: N/A
PROJECTION: N/A
SCALE: AS SHOWN

PROJECT:
GEOTECHNICAL INVESTIGATION
N11 ROADWAY ALIGNMENT
Crownpoint, New Mexico

TITLE:
SITE LOCATION MAP

REV. NO.:
DATE: 10/01/19
PROJECT NO: 1951700054
TASK ORDER NO:
SUB-CONTRACT NO:
FIGURE NO: 1

wood.
Environment and Infrastructure, Inc.
8519 Jefferson, N.E.
Albuquerque, NM 87113



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CLIENT:
Wilson & Company, Inc.

wood.
Environment and Infrastructure, Inc.
8519 Jefferson, N.E.
Albuquerque, NM 87113

LEGEND
B-04 BORING LOCATION
C-02 ADDITIONAL BORING

DWN BY:	JT
CHK'D BY:	DG
DATUM:	N/A
PROJECTION:	N/A
SCALE:	AS SHOWN

PROJECT:
GEOTECHNICAL INVESTIGATION
N11 ROADWAY ALIGNMENT
Crownpoint, New Mexico

TITLE:
SITE AND EXPLORATION PLAN

REV. NO.:	
DATE:	10/01/19
PROJECT NO:	1951700054
TASK ORDER NO:	
SUB-CONTRACT NO:	
FIGURE NO:	2

Appendix A

Field Exploration Procedures and Logs

APPENDIX A

FIELD EXPLORATION PROCEDURES AND LOGS

The following paragraphs describe our procedures associated with the field explorations and field tests Wood E&I, conducted for this project. Descriptive logs of our explorations are enclosed in this appendix.

Auger Boring Procedures

Our exploratory borings were advanced with a solid-stem auger, using a trailer-mounted drill rig operated by Wood E&I personnel. A Wood E&I engineer continuously observed the borings, logged the subsurface conditions, and collected representative soil samples. All samples were stored in watertight containers and later transported to our laboratory for further visual examination and testing. After each boring was completed, the borehole was backfilled with a mixture of bentonite chips and soil cuttings, and the surface was patched with asphalt or concrete (where appropriate).

The enclosed Boring Logs describe the vertical sequence of soils and materials encountered in each boring, based primarily on our field classifications and supported by our subsequent laboratory examination and testing. Where a soil contact was observed to be gradational, our logs indicate the average contact depth. Where a soil type changed between sample intervals, we inferred the contact depth. Our logs also graphically indicate the blow count, sample type, sample number, and approximate depth of each soil sample obtained from the borings, as well as any laboratory tests performed on these soil samples. If any groundwater was encountered in a borehole, the approximate groundwater depth is depicted on the boring log. Groundwater depth estimates are typically based on the moisture content of soil samples, the wetted height on the drilling rods, and the water level measured in the borehole after the auger has been extracted.

Boring Log

wood.	Project: N11 (1a) - Mariano Lake - 19-517-00054	Page 1 of 1	Boring No.: **B-01**
	Location: Crownpoint, NM		
Date Started: 8/19/2019	Driller / Company: EDI	Backfill: Soil Cuttings	
Date Completed: 8/19/2019	Drilling Method: HSA	Total Depth: 5.0 ft	
Northing 1,669,807	Drill Rig Type: CME 55	Casing Type: NA	Depth: 5.0 ft
Easting 2,575,495	Field Observation / Logging: J. Hays		
Surface Elevation: 7289 ft	Checked By: D. Garcia Date: 10/1/19	Depth to Groundwater: N/A	

Depth (ft)	Legend	Material Description	Elevation (ft)	Field: Sample ID	Field: Blow Count 6"-12"-18" (N)	Field: Sample	Field: Sample Type	Field: Recovery (%)	Lab: LL (%)	Lab: PI (%)	Lab: Moisture (%)	Lab: % Passing 1"	Lab: % Passing #4	Lab: % Passing #10	Lab: % Passing #40	Lab: % Passing #100	Lab: % Passing #200
1		**CLAY (CL)**, some sand, medium plasticity, tannish-light brown		B-01: 0' to 5'			AUGER		45	21	14.3	100	99	98	96	93	87
2																	
3																	
4																	
5			7284.0														
		Stopped auger @ 5 feet															

AMEC BORING LOG 1951700054.GPJ RANT 2017.GDT 11/8/19

ATD- At Time of Drilling

Boring Log

wood.	Project: N11 (1a) - Mariano Lake - 19-517-00054	Page 1 of 1	Boring No.: **B-03**
	Location: Crownpoint, NM		
Date Started: 8/19/2019	Driller / Company: EDI	Backfill: Soil Cuttings	
Date Completed: 8/19/2019	Drilling Method: HSA	Total Depth: 5.0 ft	
Northing 1,679,931	Drill Rig Type: CME 55	Casing Type: NA	Depth: 5.0 ft
Easting 2,580,358	Field Observation / Logging: J. Hays		
Surface Elevation: 7124 ft	Checked By: D. Garcia Date: 10/1/19	Depth to Groundwater: N/A	

Depth (ft)	Legend	Material Description	Elevation (ft)	Field: Sample ID	Field: Blow Count 6"-12"-18" (N)	Field: Sample	Field: Sample Type	Field: Recovery (%)	Lab: LL (%)	Lab: PI (%)	Lab: Moisture (%)	Lab: % Passing 1"	Lab: % Passing #4	Lab: % Passing #10	Lab: % Passing #40	Lab: % Passing #100	Lab: % Passing #200
1		**SANDY CLAY (CL)**, medium plasticity, light brown		B-03: 0' to 5'			AUGER		25	9	5.9	100	100	100	98	82	50
2																	
3																	
4																	
5			7119.0														
		Stopped auger @ 5 feet															

AMEC BORING LOG 1951700054.GPJ RANT 2017.GDT 11/8/19

ATD- At Time of Drilling

Boring Log

wood.	Project: N11 (1a) - Mariano Lake - 19-517-00054	Page 1 of 1	Boring No.: **B-04**
	Location: Crownpoint, NM		
Date Started: 8/19/2019	Driller / Company: EDI	Backfill: Soil Cuttings	
Date Completed: 8/19/2019	Drilling Method: HSA	Total Depth: 5.0 ft	
Northing 1,689,448	Drill Rig Type: CME 55	Casing Type: NA	Depth: 5.0 ft
Easting 2,591,355	Field Observation / Logging: J. Hays		
Surface Elevation: 7353 ft	Checked By: D. Garcia Date: 10/1/19	Depth to Groundwater: N/A	

Depth (ft)	Legend	Material Description	Elevation (ft)	Field: Sample ID	Field: Blow Count 6"-12"-18" (N)	Field: Sample	Field: Sample Type	Field: Recovery (%)	Lab: LL (%)	Lab: PI (%)	Lab: Moisture (%)	Lab: % Passing 1"	Lab: % Passing #4	Lab: % Passing #10	Lab: % Passing #40	Lab: % Passing #100	Lab: % Passing #200
1		**SANDY CLAY (CL)**, medium plasticity, dark brown		B-04: 0' to 5'			AUGER		28	12	10.1	100	100	99	98	87	53
2																	
3																	
4																	
5			7348.0														
		Stopped auger @ 5 feet															

AMEC BORING LOG 1951700054.GPJ RANT 2017.GDT 11/8/19

ATD- At Time of Drilling

Boring Log

wood.

Project:	N11 (1a) - Mariano Lake - 19-517-00054	Page 1 of 1	Boring No.: **B-05**
Location:	Crownpoint, NM		
Date Started: 8/19/2019	Driller / Company: EDI	Backfill: Soil Cuttings	
Date Completed: 8/19/2019	Drilling Method: HSA	Total Depth: 21.5 ft	
Northing 1,678,241	Drill Rig Type: CME 55	Casing Type: NA	Depth: 21.5 ft
Easting 2,579,952	Field Observation / Logging: J. Hays		
Surface Elevation: 7110 ft	Checked By: D. Garcia Date: 10/1/19	Depth to Groundwater: N/A	

Depth (ft)	Legend	Material Description	Elevation (ft)	Field: Sample ID	Field: Blow Count 6"-12"-18" (N)	Field: Sample	Field: Sample Type	Field: Recovery (%)	Lab: LL (%)	Lab: PI (%)	Lab: Moisture (%)	Lab: % Passing 1"	Lab: % Passing #4	Lab: % Passing #10	Lab: % Passing #40	Lab: % Passing #100	Lab: % Passing #200
1		**CLAY (CL)**, some sand, medium plasticity, light brown		B-05: 0' to 5'	5-5-5	X	SS		37	18	9	100	99	98	97	94	84
2																	
3																	
4																	
5			7105.0														
6				B-05: 5' to 6.5'	11-13-16	X	SS				12.7						
7																	
8																	
9																	
10			7100.0														
11				B-05: 10' to 11.5'	15-25-30	X	SS				11						
12																	
13																	
14																	
15			7095.0														
16				B-05: 15' to 16.5'	5-5-16	X	SS				8.6						
17																	
18																	
19																	
20																	
21				B-05: 20' to 21.5'	8-16-20	X	SS				18.4						
			7088.5														
		Stopped auger @ 20 feet Stopped sampler @ 21.5 feet															

AMEC BORING LOG 1951700054.GPJ RANT 2017.GDT 11/8/19

ATD- At Time of Drilling

Boring Log

wood.	Project: N11 (1a) - Mariano Lake - 19-517-00054	Page 1 of 1	Boring No.: **C-01**
	Location: Crownpoint, NM		
Date Started: 8/19/2019	Driller / Company: EDI	Backfill: Soil Cuttings	
Date Completed: 8/19/2019	Drilling Method: HSA	Total Depth: 5.0 ft	
Northing 1,687,247	Drill Rig Type: CME 55	Casing Type: NA	Depth: 5.0 ft
Easting 2,586,994	Field Observation / Logging: J. Hays		
Surface Elevation: 7416 ft	Checked By: D. Garcia Date: 10/1/19	Depth to Groundwater: N/A	

Depth (ft)	Legend	Material Description	Elevation (ft)	Field: Sample ID	Field: Blow Count 6"-12"-18" (N)	Field: Sample	Field: Sample Type	Field: Recovery (%)	Lab: LL (%)	Lab: PI (%)	Lab: Moisture (%)	Lab: % Passing 1"	Lab: % Passing #4	Lab: % Passing #10	Lab: % Passing #40	Lab: % Passing #100	Lab: % Passing #200
1		**CLAY (CL)**, some sand, medium plasticity, tannish-light brown		C-01: 0' to 5'			AUGER		37	19	10.9	100	99	97	96	95	87
2																	
3																	
4																	
5			7411.0														
		Stopped auger @ 5 feet															

AMEC BORING LOG 1951700054.GPJ RANT 2017.GDT 11/8/19

ATD- At Time of Drilling

Boring Log

wood.	Project: N11 (1a) - Mariano Lake - 19-517-00054	Page 1 of 1	Boring No.: **C-02**
	Location: Crownpoint, NM		
Date Started: 8/19/2019	Driller / Company: EDI	Backfill: Soil Cuttings	
Date Completed: 8/19/2019	Drilling Method: HSA	Total Depth: 5.0 ft	
Northing 1,683,914	Drill Rig Type: CME 55	Casing Type: NA	Depth: 5.0 ft
Easting 2,581,992	Field Observation / Logging: J. Hays		
Surface Elevation: 7208 ft	Checked By: D. Garcia Date: 10/1/19	Depth to Groundwater: N/A	

Depth (ft)	Legend	Material Description	Elevation (ft)	Field: Sample ID	Field: Blow Count 6"-12"-18" (N)	Field: Sample	Field: Sample Type	Field: Recovery (%)	Lab: LL (%)	Lab: PI (%)	Lab: Moisture (%)	Lab: % Passing 1"	Lab: % Passing #4	Lab: % Passing #10	Lab: % Passing #40	Lab: % Passing #100	Lab: % Passing #200
1		**SANDY CLAY (CL)**, medium plasticity, dark brown															
2																	
3				C-02: 0' to 5'			AUGER		28	12	8.7	100	94	91	89	80	56
4																	
5			7203.0														
		Stopped auger @ 5 feet															

AMEC BORING LOG 1951700054.GPJ RANT 2017.GDT 11/8/19

ATD- At Time of Drilling

Appendix B

Laboratory Testing Procedures and Results

APPENDIX B

LABORATORY TESTING PROCEDURES AND RESULTS

The following paragraphs describe our procedures associated with the laboratory tests Wood E&I conducted for this project. Graphical results of certain laboratory tests are enclosed in this appendix.

Visual Classification Procedures

Visual soil classifications were conducted on all samples in the field and on selected samples in our laboratory. All soils were classified in general accordance with the United Soil Classification System, which includes color, relative moisture content, primary soil type (based on grain size), and any accessory soil types. The resulting soil classifications are presented on the exploration logs contained in Appendix A.

Moisture Content Determination Procedures

Moisture content determinations were performed on representative samples to aid in identification and correlation of soil types. All determinations were made in general accordance with ASTM D-2216. The results of these tests are shown on the exploration logs contained in Appendix A.

Grain-size Analysis Procedures

A grain-size analysis indicates the range of soil particle diameters included in a particular sample. Grain-size analyses were performed on representative samples in general accordance with ASTM D-422. The results of these tests are presented on the enclosed grain-size distribution graphs and were used in soil classifications shown on the exploration logs contained in Appendix A.

Client: Wilson & Company
PO Box 94000
Albuquerque, NM 87199-4000

Attention: Mr. Derek Meier

Project Name: Mariano Lake Design

Mariana Lake, NM

Project Manager: Jacob Hays

Report Date: August 27, 2019

Project #: 19-517-00054
Work Order #: 1
Sampled By: Jacob Hays
Date Sampled: 8/19/2019

Sieve Analysis (AASHTO T11-05/T27-11)
Plasticity Index (AASHTO T89-10/T90-00)
Soil Classification (AASHTO M145-91)

SOILS / AGGREGATES

Lab Number	Sample Location	Soil Class.	L.L.	P.I.	D10	D20	D30	D50	D60	D70	CC	CU	Cmu
19-0427-01	B-01 (0'-5')	A-7-6	45	21	0	0	0	0	0	0	0	0	0
19-0427-02	B-03 (0'-5')	A-4	25	9	0	0	0	0	0.091	0.114	0	0	0
19-0427-03	B-04 (0'-5')	A-6	28	12	0	0	0	0	0.085	0.104	0	0	0
19-0427-04	C-01 (0'-5')	A-6	37	19	0	0	0	0	0	0	0	0	0
19-0427-05	C-02 (0'-5')	A-6	28	12	0	0	0	0	0.082	0.111	0	0	0
19-0427-06	B-05 (0'-5')	A-6	37	18	0	0	0	0	0	0	0	0	0

Distribution: **Client:** ☑ **File:** ☑ **Supplier:** ☑ **Email:** ☐ **Other:** Addressee (2)

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Attention: Mr. Derek Meier

Project Name: Mariano Lake Design

Mariana Lake, NM

Project Manager: Jacob Hays

Report Date: August 27, 2019

Project #: 19-517-00054
Work Order #: 1
Sampled By: Jacob Hays
Date Sampled: 8/19/2019

Sieve Analysis (AASHTO T11-05/T27-11)
Plasticity Index (AASHTO T89-10/T90-00)
Soil Classification (AASHTO M145-91)

SOILS / AGGREGATES

				Sieve Sizes																			Sieve Result are as Percent Passing.
Sample Location	**Soil Class.**	**L.L.**	**P.I.**	**#200**	**#100**	**#50**	**#40**	**#30**	**#16**	**#10**	**#8**	**#4**	**1/4"**	**3/8"**	**1/2"**	**3/4'**	**1"**	**1 1/4"**	**1 1/2"**	**2"**	**2 1/2"**	**3"**	**6"**	**12"**	**Lab Number**
B-01 (0'-5')	A-7-6	45	21	87	93	95	96	96	97	98	98	99		100											19-0427-01
B-03 (0'-5')	A-4	25	9	50	82	97	98	99	99	100															19-0427-02
B-04 (0'-5')	A-6	28	12	53	87	97	98	98	99	99	100														19-0427-03
C-01 (0'-5')	A-6	37	19	87	95	96	96	96	97	97	98	99		100											19-0427-04
C-02 (0'-5')	A-6	28	12	56	80	88	89	89	90	91	92	94		97	98	99	100								19-0427-05
B-05 (0'-5')	A-6	37	18	84	94	97	97	97	98	98	98	99		99	99	100									19-0427-06

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wood.

Client: Wilson & Company
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Albuquerque, NM 87199-4000

Attn: Mr. Derek Meier

Project Name: Mariano Lake Design

Mariana Lake, NM

Project Manager: Jacob Hays

Report Date: August 27, 2019

Project #: 19-517-00054
Report #: 2274
Work Order #: 1
Sampled By: Jacob Hays
Date Sampled: 8/19/2019

SOILS / AGGREGATES

MOISTURE CONTENT OF SOIL (ASTM D2216-10) AND IN-SITU DENSITY

Lab #	Color & Type of Material	Sample Source	Test Method	Oven Temp. (C)	Mass less than Min Req.	Material Type *	Moisture (%)	Dry Density (pcf)
19-0427-01	Tannish Lt. Brown Lean Clay	B-01 (0'-5')	B	110	☐	☐	14.3	
19-0427-02	Tannish Lt. Brown Sandy Lean Clay	B-03 (0'-5')	B	110	☐	☐	5.9	
19-0427-03	Dark Brown Sandy Lean Clay	B-04 (0'-5')	B	110	☐	☐	10.1	
19-0427-04	Tannish Lt. Brown Lean Clay	C-01 (0'-5')	B	110	☐	☐	10.9	
19-0427-05	Dark Brown Sandy Lean Clay	C-02 (0'-5')	B	110	☐	☐	8.7	
19-0427-06	Tannish Lt. Brown Lean Clay	B-05 (0'-5')	B	110	☐	☐	9.0	
19-0427-07	Tannish Lt. Brown Lean Clay/Sandy Lean Clay	B-05 (5-6.5')	B	110	☐	☐	12.7	
19-0427-08	Tannish Lt. Brown Lean Clay/Sandy Lean Clay	B-05 (10-11.5')	B	110	☐	☐	11.0	
19-0427-09	Tannish Lt. Brown Lean Clay/Sandy Lean Clay	B-05 (15-16.5')	B	110	☐	☐	8.6	
19-0427-10	Tannish Lt. Brown Lean Clay/Sandy Lean Clay	B-05 (20-21.5')	B	110	☐	☐	18.4	

Distribution: **Client:** ☑ **File:** ☑ **Supplier:** ☑ **Email:** ☐ **Other:** Addressee (2)

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MOTZZ LABORATORY, INC.

Wood
Jesse Boam
8519 Jefferson NE
Albuquerque, NM 87114

Project: 19-517-00054
Date Received: 8/29/2019
Date Reported: 9/3/2019

PO Number: 19-0427

Lab Number: 929916-1 19-0427-01 B-01 (0-5')

AASHTO Methods	Method	Result	Units	Levels
Sulfate, SO4	AASHTO T290	5085	ppm	

Lab Number: 929916-2 19-0427-02 B-03 (0-5')

AASHTO Methods	Method	Result	Units	Levels
Sulfate, SO4	AASHTO T290	98	ppm	

Lab Number: 929916-3 19-0427-03 B-04 (0-5')

AASHTO Methods	Method	Result	Units	Levels
Sulfate, SO4	AASHTO T290	193	ppm	

Lab Number: 929916-4 19-0427-04 C-01 (0-5')

AASHTO Methods	Method	Result	Units	Levels
Sulfate, SO4	AASHTO T290	1788	ppm	

Lab Number: 929916-5 19-0427-07 B-05 (5-6.5')

AASHTO Methods	Method	Result	Units	Levels
pH	AASHTO T289	7.7	SU	
Chloride, Cl	AASHTO T291	94	ppm	

Lab Number: 929916-6 19-0427-08 B-05 (10-11.5')

AASHTO Methods	Method	Result	Units	Levels
pH	AASHTO T289	7.6	SU	
Chloride, Cl	AASHTO T291	62	ppm	

MOTZZ LABORATORY, INC.

Wood
Jesse Boam
8519 Jefferson NE
Albuquerque, NM 87114

Project: 19-517-00054
Date Received: 8/29/2019
Date Reported: 9/3/2019
PO Number: 19-0427

Lab Number: 929916-7 19-0427-09 B-05 (15-16.5')

AASHTO Methods	Method	Result	Units	Levels
pH	AASHTO T289	7.6	SU	
Chloride, Cl	AASHTO T291	24	ppm	

Lab Number: 929916-8 19-0427-10 B-05 (20-21.5')

AASHTO Methods	Method	Result	Units	Levels
pH	AASHTO T289	7.3	SU	
Sulfate, SO4	AASHTO T290	806	ppm	
Chloride, Cl	AASHTO T291	8	ppm	

Client:	Wilson & Company PO Box 94000 Albuquerque, NM 87199-4000	**Report Date:**	August 27, 2019
		Project #:	19-517-00054
		Work Order #:	1
Attn:	Mr. Derek Meier	**Lab #:**	19-0427-06
Project Name:	Mariano Lake Design	**Sampled By:**	Jacob Hays
		Date Sampled:	8/19/2019
	Mariana Lake, NM	**Visual Description of Material:**	Tannish Lt. Brown Lean Clay
		Sample Source:	B-05 (0'-5')
Project Manager:	Jacob Hays	**SOILS / AGGREGATES**	

Field Measurment of Soil Resistivity Using the Wenner Four-Electrode Method (ASTM G57-06)

Soil Resistivity: 550 Ωcm

Distribution: **Client:** ☑ **File:** ☑ **Supplier:** ☑ **Email:** ☐ **Other:** Addressee (2)

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Client: Wilson & Company
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Albuquerque, NM 87199-4000

Attn: Mr. Derek Meier

Project Name: Mariano Lake Design

Project Manager: Jacob Hays

Report Date: September 25, 2019

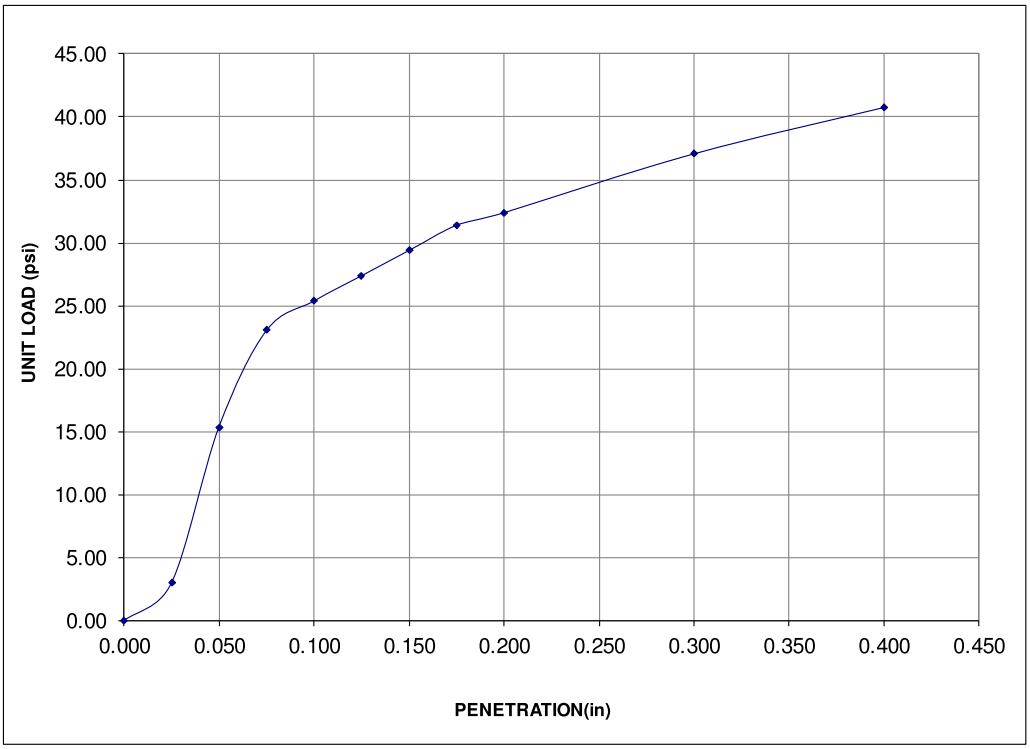
Project #: 19-517-00054
Work Order #: 2
Lab #: 19-0459-01
Sampled By: Jacob Hays
Date Sampled: 8/19/2019
Color & Type of Material: Dark Brown Sandy Lean Clay

Sample Source: B-04 and C-02

SOILS / AGGREGATES

California Bearing Ratio of Laboratory Compacted Soils (AASHTO T193-10)

% Material Retained on the 3/4" Sieve:	0	**Moisture Density Relationship:**		**Percent Moisture:**		**Penetration**	**CBR**
Blows per Lift:	3 Lifts @ 10 Blows/Lift	**AASHTO T99 Method:**	D	**Before Compaction:**	13.5	**0.1**	2.7
Percent Swell:	1.3	**Maximum Density:**	112.0	**After Compaction:**	13.8	**0.2**	2.2
Condition of Sample:	Soaked	**Optimum Moisture:**	13.0	**Top 1in. :**	22.5		
Surcharge Amount (g):	4536.0			**Average After Soak:**	22.5		
Dry Density Before Soak (pcf):	101.5	**% Relative Compaction Before Soak:**		90.6			
Dry Density After Soak (pcf):	99.3	**% Relative Compaction After Soak:**		88.6			



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Attn: Mr. Derek Meier

Project Name: Mariano Lake Design

Project Manager: Jacob Hays

Report Date: September 25, 2019

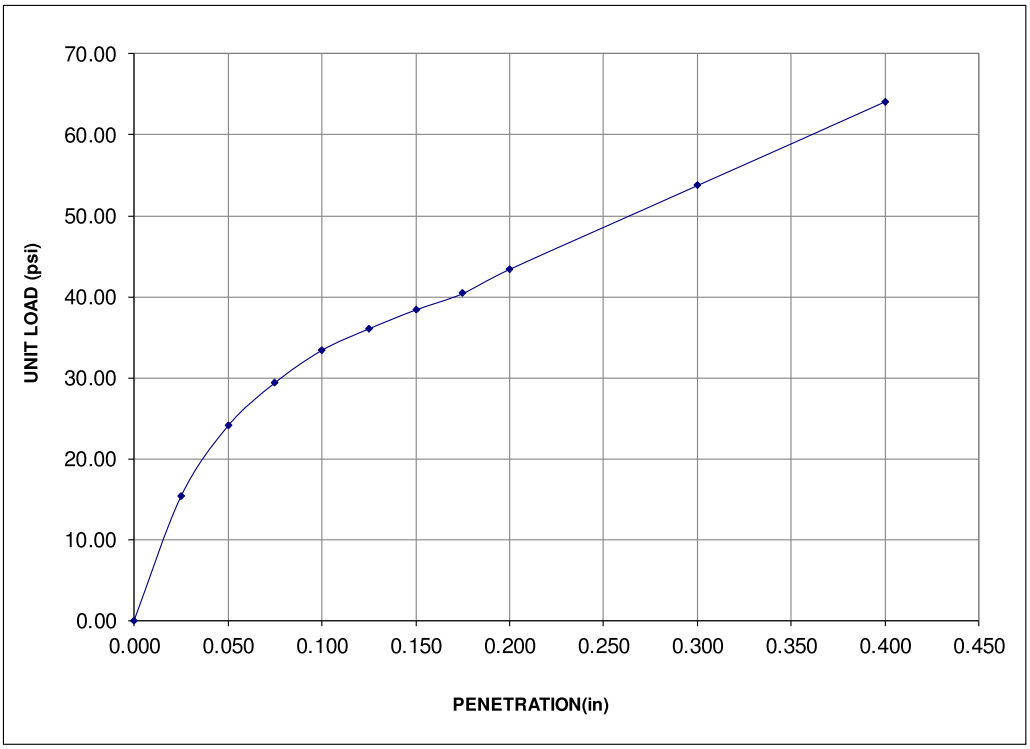
Project #: 19-517-00054
Work Order #: 2
Lab #: 19-0459-01
Sampled By: Jacob Hays
Date Sampled: 8/19/2019
Color & Type of Material: Dark Brown Sandy Lean Clay

Sample Source: B-04 and C-02

SOILS / AGGREGATES

California Bearing Ratio of Laboratory Compacted Soils (AASHTO T193-10)

% Material Retained on the 3/4" Sieve:	0	**Moisture Density Relationship:**		**Percent Moisture:**		**Penetration**	**CBR**
Blows per Lift:	5 Lifts @ 25 Blows/Lift	**AASHTO T99 Method:**	D	**Before Compaction:**	13.7	**0.1**	3.3
Percent Swell:	1.3	**Maximum Density:**	112.0	**After Compaction:**	13.7	**0.2**	2.9
Condition of Sample:	Soaked	**Optimum Moisture:**	13.0	**Top 1in. :**	20.8		
Surcharge Amount (g):	4536.0			**Average After Soak:**	20.8		
Dry Density Before Soak (pcf):	107.7	**% Relative Compaction Before Soak:**		96.2			
Dry Density After Soak (pcf):	103.8	**% Relative Compaction After Soak:**		92.6			



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Attn: Mr. Derek Meier

Project Name: Mariano Lake Design

Project Manager: Jacob Hays

Report Date: September 25, 2019

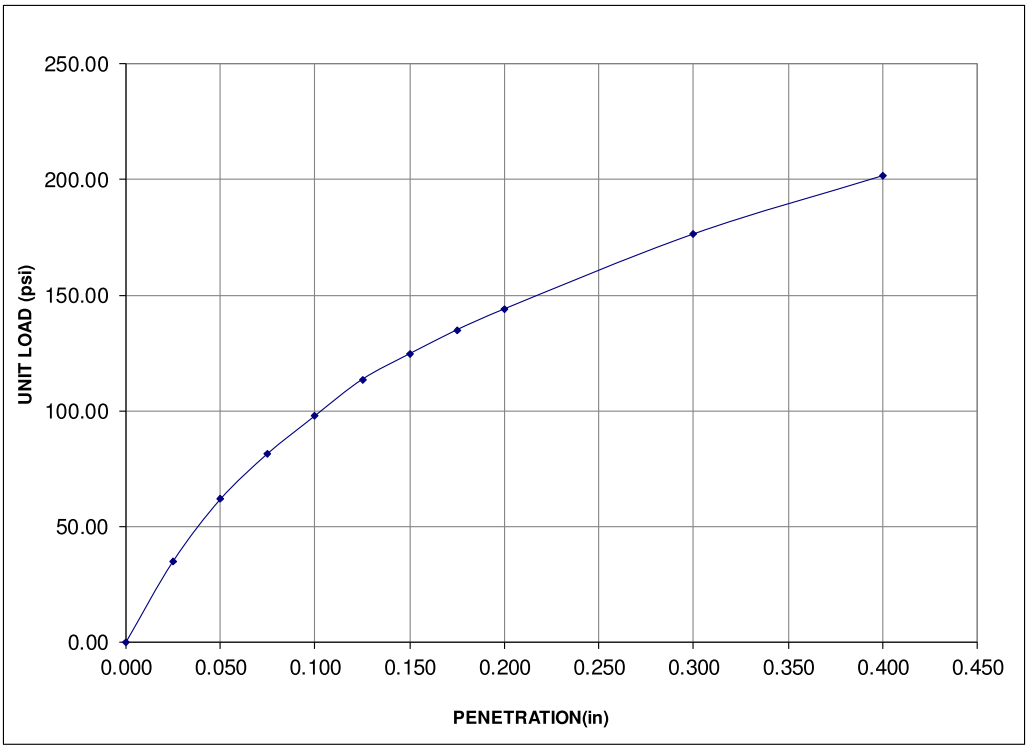
Project #: 19-517-00054
Work Order #: 2
Lab #: 19-0459-01
Sampled By: Jacob Hays
Date Sampled: 8/19/2019
Color & Type of Material: Dark Brown Sandy Lean Clay

Sample Source: B-04 and C-02

SOILS / AGGREGATES

California Bearing Ratio of Laboratory Compacted Soils (AASHTO T193-10)

% Material Retained on the 3/4" Sieve:	0	**Moisture Density Relationship:**		**Percent Moisture:**		**Penetration**	**CBR**
Blows per Lift:	5 Lifts @ 56 Blows/Lift	**AASHTO T99 Method:**	D	**Before Compaction:**	13.0	**0.1**	9.8
Percent Swell:	0.6	**Maximum Density:**	112.0	**After Compaction:**	13.8	**0.2**	9.6
Condition of Sample:	Soaked	**Optimum Moisture:**	13.0	**Top 1in. :**	16.8		
Surcharge Amount (g):	4536.0			**Average After Soak:**	16.8		
Dry Density Before Soak (pcf):	114.2	**% Relative Compaction Before Soak:**		102.0			
Dry Density After Soak (pcf):	112.2	**% Relative Compaction After Soak:**		100.2			



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Attn: Mr. Derek Meier

Project Name: Mariano Lake Design

Project Manager: Jacob Hays

Report Date: September 25, 2019

Project #: 19-517-00054
Work Order #: 2
Lab #: 19-0459-01
Sampled By: Jacob Hays
Date Sampled: 8/19/2019
Color & Type of Material: Dark Brown Sandy Lean Clay

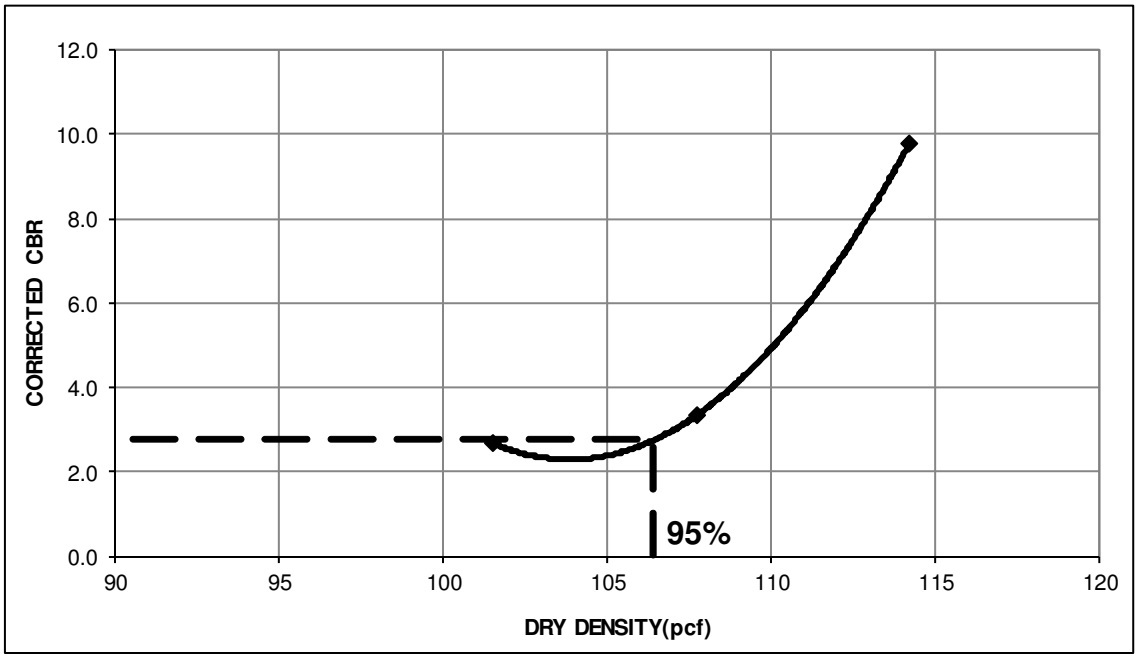
Sample Source: B-04 and C-02

SOILS / AGGREGATES

California Bearing Ratio of Laboratory Compacted Soils (AASHTO T193-10)

Moisture Density Relationship:
AASHTO T99 Method: D
Maximum Density: 112.0
Optimum Moisture: 13.0
% Compaction: 95

Density at 95% of Maximum Density: 106.4
Corrected CBR at 0.1 Penetration: 2.8



Reviewed By:_____
Jan

Distribution: **Client** ☑ **File:** ☑ **Supplier:** ☑ **Email:** ☐ **Other:** Addressee (2)

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Attn: Mr. Derek Meier

Project Name: Mariano Lake Design

Project Manager: Jacob Hays

Report Date: September 25, 2019

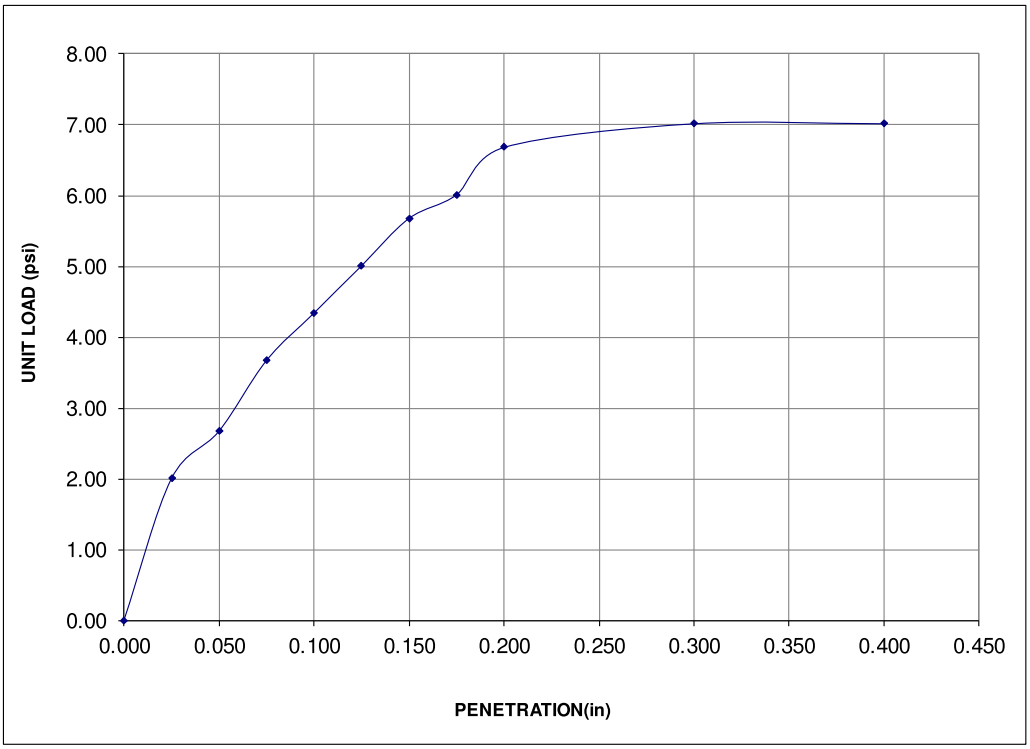
Project #: 19-517-00054
Work Order #: 2
Lab #: 19-0459-02
Sampled By: Jacob Hays
Date Sampled: 8/19/2019
Color & Type of Material: Tannish Lt. Brown Sandy Lean Clay

Sample Source: B-03

SOILS / AGGREGATES

California Bearing Ratio of Laboratory Compacted Soils (AASHTO T193-10)

% Material Retained on the 3/4" Sieve:	0	**Moisture Density Relationship:**		**Percent Moisture:**		**Penetration**	**CBR**
Blows per Lift:	3 Lifts @ 10 Blows/Lift	**AASHTO T99 Method:**	D	**Before Compaction:**	13.2	**0.1**	0.4
Percent Swell:	0.6	**Maximum Density:**	114.0	**After Compaction:**	12.6	**0.2**	0.4
Condition of Sample:	Soaked	**Optimum Moisture:**	12.5	**Top 1in. :**	24.1		
Surcharge Amount (g):	4536.0			**Average After Soak:**	24.1		
Dry Density Before Soak (pcf):	90.5	**% Relative Compaction Before Soak:**		79.4			
Dry Density After Soak (pcf):	91.8	**% Relative Compaction After Soak:**		80.5			



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Attn: Mr. Derek Meier

Project Name: Mariano Lake Design

Project Manager: Jacob Hays

Report Date: September 25, 2019

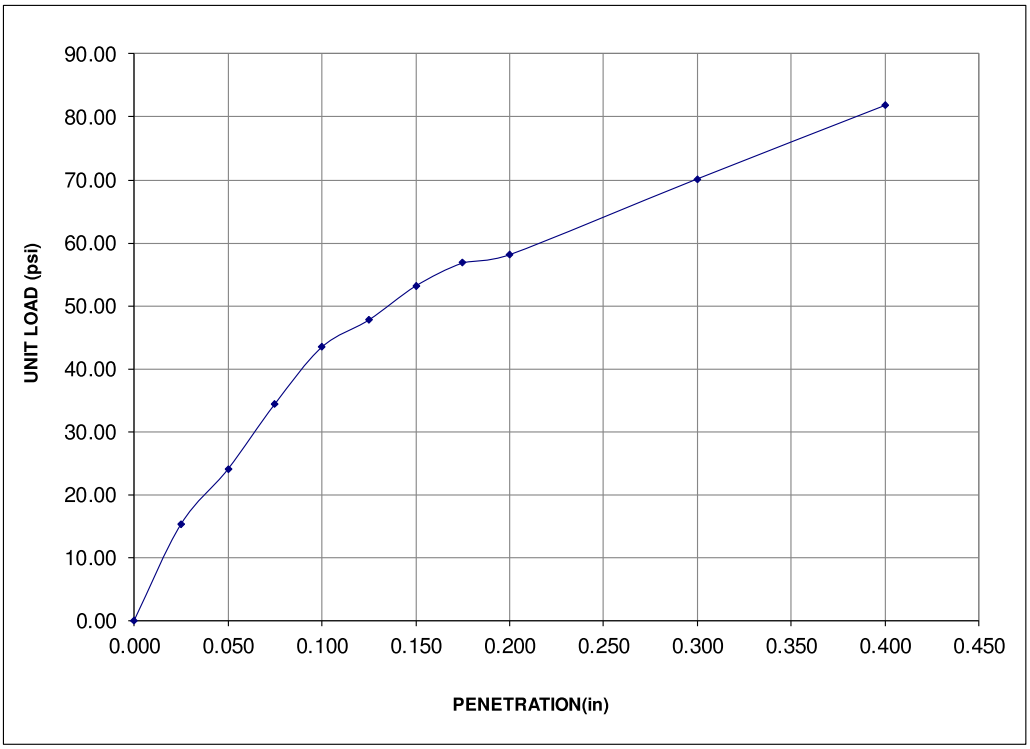
Project #: 19-517-00054
Work Order #: 2
Lab #: 19-0459-02
Sampled By: Jacob Hays
Date Sampled: 8/19/2019
Color & Type of Material: Tannish Lt. Brown Sandy Lean Clay

Sample Source: B-03

SOILS / AGGREGATES

California Bearing Ratio of Laboratory Compacted Soils (AASHTO T193-10)

% Material Retained on the 3/4" Sieve:	0	**Moisture Density Relationship:**		**Percent Moisture:**		**Penetration**	**CBR**
Blows per Lift:	5 Lifts @ 25 Blows/Lift	**AASHTO T99 Method:**	D	**Before Compaction:**	13.2	**0.1**	4.3
Percent Swell:	0.6	**Maximum Density:**	114.0	**After Compaction:**	12.2	**0.2**	3.9
Condition of Sample:	Soaked	**Optimum Moisture:**	12.5	**Top 1in. :**	20.4		
Surcharge Amount (g):	4536.0			**Average After Soak:**	20.4		
Dry Density Before Soak (pcf):	108.5	**% Relative Compaction Before Soak:**		95.2			
Dry Density After Soak (pcf):	104.7	**% Relative Compaction After Soak:**		91.8			



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Client: Wilson & Company
PO Box 94000
Albuquerque, NM 87199-4000

Attn: Mr. Derek Meier

Project Name: Mariano Lake Design

Project Manager: Jacob Hays

Report Date: September 25, 2019

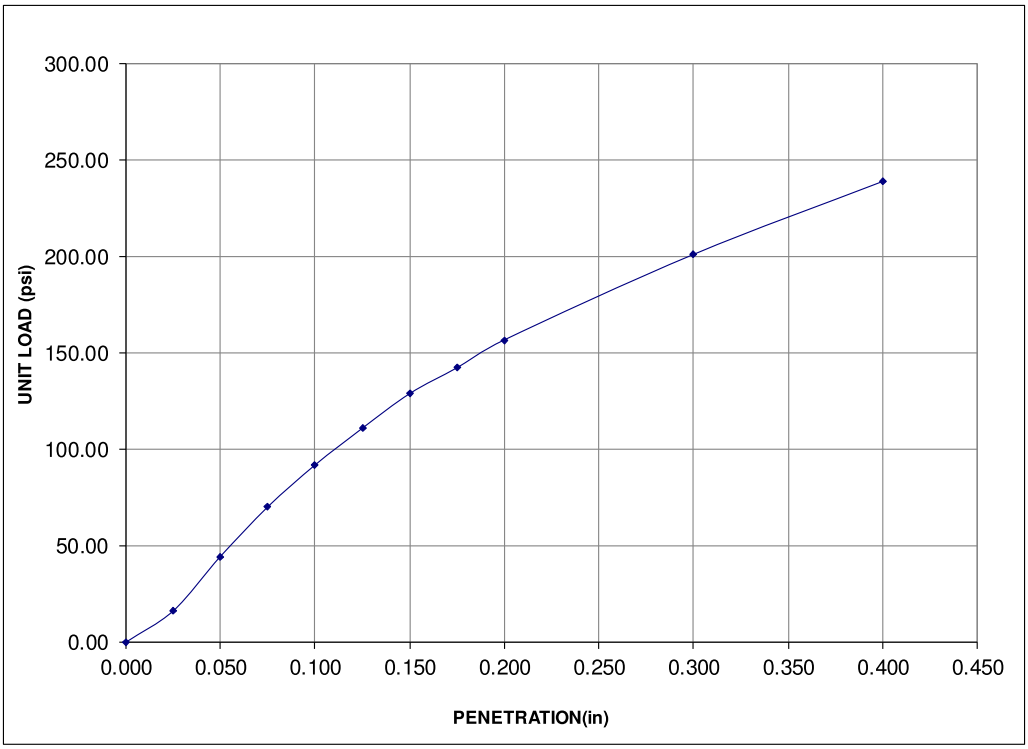
Project #: 19-517-00054
Work Order #: 2
Lab #: 19-0459-02
Sampled By: Jacob Hays
Date Sampled: 8/19/2019
Color & Type of Material: Tannish Lt. Brown Sandy Lean Clay

Sample Source: B-03

SOILS / AGGREGATES

California Bearing Ratio of Laboratory Compacted Soils (AASHTO T193-10)

% Material Retained on the 3/4" Sieve:	0	**Moisture Density Relationship:**		**Percent Moisture:**		**Penetration**	**CBR**
Blows per Lift:	5 Lifts @ 56 Blows/Lift	**AASHTO T99 Method:**	D	**Before Compaction:**	12.8	**0.1**	10.0
Percent Swell:	0.7	**Maximum Density:**	114.0	**After Compaction:**	12.7	**0.2**	11
Condition of Sample:	Soaked	**Optimum Moisture:**	12.5	**Top 1in. :**	16.4		
Surcharge Amount (g):	4536.0			**Average After Soak:**	16.4		
Dry Density Before Soak (pcf):	115.5	**% Relative Compaction Before Soak:**		101.3			
Dry Density After Soak (pcf):	112.7	**% Relative Compaction After Soak:**		98.9			



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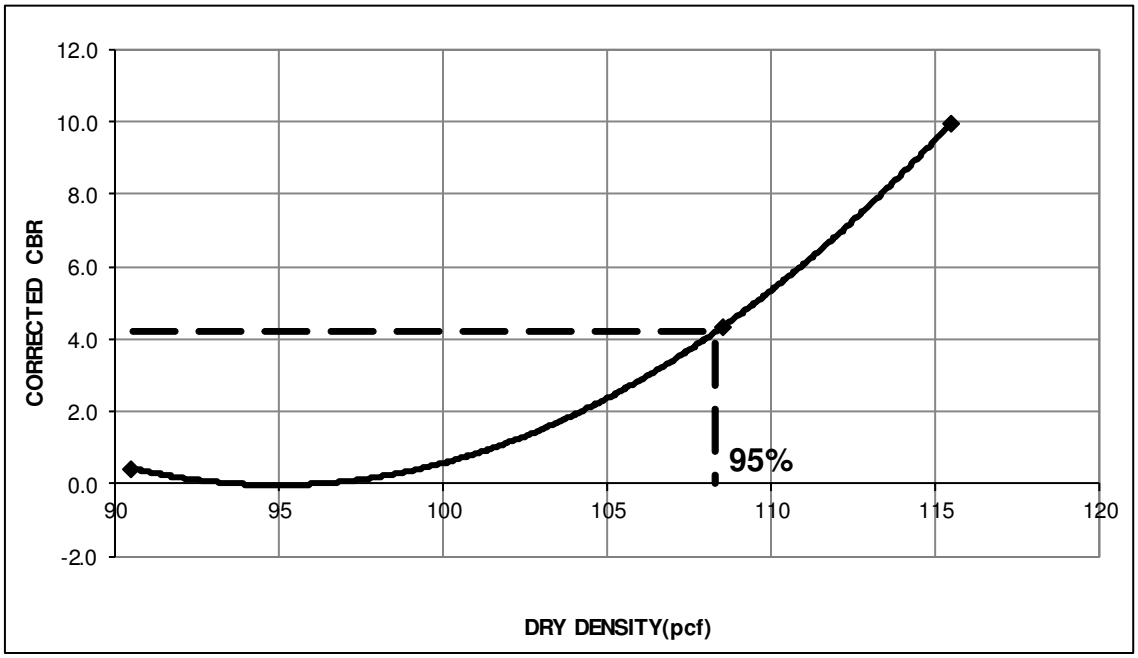
SOILS / AGGREGATES

California Bearing Ratio of Laboratory Compacted Soils (AASHTO T193-10)

Moisture Density Relationship:
AASHTO T99 Method: D
Maximum Density: 114.0
Optimum Moisture: 12.5
% Compaction: 95

Density at 95% of Maximum Density: 108.3
Corrected CBR at 0.1 Penetration: 4.2



Reviewed By:_____
Jan

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