

Michele Hanshaw Purchasing Specialist 200 SE 7th, Suite 201 Topeka, Kansas 66603 Ph. 785.251.4039 Email: Michele.hanshaw@snco.us

SHAWNEE COUNTY, KANSAS

Sherwood Regional Water District Asset Rehabilitation Project Pump Stations 16, 28, 53, 54, 57 & 61 Project No. S-401021.00

ADDENDUM NO. 2

September 27th, 2022

TO ALL BIDDERS:

Contractors submitting proposals for the above referenced project shall take note of the following changes, additions, deletions, clarifications, etc. to the Plans and Specifications which shall become a part of and have precedence over anything shown or described in the Contract Documents and shall be taken into consideration and be included with Contract Documents for the referenced project.

NOTE: Bidders must acknowledge receipt of Addenda on the first page of Document 330, BID FORM and sign below and attach this sheet to the bid submittal.

Company

BARTLETT & WEST, INC.

Andrew Wright, P.E.

Signature

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GENERAL CLARIFICATIONS

- A. The Prebid meeting minutes and sign in sheets are attached to this addendum.
- B. The deadline for submission of questions is September 30th at 5:00 P.M. An addendum will be released following this deadline including all questions and answers not previously included in an addendum.
- C. Updated Davis Bacon Wage Rates have been released since the advertisement of this project. The Wage rates currently included in the contract shall be replaced with the updated wage rates.
- D. No GFCI outlets shall be installed as part of the project.
- E. Any bypass pumping setups that cross a portion of the lake shall only be installed between November 30th and September 28th.

FRONT END DOCUMENTS

- A. Section 101 Modifications to Instructions to Bidders.
 - 1. Section 12 Paragraph 2.
 - a. Add the following entry to the list of required documents to be submitted with the bid:
 - c. KDHE SRF Forms and Certifications

KDHE SRF CONTRACT PROVISIONS

- A. Wage Rate Determination
 - 1. Replace "General Decision Number: KS20220031" dated 04/08/2022 with the updated "General Decision Number: KS20220031" dated 09/02/2022 attached to this addendum.

TECHNICAL SPECIFICATIONS

- A. Section 023033 Subsurface Investigation
 - 1. Part 1, Section 1.01, Subsection B 2: Replace GeoSource in the first sentence with Terracon
 - 2. Attach the Geotechnical Engineering Report attached to this addendum to the end of Section 023033.

PLANS

- A. Drawing E131 and E141
 - 1. In the abbreviations scheduled, change the entry for DR from "DUPLEX RECEPTACLE, GFI" to "DUPLEX RECEPTACLE"
- B. Drawing C140:
 - 1. Add the following general note to sheet C140:
 - a. BYPASS PIPING FOR BYPASS 1 SHALL ONLY BE INSTALLED FROM NOVEMBER 30TH THROUGH FEBRUARY 28TH.

ATTACHMENTS

Prebid Meeting Minutes

Prebid Meeting Sign in Sheet

Updated Davis Bacon Wage Rates

Geotechnical Engineering report.

PRE-BID MEETING AGENDA

S-401021.00 Sherwood Regional Water District Asset Rehabilitation Project Pump Stations 16, 28, 53, 54, 57 & 61 Shawnee County, Kansas

September 26, 2022

Minutes shown below in red italicized text.

1. **Owner:** Shawnee County, Kansas

Deputy	y Director of Public Works:	Jeff Hunt, PM	785) 251-6081
		,		/

2. Design: Bartlett & West, Inc. and Professional Engineering Consultants, PA

B&W Project Manager: Andy Wright	(785) 228-3135
B&W Project Engineer: Ethan Meyer	(785) 228-3103
PEC Project Manager: Alex Darby	(785) 233-8300 Ext. 3109
PEC Project Engineer: Sarah White	(785) 233-8300 Ext. 3121

3. Project Scope:

Project consists of the rehabilitation or replacement of six sanitary sewer pump stations surrounding Lake Sherwood, as well as the construction of new force mains and the rehabilitation of gravity sewers using CIPP methods.

4. Contract Time and Liquidated Damages:

Overall Project:

	Substantial Completion:	450 Days
	Final Completion:	30 Days
Individual Pump	Stations:	
	Substantial Completion:	90 Days
	Final Completion:	30 Days

A Notice to Proceed will be given for the overall project and for the individual pump stations. If the time requirements for final completion for the individual pump stations is not met, liquidated damages will be assessed until the completion of the individual pump station is completed.

Liquidated Damages are outlined in the agreement and are dependent on the total contract amount.

90 days have been included in the overall contract time to allow for procurement of equipment.

5. Bid Requirements:

Review the required forms for both the bid submittal and Contract execution.

Paragraph 12.5 of the Modifications to Instructions to Bidders lists the required bid submission documents.

KDHE SRF Forms and Certifications shall be submitted with the bid as well.

6. Bid Submission:

Bids are due October 6th, 2022 at 2:00 PM local time either through the bid portal or handdelivered to the office of the County Commissioners, 200 E. 7th, Room B-11, Topeka, Kansas.

Does the contractor have the option to submit both through the portal and in person to ensure that the bid is received? Yes, this will be allowed.

Please submit all questions to the design engineers by September 29th at 5:00 PM local time. All questions and answers will be included in an addendum.

• The deadline to submit questions has been pushed back to September 30th at 5:00 PM local time.

Questions can be sent to <u>Ethan.Meyer@bartwest.com</u>.

• Questions may also be uploaded via the Shawnee County Bid Portal.

7. Insurance Requirements:

Review the specified insurance types and limits required for this project and Contract execution listed in the supplementary conditions.

- 8. **Project Specific Requirements/Coordination:**
 - Sequencing

- Bypass pumping across portions of Lake Sherwood shall only be done between November 30th and February 28th.
- Contractor is only allowed to work on two pump stations at a time.
- Replacement stations shall be constructed prior to existing stations being decommissioned, if applicable.
- Install new manholes prior to CIPP rehabilitation.
- Install CIPP liners prior to structure rehabilitation.
- Coordination considerations
 - Coordinate with adjoining property owners for both interruption of sewer service and maintaining access during open cut work.
 - Maintain facilities in continuous operation and maintain access for Owner personnel.
 - The City of Topeka maintains these pump stations. City personnel shall be allowed access to the facilities at all times as well.
 - Do not close off any pipelines, open any valves, or otherwise affect operation existing system and facilities except as required by Drawings and Specifications, or with Owner/Engineer authorization.
- Pump Requirements
 - All pumps and control systems shall be supplied by a single manufacturer.
 - Will the required equipment be provided for PS 53 so that a manufacturer other than Flygt can provide the control panel for this station?
 - A different manufacturer would need to be provided base elbows, guide rails, and miniCASs for the new control panel.
 - The County will provide two new base elbows, guide rails, and miniCASs so that a manufacturer other than Flygt can provide the control panel for PS 53.

9. Questions and Clarifications:

- Document 840 has been removed from the bid documents via addendum 1.
- Bid items with 0 quantities have been removed from Document 330 and the electronic bid tab via addendum 1.
- Davis Bacon Wage Rates are required for this project. The wage rates currently included in the bid documents have been revised. The rates currently in the bid documents will be removed and replaced with the updated rates via addendum.

10. Outstanding Addendum Items to be addressed:

 Geotech report was not included in the bid documents it will be added via the next addendum

- Paragraph 12.5 of the Modifications to Instructions to Bidders shall be modified via the next addendum to include the KDHE SRF Forms and Certifications in the list of required bid submission documents.
- Updated Davis Bacon Wage Rates to replace current wage rates in the bid documents.

11. County Comments:

- 90 days have been included in the contract time to allow for equipment lead times. If this
 is not long enough, the County is willing to work with the contractor to allow for more
 lead time. What we do not want to happen is for construction of a pump station to start
 and then be stalled due to waiting for lead times.
- The property owners have all been contacted during the easements process. We are hopeful that we won't have too many issues with property owners during this project.
- Wade Kettle will be the State inspector for this project. He will stop by the site from time to time and will be included in any progress meetings.
- Jeff Hunt will be responsible for the wage interviews required for Davis Bacon wage rates.
- On the pump manufacturers, we just have Flygt and Fairbanks included. At this point we are not really considering other manufacturers.
- Shawnee County will provide outdoor storage at the Sherwood Treatment Plant. Jeff believes that the gate to the facility is locked every evening.

12. Contractor/Supplier Questions:

- Is harmonic filtering included in the specs?
 - Harmonic filtering so that total harmonic voltage and current distortion is less than 5% is included in the specs. Also, the manufacturer shall provide any additional filtering and or devices to meet IEEE519 requirements.
- For the pump station on Robinhood Court, does any of the electric equipment need to be moved?
 - The design team has coordinated with Evergy and told them that the equipment is in conflict with the proposed improvements from this project and will need to be moved.
- Are there any fees for Free State or Evergy meter relocations or other private utilities?
 - There are no fees known at this time, but any such fees shall be the responsibility of the contractor.
- Would the County consider including an allowance for any unexpected fees.
- Please include any expected fees in the "Pump Station in Place" bid item.
- Is a job trailer included in this project?
 - No, a job trailer is not included.

PRE-BID MEETING ATTENDEES

S-401021.00 - SHERWOOD REGIONAL WATER DISTRICT ASSET REHABILITATION PROJECT PUMP STATIONS 16, 28, 53, 54, 57 & 61 Shawnee County, Kansas

September 26, 2022

PRE-BID MEETING ATTENDANCE:

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"General Decision Number: KS20220031 09/02/2022

Superseded General Decision Number: KS20210031

State: Kansas

Construction Type: Heavy

County: Shawnee County in Kansas.

HEAVY CONSTRUCTION PROJECTS (including sewer/water construction).

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60).

<pre> If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022: </pre>	 Executive Order 14026 generally applies to the contract. The contractor must pay all covered workers at least \$15.00 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2022.
<pre>If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022: </pre>	<pre> . Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least \$11.25 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2022.</pre>

The applicable Executive Order minimum wage rate will be

adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at https://www.dol.gov/agencies/whd/government-contracts.

Modification Number 0 1 2 3	r Publication Date 01/07/2022 02/25/2022 04/08/2022 09/02/2022		
ELEC0226-001 09/01/202	21		
	Rates	Fringes	
ELECTRICIAN	\$ 33.25	18.89	
* IRON0010-016 04/01/20	922		
	Rates	Fringes	
IRONWORKER (REINFORCING STRUCTURAL)	G AND \$ 35.50	32.68	
LAB01290-001 04/01/202	22		
	Rates	Fringes	
LABORER (Asphalt, Includes Raker, Shoveler, Spreader and Distributor)			
PAIN2012-006 05/01/201	12		
	Rates	Fringes	
PAINTER (Spray Only)	\$ 22.93	11.51	
TEAM0541-003 04/01/202	22		
	Rates	Fringes	

TRUCK DRIVER

(1) Dump Truck and Lowboy

Truck.....\$ 34.14

SUKS2014-016 07/09/2014

		Rates	Fringes
CARPENTER (I	Form Work Only)\$	23.39	10.16
CARPENTER, E	Excludes Form Work\$	31.70	12.64
CEMENT MASON	N/CONCRETE FINISHER\$	5 24.67	11.76
LABORER: Co	ommon or General\$	16.25	3.06
Backhoe/Exca	avator/Trackhoe\$	\$ 31.01	13.59
OPERATOR: E	3oring Machine\$	5 17.06	4.20
OPERATOR: 0	Crane\$	37.05	13.71
OPERATOR: L	oader\$	30.13	12.34

WELDERS - Receive rate prescribed for craftperforming operation to which welding is incidental.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at

https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations

Wage and Hour Division U.S. Department of Labor 200 Constitution Avenue, N.W. Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator U.S. Department of Labor 200 Constitution Avenue, N.W. Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board U.S. Department of Labor 200 Constitution Avenue, N.W. Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

END OF GENERAL DECISIO"



Site Characterization Report

Shawnee County Sewer CCTV

Topeka, Shawnee County, Kansas

April 21, 2021 Terracon Project No. 14205013

Prepared for:

Bartlett & West, Inc. Topeka, Kansas

Prepared by:

Terracon Consultants, Inc. Topeka, Kansas April 21, 2021

Bartlett & West, Inc. 1200 SW Executive Drive Topeka, Kansas 66615



Re: Site Characterization Report Shawnee County Sewer CCTV Lake Sherwood Topeka, Shawnee County, Kansas Terracon Project No. 14205013

Dear Mr. Wright:

We have completed the Site Characterization services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. P14205013 dated April 23, 2020. This report presents the findings of the subsurface exploration and provides a site characterization for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely, Terracon Consultants, Inc.

Michael A. Snapp, P.E.

Geotechnical Engineer

m Ken

/ Jamie M. Klein, P.E. Senior Associate



lerracon

GeoReport

Terracon Consultants, Inc. 3113 SW Van Buren Street Topeka, Kansas 66611 P (785) 267 3310 F (785) 267 3382 terracon.com

REPORT TOPICS

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Note: This report was originally delivered in a web-based format. **Orange Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the *GeoReport* logo will bring you back to this page. For more interactive features, please view your project online at <u>client.terracon.com</u>.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES SITE LOCATION AND EXPLORATION PLAN EXPLORATION RESULTS

- Boring Logs with Laboratory Data
- GeoModel

SUPPORTING INFORMATION

- General Notes
- Unified Soil Classification System
- Description of Rock Properties

Note: Refer to each individual Attachment for a listing of contents.

Site Characterization Report

Shawnee County Sewer CCTV Lake Sherwood Topeka, Shawnee County, Kansas Terracon Project No. 14205013 April 21, 2021

INTRODUCTION

This report presents the results of our site characterization services performed for the proposed sanitary sewer improvements to be located within the residential areas around Sherwood Lake in Topeka, Shawnee County, Kansas.

The original geotechnical engineering Scope of Services for this project included the advancement of 12 test borings to depths ranging from approximately 10 to 30 feet below existing site grades and provide engineering recommendations. However, after further communication with the Client and City of Topeka personnel, the scope of work was reduced to the advancement of 7 test boring to depths ranging from approximately 10 to 25 feet below existing site grades to provide subsurface soil and groundwater conditions at each location as directed by the Client and City of Topeka personnel. At this time no opinions or recommendations are requested or provide herein.

Maps showing the site and boring locations are shown in the **Site Location and Exploration Plan** section. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring logs in the **Exploration Results** section.

SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project includes select locations in the residential areas surrounding Lake Sherwood in Topeka, Shawnee County, Kansas.
Existing Improvements	The project is located in an area improved with houses, driveways and associated roads.
Current Ground Cover	Varies: short grass and pavements
Existing Topography	Relatively level at each exploration point.



PROJECT DESCRIPTION

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Information Provided	Our understanding of the project is from conversations with the Client and City of Topeka and provided plan sheets C112, C122, C153 through C156, and C163 dated March 2021 prepared by the Client.
Project Description	The project will include the construction of new replacement pump stations and sanitary force mains. The pump stations have been identified at PS16, PS28, PS57, and PS61.
Proposed Structure	We understand the pump stations will extend to depths ranging from 15' to 25' below existing grade.
Grading/Slopes	Unknown at this time; however, we anticipate site grading will be limited to approximately 3 feet of cut and/or fill and that permanent slopes will be no steeper than 3H:1V (Horizontal to Vertical).
Below Grade Structures	Pump stations and force mains
Free-Standing Retaining Walls	None anticipated

GEOTECHNICAL CHARACTERIZATION

Subsurface Profile

We have developed a general characterization of the subsurface conditions, termed GeoModel, based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of the project. Detailed conditions encountered at each exploration point are indicated on the individual logs. The individual boring logs and GeoModel can be found in the **Exploration Results** section of this report. Stratification boundaries on the boring logs and GeoModel represent the approximate location of changes in stratum type; however, in situ the transition between native materials may be gradual while in existing fill changes could be abrupt.

Groundwater Conditions

The boreholes were observed while drilling for the presence and level of groundwater. The water levels observed in the boreholes can be found on the boring logs in **Exploration Results** and are summarized below.

Site Characterization Report

Shawnee County Sewer CCTV
Topeka, Shawnee County, Kansas April 21, 2021
Terracon Project No. 14205013



Boring Number	Approximate <u>Depth</u> to Groundwater While Drilling (feet) ¹	Approximate <u>Elevation</u> of Groundwater While Drilling (feet) ¹
B-16-1	Not encountered	Not encountered
B-28-1	3	1,042
B-57-1	12	994
B-57-2	9	997.5
B-57-3	Not encountered	Not encountered
B-57-4	Not encountered	Not encountered
1. Below ground su	rface	

The observations shown above do not necessarily mean stable groundwater levels were observed, or that borings which didn't encounter groundwater were actually terminated above groundwater. Due to the low permeability of the upper cohesive soils and bedrock encountered in the borings, a relatively long period may be necessary for a groundwater level to develop and stabilize in a borehole. Long term observations in piezometers or observation wells sealed from the influence of surface water are often required to define groundwater levels in materials of this type.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. In addition, perched water can develop over low permeability soil or rock strata. Therefore, groundwater levels during construction or at other times in the life of the proposed improvements may be higher or lower than the observations made during our subsurface exploration. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

GENERAL COMMENTS

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

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client, and is not intended for



third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, cost estimating, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

ATTACHMENTS



EXPLORATION AND TESTING PROCEDURES

Field Exploration

The field exploration program consisted of the following:

Boring Designations	Boring Depth (feet) ¹	Planned Location ²
B-16-1	24	Near Pump Station 16
B-28-1	24	Near Pump Station 28
B-57-1	24	Near Pump Station 57
B-57-2 through B-57-4	10	Along planed sanitary line
B-61-1	25	Near Pump Station 61

1. Below ground surface.

2. The boring locations are shown on the attached Exploration Plan

Boring Layout and Elevations: Terracon personnel provided the boring layout using handheld GPS equipment (estimated horizontal accuracy of about ± 10 feet) and referencing existing site features. Approximate ground surface elevations were obtained by interpolation from the provided topographic site plan. If more precise ground surface elevations and/or boring locations are desired, we recommend the borings be surveyed by a professional land surveyor.

Subsurface Exploration Procedures: We advanced the borings with a track-mounted rotary drill rig using continuous flight solid stem augers. Three samples were obtained in the upper 10 feet of each boring and at intervals of 5 feet thereafter. In the thin-walled tube sampling procedure, a thin-walled, seamless steel tube with a sharp cutting edge is pushed hydraulically into the soil to obtain a relatively undisturbed sample. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon is driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths.

We also observed and recorded groundwater levels during drilling and sampling. The groundwater levels are shown on the attached boring logs.

Our exploration team prepared field boring logs during drilling operations to record sampling depths, penetration distances, other relevant sampling information, visual classifications of materials encountered during drilling, and our interpretation of subsurface conditions between samples. Final boring logs, prepared from field logs, represent the geotechnical engineer's interpretation, and include modifications based on observations and laboratory tests.



Property Disturbance: We backfilled the borings with auger cuttings and bentonite chips after completion. Borings performed in paved areas were patched with cold-mix asphalt. Our services do not include repair of the site beyond backfilling our boreholes and patching existing pavements where appropriate. Excess auger cuttings were dispersed in the general vicinity of each borehole. Because backfill material often settles below the surface after a period, we recommend boreholes be checked periodically and backfilled, if necessary.

Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests. The laboratory testing program included the following types of tests:

- Moisture Content
- Dry Unit Weight
- Unconfined Compression
- Atterberg Limits

The laboratory testing program included examination of soil samples by an engineer or geologist. Based on the material's texture and plasticity, we described and classified the soil samples in accordance with the attached Unified Soil Classification System (USCS).

Rock classification was conducted using locally accepted practices for engineering purposes and was based on drilling characteristics and observation of disturbed samples and auger cuttings; rock core samples and petrographic analysis may reveal other rock types. Boring log rock classification was determined using the Description of Rock Properties.

SITE LOCATION AND EXPLORATION PLANS

Contents:

Site Location Plan Exploration Plan

Note: All attachments are one page unless noted above.

SITE LOCATION AND PREVIOUS GEOTECHNICAL DATA Shawnee County Sewer CCTV Topeka, Shawnee County, Kansas April 21, 2021 Terracon Project No. 14205013





DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Shawnee County Sewer CCTV
Topeka, Shawnee County, Kansas April 21, 2021 Terracon Project No. 14205013





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Shawnee County Sewer CCTV
Topeka, Shawnee County, Kansas April 21, 2021 Terracon Project No. 14205013

Terracon GeoReport



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Shawnee County Sewer CCTV
Topeka, Shawnee County, Kansas April 21, 2021
Terracon Project No. 14205013





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Shawnee County Sewer CCTV
Topeka, Shawnee County, Kansas April 21, 2021 Terracon Project No. 14205013

Terracon GeoReport



DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

EXPLORATION RESULTS

Contents:

Boring Logs (B-16-1, B-28-1, B-57-1 through B-57-4, and B-61-1) GeoModel

Note: All attachments are one page unless noted above.

		В	ORIN	GL	00) N	0.	B-16-'	1			F	Page	1 of 1
	PROJ	ECT:			C	LIE	NT:	Bartlett &	& West, Inc. KS					
:	SITE:	Lake Sherwood Area Topeka, KS						, opena,						
	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 39.0109° Longitude: -95.7707° Surface Ek DEPTH ELEY	ev.: 965 (Ft.) /ATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	LABORATORY HP (psf)	COMPRESSIVE STRENGTH (psf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI
		0.1 <u>INCH AGGREGATE MATERIAL</u> 0.4 FILL - SAND , coarse grained, (per drillers observations) <u>LEAN CLAY</u> , with sand, trace gravel, dark gray to dark brown with orange brown	963	- - - -	-	\times	18 15	5-5-7 N=12	1	8000 (HP)	-	21.0 8.4	114	39-21-18
				5	-						-			
		9.5 SHALEY CLAY, gray and orange brown and brown, very stiff 12.5 SHALE, gray, severe to slight weathering	955.5 1 952.5	- 10- -	-		18	6-7-11 N=18	3		-	22.6		
SHAWNEE COUNLY SE		<u></u> , g, ,		- 15- -	-	X	18	10-16-20 N=36) 4		-	19.0		
LUG-NU WELL 14205013				- - 20- -		X	5	50/5"	5		-	13.1		
		23.9 Boring Terminated at 23.9 Feet	941	_		X	5	50/5"	6,			11.5,		
	Str	atification lines are approximate. In-situ, the transition may be	gradual.					На	mmer Type: Autor	natic				
	vanceme Solid ster andonme Boring ba	nt Method: n auger nt Method: ckfilled with Auger Cuttings and/or Bentonite	See Explorati description of and additiona See Supporti symbols and	on and Te field and I data (If a ng Inform abbreviat	esting I I labora any). nation f ions.	Procee atory p	<mark>dures</mark> fo rocedu lanatio	or a Not res used Ele n of	tes: vation estimated fi	rom Client	provide	ed topo	graphic	survey.
Mater Level Observations No free water observed								Borin	g Started: 04-06-20	21	Boring	g Compl	leted: 04	I-06-2021
I HIS BOR			ne	3113 SV To	V Van I peka, I	Buren KS	St	Drill F Proje	Rig: CME 55 ect No.: 14205013		Driller	: MB		

BORING LOG NO. B-28-1 Page 1 of 1													
PRO	JECT:			C	LIE	NT:	Bartlett & Topeka, I	α West, Inc. KS					
SITE	E Lake Sherwood Area Topeka, KS												
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 38.9925° Longitude: -95.7835° Surface Electronic DEPTH ELEC	v.: 1045 (Ft.) /ATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	LABORATORY HP (psf) UNCONFINED	COMPRESSIVE STRENGTH (psf) WATER	CONTENT (%) DRY UNIT WEIGHT (2000)	ATTERBERG LIMITS	
2	FILL - LEAN TO FAT CLAY, with gravel, brown to light brown	/\1045	-	\bigtriangledown		11	6.6.15	1		17	′.9		
	 <u>SHALE</u>, silty, orange brown to gray, very severe to moderate weathering 	1040.5	5-	-	X	18	N=21	2		19	9.9		
	7.0 SHALE, with limestone lenses, olive brown and gray, moderate to slight weathering	1038	-	-		3	50/1"	3		20).1 <i>)</i>		
			10 - -	-									
5			- 15	-	X	4	50/2"	4		18	<u>8.1</u>)		
	17.0 SHALE, gray to dark gray, severe to moderate weathering	1028	- - 20-	-	\times	10	30-50/5"	5		18	3.6		
	24.4 Boring Terminated at 24.4 Feet	1020.5		-	\times	12	39-50/4"	6		19	9.9		
	Stratification lines are approximate. In-situ, the transition may be a	gradual.					Hai	mmer Type: Autom	natic				
dvancen Solid s bandonr Boring	nent Method: tem auger ment Method: backfilled with Auger Cuttings and/or Bentonite	See Exploration description of and additiona See Supportin symbols and a	on and Te field and I data (If a ng Inform abbreviat	esting I I labora any). nation fo ions.	Procee atory p or exp	dures f rocedu	iora Note Ires used Elev on of	es: /ation estimated fr	rom Client	provided t	opograpł	nic survey.	
	WATER LEVEL OBSERVATIONS						Boring	g Started: 04-07-20	21	Boring Co	ompleted:	04-07-2021	
<u> </u>	o wrine urinniy		3113 SV	V Van I	Buren	St	Drill F	Rig: CME 55		Driller: M	В		
3113 5				113 SW Van Buren St Topeka, KS Project No.: 14205013									

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 14205013 SHAWNEE COUNTY SE.GPJ TERRACON DATATEMPLATE.GDT 4/15/21

	BORING LOG NO. B-57-1 Page 1 of 1																
	PR	SOJ	ECT:			C	LIE	NT	Bartle Topel	ett & We ka. KS	est, Inc.						
	SI	TE:	Lake Sherwood Area Topeka, KS					-		,							
		GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 39.0039° Longitude: -95.7969° Surface Ele DEPTH ELE	ev.: 1006 (Ft.) VATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST	RESULTS	SAMPLE NUMBER	LABORATORY HP (psf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIMITS	
:	2		4.0			-	X	18 15	3-4 N: 5-4	4-5 =9 5-6 =11	1			28.8 22.0			
	3		LEAN CLAY (CL), trace silt, gray to brown gray, medium stiff		5	-											
			12.0	004	- 10 -		X	18	3-: N	3-4 =7	3			24.5			
	4		SILTY SAND (SM), fine grained, orange brown, medium dense 14.0 SHALE, silty, gray, very severe to moderate severe weathering	994 992 992	- - 15- -		\times	9	20-5	50/5"	4			25.1			
	5		21.0 SHALE, gray, moderate weathering	985	- - 20- -	-	X	15	20-25	-50/3"	5			21.1			
			23.8 Boring Terminated at 23.8 Feet	982	_		×	6	50)/3"	6			17.1			
		Stra	atification lines are approximate. In-situ, the transition may be	gradual.						Hammer	Type: Autor	atic					
A	banc banc Bor Sur	cemer id sten donme ing ba face C	n Auger n auger ent Method: ckfilled with Auger Cuttings and/or Bentonite lapped with Asphalt	See Exploration description of and additiona See Supportin symbols and a	on and T field and I data (If a ng Inform abbreviat	esting I I labora any). nation f ions.	Proce atory p or exp	dures f rocedu	for a lares used	Notes: Elevation	n estimated fi	om Clie	nt provid	ed topo	graphic	survey.	
	$\overline{}$	12	WATER LEVEL OBSERVATIONS ' while drilling	٦٢						Boring Star	ted: 04-06-20	21	Borin	g Comp	eted: 04	-06-2021	
					3113 SV To	V Van I peka, I	Buren KS	St		Drill Rig: Cl Project No	ME 55 .: 14205013		Driller: MB				

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 14205013 SHAWNEE COUNTY SE.GPJ TERRACON DATATEMPLATE.GDT 4/15/21

	BORING LOG NO. B-57-2 Page 1 of 1														
Р	ROJ	ECT:			C	LIE	INT	: Bartle Tope	ett & W ka. KS	est, Inc.					
S	ITE:	Lake Sherwood Area Topeka, KS							-, -						
MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 39.0046° Longitude: -95.7973° Surface Elev DEPTH ELE	.: 1006.5 (Ft.) EVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	EIFLD TEST	RESULTS	SAMPLE NUMBER	LABORATORY HP (psf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI
2		23 <u>4 INCHES ASPHALT</u> <u>LEAN TO FAT CLAY (CL/CH)</u> , darkbrown (possible fill) 3.0	1006 I,	-	-		20	-		1	5000 (HP)	3760	24.3	98	47-24-23
	Î	LEAN TO FAT CLAY (CL/CH), gray with orange brown, medium stiff to stiff		- 5	-	X	18	4- N	4-5 =9	2	-		25.1	-	
3		black to gray brown	006 5	-			18	3- N	3-4 =7	3	-		27.9	-	
	//////	Boring Terminated at 10 Feet	990.5	10 –											
	Str	atification lines are approximate. In-situ, the transition may be	e gradual.		<u> </u>				Hammer	Type: Auton	natic				
Adva Si	inceme olid ster	nt Method: n auger	See Explorati description of and additiona	ion and T field and al data (If	esting labora anv).	Proce atory p	dures 1 rocedu	for a ures used	Notes: Elevatior	n estimated f	rom Clie	ent provid	ed topo	ographic	survey.
Aba B S	Abandonment Method: Boring backfilled with Auger Cuttings and/or Bentonite Surface Capped with Asphalt			ng Inform abbrevia	nation f	or exp	olanatio	on of							
		WATER LEVEL OBSERVATIONS							Boring Star	ted: 04-07-20)21	Borir	ig Comp	oleted: 04	4-07-2021
	9'	while drilling		26	D		<u>.</u> С	n	Drill Rig: C	ME 55		Drille	er: MB		
				3113 SV To	V Van opeka, l	Buren KS	St		Project No	.: 14205013					

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 14205013 SHAWNEE COUNTY SE. GPJ TERRACON_DATATEMPLATE. GDT 4/15/21

	BORING LOG NO. B-57-3 Page 1 of 1															
	PR	OJ	ECT:			C	CLIE	INT:	Bartle Topel	ett & W ka. KS	est, Inc.					
	SIT	ſE:	Lake Sherwood Area Topeka, KS							-, -					-	
		GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 39.0046° Longitude: -95.7983° DEPTH	Surface Elev.: 1014 (Ft.) ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST	RESULTS	SAMPLE NUMBER	LABORATORY HP (psf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIMITS
:	2		<u>4 INCHES ASPHALT</u> <u>LEAN TO FAT CLAY(CL/CH)</u> , to and silt, (possible fill) 3.0		-	-		18	5-(N=	6-7 =13	1			23.2		
			LEAN TO FAT CLAY (CL/CH), medium stiff to stiff	brown,	-			24			2	7000 (HP)	3030	26.9	93	
	3		orange brown	10	5	-		18	- 2-; N	3-4 =7	3			23.1		
			Boring Terminated at 10 Feet		^{µ4} 10–											
_		Stra	atification lines are approximate. In-situ, the trans	sition may be gradual.						Hammer	Type: Autom	natic				
A.	want	amor	nt Method:							Notori						
~(Soli	d sten	n auger	See Explorati description of and additiona	on and T field and I data (If	esting d labor any).	Proce atory p	dures f rocedu	or a ures used	Elevatior	n estimated fi	rom Clie	ent provic	led topo	graphic	survey.
A	band Bori Surf	lonme ng ba face C	ent Method: ckfilled with Auger Cuttings and/or Bentonite apped with Asphalt	See Supportin symbols and a	<mark>ng Inforn</mark> abbrevia	nation tions.	for exp	olanatic	on of							
F		No	WATER LEVEL OBSERVATIONS	חר		-				Boring Star	ted: 04-07-20	21	Borin	ng Comp	leted: 04	4-07-2021
		110	nee water observed		3113 5		Buren	St		Drill Rig: Cl	ME 55		Drille	er: MB		
					To	opeka,	KS	J		Project No	.: 14205013					

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 14205013 SHAWNEE COUNTY SE.GPJ TERRACON_DATATEMPLATE.GDT 4/15/21

		В	ORING	LC)G	N	0.	B-57-4				ſ	Page	1 of 1
1	PROJ	ECT:			C	LIE	NT:	Bartlett & V	Vest, Inc. S					
:	SITE:	Lake Sherwood Area Topeka, KS						- - p ,						
	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 39.0045° Longitude: -95.8002° Surface Ele DEPTH ELE	ev.: 1025 (Ft.) EVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	LABORATORY HP (psf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI
3		LEAN TO FAT CLAY (CL/CH), light gray t light brown, stiff 3.0	o 1022	-			16		1	3000 (HP)	1710	32.4	87	
=.GD1 4/15/21		SANDSTONE, orange brown with gray, ver severe to moderately severe weathering	у	_ 5 _ _	×	X	12	16-20-17 N=37	2			12.8		
		7.0 SHALE, silty, trace sand, orange to gray, very severe to moderately severe weathering	1018 ery	-	×	\times	18	17-18-21 N=39	3			17.5		
AIGINAL REPORT. GEO SMART LOG-NO WELL 14205013 SHAWNEE COUNTY SE.GPJ TERRACC		Boring Terminated at 10 Feet												
	Str. vancemer Solid stern andonme Boring ba Surface C	atification lines are approximate. In-situ, the transition may be nt Method: n auger ent Method: ckfilled with Auger Cuttings and/or Bentonite apped with Asphalt WATER LEVEL OBSERVATIONS	e gradual. See Exploration description of fie and additional da See Supporting symbols and abb	and Tes Id and la ata (If ar Informa oreviatio	sting P aborat ny). tion fo ons.	Proceed ory pr or expl	<mark>ures</mark> fo ocedu anatio	or a Notes: res used Elevation n of Boring S	on estimated fi	rom Clie	nt provid	ed topo	graphic	survey.
I HIS BOKI	INC	nee water observed	112 31	13 SW Tope	C Van B eka, K	uren S	St	Drill Rig: Project	CME 55 No.: 14205013		Drille	r: MB		

	BORING LOG NO. B-61-1 Page 1 of 1															
F	ROJ	ECT:			C	LIE	NT	Bartle	ett & We ka KS	est, Inc.	,					
S	SITE:	Lake Sherwood Area Topeka, KS					-									
MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 38.9992° Longitude: -95.7961° Surface Elev.: 10 DEPTH ELEVA	014.5 (Ft.) TION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST	RESULTS	SAMPLE NUMBER	LABORATORY HP (psf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	
2		0.2 ∧ <u>2 INCHES GRAVEL</u> <u>FILL - LEAN TO FAT CLAY</u> , trace sand and gravel, dark brown to brown 3.0	_/ <u>1014.</u> 5	-	-	X	18	4-4 N	4-5 =9	1			22.1			
		LEAN CLAY (CL), brown gray, medium stiff to stiff		-			22			2	3000 (HP)	1290	35.1	89	45-26-19	
					-											
				- 10-		X	18	2-3 N	3-3 =6	3			30.2			
				-												
3		trace sand and silt, brown to gray brown		- 15- -	-	\times	18	0-: N	3-4 =7	4			32.0			
		gray		- - 20- -	-	X	18	2-: N	3-4 =7	5			28.0			
		25.0 Boring Terminated at 25 Feet	989.5	- - 25-	-	X	18	0 N:	5-6 =11	6			33.2			
	Str	ratification lines are approximate. In-situ, the transition may be gra	adual.						Hammer	Type: Autor	natic					
Adva S Aba E	anceme olid ster ndonme Boring ba	nt Method: Se m auger de an ent Method: Sy ackfilled with Auger Cuttings and/or Bentonite	ee Explorations escription of ad additional ee Supportir mbols and a	on and T field and I data (If ng Inform abbreviat	esting I I labora any). nation fe tions.	Proce atory p	dures f rocedu	for a ures used on of	Notes: Elevation	estimated fi	rom Clie	nt provid	led topo	ographic	: survey.	
_		WATER LEVEL OBSERVATIONS							Boring Start	ed. 04-02-20	121	Rorin	ng C.om	leted: 0.	4-07-2021	
	12	?' while drilling		2					Drill Rig: CN	1E 55	- 1	Drille	er: MB	U	, JI-LUL I	
					3113 SW Van Buren St Topeka, KS Project No.: 14205013											

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 14205013 SHAWNEE COUNTY SE.GPJ TERRACON DATATEMPLATE.GDT 4/15/21

GEOMODEL

Topeka, KS Terracon Project No. 14205013





This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	Surface	Gravel and Asphalt
2	Fill and Possible Fill Materials	Sand and Lean to Fat and Lean Clays with varying amounts of silt, sand, and gravel.
3	Cohesive Soils	Lean, Lean to Fat, and Shaley Clays, varying amounts of silt and sand, medium stiff to very stiff.
4	Cohesionless Soils	Silty Sand, fine grained, medium dense.
5	Bedrock	Shale, varying amounts of silt and limestone lenses and Sandstone, very severe to slight weathering.

LEGEND



e Course Shale

Lean Clay/Fat Clay



Silty Sand

Sandstone

NOTES:

Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project.

Numbers adjacent to soil column indicate depth below ground surface.

Groundwater levels are temporal. The levels shown are representative of the date and time of our exploration. Significant changes are possible over time. Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

SUPPORTING INFORMATION

Contents:

General Notes Unified Soil Classification System Description of Rock Properties

Note: All attachments are one page unless noted above.

GENERAL NOTES – DESCRIPTION OF SYMBOLS AND ABBREVIATIONS



	ests
Water Initially N Standard Pene Encountered Resistance (B	etration Test lows/Ft.)
Shelby Tube Split Spoon Water Level After a Specified Period of Time (HP) Hand Penetron	meter
Water Level After (T) Torvane	
Rock Core Sample Water levels indicated on the soil boring logs (DCP) Dynamic Cone	e Penetrometer
are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low	ompressive
permeability soils, accurate determination of groundwater levels is not possible with short (PID) Photo-Ionizati	on Detector
term water level observations. (OVA) Organic Vapo	r Analyzer

Descriptive Soil Classification

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

Location and Elevation Notes

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

		Strength Ter	ns							
Relative Density (More than 50%) Density determined by	of Coarse Grained Soils retained on No. 200 sieve.) Standard Penetration Resistance	Consistency of Fine Grained Soils (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance								
Descriptive Term (Density)	Standard Penetration or N-Value Blows/Ft.	Descriptive Term (Consistency)	Unconfined Compressive Strength Qu (psf)	Standard Penetration or N-Value Blows/Ft.						
Very Loose	0 – 3	Very Soft	less than 500	0 – 1						
Loose	4 – 9	Soft	500 to 1,000	2-4						
Medium Dense	10 – 29	Medium Stiff	1,000 to 2,000	4 – 8						
Dense	30 – 50	Stiff	2,000 to 4,000	8 – 15						
Very Dense	> 50	Very Stiff	4,000 to 8,000	15 – 30						
		Hard	> 8,000	> 30						

Relative Proportions of Sand and Gravel			
Descriptive Term(s) of other constituents	Percent of Dry Weight		
Trace	< 15		
With	15 – 29		
Modifier	> 30		

Relative Proportions of Fines			
Descriptive Term(s) of other constituents	Percent of Dry Weight		
Trace	< 5		
With	5 – 12		
Modifier	> 12		

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

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

UNIFIED SOIL CLASSIFICATION SYSTEM

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			Soli Classification			
Criteria for Assigning Group Symbols and Group Names Using Laboratory Te			Fests A	Group Symbol	Group Name ^B	
	Gravels: More than 50% of	Clean Gravels:	$Cu \geq 4$ and $1 \leq Cc \leq 3$ $^{\textbf{E}}$		GW	Well-graded gravel F
		Less than 5% fines ^C	Cu < 4 and/or [Cc<1 or C	c>3.0] <mark>E</mark>	GP	Poorly graded gravel F
	coarse fraction	Gravels with Fines:	Fines classify as ML or N	/H	GM	Silty gravel F, G, H
Coarse-Grained Soils:	retained on No. 4 sieve	More than 12% fines ^c	Fines classify as CL or C	Ή	GC	Clayey gravel ^{F, G, H}
on No. 200 sieve		Clean Sands:	Cu \geq 6 and 1 \leq Cc \leq 3 $^{\hbox{\scriptsize E}}$		SW	Well-graded sand
	Sands: 50% or more of coarse	Less than 5% fines ^D	Cu < 6 and/or [Cc<1 or C	c>3.0] <mark>E</mark>	SP	Poorly graded sand ^I
	fraction passes No. 4 sieve	Sands with Fines	Fines classify as ML or N	ΛH	SM	Silty sand ^{G, H, I}
		More than 12% fines ^D	Fines classify as CL or C	Ή	SC	Clayey sand ^{G, H, I}
	Silts and Clays: Liquid limit less than 50	Inorganic:	PI > 7 and plots on or ab	ove "A"	CL	Lean clay ^{K, L, M}
			PI < 4 or plots below "A" line J		ML	Silt K, L, M
		Organic:	Liquid limit - oven dried	< 0.75	0	Organic clay ^{K, L, M, N}
Fine-Grained Soils:			Liquid limit - not dried	< 0.75 OL	UL	Organic silt ^{K, L, M, O}
No. 200 sieve	Silts and Clays: Liquid limit 50 or more	Inorganic:	PI plots on or above "A"	ine	СН	Fat clay ^{K, L, M}
			PI plots below "A" line		MH	Elastic Silt K, L, M
		Organic:	Liquid limit - oven dried	< 0.75	< 0.75 OH	Organic clay ^{K, L, M, P}
			Liquid limit - not dried	< 0.10		Organic silt ^{K, L, M, Q}
Highly organic soils:	Primarily	organic matter, dark in co	olor, and organic odor		PT	Peat
^A Based on the material passing the 3-inch (75-mm) sieve.		^H If fines are organic, add "with organic fines" to group name.				
^B If field sample contained cobbles or boulders, or both, add "with cobbles		If soil contains \geq 15% gravel, add "with gravel" to group name.				
or boulders, or both" to group name.		^J If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.				
 ^C Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay. ^D Sands with 5 to 12% fines require dual symbols: SW-SM well-graded 		K If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.				
		If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.				
sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt_SP-SC poorly graded sand with clay		^M If soil contains \geq 30% plus No. 200, predominantly gravel, add				

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

- $D_{10} \times D_{60}$
- F If soil contains \geq 15% sand, add "with sand" to group name.
- ^G If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
- "gravelly" to group name.
- ^{**N**} PI ≥ 4 and plots on or above "A" line.
- PI < 4 or plots below "A" line.
- PI plots on or above "A" line.
- Q PI plots below "A" line.





	Weathering		
Fresh	Rock fresh, crystals bright, few joints may show slight staining. Rock rings under hammer if crystalline.		
Very slight	Rock generally fresh, joints stained, some joints may show thin clay coatings, crystals in broken face show bright. Rock rings under hammer if crystalline.		
Slight	Rock generally fresh, joints stained, and discoloration extends into rock up to 1 in. Joints may contain clay. In granitoid rocks some occasional feldspar crystals are dull and discolored. Crystalline rocks ring under hammer.		
Moderate	Significant portions of rock show discoloration and weathering effects. In granitoid rocks, most feldspars are dull and discolored; some show clayey. Rock has dull sound under hammer and shows significant loss of strength as compared with fresh rock.		
Moderately severe	All rock except quartz discolored or stained. In granitoid rocks, all feldspars dull and discolored and majority show kaolinization. Rock shows severe loss of strength and can be excavated with geologist's pick.		
Severe	All rock except quartz discolored or stained. Rock "fabric" clear and evident, but reduced in strength to strong soil. In granitoid rocks, all feldspars kaolinized to some extent. Some fragments of strong rock usuallyleft.		
Very severe	All rock except quartz discolored or stained. Rock "fabric" discernible, but mass effectively reduced to "soil" with only fragments of strong rock remaining.		
Complete	Rock reduced to "soil". Rock "fabric" no discernible or discernible only in small, scattered locations. Quartz may be present as dikes or stringers.		
Hardness (for engineering description of rock – not to be confused with Moh's scale for minerals)			
Very hard	Cannot be scratched with knife or sharp pick. Breaking of hand specimens requires several hard blows of geologist's pick.		

- Hard Can be scratched with knife or pick only with difficulty. Hard blow of hammer required to detach hand specimen.
- Moderately hard Can be scratched with knife or pick. Gouges or grooves to ¼ in. deep can be excavated by hard blow of point of a geologist's pick. Hand specimens can be detached by moderate blow.
- Medium Can be grooved or gouged 1/16 in. deep by firm pressure on knife or pick point. Can be excavated in small chips to pieces about 1-in. maximum size by hard blows of the point of a geologist's pick.
- Soft Can be gouged or grooved readily with knife or pick point. Can be excavated in chips to pieces several inches in size by moderate blows of a pick point. Small thin pieces can be broken by finger pressure.
- Very soft Can be carved with knife. Can be excavated readily with point of pick. Pieces 1-in. or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail.

Joint, Bedding, and Foliation Spacing in Rock ¹			
Spacing	Joints	Bedding/Foliation	
Less than 2 in.	Very close	Very thin	
2 in. – 1 ft.	Close	Thin	
1 ft. – 3 ft.	Moderately close	Medium	
3 ft. – 10 ft.	Wide	Thick	
More than 10 ft.	Very wide	Very thick	

1. Spacing refers to the distance normal to the planes, of the described feature, which are parallel to each other or nearly so.

Rock Quality Designation (RQD) 1			Joint Openness Descriptors	
RQD, as a percentage Diagnostic description			Openness	Descriptor
Exceeding 90	Excellent	-	No Visible Separation	Tight
90 – 75	Good	-	Less than 1/32 in.	Slightly Open
75 – 50	Fair	-	1/32 to 1/8 in.	Moderately Open
50 – 25	Poor	-	1/8 to 3/8 in.	Open
Less than 25	Very poor	-	3/8 in. to 0.1 ft.	Moderately Wide
1 = POD (given as a percentage) = length of each in pieces 4		-	Greater than 0.1 ft.	Wide

1. RQD (given as a percentage) = length of core in pieces 4 inches and longer / length of run

References: American Society of Civil Engineers. Manuals and Reports on Engineering Practice - No. 56. <u>Subsurface Investigation for</u> <u>Design and Construction of Foundations of Buildings.</u> New York: American Society of Civil Engineers, 1976. U.S. Department of the Interior, Bureau of Reclamation, <u>Engineering Geology Field Manual</u>.