

GEOTEK ENGINEERING & TESTING SERVICES, INC.

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March 15, 2022

City of Harrisburg 301 E. Willow Street PO Box 26 Harrisburg, South Dakota 57032

Attn: Derick Wenck, Mayor

Subj: Geotechnical Exploration Proposed West Side Sanitary Sewer Extension (Phase I) Harrisburg, South Dakota GeoTek #22-028

This correspondence presents our written report of the geotechnical exploration program for the referenced project. Our work was performed in accordance with your authorization. We are transmitting an electronic copy of our report for your use. Additional copies of our report are also being sent as noted below.

We thank you for the opportunity of providing our services on this project and look forward to continued participation during the design and construction phases. If you have any questions regarding this report, please contact our office at (605) 335-5512.

Respectfully Submitted, GeoTek Engineering & Testing Services, Inc.

Jared Haskins

Jared Haskins, PE Geotechnical Manager

Cc: Stockwell Engineers, Attn: Chad Huwe, PE Banner Associates, Attn: Alex Welbig, PE

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GEOTECHNICAL EXPLORATION PROPOSED WEST SIDE SANITARY SEWER EXTENSION (PHASE I) HARRISBURG, SOUTH DAKOTA GEOTEK #22-028

INTRODUCTION

Project Information

This report presents the results of the recent geotechnical exploration program for the proposed west side sanitary sewer extension in Harrisburg, South Dakota.

Scope of Services

Our work was performed in accordance with the authorization of Derick Wenck with the City of Harrisburg. The scope of work as presented in this report is limited to the following:

- 1. To perform 19 standard penetration test (SPT) borings to gather data on the subsurface conditions along the route of the sanitary sewer.
- 2. To perform laboratory tests that include moisture content, dry density, standard Proctor, unconfined compressive strength, pH, sulfate content, chloride content, resistivity, redox potential and sulfide content.
- 3. To prepare an engineering report that includes the results of the field and laboratory tests as well as our geotechnical engineering opinions and recommendations regarding the following:
 - Subsurface conditions;
 - Open cut installation method;
 - Trenchless installation method;
 - Corrosive potential of the soils;
 - Special geotechnical conditions that may impact the constructability and final performance of the project;
 - Quality control observation and testing.

The scope of our work was intended for geotechnical purposes only. This scope of work did not include determining the presence or extent of environmental contamination at the site or to characterize the site relative to wetlands status.

SITE & SUBSURFACE CONDITIONS

Site Location

The sanitary sewer will be installed from the main lift station along 274th Street to the intersection of Willow Street and Creekside Avenue in Harrisburg, South Dakota. The route of the sanitary sewer is shown on the attached test boring location maps (Figures 1 and 2).

Ground Surface Elevations & Test Boring Locations

The ground surface elevations at the test boring locations were provided by Banner Associates and varied from 1,384.6 feet at test boring 4 to 1,424.7 feet at test boring 19. Test boring location maps (Figures 1 and 2) are attached showing the relative location of the test borings.

Subsurface Conditions

Nineteen (19) test borings were performed on March 2, March 3 and March 9, 2022. The subsurface conditions encountered at the test boring locations are illustrated by means of the boring logs included in Appendix A.

The subsurface profile at the test boring locations consisted of the following soil types: existing fill materials, topsoil materials, fine alluvium soils, glacial fluvial soils and glacial till soils. The existing fill materials were encountered at test borings 11, 12, 14, 17, 18 and 19. The existing fill materials extended to depths varying from 2 feet to 7 feet. The topsoil materials were encountered at the surface at test borings 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15 and 16 or beneath the existing fill materials at test borings 11, 12 and 17. The fine alluvium soils were encountered at test borings 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 15, 17 and 18. The glacial fluvial soils were only encountered at test borings 2 and 13. The glacial till soils were encountered at all of the test borings.

The consistency or relative density of the soils is indicated by the standard penetration resistance ("N") values as shown on the boring logs. A description of the soil consistency or relative density based on the "N" values can be found on the attached Soil Boring Symbols and Descriptive Terminology data sheet.

We wish to point out that the subsurface conditions at other times and locations along the route of the sanitary sewer may differ from those found at our test boring locations. If different conditions are encountered during construction, then it is important that you contact us so that our recommendations can be reviewed.

Soil Types

Existing Fill Materials

The existing fill materials consisted of lean clay (CL). "N" values within the existing fill materials ranged from 4 to 17. The moisture condition of the existing fill materials was frozen, moist and wet.

Topsoil Materials

The topsoil materials consisted of lean clay (CL). "N" values (excluding the "N" values within frozen soils) within the topsoil materials ranged from 3 to 10 (consistency of soft, firm and stiff). The moisture condition of the topsoil materials was frozen, moist and wet.

Fine Alluvium Soils

Fine alluvium soils are soils with more than 50 percent by weight passing the #200 sieve that have been deposited by moving water. The fine alluvium soils consisted of lean clay (CL), fat clay (CH) and fat clay with sand (CH). "N" values within the fine alluvium soils ranged from 3 to 18 (consistency of soft, firm, stiff and very stiff). The moisture condition of the fine alluvium soils was frozen, moist and wet.

Glacial Fluvial Soils

Glacial Fluvial soils are soils with more than 50 percent by weight passing the #200 sieve that have been deposited by moving water from the melting ice of a glacier. The glacial fluvial soils consisted of lean clay (CL) and sandy lean clay (CL). "N" values within the glacial fluvial soils ranged from 6 to 14 (consistency of firm and stiff). The moisture condition of the glacial fluvial soils soils was moist and wet.

<u>Glacial Till Soils</u>

Glacial till soils are soils with more than 50 percent by weight passing the #200 sieve that have been deposited by a glacier. The glacial till soils consisted of lean clay with sand (CL), fat clay with sand (CH) and sandy lean clay (CL). "N" values within the glacial till soils ranged from 5 to 22 (consistency of firm, stiff and very stiff). The moisture condition of the glacial till soils was frozen, moist and wet.

Water Levels

Measurements to record the groundwater levels were made at the test boring locations. The time and level of the groundwater readings are recorded on the boring logs. Also, a summary of the groundwater levels is shown in Table 1. Delayed groundwater readings were made at test borings 1, 2, 3, 5, 6, 7, 8, 9, 14, 15, 16, 18 and 19.

Test	Ground Surface	Groundwat	Elevation of					
Boring	Elevation, ft	End of Drilling	Delayed	Groundwater, ft				
1	1,388.9	23	4	1,384.9				
2	1,389.9	22	6	1,383.9				
3	1,384.9	19	8	1,376.9				
4	1,384.6	14	N/A	1,370.6				
5	1,389.3	12	12	1,377.3				
6	1,387.0	12	5	1,382.0				
7	1,390.0 Dry to Cave-In Depth		16 ½	1,373.5				
8	1,395.4	Dry to Cave-In Depth	21	1,374.4				
9	1,400.3	Dry to Cave-In Depth	21	1,379.3				
10	1,404.6	Dry to Cave-In Depth	N/A	N/A				
11	1,404.9	Dry to Cave-In Depth	N/A	N/A				
12	1,409.8	Dry to Cave-In Depth	N/A	N/A				
13	1,408.1	Dry to Cave-In Depth	N/A	N/A				
14	1,408.8	Dry to Cave-In Depth	15	1,393.8				
15	1,410.6	Dry to Cave-In Depth	4	1,406.6				
16	1,412.1	Dry to Cave-In Depth	13	1,399.1				
17	1,421.8	Dry to Cave-In Depth	N/A	N/A				

 Table 1. Groundwater Levels

Ground Surface	Groundwat	Elevation of	
Elevation, ft	End of Drilling	Delayed	Groundwater, ft
1,421.5	16	10	1,411.5
1,424.7	Dry to Cave-In Depth	16	1,408.7
_	Elevation, ft 1,421.5	Elevation, ftEnd of Drilling1,421.516	Elevation, ftEnd of DrillingDelayed1,421.51610

Table 1 (Continued). Groundwater Levels

Note: Delayed groundwater readings were made at test borings 1, 2, 3, 5, 6, 7, 8, 9, 14, 15, 16, 18 and 19.

ENGINEERING REVIEW & RECOMMENDATIONS

Project Design Data

We understand that the project will consist of installing new sanitary sewer. We expect that open cut methods will be used for the majority of the installation. Trenchless methods (directional drilling) will likely be used for a portion of the installation beneath the railroad tracks on 274th Street. Directional drilling could also be used at other locations. Installation depths of 10 feet to 18 feet are expected.

The information/assumptions detailed in the project design data section of the report are important factors in our review and recommendations. If there are any corrections or additions to the information detailed in this section, then it is important that you contact us so that we can review our recommendations with regards to the revised plans.

Open Cut Installation Method

Subgrade Soils

The subgrade soils anticipated at the invert depths of the sanitary sewer will likely consist of clay soils. Where soils having moderate moisture and density values are encountered at the bottom of the trench excavations, it is our opinion that the soils are considered suitable for support of the sanitary sewer, provided they are adequately dewatered and are not disturbed by construction traffic. Areas of wet or soft soils may be encountered at the bottom of the trench excavations. These areas will require subexcavation and trench stabilization methods and materials. Appropriate bedding materials should be used for the sanitary sewer.

<u>Water Control</u>

Based on the groundwater measurements at the test boring locations (see Table 1 on pages 7 and 8), it is our opinion that water will enter the majority of the trench excavations. Dewatering procedures will be needed in order to control and remove water entering the majority of the trench excavations. Where clay soils are encountered, it will likely be possible to remove and control water entering the excavations using normal sump pumping techniques. However, if waterbearing sand soils are encountered, then extensive dewatering techniques will likely be required due to the potentially large volumes of water. The contractor should provide appropriate dewatering methods and equipment. Any water that accumulates at the bottom of the excavations should be immediately removed and surface drainage away from the excavations should be provided during construction.

OSHA Requirements

All excavations must comply with the requirements of OSHA 29 CFR, Part 1926, Subpart P, "Excavations and Trenches". This document states that the excavation safety is the responsibility of the contractor. Reference to this OSHA requirement should be included in the project specifications.

Trench Backfill

We recommend that the trench backfill be placed and compacted in uniform thin lifts (6-inch maximum lifts). The moisture content of clay backfill materials should be adjusted to a moisture level that is within plus or minus 2 percent of the optimum moisture content as determined by standard Proctor (ASTM:D698). The moisture content of granular backfill materials should be maintained at a level that will be conducive for vibratory compaction. Trench backfill should be compacted to a minimum of 95 percent of standard Proctor density (ASTM:D698).

We performed 5 standard Proctor tests for the project (2 on the existing fill materials at test borings 14 and 17, 1 on the fine alluvium soils at test boring 2 and 2 on the glacial till soils at test borings 1 and 18). The results of the standard Proctor tests are shown in Table 2.

Test Boring	Depth (ft)	Soil Type	OMC (%)	Maximum Dry Density (pcf)
1	10 to 15	Fat Clay w/ Sand (CH) – Glacial Till	19.3	104.7
2	4 ½ to 7	Fat Clay (CH) – Fine Alluvium	23.5	96.0
14	0 to 7	Lean Clay w/ Sand (CL) – Fill	20.9	101.2
17	0 to 5	Lean Clay w/ Sand (CL) – Fill	17.6	107.2
18	5 to 10	Lean Clay w/ Sand (CL) – Glacial Till	18.4	106.9

 Table 2. Standard Proctor Test Results

Based on the results of the moisture content and standard Proctor tests, it is our general opinion that the majority of the existing fill materials, fine alluvium soils and glacial till soils and a small portion of the glacial fluvial soils have in-situ moisture content levels that range from 1 percent above to 4 percent above the optimum moisture content, while some of the existing fill materials, fine alluvium soils and glacial till soils and the majority of the glacial fluvial soils have in-situ moisture content levels that range from 5 percent above to 15 percent above the optimum moisture content levels that range from 5 percent above to 15 percent above the optimum moisture content levels that range from 5 percent above to 15 percent above the optimum moisture content are considered "wet". The wet existing fill materials were encountered at test boring 14, the wet fine alluvium soils were encountered at test borings 6 and 15, the wet glacial fluvial soils were encountered at test borings 1, 2, 3, 4, 10, 12 and 18.

In our opinion, the majority of the existing fill materials, fine alluvium soils and glacial till soils and a small portion of the glacial fluvial soils can likely be reused as trench backfill, while the wet existing fill materials, wet fine alluvium soils, wet glacial fluvial soils and wet glacial till soils are not suitable or ideal for use as trench backfill. Our opinion of this is based on our observations of the collected samples and the results of the laboratory tests. The wet existing fill materials, wet fine alluvium soils, wet glacial fluvial soils and wet glacial till soils will require drying or will need to be replaced with an off-site borrow material or with suitable material available at other areas of the project. Also, the topsoil materials should not be used as trench backfill. The topsoil materials should be used as "topping" material.

If needed, the off-site borrow material should consist of either a clay or granular material. If a clay material is selected, then it should consist of a non-organic clay. Scrutiny on the clay

material's moisture content should be made prior to the acceptance and use. If a granular material is used, then it should consist of a pit-run or processed sand or gravel having a maximum particle size of 1 inch. The granular material can be placed in lifts of up to 1 foot in thickness.

Trenchless Installation Method

As previously stated, directional drilling will likely be used for a portion of the installation. It is our opinion that existing fill materials, fine alluvium soils, glacial fluvial soils or glacial till soils will be encountered during the directional drilling. It is our general opinion that the existing fill materials, fine alluvium soils and glacial fluvial soils have low to moderate strength levels and the glacial till soils have moderate to high strength levels. We estimate that the existing fill materials, fine alluvium soils and glacial fluvial soils have unconfined compressive strength values between 0.25 tons per square foot (tsf) and 1.5 tsf. We also estimate that the glacial till soils have unconfined compressive strength values between 1.0 tsf and 4.0 tsf. Rocks and cobbles may be encountered within the glacial till soils. The contractor may experience difficulties if rocks or cobbles are encountered during the installation process.

Groundwater was encountered at the majority of the test borings. With that said, water will likely enter the bore pits. Dewatering may be needed to remove and control water entering the bore pits. If water is encountered, then it would be beneficial to place a layer (12 inches) of drainage rock at the bottom of the bore pits to provide a stable base. The drainage rock should be crushed, washed and meet the gradation specifications shown in Table 3.

Tuble et Drumuge Rock Grudution Specifications								
Sieve Size	Percent Passing							
1 ¹ / ₂ -inch	100							
1-inch	70 - 90							
3/4-inch	25 - 50							
3/8-inch	0-5							

 Table 3. Drainage Rock Gradation Specifications

Modulus of Soil Reaction (E'n)

If needed, we estimated the range of the modulus of soil reaction (E'n) for the various soil types near the expected invert depths. The values are based on the estimated unconfined compressive strength values for the cohesive soils. The values are provided in Table 4.

Soil Type	Range of Modulus of Soil Reaction (psi)
Existing Fill Materials	700 to 1,500
Fine Alluvium	700 to 1,500
Glacial Fluvial	200 to 700
Glacial Till	1,500 to 5,000

Table 4. Modulus of Soil Reaction (E'n)

Corrosive Potential

Soil samples were collected from test borings 1, 9, 12 and 18 and were submitted for pH, sulfate content, chloride content, resistivity, redox potential and sulfide content testing. The results of the pH, resistivity, redox potential and sulfide content testing are shown in Table 5 and the results of the chloride content and sulfate content testing are shown in Table 7.

Test Boring	Depth (ft)	Soil Classification	pН	Resistivity (ohm-cm)	Redox Potential (mV)	Sulfide (mg/kg)
1	9 ½ to 16	CH (Glacial Till)	8.7	1,273	186	2.50
9	4 ½ to 9 ½	CH (Glacial Till)	8.0	938	212	< 0.01
12	4 ½ to 9 ½	CL (Glacial Till)	8.5	1,005	187	< 0.01
18	7 to 14 ½	CL (Glacial Till)	8.4	1,139	186	0.06

Table 5. pH, Resistivity, Redox Potential & Sulfide Content Results

Note: The resistivity values are minimum values (saturated condition).

Using the Ductile Iron Pipe Research Association's (DIPRA) 10-point system and the lab results shown in Table 5, we evaluated the corrosive potential of the tested soils. The 10-point system is based on resistivity, pH, redox potential, sulfides and moisture. An explanation of the point system is shown on Figure 3. The results of the evaluation are shown in Table 6. According to DIPRA, a value of 10 or more indicates that the soil is corrosive to underground piping, while a value below 10 indicates that the soil is not corrosive to underground piping. Based on Table 6,

the glacial till soils are corrosive. We also expect that the existing fill materials, fine alluvium soils and glacial fluvial soils would be corrosive. In our opinion, protective measures should be taken.

Test Boring	Depth (ft)	Soil Classification	Total Value	Result
1	9 ½ to 16	CH (Glacial Till)	18.5	Corrosive
9	4 ½ to 9 ½	CH (Glacial Till)	12	Corrosive
12	4 ½ to 9 ½	CL (Glacial Till)	12	Corrosive
18	7 to 14 ½	CL (Glacial Till)	14	Corrosive

 Table 6. Results of DIPRA 10-Point System Evaluation

Note: A "poor drainage, continuously wet" was used for the moisture condition (2 points).

Test Boring	Depth (ft)	Soil Classification	Sulfate (mg/kg)	Chloride (mg/kg)
1	9 ½ to 16	CH (Glacial Till)	321	7
9	4 ½ to 9 ½	CH (Glacial Till)	2,620	3
12	4 ½ to 9 ½	CL (Glacial Till)	241	2
18	7 to 14 ½	CL (Glacial Till)	165	1

 Table 7. Sulfate & Chloride Content Test Results

As shown in Table 7, the sulfate contents varied from 165 to 2,620 mg/kg and the chloride contents varied from 1 to 7 mg/kg. Generally, soils are considered mildly corrosive if the sulfate and chloride contents are below 250 mg/kg. Therefore, the glacial till soils are considered corrosive (based on the sulfate contents).

CONSTRUCTION CONSIDERATIONS

Groundwater & Surface Water

Water will likely enter the excavations due to subsurface water, precipitation or surface run off. Any water that accumulates in the bottom of the excavations should be immediately removed and surface drainage away from the excavations should be provided during construction.

Disturbance of Soils

The soils encountered at the test boring locations are susceptible to disturbance and can experience strength loss caused by construction traffic and/or additional moisture. Precautions will be required during earthwork activities in order to reduce the risk of soil disturbance. Where soft/wet soils are encountered, the excavations should be performed with low-ground-pressure construction equipment or an excavator (backhoe) having a smooth cutting edge on the bucket.

Cold Weather Precautions

If site preparation and construction is anticipated during cold weather, then we recommend that all subgrades, slabs and other improvements that may be affected by frost movements be insulated from frost penetration during freezing temperatures. If filling is performed during freezing temperatures, then all frozen soils, snow and ice should be removed from the areas to be filled prior to placing the new fill. The new fill should not be allowed to freeze during transit, placement and compaction. Concrete and asphalt should not be placed on frozen subgrades. If subgrades freeze, then we recommend that the frozen soils be removed and replaced, or completely thawed. The subgrade soils will likely require reworking and recompacting due to the loss of density caused by the freeze/thaw process.

Excavation Sideslopes

All excavations must comply with the requirements of OSHA 29 CFR, Part 1926, Subpart P, "Excavations and Trenches". This document states that the excavation safety is the responsibility of the contractor. Reference to this OSHA requirement should be included in the project specifications.

Observations & Testing

This report was prepared using a limited amount of information for the project and a number of assumptions were necessary to help us develop our conclusions and recommendations. It is recommended that our firm be retained to review the geotechnical aspects of the final design plans and specifications to check that our recommendations have been properly incorporated into the design documents.

The recommendations submitted in this report have been made based on the subsurface conditions encountered at the test boring locations. It is possible that there are subsurface conditions at the site that are different from those represented by the test borings. As a result, on-site observation during construction is considered integral to the successful implementation of the recommendations. We believe that qualified field personnel need to be on-site at the following times to observe the site conditions and effectiveness of the construction.

Excavation

We recommend that a geotechnical engineer or geotechnical engineering technician working under the direct supervision of a geotechnical engineer observe all excavations for utilities, slabs and pavements. These observations are recommended to determine if the exposed soils are similar to those encountered at the test boring locations, if unsuitable soils have been adequately removed and if the exposed soils are suitable for support of the proposed construction.

Testing

After the subgrade is observed by a geotechnical engineer/technician and approved, we recommend a representative number of compaction tests be taken during the placement of the backfill placed below slabs and pavements. The tests should be performed to determine if the required compaction has been achieved. As a general guideline, we recommend at least 1 test be taken for every 10,000 square feet of embankment fill placed, at least 1 test for every 500 feet in trench fill, and for every 2-foot thickness of fill or backfill placed. The actual number of tests should be left to the discretion of the geotechnical engineer. Samples of proposed fill and backfill materials should be submitted to our laboratory for testing to determine their compliance with our recommendations and project specifications.

SUBSURFACE EXPLORATION PROCEDURES

Test Borings

We performed 19 SPT borings on March 2, March 3 and March 9, 2022 with a truck rig equipped with hollow-stem auger. Soil sampling was performed in accordance with the

procedures described in ASTM:D1586. Using this procedure, a 2-inch O.D. split barrel sampler is driven into the soil by a 140-pound weight falling 30 inches. After an initial set of 6 inches, the number of blows required to drive the sampler an additional 12 inches is known as the penetration resistance, or "N" value. The "N" value is an index of the relative density of cohesionless soils and the consistency of cohesive soils. In addition, thin walled tube samples were obtained according to ASTM:D1587, where indicated by the appropriate symbol on the boring logs. We also performed 1 test boring using hand-operated equipment.

The test borings were backfilled with on-site materials and some settlement of these materials can be expected to occur. Final closure of the holes is the responsibility of the client or property owner.

The soil samples collected from the test boring locations will be retained in our office for a period of 1 month after the date of this report and will then be discarded unless we are notified otherwise.

Soil Classification

As the samples were obtained in the field, they were visually and manually classified by the crew chief according to ASTM:D2488. Representative portions of all samples were then sealed and returned to the laboratory for further examination and for verification of the field classification. In addition, select samples were then submitted to a program of laboratory tests. Where laboratory classification tests (sieve analysis and Atterberg limits) have been performed, classifications according to ASTM:D2487 are possible. Logs of the test borings indicating the depth and identification of the various strata, the "N" value, the laboratory test data, water level information and pertinent information regarding the method of maintaining and advancing the drill holes are also attached in Appendix A. Charts illustrating the soil classification procedures, the descriptive terminology and the symbols used on the boring logs are also attached in Appendix A.

Water Level Measurements

Subsurface groundwater levels should be expected to fluctuate seasonally and yearly from the groundwater readings recorded at the test boring locations. Fluctuations occur due to varying seasonal and yearly rainfall amounts and snowmelt, as well as other factors. It is possible that the subsurface groundwater levels during or after construction could be significantly different than the time the test borings were performed.

Laboratory Tests

We performed laboratory tests on select samples to aid in determining the index and strength properties of the soils. The tests consisted of moisture content, dry density, standard Proctor, pH, sulfate content, chloride content, resistivity, redox potential and sulfide content. The strength tests consisted of unconfined compressive strength. The laboratory tests were performed in accordance with the appropriate ASTM procedures. The results of the laboratory tests are shown on the boring logs opposite the samples upon which the tests were performed.

LIMITATIONS

The recommendations and professional opinions submitted in this report were based upon the data obtained through the sampling and testing program at the test boring locations. We wish to point out that because no exploration program can totally reveal the exact subsurface conditions for the entire site, conditions between test borings and between samples and at other times may differ from those described in our report. Our exploration program identified subsurface conditions only at those points where samples were retrieved or where water was observed. It is not standard engineering practice to continuously retrieve samples for the full depth of the test borings. Therefore, strata boundaries and thicknesses must be inferred to some extent. Additionally, some soils layers present in the ground may not be observed between sampling intervals. If the subsurface conditions encountered at the time of construction differ from those represented by our test borings, it is necessary to contact us so that our recommendations can be reviewed. The variations may result in altering our conclusions or recommendations regarding site preparation or construction procedures, thus, potentially affecting construction costs.

This report is for the exclusive use of the addressee and its representatives for use in design of the proposed project described herein and preparation of construction documents. Without written approval, we assume no responsibility to other parties regarding this report. Our conclusions, opinions and recommendations may not be appropriate for other parties or projects.

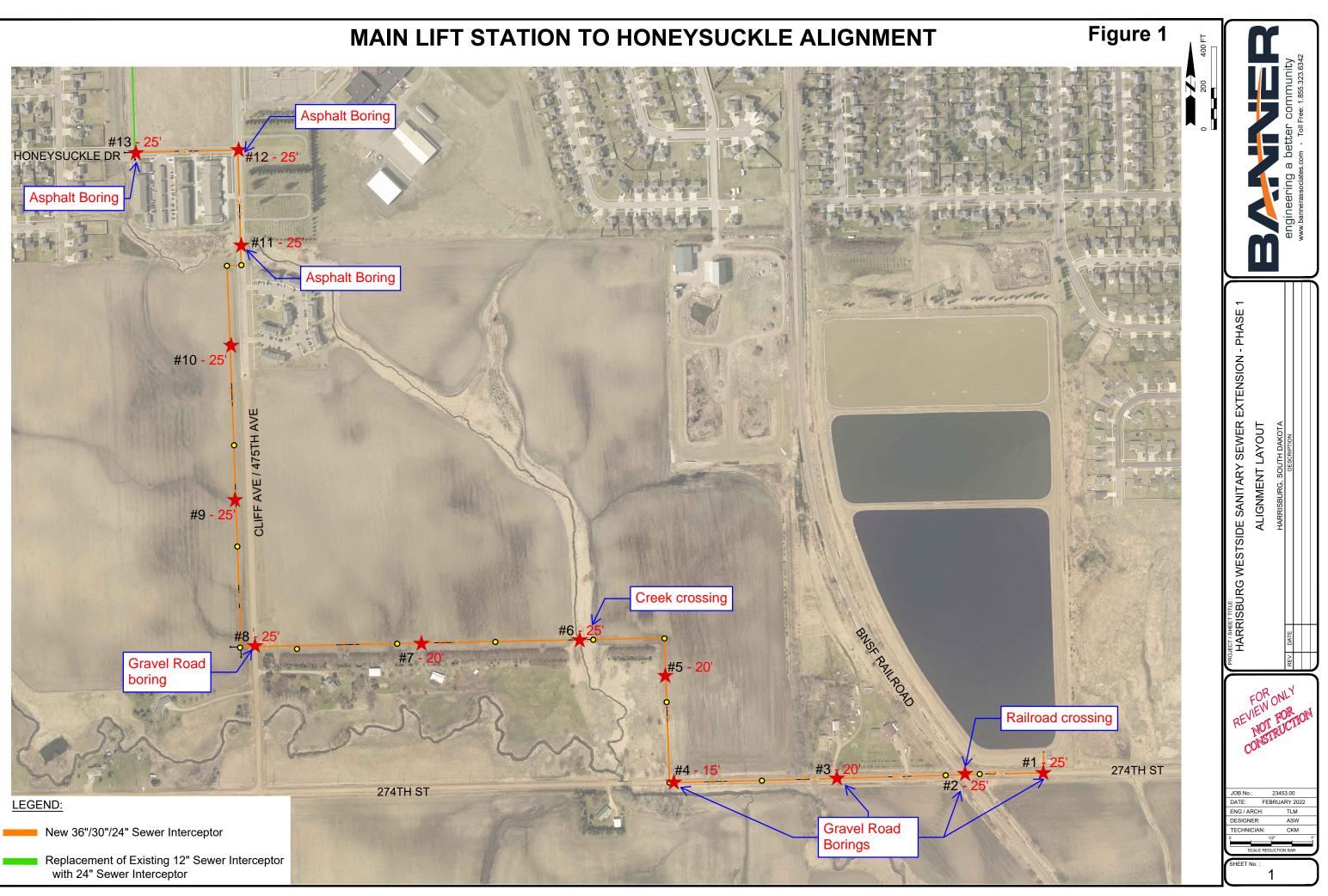
STANDARD OF CARE

The recommendations submitted in this report represent our professional opinions. Our services for your project were performed in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering profession currently practicing at this time and area.

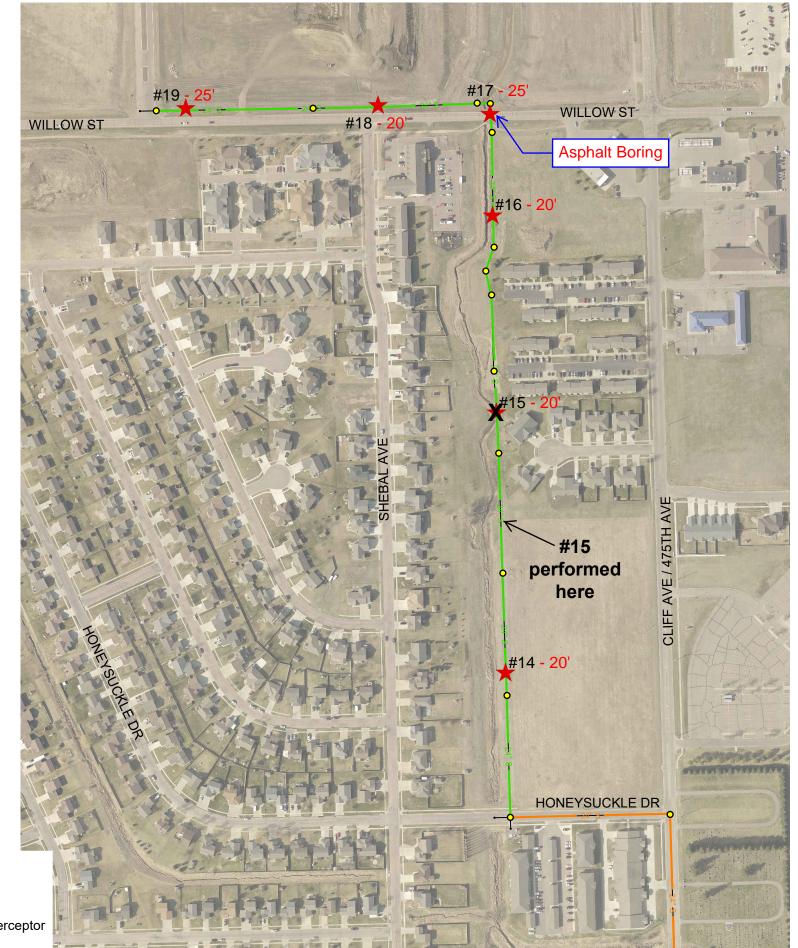
This report was prepared by: GeoTek Engineering & Testing Services, Inc.

Jared Haskins, PE Geotechnical Manager





HONEYSUCKLE TO WILLOW/CREEKSIDE ALIGNMENT



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LEGEND:

New 36"/30"/24" Sewer Interceptor

Replacement of Existing 12" Sewer Interceptor with 24" Sewer Interceptor

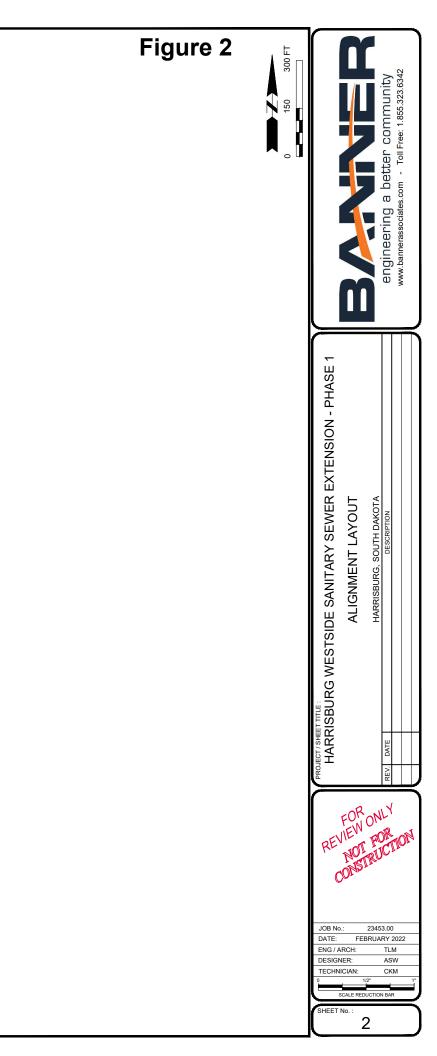


FIGURE 3

16 AWWA C105/A21.5-10

Soil Chai	racteristics Based on Samples Taken Down to Pipe Depth	
/ Resi	stivity—ohm-cm (based on water-saturated soil box):	Points
	<1,500	10
	≥1,500–1,800	8
	>1,800-2,100	5
	>2,100-2,500	2
	>2,500-3,000	1
	>3,000	0
/ pH:		
	0-2	5
	2-4	3
	4-6.5	0
	6.5–7.5	0†
	7.5-8.5	0
	>8.5	3
Redox	potential:	
	> +100 mV	0
	+50 to +100 mV	3.5
	0 to +50 mV	. 4
	Negative	5
[/] Sulfide	s:	
	Positive	3.5
	Trace	2
	Negative	0
/ Moistu	re:	
	Poor drainage, continuously wet	2
	Fair drainage, generally moist	1
	Good drainage, generally dry	0

Table A.1 Soil-test evaluation

*Ten points or greater indicates that soil is corrosive to ductile-iron pipe; protection is needed. Refer to paragraph A.3 for a description of Uniquely Severe Environments and additional considerations.

+If sulfides are present and low (<100 mv) or negative redox-potential results are obtained, add three points for this range.



GEOTECHNICAL TEST BORING LOG

-unsuitable material for trench backfill -wet soils - drying needed or replace

		COTEK # 22-028 BORING NO. 1 (1 of 1) OJECT Proposed West Side Sanitary Sewer Extension (Phase 1), Harrisburg, SD												l of 1)				
		51 Pro			i), Harrisburg, S	<u>עכ</u>		SA	MP		LABORATORY TESTS							
	DEPTH in		DESC	RIPTION O	F MATERIA	AL.		GEOLOGIC	N									
	FEET	SUR	RFACE EL	EVATION	1388.9 ft			ORIGIN		WL	NO.		/PE	wc	D	LL	PL	QU
	-	LEAN surfac	I CLAY: I ce, froze	black, soft, ⁻ n to 2' then	12" of grave wet (CL)	el at		TOPSOIL	- - _ 3		1		HSA SPT	36				
	4½								_	Ţ								
	-	LEAN browr	I CLAY V n and gra	VITH SAND : ay, moist, fir	a little grav m, (CL)	vel,		GLACIAL TILL	5 		3	X	SPT	25				
	7 _	FAT C	CLAY WI n and gra	TH SAND : a ay, moist, fir	a little grave m to stiff, (C	I, CH)		GLACIAL TILL	_ 10		4		SPT	21				
	_								10 		5	Д	SPT	22				
	-								_ _ 10		10 6	\square	BAG SPT	21				
	_								10 		7	X	SPT	22				
GEOTECHNICAL TEST BORING 22-028.GPJ GEOTEKENG.GDT 3/11/22	- - - - - -								- - - - -		8	X	SPT	26				
328.GPJ GEO	24½	LEAN CLAY WITH SAND: a little gravel, gray, wet, firm, (CL)						GLACIAL TILL	- 8		9	X	SPT	23				
3 22-	26		Bottor	n of boreho	le at 26 fee	t.				1								
JRIN									START	<u> </u>	3-2-2					3 2 7	2 12.0	8 nm
STBC		WATER LEVEL MEASUREMENTS					WATER	METH		3-2-2	۷۷	_ 00	OMPLE		J-J-2	2 12:2	o hui	
L TE	DATE		TIME	DEPTH	DEPTH	DEPTH		LEVEL	₩ETF 3.25"		ollow	<u>/ St</u> e	em A	uger				
NICA	3-3-22		2:26 pm	26		22	_	23						0				
LECH	3-3-22	2 4:	:00 pm 	26 		22	Ţ	4										
GEOI									CREW CHIEF Mike Wagner									



GEOTECHNICAL TEST BORING LOG

unsuitable material for trench backfill
 wet soils - drying needed or replace

EK # <u>22-028</u>									50		NO.		2 (1 of 1)	
T Proposed	West Side San	itary Sewer E	Extension (Ph	nase	1), Harrisburg, S	SD	<u> </u>						ATOP		
			4L		GEOLOGIC	N									
	ELEVATION	<u>1389.9 ft</u>			ORIGIN		WL	NO.	T	YPE	wc	D	LL	PL	Q
LEAN CLA frozen to 3	<u>Y</u> : black, 12" c ' then moist (C	of gravel at s CL)	surface,		TOPSOIL	_		1		HSA					
			-	_		_									
			-			_ 15		2	Х	SPT	24				
			-	_		_		10		BAG					
FAT CLAY	dark brown, r	noist, firm, ((CH)	$\overline{\prime}$	FINE	- 6		3	$\overline{\vee}$	SPT	24				
					ALLUVIUM	-	Ţ		Δ		27				
	AN CLAY: a lit	tle gravel h			GLACIAL	-									
and gray, v	vet, firm, (CL)	lite gravel, b	JOWI		TILL	_ 5		4	Х	SPT	29				
						_									
						- 8		5	\square	SPT	24				
						-			Δ						
LEAN CLA	Y WITH SAND	: a little grav	vel.		GI ACIAI	_									
brown and	gray, wet, firm	n, (CL)	,		TILL	_ 8		6	Х	SPT	28				
						_									
SANDY LE	AN CLAY: bro	wn, wet, stif	f, (CL)			11		7	M	SPT	33	98			4
						_			\square						
						_									
						-									
						_									
<u>LEAN CLA</u>	<u>Y</u> : brown, wet,	firm, (CL)			GLACIAL FLUVIAL	- 7		8	Х	SPT	37				
						_									
						_									
LEAN CLA	Y WITH SAND	: a little grav	vel,		GLACIAL	_									
gray, moisi	, stiff, (CL)				1 ILL	_									
						- 12		9	X	SPT	24				
Во	ttom of boreho	ole at 26 fee	t.	////			1								
,	WATER LEVE	L MEASUR	EMENTS			STAR	Γ	3-2-2	22	_ CO	OMPLE	TE _	3-2-2	22 1:3	5 pn
TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH		WATER LEVEL				, 01	om A	udor				
	n 26		19		22	5.25	חטו			eni A	uyei				
2 4:11 pm	n 26		18	Ţ	6										
	EAT CLAY FAT CLAY FAT CLAY FAT CLAY SANDY LE and gray, v LEAN CLA brown and SANDY LE and gray, noist	DESCRIPTION C SURFACE ELEVATION LEAN CLAY: black, 12" of frozen to 3' then moist (C FAT CLAY: dark brown, r SANDY LEAN CLAY: a lift and gray, wet, firm, (CL) LEAN CLAY WITH SAND brown and gray, wet, firm SANDY LEAN CLAY: brown brown and gray, wet, firm SANDY LEAN CLAY: brown, wet, ITIME SAMPLED DEPTH 1:36 pm 26	DESCRIPTION OF MATERIAL SURFACE ELEVATION 1389.9 ft LEAN CLAY: black, 12" of gravel at s frozen to 3" then moist (CL) FAT CLAY: dark brown, moist, firm, (CL) SANDY LEAN CLAY: a little gravel, b and gray, wet, firm, (CL) LEAN CLAY WITH SAND: a little gravel, b and gray, wet, firm, (CL) SANDY LEAN CLAY: brown, wet, stift LEAN CLAY WITH SAND: a little gravel, b and gray, wet, firm, (CL) LEAN CLAY: brown, wet, stift LEAN CLAY: brown, wet, firm, (CL) SANDY LEAN CLAY: brown, wet, stift LEAN CLAY: brown, wet, firm, (CL) Bottom of borehole at 26 fee WATER LEVEL MEASUR TIME SAMPLED DEPTH CASING DEPTH 26	DESCRIPTION OF MATERIAL SURFACE ELEVATION1389.9 ft_ LEAN CLAY: black, 12" of gravel at surface, frozen to 3' then moist (CL) FAT CLAY: dark brown, moist, firm, (CH) SANDY LEAN CLAY: a little gravel, brown and gray, wet, firm, (CL) LEAN CLAY WITH SAND: a little gravel, brown and gray, wet, firm, (CL) SANDY LEAN CLAY: brown, wet, stiff, (CL) LEAN CLAY WITH SAND: a little gravel, brown and gray, wet, firm, (CL) LEAN CLAY: brown, wet, stiff, (CL) LEAN CLAY: brown, wet, firm, (CL) LEAN CLAY: brown, wet, stiff, (CL) LEAN CLAY: brown, wet, firm, (CL) LEAN CLAY: brown, wet, firm, (CL) Bottom of borehole at 26 feet. WATER LEVEL MEASUREMENTS TIME SAMPLED DEPTH CASING DEPTH 1:36 pm 26	DESCRIPTION OF MATERIAL SURFACE ELEVATION1389.9 ft	DESCRIPTION OF MATERIAL SURFACE ELEVATION1389.9 ft_ GEOLOGIC ORIGIN LEAN CLAY: black, 12" of gravel at surface, frozen to 3' then moist (CL) TOPSOIL EAT CLAY: dark brown, moist, firm, (CH) FINE ALLUVIUM SANDY LEAN CLAY: a little gravel, brown and gray, wet, firm, (CL) GLACIAL TILL LEAN CLAY WITH SAND: a little gravel, brown and gray, wet, firm, (CL) GLACIAL TILL SANDY LEAN CLAY: brown, wet, stiff, (CL) GLACIAL TILL LEAN CLAY WITH SAND: a little gravel, brown and gray, wet, firm, (CL) GLACIAL FLUVIAL SANDY LEAN CLAY: brown, wet, stiff, (CL) GLACIAL FLUVIAL LEAN CLAY: brown, wet, firm, (CL) GLACIAL FLUVIAL SANDY LEAN CLAY: brown, wet, stiff, (CL) GLACIAL FLUVIAL SANDY LEAN CLAY: brown, wet, stiff, (CL) GLACIAL FLUVIAL SANDY LEAN CLAY: brown, wet, stiff, (CL) GLACIAL FLUVIAL LEAN CLAY WITH SAND: a little gravel, gray, moist, stiff, (CL) GLACIAL FLUVIAL Bottom of borehole at 26 feet. I WATER LEVEL MEASUREMENTS WATER LEVEL TIME SAMPLED DEPTH CASING DEPTH CAVE-IN DEPTH I 136 pm 26 - 19 22	SURFACE ELEVATION1389.9 ft	DESCRIPTION OF MATERIAL _SURFACE ELEVATION1389.9 ft_ GEOLOGIC ORIGIN N WL LEAN CLAY: black, 12" of gravel at surface, frozen to 3" then moist (CL) TOPSOIL 15 EAT CLAY: dark brown, moist, firm, (CH) FINE ALLUVIUM 6 1 SANDY LEAN CLAY: a little gravel, brown and gray, wet, firm, (CL) GLACIAL TILL 5 SANDY LEAN CLAY: a little gravel, brown and gray, wet, firm, (CL) GLACIAL TILL 8 SANDY LEAN CLAY: brown, wet, stiff, (CL) GLACIAL TILL 7 LEAN CLAY WITH SAND: a little gravel, brown and gray, wet, firm, (CL) GLACIAL FLUVIAL 11 LEAN CLAY: brown, wet, stiff, (CL) GLACIAL FLUVIAL 7 LEAN CLAY WITH SAND: a little gravel, gray, moist, stiff, (CL) GLACIAL FLUVIAL 7 LEAN CLAY WITH SAND: a little gravel, gray, moist, stiff, (CL) GLACIAL FLUVIAL 11 11 12 12 Bottom of borehole at 26 feet. 12 WATER LEVEL MEASUREMENTS START	DESCRIPTION OF MATERIAL SURFACE ELEVATION _1389.9.ft_ GEOLOGIC ORIGIN N WL NO. LEAN CLAY: black, 12" of gravel at surface, frozen to 3" then moist (CL) TOPSOIL 1 1 FAT CLAY: dark brown, moist, firm, (CH) FINE ALLUVIUM 6 1 FAT CLAY: dark brown, moist, firm, (CH) FINE ALLUVIUM 6 3 SANDY LEAN CLAY: a little gravel, brown and gray, wet, firm, (CL) GLACIAL TILL 5 4 SANDY LEAN CLAY: a little gravel, brown and gray, wet, firm, (CL) GLACIAL TILL 8 6 LEAN CLAY WITH SAND: a little gravel, brown, wet, stiff, (CL) GLACIAL TILL 7 8 LEAN CLAY: brown, wet, firm, (CL) GLACIAL TILL 7 8 GLACIAL gray, moist, stiff, (CL) GLACIAL TILL 7 8 LEAN CLAY: brown, wet, firm, (CL) GLACIAL TILL 7 8 LEAN CLAY: brown, wet, firm, (CL) GLACIAL TILL 7 8 Bottom of borehole at 26 feet. 12 9 Bottom of borehole at 26 feet. 12 9 ITIME SAMPLED DEPTH CAVE-IN DEPTH WATER LEVEL 3.23'' ID Holiow	DESCRIPTION OF MATERIAL SURFACE ELEVATION1389.9 ft GEOLOGIC ORIGIN N WL SAME NO. LEAN CLAY: black, 12" of gravel at surface, frozen to 3" then moist (CL) TOPSOIL - 1<	DESCRIPTION OF MATERIAL SURFACE ELEVATION1389.9 ft	DESCRIPTION OF MATERIAL SURFACE ELEVATION _ 1389.9 ft GEOLOGIC ORIGIN N WL NO TYPE WC LEAN CLAY: black, 12" of gravel at surface, frozen to 3" then moist (CL) 1 HSA 1 HSA EAT CLAY: dark brown, moist, firm, (CH) FINE and gray, wet, firm, (CL) 15 2 SPT 24 SANDY LEAN CLAY: a little gravel, brown and gray, wet, firm, (CL) GLACIAL TILL 5 4 SPT 28 SANDY LEAN CLAY: brown, wet, firm, (CL) GLACIAL TILL 5 4 SPT 28 LEAN CLAY WITH SAND: a little gravel, brown and gray, wet, firm, (CL) GLACIAL TILL 8 6 SPT 28 SANDY LEAN CLAY: brown, wet, stiff, (CL) GLACIAL FLUVIAL 11 7 SPT 33 LEAN CLAY WITH SAND: a little gravel, brown and gray, wet, firm, (CL) GLACIAL FLUVIAL 11 7 SPT 33 LEAN CLAY WITH SAND: a little gravel, gray, moist, stiff, (CL) GLACIAL FLUVIAL 7 8 SPT 24 LEAN CLAY WITH SAND: a little gravel, gray, moist, stiff, (CL) GLACIAL FLUVIAL 7 8 SPT 24 LEAN CLAY WITH SAND: a little gravel, gray, moist, stiff, (CL) <t< td=""><td>DESCRIPTION OF MATERIAL SURFACE ELEVATION GEOLOGIC 1389.9 fr. N SAMPLE LABOR LEAN CLAY: black, 12" of gravel at surface, frozen to 3' then moist (CL) 1 HSA 1 HSA EAT CLAY: dark brown, moist, firm, (CH) FINE and gray, wet, firm, (CL) 15 2 SPT 24 SANDY LEAN CLAY: a little gravel, brown and gray, wet, firm, (CL) GLACIAL TILL 5 4 SPT 24 SANDY LEAN CLAY: a little gravel, brown and gray, wet, firm, (CL) GLACIAL TILL 5 4 SPT 24 LEAN CLAY WITH SAND: a little gravel, brown and gray, wet, firm, (CL) GLACIAL TILL 8 6 SPT 28 LEAN CLAY WITH SAND: a little gravel, brown and gray, wet, firm, (CL) GLACIAL FLUVIAL 7 8 SPT 33 98 LEAN CLAY WITH SAND: a little gravel, gray, moist, stiff, (CL) GLACIAL FLUVIAL 7 8 SPT 33 98 LEAN CLAY WITH SAND: a little gravel, gray, moist, stiff, (CL) GLACIAL FLUVIAL 7 8 SPT 33 98 LEAN CLAY WITH SAND: a little gravel, gray, moist, stiff, (CL) GLACIAL FLUVIAL 7 8 SPT 32 LEAN CLAY WITH</td><td>DESCRIPTION OF MATERIAL SURFACE ELEVATION</td><td>DESCRIPTION OF MATERIAL SURFACE ELEVATION1389.9 fr</td></t<>	DESCRIPTION OF MATERIAL SURFACE ELEVATION GEOLOGIC 1389.9 fr. N SAMPLE LABOR LEAN CLAY: black, 12" of gravel at surface, frozen to 3' then moist (CL) 1 HSA 1 HSA EAT CLAY: dark brown, moist, firm, (CH) FINE and gray, wet, firm, (CL) 15 2 SPT 24 SANDY LEAN CLAY: a little gravel, brown and gray, wet, firm, (CL) GLACIAL TILL 5 4 SPT 24 SANDY LEAN CLAY: a little gravel, brown and gray, wet, firm, (CL) GLACIAL TILL 5 4 SPT 24 LEAN CLAY WITH SAND: a little gravel, brown and gray, wet, firm, (CL) GLACIAL TILL 8 6 SPT 28 LEAN CLAY WITH SAND: a little gravel, brown and gray, wet, firm, (CL) GLACIAL FLUVIAL 7 8 SPT 33 98 LEAN CLAY WITH SAND: a little gravel, gray, moist, stiff, (CL) GLACIAL FLUVIAL 7 8 SPT 33 98 LEAN CLAY WITH SAND: a little gravel, gray, moist, stiff, (CL) GLACIAL FLUVIAL 7 8 SPT 33 98 LEAN CLAY WITH SAND: a little gravel, gray, moist, stiff, (CL) GLACIAL FLUVIAL 7 8 SPT 32 LEAN CLAY WITH	DESCRIPTION OF MATERIAL SURFACE ELEVATION	DESCRIPTION OF MATERIAL SURFACE ELEVATION1389.9 fr





-unsuitable material for trench backfill
 -wet soils - drying needed or replace

GEOTE	-			_							BC	ORING	NO.		3 (1	1 of 1)	
	CT <u>Pro</u>					hase	1), Harrisburg, S	SD		SA	MF			ABOR	ATOR	Y TES	STS
DEPTH in					4L		GEOLOGIC ORIGIN	Ν	\\//	NO.		YPE	wc	D	LL	PL	Q
FEET			LEVATION _						VVL	NO.	'	1	wc	D			
	<u>LEAN</u> surfa	<u>I CLAY</u> : ce. froze	black, firm, ⁻ en to 2.5' the	12" of grave n moist (Cl	el at)		TOPSOIL					HSA					
		,		(-,					1		пза					
-												0.007					
-								_ 7		2	Ŵ	SPT	43				
4½								_									
4/2			ery dark brov	wn, moist, s	stiff,		FINE	- 10				ODT					
6 _	(CH)						ALLUVIUM	10		3	Ŵ	SPT	24				
	SANI	DY LEAN firm, (CL	<u>I CLAY</u> : with	gravel, bro	wn,		GLACIAL TILL										
-	wei,	IIII, (CL)				TILL	-				0.007					
8½								_ 6	⊻	4	Ŵ	SPT	28				
-		I CLAY N	NITH SAND : ay, moist, fir	a little grav	vel,		GLACIAL TILL	_									
_	DIOW	n anu gi	ay, moist, m	III, (OL)								ODT					
								8		5	Ŵ	SPT	21				
12 _																	
12 _			ITH SAND: a		el,		GLACIAL				$\overline{}$	0.007					
-	brow	n and gra	ay, moist, fir	m, (CH)			TILL	_ 7		6	Ŵ	SPT	21				
14½								_									
14/2	LEAN	I CLAY V	NITH SAND:	a little grav	vel,		GLACIAL				$\overline{}$						
	gray,	moist, fi	rm to stiff, (0	CL)			TILL	8		7	Ŵ	SPT	23				
-								_									
-								-									
-								_									
											$\overline{\wedge}$	ODT					
21 _								11		8	Ŵ	SPT	20				
		Botto	m of boreho	le at 21 fee	et.												
-								_									
_								-									
-								_									
_								_									
		WA	ATER LEVE	L MEASUR	EMENTS			STAR	Γ	3-2-2	2	_ co	MPLE	TE _	3-2-2	22 2:5	0 pn
DATE		TIME	SAMPLED	CASING	CAVE-IN		WATER	METH									
3-2-22		:47 pm	DEPTH 21	DEPTH 	DEPTH 19		LEVEL 19	3.25"	ID He	ollow	St	em A	uger				
3-2-22		:19 pm	21		16	Ţ	8										



GEOTECHNICAL TEST BORING LOG

-unsuitable material for trench backfill
 -wet soils - drying needed or replace

		± <u>22-028</u>		_							B	ORING	G NO.		4 ('	1 of 1)	
						hase	1), Harrisburg, S	SD		SA	MF	PLE		ABOR	ATOR	Y TES	STS
DEPTH in			RIPTION O		4L		GEOLOGIC ORIGIN	N		NO.		YPE	wc	D	LL	PL	Q
FEET			LEVATION		-				VVL	NU.	1	TPE	WC	D	LL	PL	Q
	<u>LE</u> fro	<u>EAN CLAY</u> : ozen to 3' th	black, 12" o ien moist (C	f gravel at s I)	surface,		TOPSOIL										
_				_)						1		HSA					
-								-			\bigvee	ODT					
_								_ 17		2	Å	SPT	39				
41/2								_									
4/2			brown and g	ıray, moist,	firm,		FINE				\bigtriangledown	ODT					
_) (C	E)					ALLUVIUM	7		3	\wedge	SPT	22				
7 _																	
' _	<u>S/</u>	ANDY LEAN	I CLAY: a lit	le gravel, b	prown,		GLACIAL				\bigtriangledown	SPT	00				
8½		oist, firm, (C					TILL	_ 7		4	\wedge	571	22				
-	LE br	EAN CLAY \ own, moist,	MITH SAND	a little grav	vel,		GLACIAL TILL	_									
_		own, moist,	11111, (OE)					5		5	\bigtriangledown	SPT	27				
_										5	\wedge	351	21				
12 _																	
12 _	LE		NITH SAND	grayish bro	own,		GLACIAL	9		6	\bigtriangledown	SPT	21				
-	m	oist, (CL)					TILL	_ 9		0	Δ	SFI	21				
14½								_	Ţ								
	LE	EAN CLAY	NITH SAND	a little grav	vel,		GLACIAL	8		7	\bigtriangledown	SPT	22				
_	gr	ay, moist, fi	irm, (CL)				TILL	-		<i>'</i>	Δ	SFI	22				
_																	
_								_									
-								_									
_								- 8		8	V	SPT	23				
21 _		Dette	waaf bawaba	la at 04 fa a	1						Δ						
_		Bollo	m of boreho	ie al Z i iee	·L.			_									
_]																
-								-									
								-									
-								-									
		\\//	ATER LEVE	MEASUR	EMENTS			STAR	 r	3-2-2	22			TE	3_2 '	22 3:4	8 pr
DATE	_	TIME	SAMPLED	CASING	CAVE-IN		WATER	METH	IOD					··	<u> </u>	<u> 22 0.4</u>	
3-2-22		3:59 pm	DEPTH 21	DEPTH 	DEPTH 18	_	LEVEL 14	3.25"	ID H	ollow	St	tem A	uger				
	-					<u>+</u>											



GEOTECHNICAL TEST BORING LOG

-unsuitable material for trench backfill

GEOTE	EK# <u>22-028</u>		_							BORI	IG NO.		5 (1 of 1)	
PROJEC	CT Proposed V	Vest Side Sani	itary Sewer E	Extension (P	hase	e 1), Harrisburg, S	SD								
DEPTH	DES	CRIPTION O	F MATERIA	AL.		GEOLOGIC			SA	MPLE		_ABOF	RATOF	RY TES	STS
in FEET		ELEVATION	1389.3 ft			ORIGIN	N	WL	NO.	TYPE	wc	D	LL	PL	QU
1		very dark br	rown, frozer	n, (CL)		TOPSOIL									
	LEAN CLAY	brown, froze	en, (CL)			FINE	+		1	HS	×				
2 _	LEAN CLAY brown and g	WITH SAND ray, moist, st	: a little grav iff, (CL)	/el,		ALLUVIUM GLACIAL TILL	_ 9		2	SP.	22				
-							- - 11		3	SP'	Г 2 1				
-							-								
-							_ 11		4	SP.	Г 21				
_							12 		5	SP.	21				
-							_ _ 12	Ţ	6	SP.	Г 2 0				
_							_ 12		7	SP.	г 23				
							- - - 12		8	SP.	г 22				
21	Botto	om of boreho	le at 21 fee	t.			-								
							-								
	W	ATER LEVE		-	.		STAR		3-9-2	22	COMPL	ETE	3-9-	22 9:23	3 am
DATE	E TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH		WATER LEVEL	METH 3.25"		ollow	<u>Stem</u>	Auaer				
3-9-22		26		24	Ţ	12	0.20		511011	0.011					
3-10-2		26		22	Ţ	12									
							CREV			004	/ Osthu				

GEOTECHNICAL TEST BORING 22-028.GPJ GEOTEKENG.GDT 3/11/22



GEOTECHNICAL TEST BORING LOG

-unsuitable material for trench backfill
 -wet soils - drying needed or replace

		<u>22-028</u>			• • • • · · · · · · · · · · · · · · · ·	1 -					BC	DRING	S NO.		6 (*	1 of 1)	
						hase	1), Harrisburg, S	SD	1	54	ME	PLE				Y TES	272
DEPTH in		DESC	RIPTION O	F MATERIA	4L		GEOLOGIC	N									
FEET	v S	URFACE E	LEVATION	1387.0 ft			ORIGIN		WL	NO.	T	YPE	WC	D	LL	PL	Q
	LE	AN CLAY:	black, froze	n to 2' then	wet,		TOPSOIL										
-	sof	t, (CL)						_		1	I	HSA					
_								_			1						
								4		2	V	SPT	26				
-											Δ						
-								_									
5									Ţ								
		AN CLAY:	dark gray, w	/et, soft to fi	irm,		FINE	3		3	X	SPT	31				
-	(Cl	_)					ALLUVIUM	_			<u> </u>						
-								_									
_								3		4	Х	SPT	33				
											4						
-								_									
_								5		5	М	SPT	46				
11								Ŭ		Ĭ	Δ						
	LE	AN CLAY V ay, moist, fi	NITH SAND	a trace of o	gravel,		GLACIAL TILL										
-	gra	iy, moist, n	пп, (СL)				TILL				$\overline{}$						
-								8		6	Å	SPT	22				
_								_									
											\neg						
-								6		7	Х	SPT	21				
-								_			4						
_								_									
-																	
-								_									
_											$\overline{}$						
								6		8	X	SPT	21				
-																	
-								-									
_								_									
-								_									
-								- 7		9	VI	SPT	21				
26		D - # -		1+ 00 f	1				4	ł	4						
			m of boreho														
		WA	ATER LEVE					STAR		3-9-2	22	_ co	OMPLE	TE _	3-9-2	2 10:4	l8 ai
DATE		TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH		WATER LEVEL	METH		مالمن	0.4	om ^	100-				
3-9-22	2	10:45 am	26		24		12	3.25"	<u>א עו</u>	UIIOW	<u> </u>	em A	uger				
3-9-22	2	11:48 am	26		22		6										
3-10-2	2 T	4:05 pm	26		10	T	5										



GEOTECHNICAL TEST BORING LOG

-unsuitable material for trench backfill

GEOTE	EK# <u>22-028</u>									BC	ORING	NO.		7 (1	1 of 1)	
PROJEC	CT Proposed V	Vest Side San	itary Sewer E	Extension (P	hase	1), Harrisburg, S	SD	1				.				
DEPTH in	DESC	CRIPTION O	F MATERIA	4L		GEOLOGIC	N				PLE				Y TES	
FEET	SURFACE E	ELEVATION	1390.0 ft			ORIGIN		WL	NO.	T	YPE	wc	D	LL	PL	QI
	LEAN CLAY	very dark b	rown to blac	⊳k,		TOPSOIL										
-	frozen to 2' tl	nen moist, (C	JL)		<u> </u>		_		1		HSA					
21⁄2					<u> </u>		_									
_/	FAT CLAY: d	lark brown, r	noist, stiff, (CH)		FINE ALLUVIUM	_ 12		2	X	SPT	23				
-							_			M						
_										\square						
6							11		3	М	SPT	20				
	LEAN CLAY brown and g	WITH SAND	: a trace of	gravel,		GLACIAL TILL										
-	brown and gi	ay, moist, si	.m, (CL)				12		4	\square	SPT	23				
-							_ 12		4	Д	351	23				
-							_									
-							11		5	М	SPT	22				
-							-			Д						
12							_									
	FAT CLAY W brown and g	/ITH SAND: a rav. moist. st	a trace of gr iff to verv si	avel, tiff. (CH)		GLACIAL TILL	11		6	М	SPT	21				
				, (0)			_			Д						
-							-									
_							12		7	X	SPT	22				
-							_	L		Η						
-							_	_								
_							_									
_							_									
_							_			\square						
21							17		8	М	SPT	21				
	Botto	om of boreho	ole at 21 fee	t.												
-							_									
-							-									
-							-									
-							_									
-							-									
	W						STAR		3-9-2	22	_ CO	OMPLE	TE _	3-9-2	2 11:4	3 ar
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH		WATER LEVEL	METH 3.25"		ollow	/ St	em A	uder				
3-9-22		21		18	_	none	0.20		2.101			.90				
3-10-2	2 4:10 pm 	21		18	T	16.5 										
							CREV	V CH	IIEF	(Codv (Osthus	5			



GEOTECHNICAL TEST BORING LOG

-unsuitable material for trench backfill

		22-028									BC	ORING	S NO.		8 (1	l of 1)	
PROJE	СТ	Proposed W	est Side Sani	itary Sewer E	xtension (Pl	hase	1), Harrisburg, S	SD					-				
DEPTH		DESC	RIPTION O	F MATERIA	AL.		GEOLOGIC	N		SA	АМF Т	PLE		ABOR	ATOR	Y TES	STS I
in FEET	L.	SURFACE E	LEVATION	1395.4 ft			ORIGIN	Ν	WL	NO.	T	YPE	wc	D	LL	PL	Q
	LE	AN CLAY:	very dark br	own, frozer	i, (CL)		TOPSOIL										
-								-		1		HSA					
2			brown and g	rov moiot	1051		FINE	_			Щ						
_	sti	ff, (CL)	biown and g	jiay, moist,	very		ALLUVIUM	_ 18		2	IXI	SPT	22				
											Ĥ						
4½																	
-	F/	own, moist,	TH SAND: a stiff (CH)	a little grave	l,		GLACIAL TILL	14		3	M	SPT	21				
_		onn, moloc,	oun, (011)					_			Д						
_								_									
								11		4	М	SPT	23				
-											Д						
-								-									
_								11		5	\square	SPT	23				
										5	\square	351	23				
12																	
12 -	F/	T CLAY W	TH SAND: a	a little grave	l,		GLACIAL	-			\square						
-	br	own and gra	ayish brown	, stiff, (CH)			TILL	_ 13		6	М	SPT	24	102			64
_								_			Ħ						
											\square						
								13		7	X	SPT	21				
-								_			H						
-																	
_								_									
19																	
	<u>F/</u>	T CLAY W	TH SAND: a	a little grave	l,		GLACIAL	_									
-	br	own, stiff to	very stiff, (0	JH)			TILL	16		8	M	SPT	21				
-								-	Ţ		Д						
_								_									
-								-									
-								-									
_								13		9	\square	SPT	23				
26								13		9	М	351	23				
		Botto	m of boreho	le at 26 fee	t.												
		WA	TER LEVE	L MEASUR	EMENTS			STAR	Γ	3-3-2	22	_ CC	OMPLE	TE _	3-3-2	22 5:4	6 pn
DATE		TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH		WATER LEVEL	METH									
3-3-22	2	10:45 am	26	 	23	+	none	3.25"	<u>ID H</u>	ollow	/ St	em A	uger				
3-3-22		4:00 pm	26		20	Ţ	21								<u> </u>	<u> </u>	
										_							



GEOTECHNICAL TEST BORING LOG

-unsuitable material for trench backfill

GEOTE	EK# <u>22-028</u>									BC	ORING	S NO.		9 (1	l of 1)	
PROJEC	CT Proposed W	est Side Sani	tary Sewer E	xtension (Ph	nase	1), Harrisburg, S	SD									
DEPTH	DESC	RIPTION O	F MATERIA	L		GEOLOGIC			SA	\MF	PLE	L	ABOR	ATOR	Y TES	STS
in FEET	SURFACE E	LEVATION	1400.3 ft			ORIGIN	Ν	WL	NO.	Т	YPE	WC	D	LL	PL	QU
1	LEAN CLAY:	very dark br	own, frozen	, (CL)		TOPSOIL										
2	LEAN CLAY:	brown, froze	en, (CL)			FINE	_		1		HSA					
-	LEAN CLAY brown, moist,	<u>NITH SAND</u> : stiff, (CL)	a little grav	el,		ALLUVIUM GLACIAL TILL	_ 10		2		SPT	20				
4½							_									
-	FAT CLAY W brown, moist,	ITH SAND: a stiff to very	little gravel stiff, (CH)	,		GLACIAL TILL	13 		3	X	SPT	21				
_							_ _ 13		4	X	SPT	22				
_							- - 12		5	X	SPT	22				
_							_ _ 12		6	X	SPT	22				
_							12 		7	X	SPT	23				
							- - 13 -	Ţ	8	X	SPT	23				
 	Botto	m of boreho	le at 26 feet				- 18		9	X	SPT	23				
	WA	ATER LEVE	L MEASUR	EMENTS			STAR	<u>.</u> Г	3-3-2	<u>22</u>		DMPLE	TE	3-3-2	22 5:52	2 pm
DATE		SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH		WATER LEVEL	METH	IOD					-			
3-3-22		26	DEPTH 	24	1	none	3.25"	ID H	ollow	<u>/ St</u>	tem A	uger				
3-3-22		26		23	Ţ	21										
					1											
							CREV	V CH	IIEF	Ν	/like V	Vagne	r			

GEOTECHNICAL TEST BORING 22-028.GPJ GEOTEKENG.GDT 3/11/22



GEOTECHNICAL TEST BORING LOG

unsuitable material for trench backfill
 wet soils - drying needed or replace

	EK # <u>22-028</u>	loot Side Ser		stancian (Db-	se 1), Harrisburg, S	6 D			BOR	NG N	0.		10 (1 of 1))
			-	•		50		SA	MPLE		L	ABOR	ATOR	Y TES	STS
DEPTH in				AL	GEOLOGIC ORIGIN	Ν	\\//	NO.	TYP		vc	D	LL	PL	Q
FEET							VVL	NO.	IIF	- *	10	D		гь	
1	LEAN CLAY :	-		n, (CL)	TOPSOIL			1	н						
2	FAT CLAY: b	rown, frozen	, (CH)		FINE ALLUVIUM			'							
-	FAT CLAY W brown, moist	/ ITH SAND : a , stiff, (CH)	a little grave	l,	GLACIAL	_ 11		2	SF	י די	22				
-						- - 12 -		3	SF	ν τ	21				
-						_ _ 10		4	SF	PT	22				
91⁄2	FAT CLAY W gray, moist, s		prown and c	lark	GLACIAL TILL	12		5	SF	рт т	22				
_						_ _ 12		6	SF	PT	21				
_						- - -		7	SF	PT 1	22				
- - - -						- - - - - -		8	SF	' т (;	23				
- 24½ -	SANDY LEA	<u>N CLAY</u> : a tra . firm. (CL)	ace of grave	əl,	GLACIAL TILL			9	SF	. Τ	28				
26		om of boreho	le at 26 fee	t l	//		-	┝─┤	/	_ -					
	W					STAR		3-3-2	2	COM	PLE	TE _	3-3-2	22 5:5	7 pm
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL	METH 3.25"		പിറം	Ster		er				
3-3-22	2 1:00 pm	26		18	none	0.20		511011	0.011	uy	~				
						CRE				e Wa					



GEOTECHNICAL TEST BORING LOG

-unsuitable material for trench backfill

		22-028		_							BC	DRING	NO.		11 (1 of 1))
PROJE	CT F	Proposed W	est Side Sani	itary Sewer E	Extension (I	Phase	1), Harrisburg, S	SD	1								
DEPTH		DESC	RIPTION O	F MATERIA	۹L		GEOLOGIC	N		SA	AMF I	PLE		abor I	ATOR	Y TES	JIS
in FEET	l _−s	URFACE E	LEVATION	1404.9 ft			ORIGIN	IN	WL	NO.	Т	YPE	WC	D	LL	PL	Q
	bro	wn and bla	Y LEAN CLA ack, frozen t d 6" of grave	o 2.5' then	moist, 6"		FILL	_		1		HSA					
-								_ 17 _		2	X	SPT	16				
41⁄2	LE	AN CLAY:	black, moist	t, firm, (CL)		××	TOPSOIL	- 8		3	X	SPT	30				
7 _	<u>LE</u> (Cl		brown and g	gray, moist,	firm,		FINE ALLUVIUM	_ 5		4	X	SPT	22				
91⁄2	LE bro	AN CLAY Nown and gra	NITH SAND ayish brown	: a little grav , moist, firm	vel, ı, (CL)		GLACIAL TILL	- - -		5	X	SPT	22				
-								_ 8		6	X	SPT	21				
14½	FA bro	T CLAY W own and da	I TH SAND : a Irk gray, mo	a little grave ist, firm to s	el, tiff, (CH)		GLACIAL TILL	- - -		7	X	SPT	22				
-								- - 13 -		8	X	SPT	21				
24½ _	<u>LE</u> gra	AN CLAY I ay, moist, s	<u>MITH SAND</u> tiff, (CL)	: a little grav	vel,		GLACIAL TILL	_ 		9	$\overline{\mathbf{A}}$	SPT	21				
26 _		-	m of boreho	le at 26 fee	t	<i>[</i> ///			-								
		WA	ATER LEVE		1			STAR		3-3-2	22	_ co	OMPLE	TE _	3-3-2	22 6:0	1 pn
DATE	=	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN		WATER LEVEL	METH 3.25"		ماامه	, 94	om A	uder				
3-3-22	2	2:30 pm	26		23		none	0.20									
						1		1									



GEOTECHNICAL TEST BORING LOG

-unsuitable material for trench backfill
 -wet soils - drying needed or replace

	EK # <u>22-028</u>									BC	ORING	NO.		12 (1 of 1))
		West Side San	itary Sewer E	xtension (Pha	ase '	I), Harrisburg, S	SD	1	64	NAE	PLE				Y TES	
DEPTH in	DE	SCRIPTION C	F MATERIA	L		GEOLOGIC	N									
FEET		ELEVATION	1409.8 ft			ORIGIN		WL	NO.	T	YPE	wc	D	LL	PL	Q
2 _	FILL, MOS brown, froz at the surfa	TLY LEAN CL zen, 4" of asph ace	AY : a little g alt and 8" of	ravel, ^F gravel		FILL	_		1		HSA					
-	LEAN CLA	Y : black, mois	t, stiff, (CL)			TOPSOIL	_ 10		2	Å	SPT	30				
4½ -	LEAN CLA brown and (CL)	<u>Y WITH SAND</u> dark brown, m	: a little grav noist, firm to	rel, stiff,		GLACIAL TILL	7		3	X	SPT	27				
-							9		4	X	SPT	22				
_							9		5	X	SPT	21				
- - - , , , ,							9		6	X	SPT	20				
14½ 	FAT CLAY gray, mois	WITH SAND: t, firm to stiff, (prown and d CH)	ark		GLACIAL TILL	14 		7	X	SPT	23				
-							- - 7 -		8	X	SPT	22				
- - 26 _	Bc	ttom of boreho	ole at 26 fee	t.			- - 14	-	9	X	SPT	24				
		WATER LEVE					07407									7
DATE		SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH		WATER LEVEL	START METH	IOD	<u>3-3-2</u>				:1E _	3-3-2	22 6:07	<u>ı pn</u>
3-3-22	2 3:30 pn			24		none	3.25"	<u>וט חו</u>	UIIOW	5	em A	uger				



GEOTECHNICAL TEST BORING LOG

-wet soils - drying needed or replace

GEOTE	EK #	22-028		_							BC	DRING	S NO.		13 (1 of 1)	
PROJE	CT F	Proposed W	est Side Sani	tary Sewer E	xtension (F	hase	1), Harrisburg, S	SD									
DEPTH		DESC	RIPTION O	F MATERIA	AL.		GEOLOGIC	N		SA	AMF I	PLE		ABOR	ATOR	Y TES	STS
in FEET	S	URFACE E	LEVATION	1408.1 ft			ORIGIN	N	WL	NO.	Т	YPE	wc	D	LL	PL	Q
	bro to s	wn and gra	WITH SAND ay, frozen to asphalt and (2' then mo	ist, firm		GLACIAL TILL	_		1		HSA					
-	501							7		2	X	SPT	23				
_								9		3	X	SPT	21				
7	LE to	AN CLAY : wet, firm, (a trace of gr CL)	avel, brown	ı, moist		GLACIAL FLUVIAL	_ 7		4	X	SPT	21				
_								6 		5	X	SPT	28				
-								- _ 7		6	X	SPT	30				
14½	<u>LE</u> gra	AN CLAY: ay, wet, stif	a trace of gr f, (CL)	avel, brown	i and		GLACIAL FLUVIAL	14 		7	X	SPT	26				
- 19½ -	FA bro (Cl	wn and da	I <mark>TH SAND</mark> : a rk gray, moi	a little grave ist, stiff to ve	l, ery stiff,		GLACIAL TILL	- - - - 14 -		8	X	SPT	23				
- - 26 _		Botto	m of boreho	le at 26 fee	t.			- 22		9	X	SPT	22				
								07455									7
			ATER LEVE	L MEASUR CASING	EMENTS CAVE-IN		WATER	START METH		3-3-2	22		OMPLE	:IE _	3-3-2	22 4:27	<u>r</u> pn
DATE		TIME	DEPTH	DEPTH	DEPTH		LEVEL	3.25"		ollow	/ St	em A	uger				
3-3-22	2	4:27 pm	26		24	+	none										
	-+					+											
						-		CREV			•	Aiko V	Vagne				



GEOTECHNICAL TEST BORING LOG

-wet soils - drying needed or replace

		K# <u>22-028</u>	No - 4 01 1 0								BORIN	G NO.		14 ((1 of 1))
DEI	OJEC PTH n ET	DES	West Side San CRIPTION C ELEVATION	F MATERI		hase	e 1), Harrisburg, S GEOLOGIC ORIGIN	SD N	WL	SA NO.	MPLE TYPE	L WC	ABOR		Y TES	STS QI
	-	FILL, MOST	LY LEAN CL frozen to 2' t	AY : brown a	and		FILL	_		1	HSA					
	_							_ 6		2	SPT	27				
-	- - 7							4		3 9	SPT BAG					
	-	FAT CLAY V brown and g	<u>VITH SAND</u> : a jray, moist, st	a little grave liff, (CH)	el, dark		GLACIAL TILL	10		4	SPT	21				
1	2							15 		5	SPT	. 19				
I	-	FAT CLAY V brown and c stiff, (CH)	VITH SAND : a lark brown, m	a little grave noist, stiff to	el, very		GLACIAL TILL	_ 15 _		6	SPT	19				
	_							16 	Ţ	7	SPT	21				
	-							-								
2	_ 21 _	Bott	om of boreho	ole at 21 fee	·t.			15		8	SPT	22				
	-							-								
	_							_								
		W	ATER LEVE					STAR	_	3-3-2	2 0	COMPLE	TE _	3-3-2	22 3:24	4 pm
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH		WATER LEVEL	METH		ollow	Stem	Augor				
3	3-3-22	i	21		19		none	5.20	<u>ח עו</u>		JUEIN					
3	3-4-22		21		16	Ţ	15									
								CREV			N #11-	Wagne				



GEOTECHNICAL TEST BORING LOG

-unsuitable material for trench backfill -wet soils - drying needed or replace

		22-028	loot Side Ser	-	whome is an (P	ha		20			B	ORING	G NO.		15 ((1 of 1))
	از					nase	e 1), Harrisburg, S	SD	1	SA	MF	PLE		ABOR	ATOR	Y TES	STS
DEPTH in			RIPTION O		AL .		GEOLOGIC	Ν									
FEET	I V	SURFACE E	LEVATION	1410.6 ft			ORIGIN		WL	NO.	I	YPE	wc	D	LL	PL	Q
	LE		black, froze	n to 2' then	moist,		TOPSOIL										
-	1111	m, (CL)						_		1	L	HSA					
-								-									
3								_ 5		2	Х	SPT	33				
		EAN CLAY: L)	brown and g	gray, moist,	stiff,		FINE ALLUVIUM		T								
-	,0	· L)					ALLOVION		<u> </u>								
5½								- 9		3	V	SPT	24				
_	<u>F/</u>	AT CLAY W	ITH SAND: a	a little grave	l,		GLACIAL	_			\square						
	br	own and gra	ay, moist, st	iff, (CH)			TILL										
-										4	\bigvee	SPT	19				
-								_ 11		4	\wedge	501	19				
_								_									
								13		5	Х	SPT	20				
-								_		ľ	<u> </u>						
-								_									
_								14		6	Х	SPT	23				
14½								_									
-	br	<u>AN CLAY N</u> own and da	<u>WITH SAND</u> : Irk brown, m	a little grav	/el, tiff (CL)		GLACIAL TILL	16		7	V	SPT	21				
-					, (0_)			_			\square						
								_									
-								_									
19½								-									
			NITH SAND	a little grav	/el,		GLACIAL				\bigtriangledown						
21	gr	ay, moist, s	tiff, (CL)				TILL	10		8	Å	SPT	22				
- 1		Botto	m of boreho	le at 21 fee	t.				1								
-								_									
_								_									
_								_									
-								-									
-								_									
		1.0 / 0						0745									
- ·	. 1		ATER LEVE	L MEASUR CASING	CAVE-IN		WATER	STAR [®]		3-3-2	2	_ (OMPLE		3-3-2	22 1:1:	∠ pr
DATE		TIME	DEPTH	DEPTH	DEPTH		LEVEL	3.25"		ollow	S	tem A	uger				
3-3-22		1:12 pm	21		19		none						-				
3-4-22	<u> </u>	4:05 pm 	21 		9	<u> </u>	4										
				-		_		CREV				A.1	Vagne				



GEOTECHNICAL TEST BORING LOG

-unsuitable material for trench backfill

		<u>22-028</u>		_							BO	RING	S NO.		16 (1 of 1))
	СТ	Proposed W	est Side Sani	tary Sewer E	Extension (P	hase	1), Harrisburg, S	SD			MPI					Y TES	279
DEPTH in			RIPTION O		4L		GEOLOGIC	N									
FEET	V	SURFACE E	LEVATION	1412.1 ft			ORIGIN		WL	NO.	TY	'PE	wc	D	LL	PL	QI
	LE		very dark br	own to blac	∶k,		TOPSOIL										
-	пс	ozen, (CL)						_		1		HSA					
-								_									
3 _							GLACIAL	7		2	XI	SPT	38				
_	br	own and gra	NITH SAND : ay, moist, st	iff, (CL)	/el,			_			Ĥ						
											\mathbb{H}						
_								9		3	X	SPT	22				
-								_			Ħ.						
-								_			\square						
-								_ 12		4	M	SPT	22				
01/								_									
9½	LE	EAN CLAY	NITH SAND	a little grav	/el,		GLACIAL				\square						
	br	own and da	ırk brown, m	oist, stiff, (0	CL)		TILL	15		5	M	SPT	21				
12																	
12 _	L	EAN CLAY	NITH SAND	a little grav	/el,		GLACIAL	- 40			\square	о р т					
_	gr	ay, moist, s	tiff, (CL)				TILL	_ 13	Ţ	6	Ŋ,	SPT	22				
-								_									
_								- 11		7	\square .	SPT	22				
-										<i>'</i>	Δ`	551					
_																	
-								_									
-								_									
-								- 11		8	Μ.	SPT	22				
21 _		Botto	m of boreho	lo at 21 foo	+				-		$ \rangle$						
-		Dotto			ι.			_									
_								_									
-								_									
-																	
_								_									
		WA	ATER LEVE	L MEASUR	EMENTS			STAR	<u> </u> Г	3-3-2	22	C		TE	3-3-2	2 11:4	4 ar
DATE		TIME	SAMPLED	CASING	CAVE-IN		WATER	METH	-IOD								
3-3-22		11:44 am	DEPTH 21	DEPTH 	DEPTH 19		LEVEL	3.25"	ID H	ollow	<u>/ Ste</u>	em A	uger				
3-4-22		4:10 pm	21		14	Ţ	13										
								CREV					Vagne				



GEOTECHNICAL TEST BORING LOG

-unsuitable material for trench backfill

	EK # <u>22-028</u>		_							BOF	RING	S NO.		17 (1 of 1)
PROJEC	CT Proposed W		-		Phase		SD		SA	MPL	ΕĪ	L	ABOR	ATOR	Y TES	STS
in				4L		GEOLOGIC ORIGIN	Ν	w	NO.	TYF	ΡF	wc	D	LL	PL	Q
FEET	FILL, MOSTL dark brown, f asphalt and 8	Y LEAN CL	<u>\Y</u>: brown a then moist	t, 6" of		FILL	_		1		ISA					
_							- _ 13		2	Δ	PT	23				
_							12		10 3		AG PT	21				
7	LEAN CLAY: moist, firm, (0	very dark br CL)	own to blac	ck,		TOPSOIL	_ 5		4	s	PT	32				
9½ -	FAT CLAY W stiff, (CH)	'ITH SAND: C	lark brown,	moist,		FINE ALLUVIUM	9		5	s	PT	23				
12 _	FAT CLAY W brown and gr	' ITH SAND : a ay, moist, st	a little grave iff to very s	el, tiff, (CL)		GLACIAL TILL	_ 14		6	s	PT	22				
-							- - - -		7	s	PT	20	101			81
-							- - 18 -		8	S	PT	22				
24½	LEAN CLAY	WITH SAND	a little grav	vel,		GLACIAL	- - - - 16		9	$\overline{\mathbb{V}}_{s}$	PT	21				
26		om of boreho		.+				-	Ľ	4						
							-									
DATE	WATER LEVEL MEASUREMENTS					WATER	STAR [®]		3-3-2	2	CC	OMPLE	TE _	3-3-2	22 2:0	9 pm
3-3-22	DEPIH DEPIH DEPIH					LEVEL	3.25"	<u>ID H</u>	ollow	Ste	<u>m A</u>	uger				
							CREV					Vagne				



GEOTECHNICAL TEST BORING LOG

-wet soils - drying needed or replace

		¢ <u>22-028</u>		_	., . ,						BC	ORING	S NO.		18 (1 of 1))
				-	•	nase	1), Harrisburg, S	50		S/	2ME	PLE			ATOR	Y TES	STS
DEPTH			RIPTION O		AL.		GEOLOGIC	N									
FEET	V	SURFACE E	LEVATION	1421.5 ft			ORIGIN		WL	NO.	T	YPE	wc	D	LL	PL	QU
	FI	LL, MOSTL	Y LEAN CLA	<u>AY</u>: brown a	nd	\bigotimes	FILL										
-	da	ark brown, fr	rozen					_		1		HSA					
2				4. 01 41	: . 4	\bigotimes		_									
	(C	ATCLAY : Dr CH)	rown, frozen	to 3° then r	noist,		FINE ALLUVIUM	10		2	M	SPT	25				
3½											Д						
-	br	own and ar	VITH SAND : ay, moist to	wet, firm to	ver, stiff.		GLACIAL TILL	_									
_		CL)	,	,	,			9		3	М	SPT	21				
								9		3	М	351					
										9		BAG					
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_								9		4	X	SPT	21				
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_								- 7	Į₹	5	M	SPT	22				
_								_			Д						
-								-			\square						
-								9		6	M	SPT	27				
_								_			Ħ						
14½	E/		ITH SAND: a	little grave	1		GLACIAL				\vdash						
_	br	own and da	irk brown, m	ioist, stiff, (C	', CL)		TILL	12		7	IXI	SPT	21				
-								_			Щ						
_								_									
-								_									
_								_									
											\square						
								13		8	X	SPT	23				
21		Botto	m of boreho	le at 21 fee	t.						\square						
-								_									
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_								_									
-																	
	WATER LEVEL MEASUREMENTS					1		STAR	<u>і </u>	3-3-2	⊥ 22		L DMPLE		3-3-0	2 10:4	3 am
DATE		TIME	SAMPLED	CASING	CAVE-IN		WATER	METH	HOD						0-0-2	. <u>~ 10.4</u>	
			DEPTH	DEPTH	DEPTH 16	_	LEVEL 16	3.25"	ID H	ollow	/ St	em A	uger				
<u>3-3-22</u> 3-3-22		10:43 am 4:55 pm	21 21		16 15	▼	<u>16</u> 10										
	-					+											
								CREV	N CH	IIEF	Ν	/like V	Vagne	er			



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GEOTEK ENGINEERING & TESTING SERVICES, INC. 909 E 50th St N Sioux Falls, South Dakota, 57104 605-335-5512 Fax jhaskins@geotekeng.com

GEOTECHNICAL TEST BORING LOG

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	K # 22-028 CT Proposed W	/est Side Sani	tary Sewer E	xtension (Pr	nase	e 1), Harrisburg, \$	SD			BORI	NG N	0.		19 (1 of 1))
DEPTH	DESC	RIPTION O	F MATERIA			GEOLOGIC			SA	MPLE		L/	ABOR	ATOR	Y TES	STS
in FEET	SURFACE E					ORIGIN	N	WL	NO.	TYPE	E V	vc	D	LL	PL	QU
-	FILL, MOSTL dark brown, f	Y LEAN CLA	\Y : brown a		×	FILL	_		1	нз	A					
-							9		2	SP	т	16				
41⁄2	LEAN CLAY brown and gr	WITH SAND ay, moist, st	a little grav iff, (CL)	vel,		GLACIAL TILL	- 9 -		3	SP	т	21				
-							9		4	SP	т	22				
_							9		5	SP	т	22				
12 _	FAT CLAY W brown and gr	' ITH SAND : a ay, moist, (C	a little grave CH)	Ι,		GLACIAL TILL	_ 11		6	SP	т	24				
14½	LEAN CLAY brown and da	<u>WITH SAND</u> : ark brown, m	a little grav oist, stiff, (C	vel, CL)		GLACIAL TILL	 15 	Ţ	7	SP	т	23				
- - 19½							-									
-	LEAN CLAY gray, moist, s	LEAN CLAY WITH SAND: a little gravel, gray, moist, stiff, (CL)				GLACIAL TILL	- -		8	SP	т	22				
_ 26	Rotte	m of boreho	le at 26 fee	t			- - 12		9	SP	т	23				
							0745	<u> </u>						0.0.0		
DATE		ATER LEVE SAMPLED DEPTH	L MEASUR CASING DEPTH	EMENTS CAVE-IN DEPTH		WATER LEVEL	STAR METH 3.25"	HOD	<u>3-3-2</u>				:IE _	<u>3-3-2</u>	2 10:0	iu am
3-3-22	2 10:00 am 26 24				none	3.25	H עו			Aug						
3-3-22	22 4:59 pm 26 18				Ţ	16										
				-		CREV			N 4:1-	e Wa	0.5	r				

SOIL CLASSIFICATION CHART

R A			SYME	BOLS	TYPICAL
171			GRAPH	LETTER	DESCRIPTIONS
	GRAVEL AND	CLEAN GRAVELS		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
	GRAVELLY SOILS	(LITTLE OR NO FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
COARSE GRAINED SOILS	MORE THAN 50% OF COARSE	GRAVELS WITH FINES		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
	FRACTION RETAINED ON NO. 4 SIEVE	(APPRECIABLE AMOUNT OF FINES)		GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS	SAND AND	CLEAN SANDS		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
LARGER THAN NO. 200 SIEVE SIZE	SANDY SOILS	(LITTLE OR NO FINES)		SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION	SANDS WITH FINES		SM	SILTY SANDS, SAND - SILT MIXTURES
	PASSING ON NO. 4 SIEVE	(APPRECIABLE AMOUNT OF FINES)		SC	CLAYEY SANDS, SAND - CLAY MIXTURES
				ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
00120				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE				МН	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		СН	INORGANIC CLAYS OF HIGH PLASTICITY
				ОН	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
Н	GHLY ORGANIC S	SOILS	<u></u> 	РТ	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

SYMBOLS FOR DRILLING AND SAMPLING

nbol Definition	
Bag sample	
Continuous split-sp	poon sampling
Drilling mud	
Flight auger; numb	per indicates outside diameter in inches
Hand auger; numb	per indicates outside diameter in inches
A Hollow stem auger	r; number indicates inside diameter in inches
Liner sample; num	ber indicates outside diameter of liner sample
Standard penetrati	ion resistance (N-value) in blows per foot
R No water level mea	asurement recorded, primarily due to presence of drilling fluid
R No sample retrieve	ed; classification is based on action of drilling equipment and/or
	ion test (N-value) using standard split-spoon sampler
	e; 2-inch outside diameter unless otherwise noted
Water level directly	y measured in boring
Water level symbo	d in the second s
	gBag sampleGContinuous split-splitADrilling mudAFlight auger; numbAHand auger; numbAHollow stem augerCAHollow stem augerCAStandard penetrationCAShelby tube sampleCAShelby tube sampleCASplit-spoon sampleCAWater level direction

SYMBOLS FOR LABORATORY TESTS

Symbol	Definition
WC	Water content, percent of dry weight; ASTM:D2216
D	Dry density, pounds per cubic foot
LL	Liquid limit; ASTM:D4318
PL	Plastic limit; ASTM:D4318
QU	Unconfined compressive strength, pounds per square foot; ASTM:D2166

DENSITY/CONSISTENCY TERMINOLOGY

Density		Consistency
<u>Term</u>	N-Value	<u>Term</u>
Very Loose	0-4	Soft
Loose	5-8	Firm
Medium Dense	9-15	Stiff
Dense	16-30	Very Stiff
Very Dense	Over 30	Hard

PARTICLE SIZES

Term	Particle Size
Boulder	Over 12"
Cobble	3" – 12"
Gravel	#4 – 3"
Coarse Sand	#10 – #4
Medium Sand	#40 – #10
Fine Sand	#200 – #40
Silt and Clay	passes #200 sieve

DESCRIPTIVE TERMINOLOGY

<u>Term</u>	<u>Definition</u>
Dry	Absence of moisture, powdery
Frozen	Frozen soil
Moist	Damp, below saturation
Waterbearing	Pervious soil below water
Wet	Saturated, above liquid limit
Lamination	Up to 1/2" thick stratum
Layer	¹ / ₂ " to 6" thick stratum
Lens	1/2" to 6" discontinuous stratum

GRAVEL PERCENTAGES

Term	Range
A trace of gravel	2-4%
A little gravel	5-15%
With gravel	16-50%



MOISTURE - DENSITY TEST REPORT

REPORTED TO:

City of Harrisburg Derick Wenck PO Box 26 Harrisburg, SD 57032 PROJECT: 22-028 Proposed West Side Sanitary Sewer Extension (Phase 1) Harrisburg, SD COPIES TO:

DATE REPORTED: 3/10/2022

1

SAMPLE DATA

Sample No.: ASTM Test Method: Soil Classification:

Remarks:

Fat Clay with Sand, Brown and Gray (CH) SB 1 (10' to 15')

MOISTURE CONTENT (%)

D698B Manual

 Date Received:
 3/2/2022

 Date Tested:
 3/8/2022

	TEST DATA																												
140	П																Т					-						Maximum Density, pcf:	104.7
					∖⊧			c	urv	• e fo	r 10	0%	satı	urat	ion	fors	spe	cific	gra	vity	/eq	ual	to 2	2.65			1	Optimum Moisture, %:	19.3
135							-	1									1						1				t		10.0
100	$\left \right $		_	+	-		+			-	+	_	-		-	\square	+	$\left \right $		+	\square	+			+		+	Percent Passing, %:	
						\setminus	-	_			-		_				_					-			-			3/4":	100
130							+					-	-				+			+		-			-		Ħ	3/8":	100
					+		Y													+		+			1		Ħ	#4:	100
																												#200:	78
125							-	1									+				H						+		
					-		+			-	-	_	-				-			-		-			-		\square	Atterberg Limits (ASTM: D4318):	
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MOISTURE - DENSITY TEST REPORT

REPORTED TO:

City of Harrisburg Derick Wenck PO Box 26 Harrisburg, SD 57032 **PROJECT:** 22-028

Harrisburg, SD

Proposed West Side Sanitary Sewer Extension (Phase 1) COPIES TO:

DATE REPORTED:	3/10/2022	SAMPLE DATA		
Sample No.:	2		Date Received: 3/2/2022	
STM Test Method:	D698B Manual		Date Tested: 3/7/2022	
Soil Classification:	Fat Clay, Dark Brown (Cl	H)		
Remarks:	SB 2 (4 1/2' to 7')			
		TEST DATA		
140			Maximum Density, pcf:	96.0
	Curve for 100% satu	ration for specific gravity equal to 2.65	Optimum Moisture, % :	23.5
135				
			Percent Passing, %:	
			3/4":	100
130			3/8":	100
			#4: #200:	100 87
125			#200:	0/
			Atterberg Limits (ASTM: D4318):	
			Liquid Limit:	
120 -			Plastic Limit:	
			Plasticity Index:	
115 -				
L 110				
S 110 -			-	
Δ Δ				
105			-	
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			Rut Du	ed)
			1 million	
	10 15 20	0 25 30 35 4 CONTENT (%)		



MOISTURE - DENSITY TEST REPORT

REPORTED TO:

City of Harrisburg Derick Wenck PO Box 26 Harrisburg, SD 57032 **PROJECT**: 22-028 Proposed West Side Sanitary Sewer Extension (Phase 1)

Harrisburg, SD

COPIES TO:

DATE REPORTED: 3/10/2022

3

D698B Manual

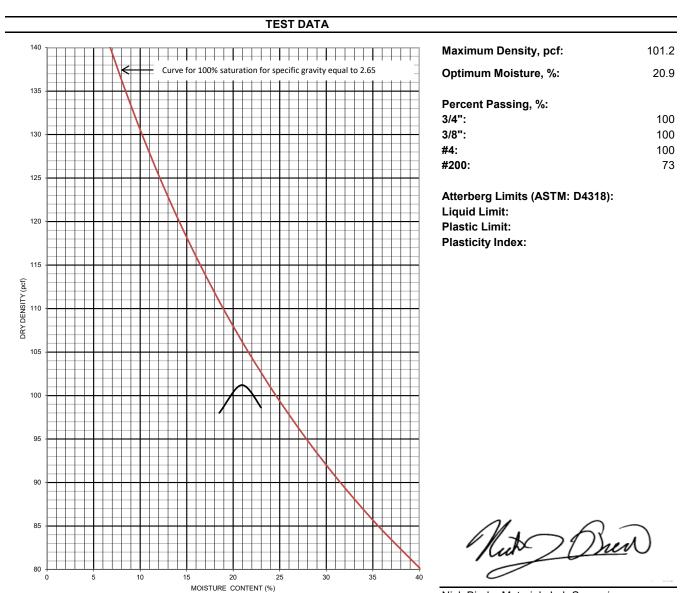
SAMPLE DATA

Sample No.: ASTM Test Method: Soil Classification:

Remarks:

Lean Clay with Sand, Brown and Dark Brown (CL) SB 14 (0' to 7')
 Date Received:
 3/3/2022

 Date Tested:
 3/7/2022





3/10/2022

MOISTURE - DENSITY TEST REPORT

3/9/2022

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100 100

74

REPORTED TO:

City of Harrisburg Derick Wenck PO Box 26 Harrisburg, SD 57032

DATE REPORTED:

PROJECT: 22-028 Proposed West Side Sanitary

Harrisburg, SD

SAMPLE DATA

Sewer Extension (Phase 1)

COPIES TO:

4 Date Received: 3/3/2022 Sample No.: **ASTM Test Method:** D698B Manual Date Tested: Soil Classification: Lean Clay with Sand, Brown (CL) **Remarks:** SB 17 (0' to 5') TEST DATA 140 Maximum Density, pcf: for specific gravity equal to 2.65 **Optimum Moisture**, %: 135 Percent Passing, %: 3/4": 130 3/8": #4: #200: 125 Liquid Limit: 120 **Plastic Limit: Plasticity Index:** 115 DRY DENSITY (pcf) 110 105 100 95 90 85 80 10 30 35 15 20 25 MOISTURE CONTENT (%)

Atterberg Limits (ASTM: D4318):





MOISTURE - DENSITY TEST REPORT

REPORTED TO:

City of Harrisburg Derick Wenck PO Box 26 Harrisburg, SD 57032 **PROJECT:** 22-028

Harrisburg, SD

Proposed West Side Sanitary

Sewer Extension (Phase 1)

COPIES TO:

DATE REPORTED: 3/10/2022 SAMPLE DATA Sample No.: 5 Date Received: 3/3/2022 ASTM Test Method: D698B Manual Date Tested: 3/8/2022 Soil Classification: Lean Clay with Sand, Brown (CL) SB 18 (5' to 10') Remarks: TEST DATA 140 Maximum Density, pcf: 106.9 for specific gravity equal to 2.65 Optimum Moisture, %: 18.4 135 Percent Passing, %: 3/4": 100 3/8": 100 130 #4: 100 #200: 77 125 Atterberg Limits (ASTM: D4318): Liquid Limit: 120 Plastic Limit: Plasticity Index: 115 DRYDENSITY (pcf) 110 105 100 95 90 85 Mier 80 10 15 20 25 30 35 40 MOISTURE CONTENT (%)