September 21, 2007

Banner Associates, Inc.
409 22nd Avenue South
PO Box 298
Brookings, SD 57006

Attn: Mr. Tim Conner

Subj: Geotechnical Exploration
Proposed Ground Storage Water Reservoirs
Lewis and Clark Rural Water System
270th Street and 467th Avenue
Near Tea, South Dakota
GeoTek #07-180

This correspondence presents our written report of the geotechnical exploration program for the referenced project. Our work was performed in accordance with your written authorization dated February 16, 2007. We are transmitting two copies of our report for your use. An additional copy is 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.

Jeff Christensen, PE
Geotechnical Manager

Cc: Banner (Rapid City); Attn: Dave LaFrance

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GEOTECHNICAL EXPLORATION
PROPOSED GROUND STORAGE WATER RESERVOIRS
LEWIS AND CLARK RURAL WATER SYSTEM
270TH STREET AND 467TH AVENUE
NEAR TEA, SOUTH DAKOTA
GEOTEK #07-180

INTRODUCTION

Project Information

This report presents the results of the recent geotechnical exploration program for the proposed ground storage water reservoirs for Lewis and Clark Rural Water System at 270th Street and 467th Avenue near Tea, South Dakota.

Scope of Services

Our work was performed in accordance with the written authorization of Tim Conner with Banner Associates. The authorized scope of services included the following:

1. To perform thirty-nine (39) standard penetration test (SPT) borings to explore the subsurface conditions at the project site.

2. To perform laboratory tests including resistivity, pH, chloride content, sulfate content, moisture content, dry density, Atterberg limits (liquid and plastic limits), hydrometer/sieve analysis, unconfined compressive strength, swell pressure, percent swell, triaxial compression and consolidation.

3. To prepare an engineering report including the results of the field and laboratory tests as well as our geotechnical engineering opinions and recommendations regarding the following:

    - Site preparation and excavation/filling procedures;
    - Foundation types and depths, allowable bearing capacity and estimated potential settlements of foundations and floor slabs;
    - Foundation backfill and lateral pressures;
    - Pavement subgrade and thickness design;
    - Comments regarding factors that may impact the constructability and final performance of the project;
    - Quality control observations 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 AND SUBSURFACE CONDITIONS

Site Location and Description

The project site is located southwest of the intersection of 270th Street and 467th Avenue approximately one mile west and two miles north of Tea, South Dakota. The site has previously been used for agricultural purposes. The topography of the site is rolling and generally slopes downward to the south. The surface elevations at the boring locations varied from 1521.4 feet to 1514.9 feet. The boring locations were staked by Banner Associates and the ground surface elevations at the boring locations were also furnished by Banner Associates.

Subsurface Conditions

Thirty-nine (39) test borings were performed at the site from May 15 through August 31, 2007. The subsurface conditions encountered at the test boring locations are illustrated by means of the boring logs included in Appendix A. We wish to point out that the subsurface conditions at other times and locations at the site may differ from those found at our test boring locations. If different conditions are encountered during construction, it is necessary that you contact us so that our recommendations can be reviewed.

The subsurface conditions encountered at the boring locations consist of 0 to 7 feet of topsoil materials at the surface overlying mostly sandy lean clay (glacial till) soils. Fat clay (fine alluvium) soils were encountered above the sandy lean clay (glacial till) soils at some of the boring locations. Deposits of sand (outwash) soils were encountered intermixed with the glacial till at the deep boring locations at depths greater than 70 feet.

The consistency of the sandy lean clay (glacial till) soils varied from soft to hard. The consistency of the fat clay (fine alluvium) soils varied from soft to firm. The relative density of

the sand soils varied from medium dense to very dense. The consistency and density of the soils are indicated by the standard penetration resistance ("N") values as shown on the boring logs.

Water Levels

Measurements to record the groundwater levels were made at the boring locations. The time and level of the groundwater readings are recorded on the boring logs. Groundwater was measured at depths of 3 feet to 7 feet at the borings. Groundwater measurements were not made at several of the boring locations because drilling fluid was used to advance the borings.

The water levels indicated on the boring logs may not be an accurate indication of the depth or lack of subsurface groundwater. A long period of time is generally required for subsurface water to stabilize in the impervious soils encountered at the boring locations. Long term groundwater monitoring was not included in our work scope.

Subsurface groundwater levels should be expected to fluctuate seasonally and yearly from the groundwater readings recorded at the borings. 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 borings were performed.

ENGINEERING REVIEW AND RECOMMENDATIONS

Project Design Data

We understand that the project will consist of constructing two new ground storage water reservoirs for Lewis and Clark Rural Water System located southwest of the intersection of 270th Street and 467th Avenue near Tea, South Dakota. The reservoirs will have prestressed concrete construction with a floor elevation of 1522.0 feet. The finished exterior grade around the exterior of the reservoirs will be raised to approximate elevation 1526.0 feet. The reservoirs will have a diameter of 226 feet, a water depth of 48 feet and will have a capacity of 15 million gallons each. The reservoirs will be supported by a circular reinforced concrete shallow spread footing foundation. The maximum total settlement is approximately 5 ½ to 6 inches and the

maximum differential tilting at the base is approximately 2 ½ to 3 inches. The footing pressure with a full tank is 4,500 psf and the floor pressure with a full tank is 3,170 psf.

A pump station building will be constructed between the two reservoirs. The pump station building will be a one-story structure with CMU walls and will have approximate dimensions of 88 feet by 138 feet. A diesel generator building will be located adjacent to the west side of the pump station building. The pump station building will have a main floor elevation of 1520.0 feet. We understand that some below-grade concrete vaults will be constructed as part of the project.

Asphalt-surfaced driveways will provide access from 270th Street and 467th Avenue. An asphalt-surfaced parking lot will be located on the west side of the pump station building. The project will also include some gravel-surfaced roads for access to the structures at the site.

The above information/assumptions are important factors in our review and recommendations. If there are any corrections or additions to the above-mentioned data, it is necessary that you contact us so that we can review our recommendations with regards to the revised plans.

Discussion

Typically, a shallow spread footing foundation is the most cost effective type of foundation system. It is our opinion a shallow spread footing foundation system can be used for support of the proposed reservoirs and pump station building after the recommended site preparation has been performed.

Site Preparation

Excavation

It is our opinion that the sandy lean clay (glacial till) soils encountered at and below elevation 1505.0 feet for the east reservoir and elevation 1508.0 feet for the west reservoir are considered suitable for support of the shallow spread footing foundation system and floor slab. We recommend site preparation for the reservoirs consists of excavating to elevation 1505.0 feet for

the east reservoir and elevation 1508.0 feet for the west reservoir followed by the placement of a layered system of granular structural fill up to the design bottom of foundation and floor elevation. The bottom of the excavation should be laterally oversized one foot beyond the edges of the foundation for each vertical foot of structural fill required below the foundation (1 horizontal : 1 vertical).

The test borings for the pump station and generator building encountered up to 7 feet of topsoil materials at the surface overlying fat clay (fine alluvium) and sandy lean clay (glacial till) soils. It is our opinion that the topsoil materials and soft fat clay soils are not considered suitable for support of the pump station and generator building. We recommend site preparation for the pump station and generator building consists of removing the topsoil materials and fat clay (fine alluvium) soils prior to placing compacted structural fill needed to attain the design grades. Please refer to Table 1 shown below that summarizes the anticipated minimum excavation depths to remove unsuitable soils encountered at the boring locations. The depths of the excavation will likely vary between the boring locations. The bottom of the excavation should be laterally oversized one foot beyond the edges of the foundation for each vertical foot of structural fill required below the foundation (1 horizontal : 1 vertical).

Table 1. Estimated Excavation Depths for Pump Station/Generator

Boring Number	Surface Elevation, ft	Anticipated Excavation Depth, ft	Approximate Excavation Elevation, ft
9	1521.1	2	1519.1
11	1515.9	9	1506.9
13	1516.2	9 ½	1506.7
14	1517.9	2	1515.9
15	1516.1	9	1517.1

Disturbance and Groundwater

The predominant clayey soils encountered at the 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. The excavations should be performed with a track-driven excavator (backhoe) having a smooth cutting edge on the bucket to minimize soil disturbance.

The risk of soil disturbance increases significantly with additional moisture and the presence of water. Based on the groundwater measurements, water will likely enter the excavations as a result of subsurface water. In addition, precipitation and surface run off water may also enter the excavations. It will likely be possible to remove and control water entering the excavations using normal sump pumping techniques due to the low permeable characteristics of the predominant clayey soils encountered at the boring locations. However, lenses and layers of sand may be encountered, requiring more extensive dewatering techniques depending upon the subsurface water levels present during construction and the required excavation depths. 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. Water should be continuously pumped, if required, until the structural fill has been placed to a level of at least 3 feet above the water level.

Filling

We recommend placing a layer of lightly compacted rock in the bottom of the reservoir excavations and the deeper portions of the pump station/generator excavation to transmit water to sump locations and to provide a stable working surface for the placement and compaction of the remaining granular structural fill. This layer of rock should be at least 18 inches thick. The rock should be washed and have 100 percent by weight passing the 1 ½-inch sieve and no more than 5 percent by weight passing the #4 sieve. A layer of geotextile drainage/filtration fabric should be placed over the top of the rock layer.

The remainder of the granular structural fill should consist of a medium to coarse grained, free-draining sand or sand/gravel having a maximum size of 2-inch with less than 40 percent by weight passing the #40 sieve and less than 5 percent by weight passing the #200 sieve.

The fill and backfill materials should be placed and uniformly compacted in thin lifts, using vibratory compactors sized for the individual tasks. For heavy, self-propelled compactors, the fill should be placed in loose lifts of 12 inches or less. For hand-operated compactors, the fill should be placed in loose lifts of 6 inches or less. Table 2 presents a summary of the

recommended compaction criteria for the various areas that will likely require fill or backfill. The percentages shown are expressed as minimums of standard Proctor density (ASTM:D698).

Table 2. Recommended Compaction Requirements

Structure	Minimum Compaction, percent
Beneath Foundations and Floors	100
Exterior Foundation Backfill	95-98
Exterior Pavements and Sidewalks	97

Foundations

Once the site has been prepared as previously recommended in section Site Preparation, the proposed reservoirs and pump station/generator building can be supported by a shallow spread footing foundation systems. It is our opinion the spread footing foundations for the reservoirs can be designed using a net allowable soil bearing pressure of 4,500 pounds per square foot (psf) if the site has been prepared according to our recommendations in section Site Preparation. It is our opinion the spread footing foundation for the pump station/generator building can be designed using a net allowable soil bearing pressure of 3,000 pounds per square foot (psf) if the site has been prepared according to our recommendations in section Site Preparation. The net allowable soil bearing pressure is based on the soil conditions encountered at the test borings, the results of the field and laboratory tests, recommended compaction levels and past experience with similar soil conditions. It is our opinion the recommended bearing pressures should provide a minimum safety factor of 3.0 against shear or base failure.

We recommend all foundations be placed at a sufficient depth for frost protection. The perimeter footings for heated buildings should be placed such that the bottom of the footing is a minimum of 4 feet below finished exterior grade. Interior footings in heated buildings can be placed beneath the floor slab. Footings for unheated areas and canopies, or footings that are not protected from frost during freezing temperatures, should be placed at a minimum depth of 5 feet below the lowest adjacent grade.

Settlement

Using the 4,500 psf footing pressure and the 3,170 psf uniform floor pressure along with the consolidation test data, we calculated the total settlements of the reservoirs to be 5 to 5 ½ inches for the east reservoir and 4 ½ to 5 inches for the west reservoir. We estimate differential tilting at the base of the reservoirs to be less than 2 inches and differential settlement between the ring footing and the floor to be less than ½ inch. We estimate minimal risk for localized differential settlement beneath the reservoirs due to the significant depth of compacted structural fill that will be placed. Unknown soil conditions at the site that are different from those depicted at the boring locations could increase the amount of expected settlement. We recommend using flexible connections for piping and other features to accommodate the settlement.

Below-Grade Wall Backfill – Water Control

Drainage

A backfill drainage system can be provided for below-grade walls to collect and remove water and to prevent hydrostatic pressure on the walls. The drainage system should consist of slotted or perforated drainage pipes located at the bottom of the backfill trench, at an elevation lower than the below-grade floor elevations. In addition, drainage pipes should be placed beneath the below-grade floor slabs with a maximum spacing of 25 feet between pipes. The drainage pipes should be surrounded by a properly graded rock filter that is wrapped in a geotextile filter fabric to minimize clogging. The drainage pipes should be connected to a suitable means of discharge. If the backfill drainage system is not utilized, the structures should be designed to resist uplift forces caused by buoyancy.

Backfilling

We recommend a damp/water proofing material be applied to the below-grade walls prior to backfilling. The backfill materials placed against below-grade walls exert lateral forces on the walls. If a backfill drainage system is provided, we recommend using free-draining sand for backfill in order to minimize these lateral forces and to optimize drainage. We recommend the

free-draining sand contain no more than 5 percent by weight passing the #200 sieve, which would consist of (SP) soils. The zone of sand backfill should extend a minimum of 2 feet outside the bottom of the wall and then extend upward and outward at a slope no steeper than 1:1 (horizontal to vertical). We recommend capping the sand backfill section with 1 to 2 feet of clayey soil in exterior areas that will not have asphalt or concrete surfacing to minimize infiltration of surface waters. The sand backfill soils should be placed and compacted according to our previous recommendations in the section entitled Site Preparation – Filling. If a backfill drainage system is not provided, the on-site sandy lean clay soils could be used for backfill of the below-grade walls. However, the sandy lean clay backfill soils will produce much higher lateral pressures and are more susceptible to frost heave. The foundation walls should be braced prior to backfilling in order to reduce the risk of damaging the walls.

Lateral Pressures

We recommend the below-grade walls be designed to resist at-rest lateral earth pressures. Lateral pressures will be significantly higher if the walls are backfilled with soils other than the free-draining sand, or if they are not drained and become saturated. Please refer to Table 3 showing the equivalent fluid unit weight values (pcf) for ultimate lateral earth pressures in the at-rest condition.

Table 4. Equivalent Fluid Unit Weights

Soil Type	At Rest Drained	At Rest Submerged
Sand (SP)	50	90
Sandy Lean Clay (CL)	105	120

Exterior Foundation Backfill

We recommend non-organic sandy lean clay soils be used as exterior foundation backfill for the frost-depth footings. We recommend that the moisture content of the clay backfill soils be adjusted to a level within 3 percent of the optimum moisture content as defined by standard Proctor. The exterior foundation backfill soils should be placed and compacted according to our previous recommendations in the section entitled Site Preparation - Filling.

Site Drainage

Proper site drainage should be provided during and after construction. General site grading should direct all surface waters away from the excavations. Any water that accumulates in the excavations should be removed as soon as possible.

It is important that a positive slope be provided away from the structure for proper drainage. Finished grades should be sloped away from the structure with a minimum slope of 1 inch per foot starting at the foundation and extending to at least 10 feet beyond the excavation line. If pavement will be placed immediately next to the structure, a slope of at least ¼ inch per foot away from the foundation should be used for the pavement, if possible. The joint between the pavement and the foundation should be properly sealed and maintained.

Expansive Soils

The sandy lean clay (glacial till) soils encountered at the boring locations have a low potential for expansion. The fat clay (fine alluvium) soils encountered at some of the boring locations have a moderate potential for expansion. We recommend removing the fat clay (fine alluvium) soils from beneath structures.

Parking Lot and Access Drives

We understand asphalt-surfaced driveways and parking lot will be constructed as part of the project. In addition, gravel-surfaced access roads will be constructed to the various site features. We anticipate the vehicle traffic will vary from automobiles to occasional trucks. We anticipate grade changes for the proposed vehicle areas will mostly involve filling.

The test borings encountered topsoil materials overlying sandy lean clay (glacial till) and fat clay (fine alluvium) soils. The results of the field and laboratory tests indicate moderate density and moisture levels for the sandy lean clay subgrade soils. However, the fat clay (fine alluvium) soils were typically encountered at the borings located in some of the lower portions of the site and the fat clay soils are in a somewhat wet/soft condition.

We recommend site preparation for the proposed pavement areas consist of removing the topsoil materials and excessively wet soils. We recommend removing the upper 2 feet of the topsoil if the topsoil materials extend deeper than 2 feet. Track-driven dozers or excavators with smooth-edged buckets may be required for the stripping and removals in the existing ditches and low-lying areas due to the presence of water and soft/wet soils. The exposed subgrade should be scarified to a minimum depth of 8 inches and moisture-conditioned to a water content within 2 percent of the optimum water content. The moisture-conditioned soils should then be compacted to a minimum density of 97 percent of standard Proctor density. Either granular or non-organic clay soils having a liquid limit less than 45 should be placed as subgrade fill to the design elevations. The fill should be compacted in thin lifts to a minimum of 97 percent of standard Proctor density. In addition to the compaction requirement, the fill should be moisture-conditioned to a water content level within 2 percent of the optimum water content as defined by standard Proctor.

Areas of unstable subgrade may be encountered after stripping and removals. The segments of the project having existing ditches or low-lying areas are most prone to unstable subgrade conditions. The soils within an unstable area should be removed, and either moisture-conditioned and recompacted, or replaced with suitable pavement embankment soils. If the unstable area will not stabilize using this method, a geotextile stabilization fabric with approximately 12 inches of coarse granular subbase may be used. The depth of the granular subbase material may need to be adjusted based on the severity of the unstable subgrade. The fabric should meet the requirements for MSE Geotextile Fabric in Section 831 of the SDDOT Standard Specifications. The coarse granular subbase should consist of crushed quartzite “surge rock” or recycled concrete meeting the grading requirements for Subbase in Section 882 of the SDDOT Standard Specifications with the exceptions of 100 percent passing 4” sieve and 0-10 percent passing the #200 sieve. Pavement embankment soils and gravel base course materials can then be placed above the stabilized areas.

We estimate a California Bearing Ratio (CBR) value of 2 to 4 for the predominantly clay soils encountered at the boring locations. Table 5 shows the recommended asphalt pavement section thicknesses based on the subsurface conditions and the anticipated traffic loads.

Table 5. Recommended Pavement Section Thicknesses

Pavement Description	Asphalt Surfacing	Aggregate Base Course
Car Only Areas	3	6
Heavy Duty Areas	4	8

We recommend the aggregate base course meet the requirements of section 882 of the South Dakota Department of Transportation Standard Specifications for Roads and Bridges. The aggregate base course materials should be compacted to a minimum of 97 percent of standard Proctor density. The bituminous pavement should meet the requirements of sections 320 and 321 for Class G.

For the gravel-surfaced access roads, we recommend placing geotextile stabilization fabric and 8 inches of coarse granular subbase due to the loss of subgrade support from freeze/thaw conditions. We recommend placing a minimum of 6 inches of gravel surfacing placed over the coarse granular subbase and geotextile fabric. The gravel surfacing materials should meet the requirements of section 882 of the South Dakota Department of Transportation Standard Specifications for Roads and Bridges. The gravel surfacing materials should be compacted to a minimum of 97 percent of standard Proctor density.

It should be noted that routine maintenance such as crack filling, localized patching, and seal coating should be expected with all pavements in our recommendations. The above designs could be reduced if the owner is willing to assume additional maintenance costs or potentially shorter pavement life.

CONSTRUCTION CONSIDERATIONS

Groundwater and Surface Water

Based on the groundwater measurements, water will likely enter the excavation as a result of subsurface water. In addition, precipitation and surface run off water may also enter the excavation. It will likely be possible to remove and control water entering the excavation using normal sump pumping techniques due to the low permeable characteristics of the predominant

clayey soils encountered at the boring locations. However, lenses and layers of sand may be encountered, requiring more extensive dewatering techniques depending upon the subsurface water levels present during construction and the required excavation depths. Any water that accumulates in the bottom of the excavation should be immediately removed and surface drainage away from the excavation should be provided during construction. The dewatering efforts should be continued in order to maintain the groundwater level a sufficient depth below the work areas.

Disturbance of Soils

The predominant clayey soils encountered at the 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. The excavation should be performed with a track-driven excavator (backhoe) having a smooth cutting edge on the bucket to minimize soil disturbance. If the soils become disturbed, additional excavation and filling will be required.

Cold Weather Precautions

If site preparation and construction is anticipated during cold weather, we recommend all foundations, 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, 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 should not be placed on frozen subgrades. Frost should not be allowed to penetrate below the foundations. If subgrade soils freeze, we recommend the frozen soils be removed and replaced, or completely thawed, prior to placement of the concrete. 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 and 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 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 foundations, slabs and pavements. These observations are recommended to determine if the exposed soils are similar to those encountered at the boring locations, if unsuitable soils have been adequately removed and if the exposed soils are suitable for support of the proposed construction. These observations should be performed prior to placement of fill or foundations.

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 structural fill and backfill placed below foundations, slabs and pavements, beside foundation walls and behind retaining walls. The tests should be performed to determine if the required compaction has been achieved. As a general guideline, we recommend at least one test be taken for every 2,000 square feet of structural fill placed in building and paved areas, at least one test for every 75 to 100 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

Thirty-nine (39) standard penetration test (SPT) borings were drilled from May 15 through August 31, 2007, 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.

The 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 boring locations will be retained in our office for a period of one 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, selected 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 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

Measurements for groundwater levels were made at the boring locations both at the time they were completed and just before being backfilled. The groundwater level measurements are shown on the bottom of the boring logs.

The water levels indicated on the boring logs may not be an accurate indication of the depth or lack of subsurface groundwater. A long period of time is generally required for subsurface water to stabilize in the impervious soils encountered at the boring locations. Long term water level monitoring was not included in our scope of work.

Subsurface groundwater levels should be expected to fluctuate seasonally and yearly from the groundwater readings recorded at the borings. 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 borings were performed.

Laboratory Tests

Laboratory tests were performed on selected samples to aid in determining the index and strength properties of the soils. The index tests consisted of resistivity, pH, chloride content, sulfate content, moisture content, dry density, Atterberg limits (liquid limit and plastic limit), swell pressure, percent swell and consolidation. The strength tests consisted of unconfined compressive strength and triaxial compression. 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 or on the data sheets included in Appendix A.

LIMITATIONS

The recommendations and professional opinions submitted in this report were based upon the data obtained through the sampling and testing program at the 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 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 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 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 the 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.

Jeff Christensen, PE
Geotechnical Manager

SCALE 1" = 100'

SE1/4 SEC. 16-T100N-R51W

℄ LEWIS & CLARK WATER PIPELINE

NE CORNER
SEC. 21-T100N-R51W

270TH STREET
SECTION LINE

1287.00'

DECORATIVE FENCE

FUTURE GRAVEL SURFACING
NOT PART OF THIS CONTRACT

GRAVEL SURFACING

FUTURE PIPING
NOT PART OF THIS CONTRACT

ASPHALT SURFACING

FUTURE PIPING
NOT PART OF THIS CONTRACT

FUTURE 10 MILLION GALLON GROUND LEVEL STORAGE RESERVOIR (ULTIMATE)

185'

15 MILLION GALLON GROUND LEVEL STORAGE RESERVOIR

235'

15 MILLION GALLON GROUND LEVEL STORAGE RESERVOIR

PUMP STATION

Fire Service Water

ASPHALT SURFACING

GRAVEL SURFACING

GSR2 Effluent

GSR1 Effluent

Fuel Tank

Bypass

8' Retaining Wall

GSR2 Influent

GSR1 Influent

GRAVEL SURFACING

Influent Line

ANODE GROUND BED (BURIED)

DETENTION POND

CHAIN LINK FENCE

DETENTION POND

467.00'

20'

467.00'

467TH AVENUE
SECTION LINE

1287.00'

CULVERT W/
CONCRETE OVERFLOW

NE1/4 SEC. 21-T100N-R51W
LINCOLN COUNTY, SOUTH DAKOTA

℄ LEWIS & CLARK WATER PIPELINE

FOR REVIEW ONLY
NOT FOR CONSTRUCTION

F:\20000-16-01\ACAD\STORAGE-FACILITY-SITE.DWG;9/17/2007 7:33 AM

BANNER

409 22nd Ave. S. P.O. Box 29
Brookings, South Dakota 5700
605-692-6342
www.bannerassociates.com

℄ LEWIS & CLARK

CONSULTANTS:

FOR REVIEW ONLY
NOT FOR CONSTRUCTION

PROJECT TITLE:

LEWIS & CLARK
REGIONAL
WATER
SYSTEM

PROJECT LOCATION:

TEA
SOUTH DAKOTA

REV.	DATE	DESCRIPTION

DRAWN BY: S.A.N.
DESIGNED BY: R.S.U.
CHECKED BY: R.G.H.
JOB NO: 20000.16.01
DATE: SEPT. 07

0 1/2" 1"
SCALE REDUCTION BAR

SHEET TITLE:

TEA
PUMP STATION

SITE PLAN

FIGURE NO.:

2

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 E. 50th Street North
Sioux Falls, SD 57104
605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **1 (1 of 1)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

SURFACE ELEVATION 1519.0 ft

DEPTH in FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	ORGANIC FAT CLAY: black, moist, firm, (OH)	TOPSOIL			1	HSA					
2	**FAT CLAY**: gray, moist, firm, (CH)	FINE ALLUVIUM	5		2	SPT					
			5	▼	3	SPT					
7	**FAT CLAY**: mottled brown and gray, moist, firm, (CH)	FINE ALLUVIUM	5		4	SPT					
9½	**SANDY LEAN CLAY**: a little gravel, brown, moist, firm to stiff, (CL)	GLACIAL TILL	7		5	SPT					
			9		6	SPT					
			9		7	SPT					
19½	**SANDY LEAN CLAY**: a little gravel, mottled brown and dark gray, moist, stiff, (CL)	GLACIAL TILL	14		8	SPT					
21	Bottom of borehole at 21 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
5-15-07	3:03 pm	21	--	19.5	9
6-8-07	2:25 pm	21	--	8	▼ 5.5
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--	--	--	--	--	--

START 5-15-07 COMPLETE 5-15-07 3:03 pm

METHOD
3.25" ID Hollow Stem Auger

CREW CHIEF Gordy Hawkey

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **2 (1 of 1)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

SURFACE ELEVATION 1519.5 ft

DEPTH in FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
2	**ORGANIC FAT CLAY**: black, moist, stiff, (OH)	TOPSOIL			1	HSA					
4½	**FAT CLAY**: dark brown, moist, stiff, (CH)	FINE ALLUVIUM	10		2	SPT					
7	**FAT CLAY**: grayish brown, moist, firm, (CH)	FINE ALLUVIUM	8	▼	3	SPT					
	SANDY LEAN CLAY: a little gravel, brown, moist, firm to stiff, (CL)	GLACIAL TILL	5		4	SPT					
			7		5	SPT					
			9		6	SPT					
			10		7	SPT					
19½	**SANDY LEAN CLAY**: a little gravel, dark gray, moist, stiff, (CL)	GLACIAL TILL	10		8	SPT					
21	Bottom of borehole at 21 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
5-15-07	3:50 pm	21	--	19.5	14
6-8-07	2:28 pm	21	--	7	▼ 6
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START 5-15-07 COMPLETE 5-15-07 3:46 pm

METHOD
3.25" ID Hollow Stem Auger

CREW CHIEF Gordy Hawkey

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **3 (1 of 1)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1519.5 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
2	**ORGANIC FAT CLAY**: black, moist, stiff, (OH)	TOPSOIL			1	HSA					
4½	**FAT CLAY**: dark brown, moist, firm, (CH)	FINE ALLUVIUM	9		2	SPT					
7	**FAT CLAY**: mottled brown and gray, moist, firm, (CH)	FINE ALLUVIUM	5	▼	3	SPT					
	SANDY LEAN CLAY: a little gravel, brown, moist, firm to stiff, a lens of sand below 9.50ft. (CL)	GLACIAL TILL	5		4	SPT					
			7		5	SPT					
			9		6	SPT					
14½	**SANDY LEAN CLAY**: a little gravel, mottled brown and dark gray, moist, stiff, (CL)	GLACIAL TILL	10		7	SPT					
19½	**SANDY LEAN CLAY**: a little gravel, dark gray, moist, stiff, (CL)	GLACIAL TILL	9		8	SPT					
21	Bottom of borehole at 21 feet.										

WATER LEVEL MEASUREMENTS

START 5-15-07 COMPLETE 5-15-07 4:29 pm

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
5-15-07	4:30 pm	21	--	19.5	13
6-8-07	2:30 pm	21	--	9	▼ 6.5
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METHOD
3.25" ID Hollow Stem Auger

CREW CHIEF Gordy Hawkey

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **4 (1 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

SURFACE ELEVATION 1515.2 ft

DEPTH in FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	WC	D	LL	PL	QU
	ORGANIC FAT CLAY: black, moist, (OH)	TOPSOIL			1	FA					
2	**FAT CLAY**: dark brown, moist, firm, (CH)	FINE ALLUVIUM	7	▼	2	SPT					
4½	**FAT CLAY**: grayish brown, moist, firm, (CH)	FINE ALLUVIUM	5		3	SPT	27	97			1800
7	**SANDY LEAN CLAY**: a little gravel, brown, firm to stiff, (CL)	GLACIAL TILL	6		4	SPT	29	94			
			9		5	SPT	24	104			4000
14	**SANDY LEAN CLAY**: a little gravel, dark brown, stiff, (CL)	GLACIAL TILL	10		6	SPT					
19	**SANDY LEAN CLAY**: a little gravel, dark gray, stiff, (CL)	GLACIAL TILL	13		7	SPT					
			10		8	SPT					
			13		9	SPT					

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
5-18-07	9:00 am	7	--	7	▼ 3
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START 5-18-07 COMPLETE 5-18-07 10:35 am

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 E. 50th Street North
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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **4 (2 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1515.2 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LAB WC	LAB D	LAB LL	LAB PL	LAB QU
	SANDY LEAN CLAY: a little gravel, dark gray, stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	10		10	SPT					
			11		11	SPT					
			10		12	SPT					
			11		13	SPT					
			14		14	SPT					
			12		15	SPT					
61	Bottom of borehole at 61 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
5-18-07	9:00 am	7	--	7	▼ 3
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--	--	--	--	--	--
--	--	--	--	--	--

START 5-18-07 COMPLETE 5-18-07 10:35 am

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **5 (1 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1517.9 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, brown, moist, firm to stiff, a 6" layer of topsoil at the surface (CL)	GLACIAL TILL			1	FA					
			8		2	SPT					
			6		3	SPT	22	104			4200
			8		4	SPT					
			9		5	SPT	24	104			4800
			14		6	SPT					
			13		7	SPT					
24	**SANDY LEAN CLAY**: a little gravel, dark brown, moist, very stiff, a lens of sand below 24.5' (CL)	GLACIAL TILL	16		8	SPT					
			17		9	SPT					

WATER LEVEL MEASUREMENTS

START 5-15-07 COMPLETE 5-15-07 11:20 am

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **5 (2 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1517.9 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, dark brown, moist, very stiff, a lens of sand below 24.5' (CL) *(Continued from previous page)*	GLACIAL TILL	19		10	SPT					
39	**SANDY LEAN CLAY**: a little gravel, dark gray, moist, very stiff to stiff, (CL)	GLACIAL TILL	16		11	SPT					
			13		12	SPT					
			13		13	SPT					
			15		14	SPT					
			18		15	SPT					
61	Bottom of borehole at 61 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 5-15-07 COMPLETE 5-15-07 11:20 am

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **6 (1 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1516.6 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
2	**ORGANIC FAT CLAY**: black, moist, (OH)	TOPSOIL			1	HSA					
	SANDY LEAN CLAY: a little gravel, brown, moist, firm to very stiff, (CL)	GLACIAL TILL	8		2	SPT					
			12		3	SPT					
			13		4	SPT					
			13		5	SPT					
			16		6	SPT					
			17		7	SPT					
			17		8	SPT					
			19		9	SPT					
			22		10	SPT					

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 5-17-07 COMPLETE 5-17-07 11:23 am

METHOD
Rotary Mud Drilling

CREW CHIEF Gordy Hawkey

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **6 (2 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1516.6 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, brown, moist, firm to very stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	22		11	SPT					
39½	**SANDY LEAN CLAY**: a little gravel, dark gray, moist, very stiff, (CL)	GLACIAL TILL	16		12	SPT					
			16		13	SPT					
			16		14	SPT					
			17		15	SPT					
			19		16	SPT					
61	Bottom of borehole at 61 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 5-17-07 COMPLETE 5-17-07 11:23 am

METHOD
Rotary Mud Drilling

CREW CHIEF Gordy Hawkey

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **7 (1 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

SURFACE ELEVATION 1517.1 ft

DEPTH in FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	ORGANIC FAT CLAY: black, moist, (OH)	TOPSOIL			1	HSA					
2	**FAT CLAY**: dark brown, moist, soft, (CH)	FINE ALLUVIUM	3		2	SPT					
4½	**SANDY LEAN CLAY**: a little gravel, brown, moist, firm to very stiff, (CL)	GLACIAL TILL	7		3	SPT					
			7		4	SPT	24	102			1700
			9		5	SPT					
			13		6	SPT					
			16		7	SPT					
			16		8	SPT					
			17		9	SPT					
29½	**SANDY LEAN CLAY**: a little gravel, dark gray, moist, very stiff, (CL)	GLACIAL TILL	20		10	SPT					

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 5-17-07 COMPLETE 5-17-07 3:23 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Gordy Hawkey

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **7 (2 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1517.1 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, dark gray, moist, very stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	17		11	SPT					
			16		12	SPT					
			16		13	SPT					
			16		14	SPT					
			20		15	SPT					
			17		16	SPT					
61	Bottom of borehole at 61 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 5-17-07 COMPLETE 5-17-07 3:23 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Gordy Hawkey

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **8 (1 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

SURFACE ELEVATION 1520.4 ft

DEPTH in FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, brown, moist, firm to stiff, (CL)	GLACIAL TILL			1	FA					
			4		2	SPT					
			5		3	SPT					
			8	▼	4	SPT	23	103			3400
			10		5	SPT					
			9		6	SPT					
19	**SANDY LEAN CLAY**: a little gravel, mottled brown, very stiff, (CL)	GLACIAL TILL	18		7	SPT					
			19		8	SPT					
			22		9	SPT					

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
5-18-07	12:15 pm	7	--	7	▼ 7
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START 5-18-07 COMPLETE 5-18-07 1:50 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
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605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **8 (2 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1520.4 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LAB WC	LAB D	LAB LL	LAB PL	LAB QU
	SANDY LEAN CLAY: a little gravel, mottled brown, very stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	21		10	SPT					
			20		11	SPT					
44	**SANDY LEAN CLAY**: a little gravel, mottled brown and dark gray, very stiff, (CL)	GLACIAL TILL	22		12	SPT					
49	**SANDY LEAN CLAY**: a little gravel, dark gray, stiff, (CL)	GLACIAL TILL	14		13	SPT					
			14		14	SPT					
			15		15	SPT					
61	Bottom of borehole at 61 feet.										

WATER LEVEL MEASUREMENTS

START 5-18-07 COMPLETE 5-18-07 1:50 pm

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
5-18-07	12:15 pm	7	--	7	▼ 7
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--	--	--	--	--	--

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **9 (1 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL SURFACE ELEVATION 1521.1 ft	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, brown, moist, firm to very stiff, (CL)	GLACIAL TILL			1	HSA					
			6		2	SPT					
			7		3	SPT					
			10		4	SPT					
			10		5	SPT					
			16		6	SPT					
			16		7	SPT					
			17		8	SPT					
			19		9	SPT					
			17		10	SPT					

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 5-18-07 COMPLETE 5-18-07 2:23 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Gordy Hawkey

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

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& TESTING SERVICES, INC.
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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **9 (2 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1521.1 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, brown, moist, firm to very stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	18		11	SPT					
			16		12	SPT					
44½	**SANDY LEAN CLAY**: a little gravel, dark gray, moist, stiff to very stiff, (CL)	GLACIAL TILL	18		13	SPT					
			14		14	SPT					
			16		15	SPT					
61			16		16	SPT					
	Bottom of borehole at 61 feet.										

WATER LEVEL MEASUREMENTS

START 5-18-07 COMPLETE 5-18-07 2:23 pm

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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METHOD
Rotary Mud Drilling

CREW CHIEF Gordy Hawkey

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 E. 50th Street North
Sioux Falls, SD 57104
605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **10 (1 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

SURFACE ELEVATION 1517.0 ft

DEPTH in FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	ORGANIC FAT CLAY: black, moist, (OH)	TOPSOIL			1	FA					
2	**SANDY LEAN CLAY**: a little gravel, brown, moist, firm to stiff, (CL)	GLACIAL TILL	8		2	SPT					
			8		3	SPT					
			8		4	SPT	20	109			9400
			10		5	SPT					
			17		6	SPT					
19	**SANDY LEAN CLAY**: a little gravel, mottled brown, very stiff, (CL)	GLACIAL TILL	18		7	SPT					
			18		8	SPT					
			16		9	SPT					
34	*(Text begins on next page)*										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 5-17-07 COMPLETE 5-17-07 5:30 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **10 (2 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1517.0 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LAB WC	LAB D	LAB LL	LAB PL	LAB QU
	SANDY LEAN CLAY: a little gravel, dark gray, stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	15		10	SPT					
			14		11	SPT					
			13		12	SPT					
			15		13	SPT					
			15		14	SPT					
			18		15	SPT					
61	Bottom of borehole at 61 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 5-17-07 COMPLETE 5-17-07 5:30 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 E. 50th Street North
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605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **11 (1 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

SURFACE ELEVATION 1515.9 ft

DEPTH in FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
2	**ORGANIC FAT CLAY**: black, moist, (OH)	TOPSOIL			1	FA					
	FAT CLAY: dark brown, moist, soft, (CH)	FINE ALLUVIUM	4	▼	2	SPT					
6			4		3	SPT					
	FAT CLAY: grayish brown, moist, soft, (CH)	FINE ALLUVIUM	4		4	SPT	29	93			
9	**SANDY LEAN CLAY**: a little gravel, brown, moist, firm, (CL)	GLACIAL TILL	8		5	SPT					
14	**SANDY LEAN CLAY**: a little gravel, mottled brown, moist, stiff to very stiff, (CL)	GLACIAL TILL	12		6	SPT					
			19		7	SPT					
24	**SANDY LEAN CLAY**: a little gravel, mottled brown and dark gray, moist, very stiff, (CL)	GLACIAL TILL	17		8	SPT					
29	**SANDY LEAN CLAY**: a little gravel, dark gray, moist, stiff, (CL)	GLACIAL TILL	14		9	SPT					

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
5-17-07	1:40 pm	7	--	7	▼ 3
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START 5-17-07 COMPLETE 5-17-07 3:30 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 E. 50th Street North
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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **11 (2 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1515.9 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, dark gray, moist, stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	14		10	SPT					
			16		11	SPT					
			11		12	SPT					
			14		13	SPT					
			13		14	SPT					
			13		15	SPT					
61	Bottom of borehole at 61 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
5-17-07	1:40 pm	7	--	7	▼ 3
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START 5-17-07 COMPLETE 5-17-07 3:30 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTEK ENGINEERING
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909 E. 50th Street North
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605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **12 (1 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1516.0 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	ORGANIC FAT CLAY: black, moist, (OH)	TOPSOIL			1	FA					
2	**SANDY LEAN CLAY**: a little gravel, brown, moist, firm to stiff, (CL)	GLACIAL TILL	5		2	SPT					
			6		3	SPT					
			7		4	SPT	20	108			
			11		5	SPT					
14	**SANDY LEAN CLAY**: a little gravel, dark brown, moist, stiff to very stiff, (CL)	GLACIAL TILL	15		6	SPT					
			20		7	SPT					
			18		8	SPT					
			20		9	SPT					
34	*(Text begins on next page)*										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 5-15-07 COMPLETE 5-15-07 3:00 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **12 (2 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1516.0 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LAB WC	LAB D	LAB LL	LAB PL	LAB QU
	SANDY LEAN CLAY: a little gravel, dark gray, moist, very stiff to stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	16		10	SPT					
			14		11	SPT					
			13		12	SPT					
			14		13	SPT					
			14		14	SPT					
			15		15	SPT					
61	Bottom of borehole at 61 feet.										

WATER LEVEL MEASUREMENTS

START 5-15-07 COMPLETE 5-15-07 3:00 pm

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **13 (1 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

SURFACE ELEVATION 1516.2 ft

DEPTH in FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	ORGANIC FAT CLAY: black, moist, firm, (OH)	TOPSOIL			1	HSA					
			7		2	SPT					
			8		3	SPT					
7	**FAT CLAY**: mottled brown and gray, moist, firm, (CH)	FINE ALLUVIUM	6		4	SPT					
9½	**SANDY LEAN CLAY**: a little gravel, brown, moist, firm to very stiff, (CL)	GLACIAL TILL	6		5	SPT	26	98			3000
			9		6	SPT					
			9		7	SPT					
			17		8	SPT					
24½	**SANDY LEAN CLAY**: a little gravel, mottled brown and dark gray, moist, very stiff, (CL)	GLACIAL TILL	16		9	SPT					
29½	**SANDY LEAN CLAY**: a little gravel, dark gray, moist, stiff to very stiff, (CL)	GLACIAL TILL	15		10	SPT					

WATER LEVEL MEASUREMENTS

START 5-17-07 COMPLETE 5-17-07 5:57 pm

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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METHOD
Rotary Mud Drilling

CREW CHIEF Gordy Hawkey

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **13 (2 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1516.2 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, dark gray, moist, stiff to very stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	14		11	SPT					
			15		12	SPT					
			15		13	SPT					
			16		14	SPT					
			16		15	SPT					
			16		16	SPT					
61	Bottom of borehole at 61 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 5-17-07 COMPLETE 5-17-07 5:57 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Gordy Hawkey

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **14 (1 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1517.9 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
2	**SANDY LEAN CLAY**: a trace of gravel, dark brown, moist, (CL)	GLACIAL TILL			1	HSA					
	SANDY LEAN CLAY: a little gravel, brown, moist, stiff to very stiff, (CL)	GLACIAL TILL	10		2	SPT					
			9		3	SPT					
			10		4	SPT					
			15		5	SPT					
			16		6	SPT					
			22		7	SPT					
			19		8	SPT					
			20		9	SPT					
29½	**SANDY LEAN CLAY**: a little gravel, dark gray, moist, very stiff, (CL)	GLACIAL TILL	25		10	SPT					

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 5-18-07 COMPLETE 5-18-07 11:02 am

METHOD
Rotary Mud Drilling

CREW CHIEF Gordy Hawkey

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **14 (2 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1517.9 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LAB WC	LAB D	LAB LL	LAB PL	LAB QU
	SANDY LEAN CLAY: a little gravel, dark gray, moist, very stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	16		11	SPT					
			16		12	SPT					
			17		13	SPT					
			16		14	SPT					
			16		15	SPT					
			16		16	SPT					
61	Bottom of borehole at 61 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 5-18-07 COMPLETE 5-18-07 11:02 am

METHOD
Rotary Mud Drilling

CREW CHIEF Gordy Hawkey

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 E. 50th Street North
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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **15 (1 of 5)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1516.1 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LAB WC	LAB D	LAB LL	LAB PL	LAB QU
	ORGANIC FAT CLAY: black, moist, soft to stiff, (OH)	TOPSOIL			1	FA					
			4	▼	2	SPT					
			6		3	SPT					
6	**FAT CLAY**: grayish brown, moist, soft, (CH)	FINE ALLUVIUM									
			4		4	SPT					
9	**SANDY LEAN CLAY**: a little gravel, brown, moist, firm, (CL)	GLACIAL TILL	7		5	SPT	24	101			3700
			7		6	SPT	24	101			
19	**SANDY LEAN CLAY**: a little gravel, dark brown, moist, very stiff, (CL)	GLACIAL TILL	18		7	SPT					
24	**SANDY LEAN CLAY**: a little gravel, dark gray, moist, very stiff to stiff, (CL)	GLACIAL TILL	17		8	SPT					
			15		9	SPT	21	108			4800

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
5-16-07	9:20 am	7	--	7	▼ 3
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START 5-16-07 COMPLETE 5-17-07 12:00 am

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **15 (2 of 5)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1516.1 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, dark gray, moist, very stiff to stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	13		10	SPT					
			14		11	SPT					
			13		12	SPT					
			14		13	SPT	21	108			4000
			19		14	SPT					
			16		15	SPT					
			16		16	SPT					

WATER LEVEL MEASUREMENTS

START 5-16-07 COMPLETE 5-17-07 12:00 am

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
5-16-07	9:20 am	7	--	7	▼ 3
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METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **15 (3 of 5)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1516.1 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LAB WC	LAB D	LAB LL	LAB PL	LAB QU
	SANDY LEAN CLAY: a little gravel, dark gray, moist, very stiff to stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	16		17	SPT					
74	**SAND**: a little gravel, medium grained, gray, waterbearing, medium dense, (SP)	OUTWASH	9		18	SPT					
79	**SANDY LEAN CLAY**: a little gravel, dark gray, moist, very stiff, (CL)	GLACIAL TILL	21		19	SPT					
			15		20	SPT					
			16		21	SPT	22	104			3100
			20		22	SPT					
			17		23	SPT					

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
5-16-07	9:20 am	7	--	7	▼ 3
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START 5-16-07 COMPLETE 5-17-07 12:00 am

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 E. 50th Street North
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605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **15 (4 of 5)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1516.1 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LAB TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, dark gray, moist, very stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	19		24	SPT					
			23		25	SPT					
			22		26	SPT					
			34		27	SPT					
124	**SAND**: a little gravel, medium grained, gray, waterbearing, very dense, (SP)	OUTWASH	38		28	SPT					
			35		29	SPT					
			39		30	SPT					

WATER LEVEL MEASUREMENTS

START 5-16-07 COMPLETE 5-17-07 12:00 am

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
5-16-07	9:20 am	7	--	7	▼ 3
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METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **15 (5 of 5)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1516.1 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LAB TESTS WC	D	LL	PL	QU
	SAND: a little gravel, medium grained, gray, waterbearing, very dense, (SP) *(Continued from previous page)*	OUTWASH	48		31	SPT					
			44		32	SPT					
149	**SANDY LEAN CLAY**: a little gravel, dark gray, moist, hard, (CL)	GLACIAL TILL	40		33	SPT					
154	**SILTY SAND**: fine grained, dark gray, waterbearing, dense, (SM)	OUTWASH	25		34	SPT					
159											
160	**LEAN CLAY**: dark gray, moist, (CL)	GLACIAL TILL			35	SPT					
	SAND: fine to medium grained, gray, waterbearing, very dense, (SP)	OUTWASH	60		36	SPT					
			50/.3		37	SPT					
169	**SAND**: a little gravel, medium grained, gray, waterbearing, dense, (SP)	OUTWASH	18		38	SPT					
171	Bottom of borehole at 171 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
5-16-07	9:20 am	7	--	7	▼ 3
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START 5-16-07 COMPLETE 5-17-07 12:00 am

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 E. 50th Street North
Sioux Falls, SD 57104
605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **16 (1 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1520.8 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	ORGANIC FAT CLAY: black, moist, (OH)	TOPSOIL			1	HSA					
2	**SANDY LEAN CLAY**: a little gravel, brown, moist, firm to very stiff, (CL)	GLACIAL TILL	8		2	SPT					
			7		3	SPT	21	105			3500
			13		4	SPT					
			11		5	SPT					
			15		6	SPT					
			15		7	SPT					
			12		8	SPT					
			13		9	SPT					
			18		10	SPT					
34½	*(Text begins on next page)*										

WATER LEVEL MEASUREMENTS

START 5-22-07 COMPLETE 5-22-07 11:01 am

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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METHOD
Rotary Mud Drilling

CREW CHIEF Gordy Hawkey

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 E. 50th Street North
Sioux Falls, SD 57104
605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **16 (2 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1520.8 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LAB WC	LAB D	LAB LL	LAB PL	LAB QU
	SANDY LEAN CLAY: a little gravel, mottled brown and dark gray, very stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	20		11	SPT					
			20		12	SPT					
44½	**SANDY LEAN CLAY**: a little gravel, dark gray, moist, stiff, (CL)	GLACIAL TILL	15		13	SPT					
			15		14	SPT					
			15		15	SPT					
			15		16	SPT					
61	Bottom of borehole at 61 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 5-22-07 COMPLETE 5-22-07 11:01 am

METHOD
Rotary Mud Drilling

CREW CHIEF Gordy Hawkey

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **17 (1 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

SURFACE ELEVATION 1521.3 ft

DEPTH in FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LAB WC	LAB D	LAB LL	LAB PL	LAB QU
	ORGANIC FAT CLAY: black, moist, (OH)	TOPSOIL			1	HSA					
2	**FAT CLAY**: dark brown, moist, stiff, (CH)	FINE ALLUVIUM	7		2	SPT					
4½	**SANDY LEAN CLAY**: a little gravel, brown, moist, firm to stiff, (CL)	GLACIAL TILL	8		3	SPT	31	90			2400
			11		4	SPT					
9½	**SANDY LEAN CLAY**: a little gravel, brown, moist, stiff, (CL)	GLACIAL TILL	9		5	SPT					
			13		6	SPT					
			12		7	SPT					
			13		8	SPT					
24½	**SANDY LEAN CLAY**: a little gravel, dark gray, moist, stiff to very stiff, (CL)	GLACIAL TILL	12		9	SPT					
			16		10	SPT					

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 5-22-07 COMPLETE 5-22-07 2:40 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Gordy Hawkey

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 E. 50th Street North
Sioux Falls, SD 57104
605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **17 (2 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1521.3 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LAB WC	LAB D	LAB LL	LAB PL	LAB QU
	SANDY LEAN CLAY: a little gravel, dark gray, moist, stiff to very stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	12		11	SPT					
			14		12	SPT					
			12		13	SPT					
			12		14	SPT					
			16		15	SPT					
			13		16	SPT					
61	Bottom of borehole at 61 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 5-22-07 COMPLETE 5-22-07 2:40 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Gordy Hawkey

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 E. 50th Street North
Sioux Falls, SD 57104
605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **18 (1 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

SURFACE ELEVATION 1521.4 ft

DEPTH in FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	ORGANIC FAT CLAY: black, moist, (OH)	TOPSOIL			1	HSA					
2	**SANDY LEAN CLAY**: a little gravel, brown, moist, firm to very stiff, (CL)	GLACIAL TILL	6		2	SPT					
			6		3	SPT					
			8		4	SPT	27	94			3000
	FAT CLAY: a trace of gravel, brown, moist, stiff, (CH)		9		5	SPT					
12			10		6	SPT					
			10		7	SPT					
			17		8	SPT					
			12		9	SPT					
			17		10	SPT					

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 5-21-07 COMPLETE 5-21-07 1:05 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Gordy Hawkey

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 E. 50th Street North
Sioux Falls, SD 57104
605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **18 (2 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

SURFACE ELEVATION 1521.4 ft

DEPTH in FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, brown, moist, firm to very stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	20		11	SPT					
	LEAN CLAY WITH SAND: a little gravel, brown, moist, stiff to very stiff, (CL)										
39½	**LEAN CLAY WITH SAND**: a little gravel, brown, moist, stiff to very stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	22		12	SPT					
	SANDY LEAN CLAY: a little gravel, mottled brown and dark gray, moist, very stiff, (CL)										
44½	**SANDY LEAN CLAY**: a little gravel, dark gray, moist, stiff to very stiff, (CL)	GLACIAL TILL	17		13	SPT					
			17		14	SPT					
			14		15	SPT					
			16		16	SPT					
61	Bottom of borehole at 61 feet.										

WATER LEVEL MEASUREMENTS

START 5-21-07 COMPLETE 5-21-07 1:05 pm

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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METHOD
Rotary Mud Drilling

CREW CHIEF Gordy Hawkey

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **19 (1 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1520.5 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a trace of gravel, mottled brown and gray, moist, firm to soft, a 6" layer of topsoil at the surface (CL)	GLACIAL TILL			1	FA					
			5		2	SPT					
			4	▼	3	SPT					
7	**SANDY LEAN CLAY**: a little gravel, brown, moist, firm to stiff, (CL)	GLACIAL TILL	8		4	SPT					
			10		5	SPT					
			13		6	SPT					
19	**SANDY LEAN CLAY**: a little gravel, mottled brown, moist, stiff to very stiff, (CL)	GLACIAL TILL	15		7	SPT					
			17		8	SPT					
			20		9	SPT					
34	*(Text begins on next page)*										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
5-22-07	3:00 pm	7	--	7	▼ 6
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START 5-22-07 COMPLETE 5-22-07 4:15 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 E. 50th Street North
Sioux Falls, SD 57104
605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **19 (2 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1520.5 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LAB WC	LAB D	LAB LL	LAB PL	LAB QU
	SANDY LEAN CLAY: a little gravel, dark gray, moist, very stiff to stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	16		10	SPT					
			13		11	SPT					
			15		12	SPT					
			14		13	SPT					
			14		14	SPT					
			14		15	SPT					
61	Bottom of borehole at 61 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
5-22-07	3:00 pm	7	--	7	▼ 6
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START 5-22-07 COMPLETE 5-22-07 4:15 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 E. 50th Street North
Sioux Falls, SD 57104
605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **20 (1 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1520.6 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a trace of gravel, mottled brown and gray, moist, soft, a 6" layer of topsoil at the surface (CL)	GLACIAL TILL			1	FA					
			4		2	SPT					
4	**SANDY LEAN CLAY**: a trace of gravel, grayish brown, moist, soft, (CL)	GLACIAL TILL	4		3	SPT					
7	**SANDY LEAN CLAY**: a little gravel, brown, moist, firm, (CL)	GLACIAL TILL	6	▼	4	SPT					
			8		5	SPT					
14	**SANDY LEAN CLAY**: a little gravel, mottled brown, moist, stiff to very stiff, (CL)	GLACIAL TILL	12		6	SPT					
			19		7	SPT					
			29		8	SPT					
29	**SANDY LEAN CLAY**: a little gravel, dark gray, moist, very stiff to stiff, (CL)	GLACIAL TILL	18		9	SPT					

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
5-22-07	9:15 am	7	--	7	▼ 7
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START 5-22-07 COMPLETE 5-22-07 11:10 am

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 E. 50th Street North
Sioux Falls, SD 57104
605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **20 (2 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1520.6 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, dark gray, moist, very stiff to stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	14		10	SPT					
			16		11	SPT					
			15		12	SPT					
			11		13	SPT					
			16		14	SPT					
			14		15	SPT					
61	Bottom of borehole at 61 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
5-22-07	9:15 am	7	--	7	▼ 7
--	--	--	--	--	--
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--	--	--	--	--	--

START 5-22-07 COMPLETE 5-22-07 11:10 am

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 E. 50th Street North
Sioux Falls, SD 57104
605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **21 (1 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

SURFACE ELEVATION 1520.6 ft

DEPTH in FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, brown, moist, soft to firm, a 6" layer of topsoil at the surface (CL)	GLACIAL TILL			1	FA					
			4	▼	2	SPT					
			5		3	SPT					
			8		4	SPT	22	105			4000
9	**SANDY LEAN CLAY**: a little gravel, mottled brown, moist, stiff to very stiff, (CL)	GLACIAL TILL	11		5	SPT					
			14		6	SPT					
			17		7	SPT					
			16		8	SPT					
29	**SANDY LEAN CLAY**: a little gravel, dark gray, moist, very stiff to stiff, (CL)	GLACIAL TILL	21		9	SPT					

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
5-21-07	9:30 am	7	--	7	▼ 4
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START 5-21-07 COMPLETE 5-21-07 1:20 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 E. 50th Street North
Sioux Falls, SD 57104
605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **21 (2 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1520.6 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, dark gray, moist, very stiff to stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	22		10	SPT					
			15		11	SPT					
			21		12	SPT					
			15		13	SPT					
			14		14	SPT					
			16		15	SPT					
61	Bottom of borehole at 61 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
5-21-07	9:30 am	7	--	7	▼ 4
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START 5-21-07 COMPLETE 5-21-07 1:20 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
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605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **22 (1 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1520.1 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, brown, moist, firm to stiff, (CL)	GLACIAL TILL			1	FA					
			4		2	SPT					
			6	▼	3	SPT					
			8		4	SPT					
			9		5	SPT					
			12		6	SPT					
19	**SANDY LEAN CLAY**: a little gravel, mottled brown, moist, very stiff, (CL)	GLACIAL TILL	16		7	SPT					
			16		8	SPT					
			21		9	SPT					

WATER LEVEL MEASUREMENTS

START 5-21-07 COMPLETE 5-21-07 3:50 pm

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
5-21-07	1:50 pm	7	--	7	▼ 6
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METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
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909 E. 50th Street North
Sioux Falls, SD 57104
605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **22 (2 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1520.1 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, mottled brown, moist, very stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	19		10	SPT					
39	**SANDY LEAN CLAY**: a little gravel, dark gray, moist, very stiff to stiff, (CL)	GLACIAL TILL	18		11	SPT					
			15		12	SPT					
			14		13	SPT					
			15		14	SPT					
			15		15	SPT					
61	Bottom of borehole at 61 feet.										

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
5-21-07	1:50 pm	7	--	7	▼ 6
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START 5-21-07 COMPLETE 5-21-07 3:50 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 E. 50th Street North
Sioux Falls, SD 57104
605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **23 (1 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1520.7 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, brown, moist, soft to firm, a 6" layer of topsoil at the surface (CL)	GLACIAL TILL			1	FA					
			3		2	SPT					
			6		3	SPT					
			8		4	SPT					
			9		5	SPT					
14	**SANDY LEAN CLAY**: a little gravel, mottled brown, moist, stiff to very stiff, (CL)	GLACIAL TILL									
			11		6	SPT					
			14		7	SPT					
			15		8	SPT					
			19		9	SPT					

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 5-22-07 COMPLETE 5-22-07 2:15 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 E. 50th Street North
Sioux Falls, SD 57104
605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **23 (2 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1520.7 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, mottled brown, moist, stiff to very stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	22		10	SPT					
			19		11	SPT					
44	**SANDY LEAN CLAY**: a little gravel, dark gray, moist, stiff, (CL)	GLACIAL TILL	13		12	SPT					
			14		13	SPT					
			13		14	SPT					
			16		15	SPT					
61	Bottom of borehole at 61 feet.										

WATER LEVEL MEASUREMENTS

START 5-22-07 COMPLETE 5-22-07 2:15 pm

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **24 (1 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1521.2 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LAB WC	LAB D	LAB LL	LAB PL	LAB QU
2	**FAT CLAY**: dark brown, moist, (CH)	FINE ALLUVIUM			1	HSA					
	SANDY LEAN CLAY: a little gravel, brown, moist, firm to very stiff, (CL)	GLACIAL TILL	7		2	SPT					
			7		3	SPT	27	95			
			11		4	SPT					
			8		5	SPT					
			15		6	SPT					
			14		7	SPT					
			19		8	SPT					
			22		9	SPT					
			20		10	SPT					
34½	*(Text begins on next page)*										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START COMPLETE

METHOD
Rotary Mud Drilling

CREW CHIEF Gordy Hawkey

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **24 (2 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1521.2 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, dark gray, moist, stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	15		11	SPT					
			15		12	SPT					
			15		13	SPT					
			14		14	SPT					
			14		15	SPT					
			14		16	SPT					
61	Bottom of borehole at 61 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START COMPLETE

METHOD
Rotary Mud Drilling

CREW CHIEF Gordy Hawkey

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **25 (1 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1521.1 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, brown, moist, firm to stiff, (CL)	GLACIAL TILL			1	HSA					
			5		2	SPT					
			5		3	SPT					
			9		4	SPT					
			11		5	SPT					
			9		6	SPT					
			9		7	SPT					
19½	**SANDY LEAN CLAY**: a little gravel, brown mottled, moist, stiff to very stiff, (CL)	GLACIAL TILL	12		8	SPT					
			18		9	SPT					
			22		10	SPT					
32	**SANDY LEAN CLAY**: a little gravel, mottled brown and dark gray, moist, very stiff, (CL)	GLACIAL TILL									

(Text begins on next page)

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 6-7-07 COMPLETE 6-7-07 3:23 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Gordy Hawkey

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

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& TESTING SERVICES, INC.
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Sioux Falls, SD 57104
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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **25 (2 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1521.1 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, mottled brown and dark gray, moist, very stiff, (CL) *(Continued from previous page)* **LEAN CLAY WITH SAND**: a little gravel, mottled brown and dark gray, moist, very stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	21		11	SPT					
39½	**SANDY LEAN CLAY**: a little gravel, dark gray, moist, very stiff to stiff, (CL)	GLACIAL TILL	17		12	SPT					
			17		13	SPT					
			13		14	SPT					
			15		15	SPT					
			15		16	SPT					
61	Bottom of borehole at 61 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 6-7-07 COMPLETE 6-7-07 3:23 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Gordy Hawkey

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

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& TESTING SERVICES, INC.
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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **26 (1 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1521.0 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LAB WC	LAB D	LAB LL	LAB PL	LAB QU
	ORGANIC FAT CLAY: black, moist, (OH)	TOPSOIL			1	HSA					
2	**SANDY LEAN CLAY**: a little gravel, brown mottled, moist, stiff, (CL)	GLACIAL TILL	9		2	SPT					
	FAT CLAY: mottled brown and gray, moist, firm, (CH)		7		3	SPT					
7	**SANDY LEAN CLAY**: a little gravel, brown, moist, stiff, (CL)	GLACIAL TILL	9		4	SPT	20	108			3200
			9		5	SPT					
12	**SANDY LEAN CLAY**: a little gravel, brown mottled, moist, stiff to very stiff, a layer of cobbles at 24.5' (CL)	GLACIAL TILL	15		6	SPT					
			14		7	SPT					
			14		8	SPT					
					9	NSR					
			15		10	SPT					
32	**SANDY LEAN CLAY**: a little gravel, mottled brown and dark gray, moist, very stiff, (CL)	GLACIAL TILL									

(Text begins on next page)

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 6-7-07 COMPLETE 6-7-07 11:24 am

METHOD
Rotary Mud Drilling

CREW CHIEF Gordy Hawkey

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **26 (2 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1521.0 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, mottled brown and dark gray, moist, very stiff, (CL) *(Continued from previous page)* **LEAN CLAY WITH SAND**: a little gravel, mottled brown and dark gray, moist, very stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	21		11	SPT					
39½	**SANDY LEAN CLAY**: a little gravel, mottled mottled, moist, very stiff, (CL)	GLACIAL TILL	17		12	SPT					
			18		13	SPT					
49½	**SANDY LEAN CLAY**: a little gravel, dark gray, moist, very stiff, (CL)	GLACIAL TILL	16		14	SPT					
			16		15	SPT					
61	Bottom of borehole at 61 feet.		16		16	SPT					

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 6-7-07 COMPLETE 6-7-07 11:24 am

METHOD
Rotary Mud Drilling

CREW CHIEF Gordy Hawkey

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **27 (1 of 5)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

SURFACE ELEVATION 1521.0 ft

DEPTH in FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a trace of gravel, mottled brown and gray, moist, soft, a 6" layer of topsoil at the surface (CL)	GLACIAL TILL			1	FA					
			4		2	SPT					
4	**SANDY LEAN CLAY**: a little gravel, brown, moist, firm to stiff, (CL)	GLACIAL TILL	5	▼	3	SPT					
			6		4	SPT					
			10		5	SPT					
			12		6	SPT					
19	**SANDY LEAN CLAY**: a little gravel, mottled brown, moist, stiff to very stiff, (CL)	GLACIAL TILL	15		7	SPT					
			12		8	SPT					
			20		9	SPT					

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
6-7-07	9:25 am	7	--	7	▼ 4
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START 6-7-07 COMPLETE 6-8-07 2:00 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
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909 E. 50th Street North
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605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **27 (2 of 5)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1521.0 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LAB WC	LAB D	LAB LL	LAB PL	LAB QU
	SANDY LEAN CLAY: a little gravel, mottled brown, moist, stiff to very stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	19		10	SPT	24	103			6100
			20		11	SPT					
44	**SANDY LEAN CLAY**: a little gravel, dark gray, moist, stiff, (CL)	GLACIAL TILL	14		12	SPT					
			13		13	SPT					
			12		14	SPT					
			13		15	SPT					
			12		16	SPT	21	105			3300

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
6-7-07	9:25 am	7	--	7	▼ 4
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START 6-7-07 COMPLETE 6-8-07 2:00 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 E. 50th Street North
Sioux Falls, SD 57104
605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **27 (3 of 5)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL SURFACE ELEVATION 1521.0 ft	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, dark gray, moist, stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	13		17	SPT					
			13		18	SPT					
			15		19	SPT					
			14		20	SPT					
			15		21	SPT					
			17		22	SPT					
			16		23	SPT					

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
6-7-07	9:25 am	7	--	7	▼ 4
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START 6-7-07 COMPLETE 6-8-07 2:00 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **27 (4 of 5)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1521.0 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LAB TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, dark gray, moist, stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	17		24	SPT					
			23		25	SPT					
			20		26	SPT					
			21		27	SPT					
124	**SAND**: a little gravel, medium grained, grayish brown, waterbearing, very dense, (SP)	OUTWASH	44		28	SPT					
			50/.8		29	SPT					
			46		30	SPT					

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
6-7-07	9:25 am	7	--	7	▼ 4
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START 6-7-07 COMPLETE 6-8-07 2:00 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 E. 50th Street North
Sioux Falls, SD 57104
605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **27 (5 of 5)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1521.0 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LAB TESTS WC	D	LL	PL	QU
	SAND: a little gravel, medium grained, grayish brown, waterbearing, very dense, (SP) *(Continued from previous page)*	OUTWASH	50/.6		31	SPT					
			44		32	SPT					
			39		33	SPT					
154	**SAND**: fine grained, gray, waterbearing, very dense, (SP)	OUTWASH	48		34	SPT					
159	**LEAN CLAY**: dark gray, moist, very stiff to hard, (CL)	GLACIAL TILL	28		35	SPT					
			39		36	SPT					
169	**SAND**: fine grained, gray, waterbearing, very dense, (SP)	OUTWASH	50/.4		37	SPT					
171	Bottom of borehole at 171 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
6-7-07	9:25 am	7	--	7	▼ 4
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START 6-7-07 COMPLETE 6-8-07 2:00 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **28 (1 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1517.3 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, brown, moist, stiff, a 4" layer of topsoil at the surface (CL)	GLACIAL TILL			1	FA					
			9		2	SPT					
			12		3	SPT					
			11		4	SPT					
			12		5	SPT					
14	**SANDY LEAN CLAY**: a little gravel, dark brown, moist, stiff to very stiff, (CL)	GLACIAL TILL	14		6	SPT	22	107			5900
			16		7	SPT					
			18		8	SPT					
			19		9	SPT					
34	*(Text begins on next page)*										

WATER LEVEL MEASUREMENTS

START 8-30-07 COMPLETE 8-30-07 11:15 am

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **28 (2 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL SURFACE ELEVATION 1517.3 ft	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, dark gray, moist, stiff to very stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	12		10	SPT					
			16		11	SPT					
			16		12	SPT					
			16		13	SPT					
			16		14	SPT					
			19		15	SPT					
61	Bottom of borehole at 61 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 8-30-07 COMPLETE 8-30-07 11:15 am

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **29 (1 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1520.0 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a trace of gravel, mottled brown and gray, moist, firm, (CL)	GLACIAL TILL			1	FA					
			7		2	SPT					
			5		3	SPT					
7	**SANDY LEAN CLAY**: a little gravel, brown, moist, firm to stiff, (CL)	GLACIAL TILL	6		4	SPT					
			8		5	SPT	22	105			4100
			9		6	SPT					
19	**SANDY LEAN CLAY**: a little gravel, dark brown, moist, very stiff, (CL)	GLACIAL TILL	18		7	SPT					
			20		8	SPT					
			19		9	SPT					

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 8-30-07 COMPLETE 8-30-07 2:20 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 E. 50th Street North
Sioux Falls, SD 57104
605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **29 (2 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1520.0 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, dark brown, moist, very stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	21		10	SPT					
			24		11	SPT					
44	**SANDY LEAN CLAY**: a little gravel, dark gray, moist, very stiff to stiff, (CL)	GLACIAL TILL	16		12	SPT					
			15		13	SPT					
			13		14	SPT					
			15		15	SPT					
61	Bottom of borehole at 61 feet.										

WATER LEVEL MEASUREMENTS

START 8-30-07 COMPLETE 8-30-07 2:20 pm

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **30 (1 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1518.7 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LAB WC	LAB D	LAB LL	LAB PL	LAB QU
	SANDY LEAN CLAY: a trace of gravel, mottled brown and gray, dry, stiff, a 6" layer of topsoil at the surface (CL)	GLACIAL TILL			1	FA					
			9		2	SPT					
6			13		3	SPT					
	SANDY LEAN CLAY: a little gravel, brown, moist, stiff to firm, (CL)	GLACIAL TILL	12		4	SPT					
			6		5	SPT	22	103			
14	**SANDY LEAN CLAY**: a little gravel, mottled brown, moist, stiff, (CL)	GLACIAL TILL	11		6	SPT					
			14		7	SPT					
24	**SANDY LEAN CLAY**: a little gravel, dark gray, moist, stiff, (CL)	GLACIAL TILL	9		8	SPT					
			11		9	SPT					

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 8-17-07 COMPLETE 8-17-07 10:20 am

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **30 (2 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1518.7 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, dark gray, moist, stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	9		10	SPT					
			10		11	SPT					
			11		12	SPT					
			14		13	SPT					
			10		14	SPT					
			14		15	SPT					
61	Bottom of borehole at 61 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 8-17-07 COMPLETE 8-17-07 10:20 am

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **31 (1 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1518.7 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a trace of gravel, mottled brown and gray, moist, stiff to firm, a 3" layer of topsoil at the surface (CL)	GLACIAL TILL			1	FA					
			9		2	SPT					
			8		3	SPT					
6	**SANDY LEAN CLAY**: a little gravel, brown, moist, firm to stiff, (CL)	GLACIAL TILL									
			8		4	SPT					
			9		5	SPT					
14	**SANDY LEAN CLAY**: a little gravel, mottled brown, moist, stiff to very stiff, (CL)	GLACIAL TILL									
			13		6	SPT					
			13		7	SPT					
			17		8	SPT					
			14		9	SPT					
34	*(Text begins on next page)*										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 8-30-07 COMPLETE 8-30-07 4:40 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 E. 50th Street North
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605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **31 (2 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1518.7 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, dark gray, moist, stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	10		10	SPT					
			12		11	SPT					
			13		12	SPT					
			14		13	SPT					
			14		14	SPT					
			16		15	SPT					
61	Bottom of borehole at 61 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 8-30-07 COMPLETE 8-30-07 4:40 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 E. 50th Street North
Sioux Falls, SD 57104
605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **32 (1 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

SURFACE ELEVATION 1518.7 ft

DEPTH in FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	ORGANIC FAT CLAY: black, moist, (OH)	TOPSOIL			1	FA					
2	**FAT CLAY**: mottled brown and gray, dry to moist, stiff to firm, (CH)	FINE ALLUVIUM	12		2	SPT					
			7		3	SPT					
7	**SANDY LEAN CLAY**: a little gravel, brown, moist, stiff, (CL)	GLACIAL TILL	9		4	SPT					
			9		5	SPT	23	103			5100
14	**SANDY LEAN CLAY**: a little gravel, mottled brown, moist, stiff, (CL)	GLACIAL TILL	10		6	SPT					
19	**SANDY LEAN CLAY**: a little gravel, dark gray, moist, firm to stiff, (CL)	GLACIAL TILL	8		7	SPT					
			9		8	SPT					
			9		9	SPT					

WATER LEVEL MEASUREMENTS

START 8-16-07 COMPLETE 8-16-07 3:05 pm

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTEK ENGINEERING
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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **32 (2 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1518.7 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LAB WC	LAB D	LAB LL	LAB PL	LAB QU
	SANDY LEAN CLAY: a little gravel, dark gray, moist, firm to stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	10		10	SPT					
			10		11	SPT					
			10		12	SPT					
			13		13	SPT					
			13		14	SPT					
			12		15	SPT					
61	Bottom of borehole at 61 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 8-16-07 COMPLETE 8-16-07 3:05 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **33 (1 of 5)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1519.0 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	LEAN CLAY: mottled brown and gray, moist, firm, (CL)	FINE ALLUVIUM			1	HSA					
			8		2	SPT					
4	**SANDY LEAN CLAY**: a little gravel, brown, moist, firm, (CL)	GLACIAL TILL	7		3	SPT					
			7		4	SPT					
9½	**SANDY LEAN CLAY**: a little gravel, brown mottled, moist, stiff to very stiff, (CL)	GLACIAL TILL	8		5	SPT	24	101			
			14		6	SPT					
			16		7	SPT					
24½	**SANDY LEAN CLAY**: a little gravel, dark gray, moist, stiff to very stiff, (CL)	GLACIAL TILL	16		8	SPT					
			14		9	SPT					

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 8-30-07 COMPLETE 8-31-07 3:14 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Gordy Hawkey

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **33 (2 of 5)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1519.0 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, dark gray, moist, stiff to very stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	13		10	SPT					
			14		11	SPT					
			14		12	SPT					
			14		13	SPT					
			16		14	SPT					
			17		15	SPT					
			16		16	SPT					

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 8-30-07 COMPLETE 8-31-07 3:14 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Gordy Hawkey

GEOTEK ENGINEERING
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909 E. 50th Street North
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605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **33 (3 of 5)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1519.0 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, dark gray, moist, stiff to very stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	18		17	SPT					
			19		18	SPT					
79½	**SANDY LEAN CLAY**: a trace of gravel, brown, moist, stiff, (CH)	GLACIAL TILL	13		19	SPT					
84½	**SANDY LEAN CLAY**: a little gravel, dark gray, moist, very stiff, (CL)	GLACIAL TILL	19		20	SPT					
			21		21	SPT					
			21		22	SPT					

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 8-30-07 COMPLETE 8-31-07 3:14 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Gordy Hawkey

GEOTEK ENGINEERING
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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **33 (4 of 5)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1519.0 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LAB WC	LAB D	LAB LL	LAB PL	LAB QU
	SANDY LEAN CLAY: a little gravel, dark gray, moist, very stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	24		23	SPT					
			21		24	SPT					
			28		25	SPT					
			28		26	SPT					
			28		27	SPT					
129½	**SAND**: a little gravel, medium grained, brown, waterbearing, very dense to dense, (SP)	OUTWASH	58		28	SPT					
			42		29	SPT					

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 8-30-07 COMPLETE 8-31-07 3:14 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Gordy Hawkey

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **33 (5 of 5)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

SURFACE ELEVATION 1519.0 ft

DEPTH in FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SAND: a little gravel, medium grained, brown, waterbearing, very dense to dense, (SP) *(Continued from previous page)*	OUTWASH	40		30	SPT					
			48		31	SPT					
149½	**SANDY LEAN CLAY**: a little gravel, very dark gray, moist, very stiff to hard, (CL)	GLACIAL TILL	34		32	SPT					
			34		33	SPT					
159½	**SAND**: a little gravel, medium grained, brown, waterbearing, very dense, (SP)	OUTWASH	48		34	SPT					
164½	**SILTY SAND**: fine grained, brown, waterbearing, very dense, (SM)	OUTWASH	43		35	SPT					
169½	**SAND**: a little gravel, medium grained, brown, waterbearing, very dense, (SP)	OUTWASH	46		36	SPT					
171	Bottom of borehole at 171 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 8-30-07 COMPLETE 8-31-07 3:14 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Gordy Hawkey

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **34 (1 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1519.2 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	FILL, MOSTLY CLAY: a trace of gravel, brown and black, moist	FILL			1	FA					
			9		2	SPT					
3½	**SANDY LEAN CLAY**: mottled brown and gray, moist, firm to soft, (CL)	GLACIAL TILL	8		3	SPT					
			4		4	SPT					
9½	**SANDY LEAN CLAY**: a little gravel, brown, moist, firm, (CL)	GLACIAL TILL	6		5	SPT	24	101			
			8		6	SPT	25	99			4400
19½	**SANDY LEAN CLAY**: a little gravel, mottled brown, moist, stiff, (CL)	GLACIAL TILL	12		7	SPT					
24	**SANDY LEAN CLAY**: a little gravel, mottled brown and dark gray, moist, stiff, (CL)	GLACIAL TILL	13		8	SPT					
29	**SANDY LEAN CLAY**: a little gravel, dark gray, moist, stiff, (CL)	GLACIAL TILL	10		9	SPT					

WATER LEVEL MEASUREMENTS

START 8-16-07 COMPLETE 8-16-07 11:45 am

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **34 (2 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1519.2 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, dark gray, moist, stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	10		10	SPT					
			8		11	SPT					
			12		12	SPT					
			13		13	SPT					
			14		14	SPT					
			13		15	SPT					
61	Bottom of borehole at 61 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 8-16-07 COMPLETE 8-16-07 11:45 am

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **35 (1 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1515.3 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	WC	D	LL	PL	QU
2	**ORGANIC FAT CLAY**: black, moist, (OH)	TOPSOIL			1	FA					
3½	**FAT CLAY**: dark brown, moist, soft, (CH)	FINE ALLUVIUM	4		2	SPT					
	SANDY LEAN CLAY: a trace of gravel, mottled brown and gray, moist, soft, (CL)	GLACIAL TILL	4	▼	3	SPT					
			5		4	SPT					
9	**SANDY LEAN CLAY**: a little gravel, brown, moist, firm, (CL)	GLACIAL TILL	8		5	SPT	28	97			
			8		6	SPT					
19	**SANDY LEAN CLAY**: a little gravel, mottled brown, moist, stiff, (CL)	GLACIAL TILL	11		7	SPT					
24	**SANDY LEAN CLAY**: a little gravel, dark gray, moist, stiff, (CL)	GLACIAL TILL	11		8	SPT					
			11		9	SPT					

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
8-17-07	1:50 pm	7	--	7	▼ 4
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START 8-17-07 COMPLETE 8-17-07 3:45 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **35 (2 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1515.3 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LAB WC	LAB D	LAB LL	LAB PL	LAB QU
	SANDY LEAN CLAY: a little gravel, dark gray, moist, stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	12		10	SPT					
			11		11	SPT					
			11		12	SPT					
			16		13	SPT					
			15		14	SPT					
			15		15	SPT					
61	Bottom of borehole at 61 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
8-17-07	1:50 pm	7	--	7	▼ 4
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START 8-17-07 COMPLETE 8-17-07 3:45 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 E. 50th Street North
Sioux Falls, SD 57104
605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **36 (1 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1517.6 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, brown, dry to moist, stiff to firm, a 3" layer of topsoil at the surface (CL)	GLACIAL TILL			1	FA					
			16		2	SPT					
			11		3	SPT					
			7		4	SPT					
			6		5	SPT					
			12		6	SPT					
			15		7	SPT					
24	**SANDY LEAN CLAY**: a little gravel, dark gray, moist, stiff, (CL)	GLACIAL TILL	15		8	SPT					
			14		9	SPT					

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 8-31-07 COMPLETE 8-31-07 11:00 am

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 E. 50th Street North
Sioux Falls, SD 57104
605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **36 (2 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1517.6 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, dark gray, moist, stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	14		10	SPT					
			14		11	SPT					
			14		12	SPT					
			15		13	SPT					
			15		14	SPT					
			16		15	SPT					
61	Bottom of borehole at 61 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
--	--	--	--	--	--
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START 8-31-07 COMPLETE 8-31-07 11:00 am

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 E. 50th Street North
Sioux Falls, SD 57104
605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **37 (1 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

SURFACE ELEVATION 1519.0 ft

DEPTH in FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	WC	D	LL	PL	QU
	SANDY LEAN CLAY: a trace of gravel, mottled brown and gray, moist, firm, a 3" layer of topsoil at the surface (CL)	GLACIAL TILL			1	FA					
			6		2	SPT					
			6		3	SPT					
7	**SANDY LEAN CLAY**: a little gravel, brown, moist, firm to stiff, (CL)	GLACIAL TILL	8		4	SPT					
			5		5	SPT	22	104			
			13		6	SPT					
19	**SANDY LEAN CLAY**: a little gravel, dark brown, moist, stiff, (CL)	GLACIAL TILL	14		7	SPT					
			15		8	SPT					
29	**SANDY LEAN CLAY**: a little gravel, dark gray, moist, stiff, (CL)	GLACIAL TILL	11		9	SPT					

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 8-31-07 COMPLETE 8-31-07 2:00 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 E. 50th Street North
Sioux Falls, SD 57104
605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **37 (2 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1519.0 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LAB WC	LAB D	LAB LL	LAB PL	LAB QU
	SANDY LEAN CLAY: a little gravel, dark gray, moist, stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	11		10	SPT					
			12		11	SPT					
			12		12	SPT					
			12		13	SPT					
			15		14	SPT					
			14		15	SPT					
61	Bottom of borehole at 61 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
--	--	--	--	--	--
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START 8-31-07 COMPLETE 8-31-07 2:00 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 E. 50th Street North
Sioux Falls, SD 57104
605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **38 (1 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1514.9 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	ORGANIC FAT CLAY: black, moist, (OH)	TOPSOIL			1	FA					
2											
	FAT CLAY: dark brown, moist, firm, (CH)	FINE ALLUVIUM	6		2	SPT					
3½	**SANDY LEAN CLAY**: a trace of gravel, grayish brown, moist, soft, (CL)	GLACIAL TILL	4	▼	3	SPT					
7	**SANDY LEAN CLAY**: a little gravel, brown, moist, stiff to firm, (CL)	GLACIAL TILL	9		4	SPT	22	105			6200
			7		5	SPT					
14	**SANDY LEAN CLAY**: a little gravel, mottled brown, moist, stiff, (CL)	GLACIAL TILL	14		6	SPT					
19	**SANDY LEAN CLAY**: a little gravel, dark gray, moist, firm to stiff, (CL)	GLACIAL TILL	8		7	SPT					
			9		8	SPT					
			9		9	SPT					

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
8-17-07	10:45 am	7	--	7	▼ 6
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START 8-17-07 COMPLETE 8-17-07 12:40 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 E. 50th Street North
Sioux Falls, SD 57104
605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **38 (2 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1514.9 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LAB TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a little gravel, dark gray, moist, firm to stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	10		10	SPT					
			12		11	SPT					
			10		12	SPT					
			12		13	SPT					
			10		14	SPT					
			13		15	SPT					
61	Bottom of borehole at 61 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
8-17-07	10:45 am	7	--	7	▼ 6
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START 8-17-07 COMPLETE 8-17-07 12:40 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 E. 50th Street North
Sioux Falls, SD 57104
605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **39 (1 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1517.2 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	SANDY LEAN CLAY: a trace of gravel, mottled brown and gray, dry to moist, firm to stiff, a 4" layer of topsoil at the surface (CL)	GLACIAL TILL			1	FA					
			5		2	SPT					
6			13		3	SPT					
	SANDY LEAN CLAY: a little gravel, brown, moist, firm, (CL)	GLACIAL TILL	6		4	SPT					
9	**SANDY LEAN CLAY**: a little gravel, mottled brown, moist, firm, (CL)	GLACIAL TILL	8		5	SPT					
14	**SANDY LEAN CLAY**: a little gravel, brown, moist, stiff, (CL)	GLACIAL TILL	11		6	SPT					
19	**SANDY LEAN CLAY**: a little gravel, mottled brown and dark gray, moist, stiff, (CL)	GLACIAL TILL	15		7	SPT					
24	**SANDY LEAN CLAY**: a little gravel, dark gray, moist, stiff, (CL)	GLACIAL TILL	11		8	SPT					
			13		9	SPT					

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
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START 8-22-07 COMPLETE 8-22-07 2:50 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

GEOTEK ENGINEERING
& TESTING SERVICES, INC.
909 E. 50th Street North
Sioux Falls, SD 57104
605-335-5512 Fax 605-335-0773

GEOTECHNICAL TEST BORING LOG

GEOTEK # **07-180** BORING NO. **39 (2 of 2)**

PROJECT **Proposed Ground Storage Water Reservoirs, Lewis & Clark Rural Water System, 270th St. & 467th Ave., Near Tea, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 1517.2 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LAB WC	LAB D	LAB LL	LAB PL	LAB QU
	SANDY LEAN CLAY: a little gravel, dark gray, moist, stiff, (CL) *(Continued from previous page)*	GLACIAL TILL	10		10	SPT					
			12		11	SPT					
			12		12	SPT					
			20		13	SPT					
			14		14	SPT					
			15		15	SPT					
61	Bottom of borehole at 61 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
--	--	--	--	--	--
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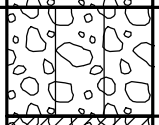
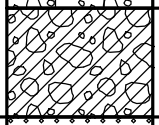
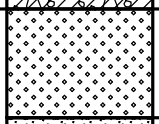
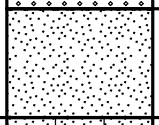
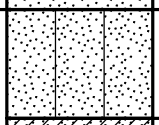
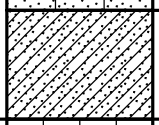
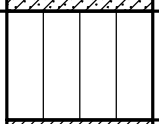
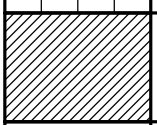
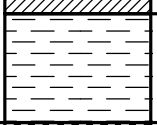
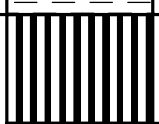
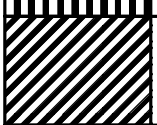
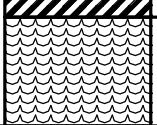
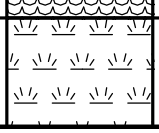
START 8-22-07 COMPLETE 8-22-07 2:50 pm

METHOD
Rotary Mud Drilling

CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 07-180.GPJ GEOTEKENG.GDT 9/25/07

SOIL CLASSIFICATION CHART

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

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

BORING LOG SYMBOLS AND DESCRIPTIVE TERMINOLOGY

SYMBOLS FOR DRILLING AND SAMPLING

Symbol	Definition
Bag	Bag sample
CS	Continuous split-spoon sampling
DM	Drilling mud
FA	Flight auger; number indicates outside diameter in inches
HA	Hand auger; number indicates outside diameter in inches
HSA	Hollow stem auger; number indicates inside diameter in inches
LS	Liner sample; number indicates outside diameter of liner sample
N	Standard penetration resistance (N-value) in blows per foot
NMR	No water level measurement recorded, primarily due to presence of drilling fluid
NSR	No sample retrieved; classification is based on action of drilling equipment and/or material noted in drilling fluid or on sampling bit
SH	Shelby tube sample; 3-inch outside diameter
SPT	Standard penetration test (N-value) using standard split-spoon sampler
SS	Split-spoon sample; 2-inch outside diameter unless otherwise noted
WL	Water level directly measured in boring
▼	Water level symbol

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
Term	N-Value	Term
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

Term	Definition
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 ½” thick stratum
Layer	½” to 6” thick stratum
Lens	½” to 6” discontinuous stratum

GRAVEL PERCENTAGES

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

LABORATORY TEST RESULTS

Boring	Depth (ft)	Soil Type	pH	Chloride (mg/kg)	Sulfate (mg/kg)
25	7-8.5	Sandy Lean Clay	7.9	7	4340
26	4.5-6	Sandy Lean Clay	8.4	4	37

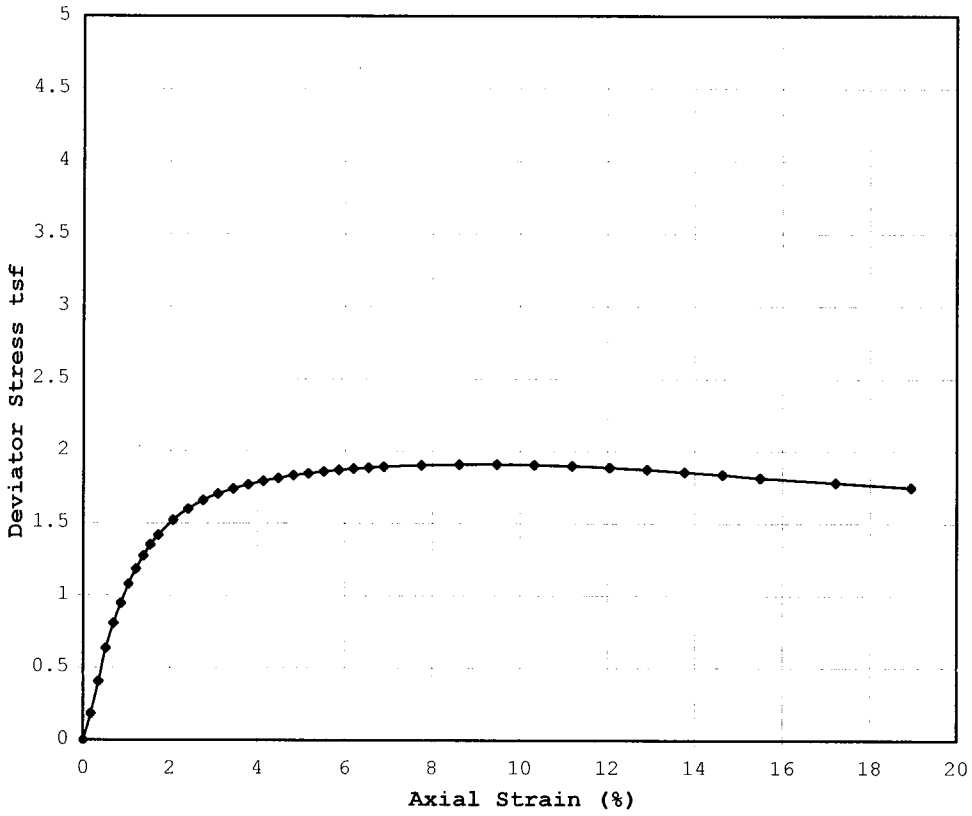
Boring	Depth (ft)	Soil Type	Water Content (%)	Dry Unit Wt. (pcf)	Resistivity (ohm-cm)
2	2-4.5	Fat Clay	29.3	92.3	612
9	5-7.5	Sandy Lean Clay	22.2	104.0	930
15	6-8.5	Fat Clay	27.3	95.2	795

Triaxial U-U Stress/Strain Curves

Project: Proposed Ground Storage Water Reservoirs - Lewis & Clark Rural Water Systems -Near Tea, SD - #07-180 Job: 6110

Client: Geotek Engineering & Testing Services, Inc. Date: 6/21/07

Remarks: Specimens trimmed to given sizes; Allowed to adjust under applied confing pressures for about 10 minutes.



Boring: SB-9 Depth: 5-7.5 (Bot.)

Sample #:

Soil Type: Sandy Lean Clay w/a Little Gravel (CL)

Strain Rate (in/min): 0.059

Sample Type: 3T

Dia. (in) 2.84 Ht. (in) 5.81

Height to Diameter Ratio: 2.05

Max Deviator Stress: 1.91 tsf

Strain at Failure (%): 9.47

Confining Pressure: 0.38 tsf

W.C. (%): 20.7

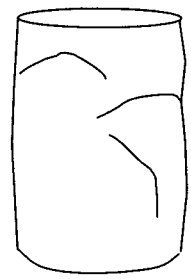
Yd (pcf): 103.2

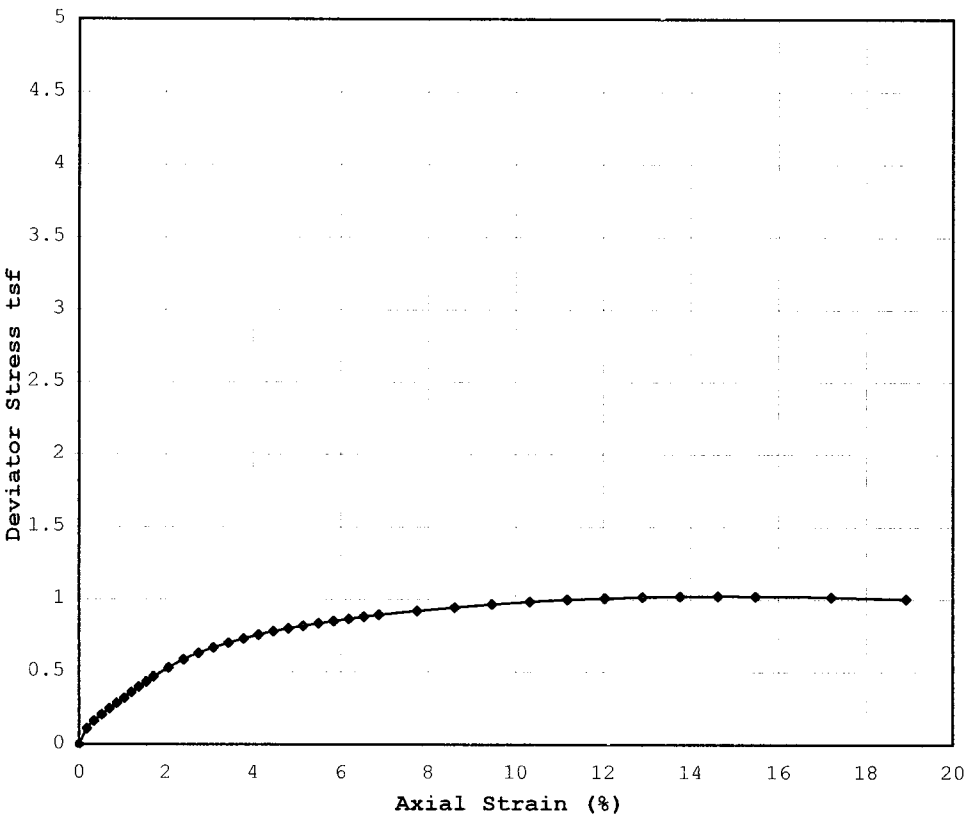
LL: 48.5

PL: 18.4

PI: 30.1

Sketch of Specimen After Failure





Boring: SB-15 Depth: 6-8.5 (Mid-Top)

Sample #:

Soil Type: Lean Clay (CL)

Strain Rate (in/min): 0.059

Sample Type: 3T

Dia. (in): 2.83 Ht. (in): 5.81

Height to Diameter Ratio: 2.05

Max Deviator Stress: 1.02 tsf

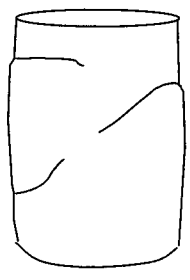
Strain at Failure (%): 14.62

Confining Pressure: 0.33 tsf

W.C. (%): 27.7

Yd (pcf): 95.0

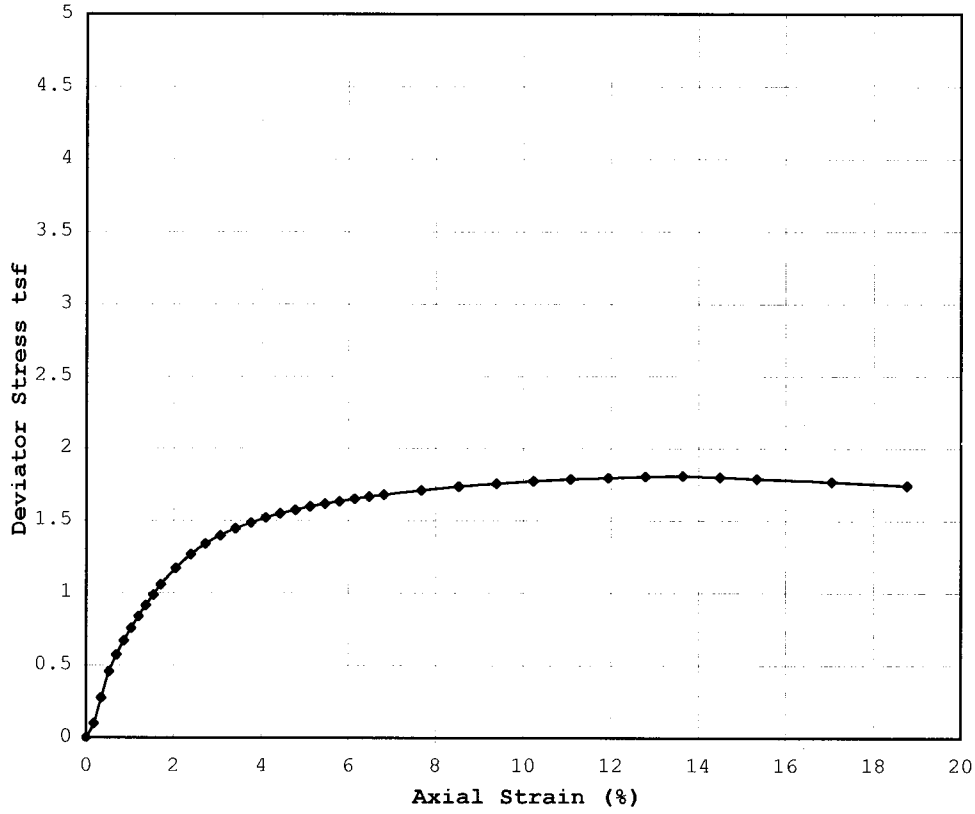
Sketch of Specimen After Failure



9301 Bryant Ave. South, Suite 107 SOIL ENGINEERING TESTING, INC. Bloomington, Minnesota 55420-3436

Triaxial U-U Stress/Strain Curves

Project: Proposed Ground Storage Water Reservoirs - Lewis & Clark Rural Water Systems -Near Tea, SD - #07-180 Job: 6110
Client: Geotek Engineering & Testing Services, Inc. Date: 6/21/07
Remarks: Specimens trimmed to given sizes; Allowed to adjust under applied confing pressures for about 10 minutes.



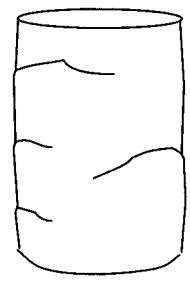
Boring: SB-15 Depth: 12.5-15 (Mid-Top)
Sample #:
Soil Type: Sandy Lean Clay w/a Little Gravel (CL)

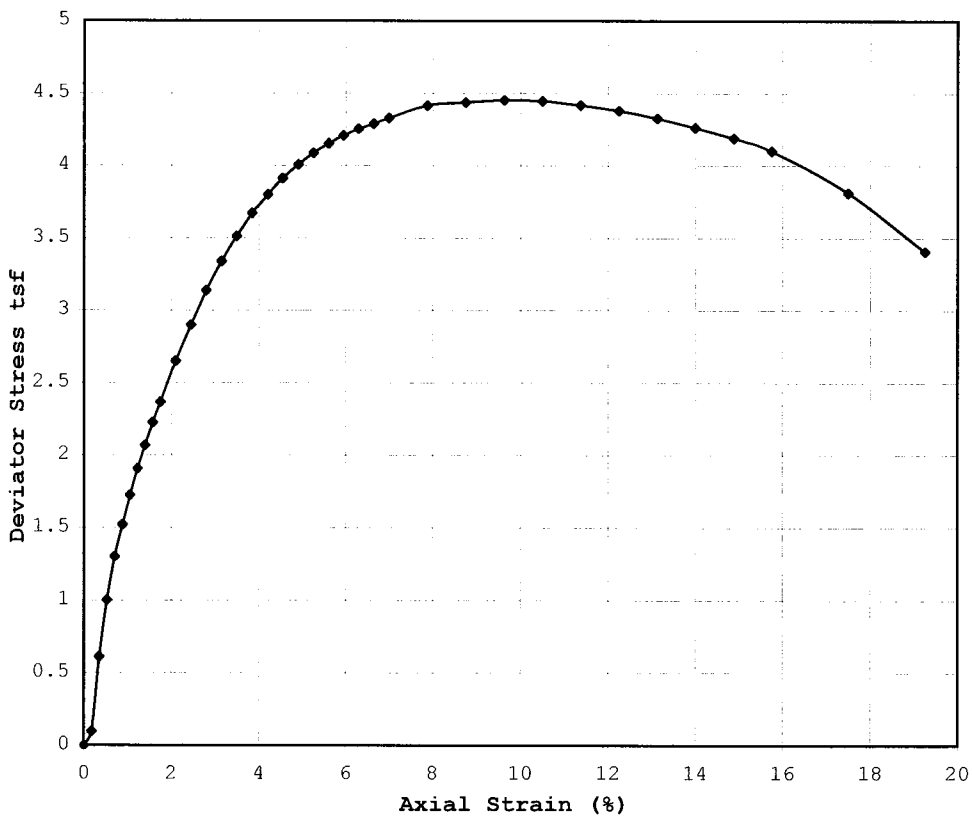
Strain Rate (in/min): 0.059
Sample Type: 3T
Dia. (in) 2.84 Ht. (in) 5.87
Height to Diameter Ratio: 2.06

Max Deviator Stress: 1.81 tsf
Strain at Failure (%): 13.65
Confining Pressure: 0.63 tsf

W.C. (%) 24.3
Yd (pcf): 100.0

Sketch of Specimen After Failure





Boring: SB-15 Depth: 20-22 (Mid)
Sample #:
Soil Type: Sandy Lean Clay w/a Little Gravel (CL)

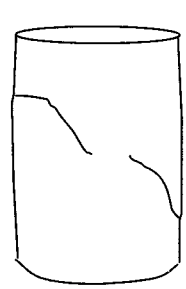
Strain Rate (in/min): 0.059
Sample Type: 3T

Dia. (in): 2.87 Ht. (in): 5.72
Height to Diameter Ratio: 1.99

Max Deviator Stress: 4.45 tsf
Strain at Failure (%): 9.62
Confining Pressure: 1.07 tsf

W.C. (%): 19.9
Yd (pcf): 108.2

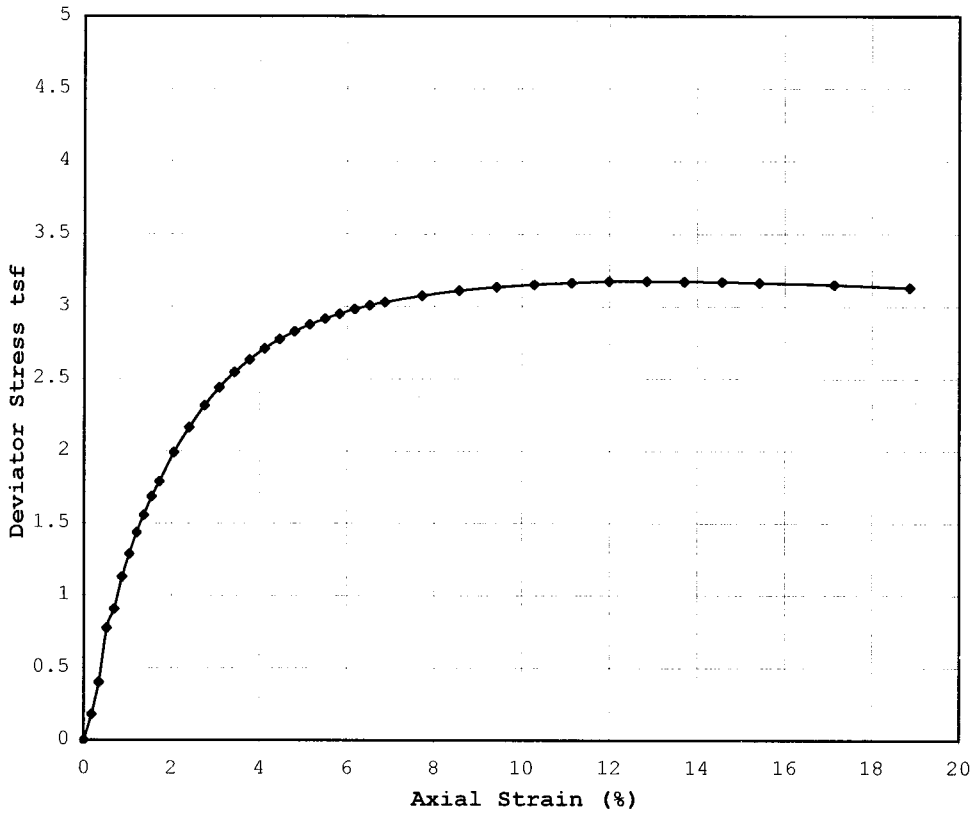
Sketch of Specimen After Failure



9301 Bryant Ave. South, Suite 107 SOIL ENGINEERING TESTING, INC. Bloomington, Minnesota 55420-3436

Triaxial U-U Stress/Strain Curves

Project: Proposed Ground Storage Water Reservoirs - Lewis & Clark Rural Water Systems -Near Tea, SD - #07-180 Job: 6110
Client: Geotek Engineering & Testing Services, Inc. Date: 6/21/07
Remarks: Specimens trimmed to given sizes; Allowed to adjust under applied confing pressures for about 10 minutes.



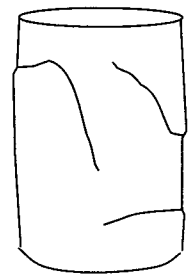
Boring: SB-15 Depth: 40-42.5 (Mid)
Sample #:
Soil Type: Sandy Lean Clay w/a Little Gravel (CL)

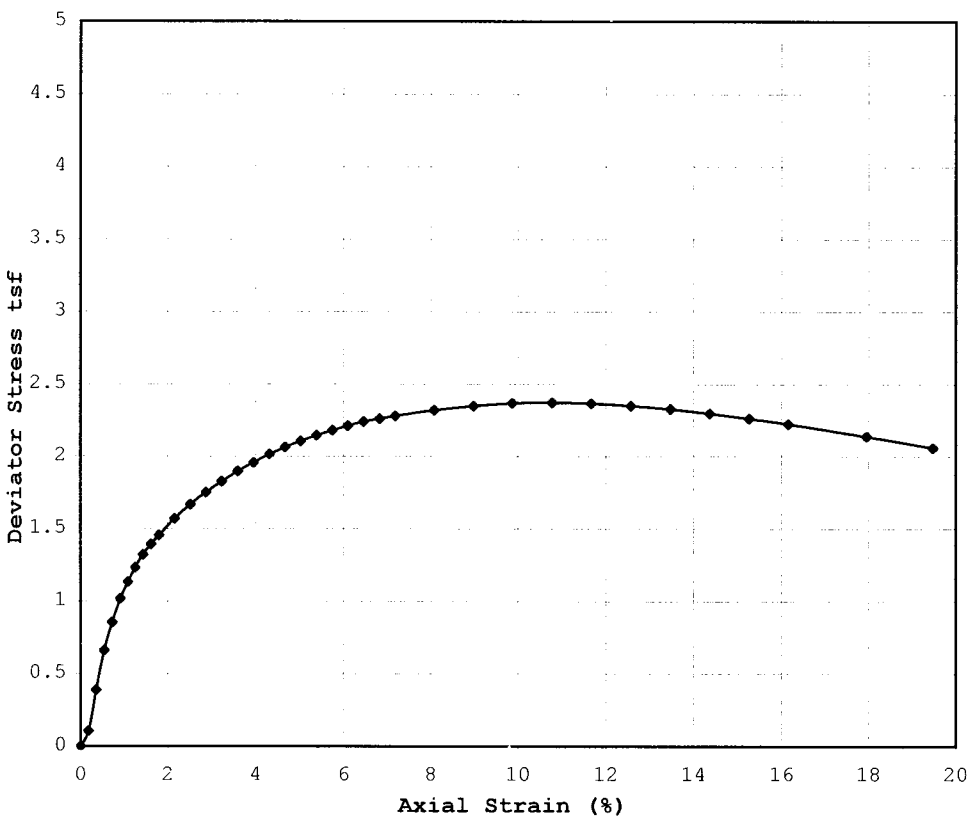
Strain Rate (in/min): 0.059
Sample Type: 3T
Dia. (in) 2.85 Ht. (in) 5.83
Height to Diameter Ratio: 2.05

Max Deviator Stress: 3.17 tsf
Strain at Failure (%): 12.85
Confining Pressure: 2.23 tsf

W.C. (%) 18.4
Yd (pcf): 111.2

Sketch of Specimen After Failure





Boring: SB-25 Depth: 10-12.5 (Bot)
Sample #:
Soil Type: Sandy Lean Clay w/a Little Gravel (CL)

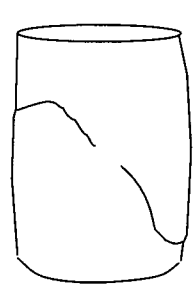
Strain Rate (in/min): 0.059
Sample Type: 3T

Dia. (in): 2.76 Ht. (in): 5.57
Height to Diameter Ratio: 2.02

Max Deviator Stress: 2.37 tsf
Strain at Failure (%): 10.78
Confining Pressure: 0.63 tsf

W.C. (%): 21.0
Yd (pcf): 105.7

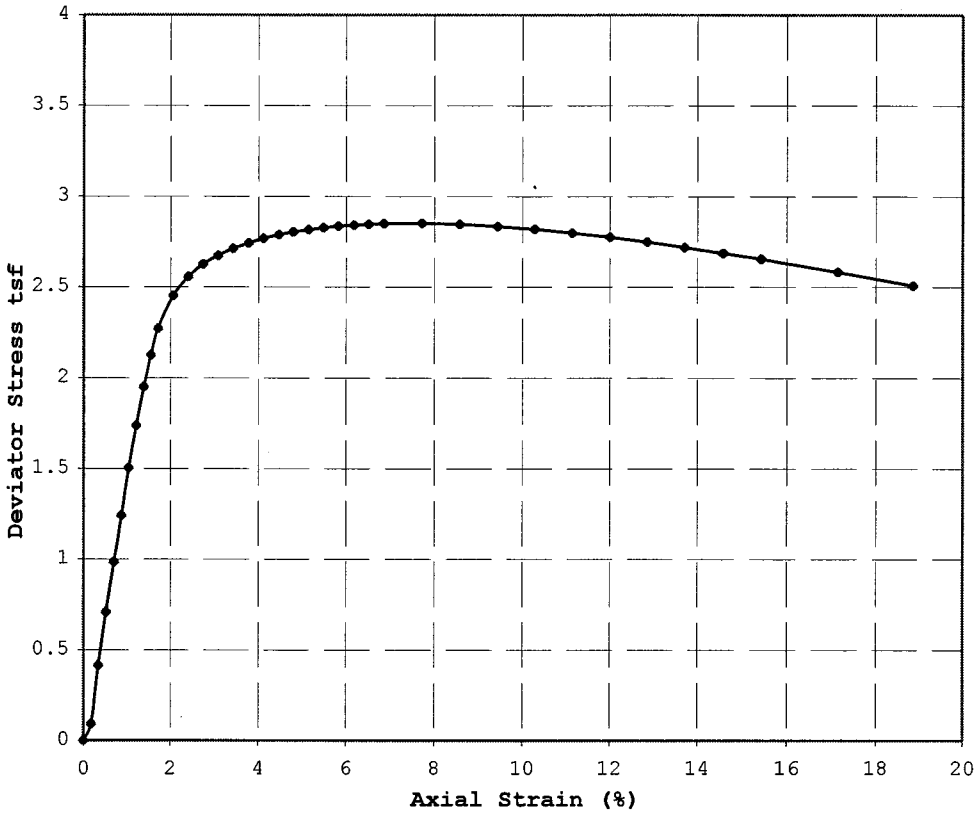
Sketch of Specimen After Failure



9301 Bryant Ave. South, Suite 107 SOIL ENGINEERING TESTING, INC. Bloomington, Minnesota 55420-3436

Triaxial U-U Stress/Strain Curves

Project: Lewis & Clark Ground Storage Reservoirs — Job: 6210
Client: Geotek Engineering & Testing Services, Inc. — Date: 8/28/07
Remarks:



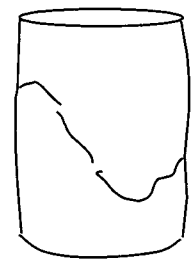
Boring: SB-34 Depth: 14 - 16 (Top)
Sample #:
Soil Type: Sandy Lean Clay w/a Little Gravel (CL)

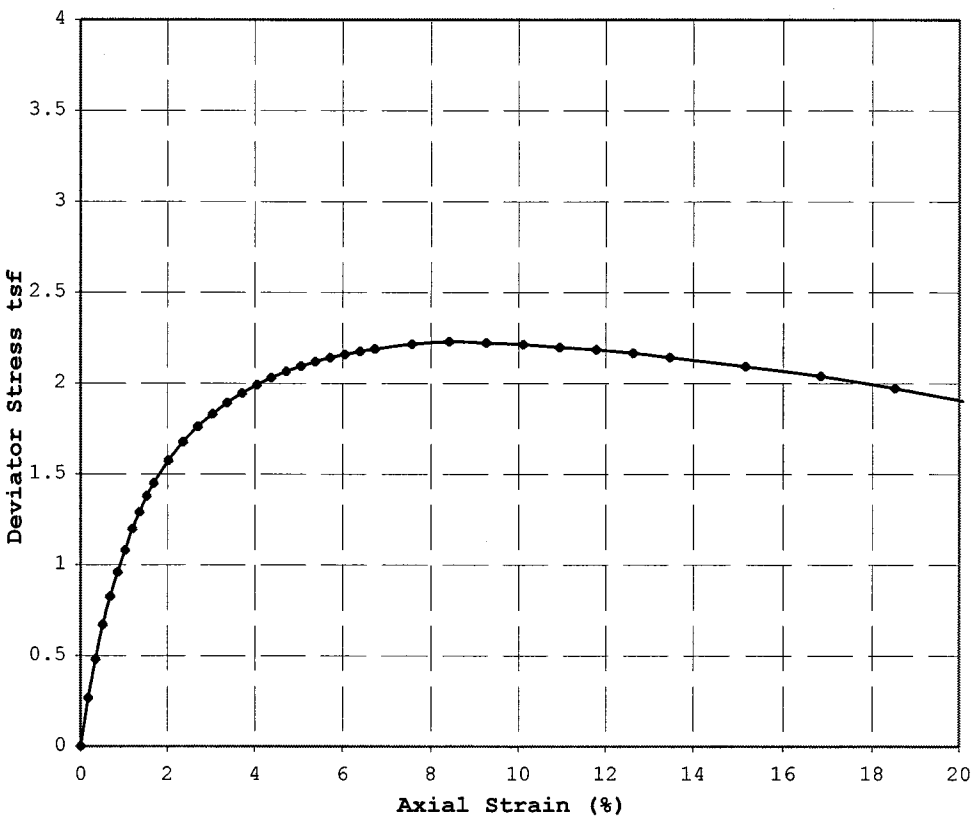
Strain Rate (in/min): 0.050
Sample Type: 3T
Dia. (in) 2.88 Ht. (in) 5.83
Height to Diameter Ratio: 2.03

Max Deviator Stress: 2.85 tsf
Strain at Failure (%): 7.72
Confining Pressure: 0.645 tsf

W.C. (%) 22.1
Yd (pcf): 103.8

Sketch of Specimen After Failure





Boring: SB-34 Depth: 24 - 26 (Bot.)
Sample #:
Soil Type: Lean Clay w/Sand (CL)

Strain Rate (in/min): 0.050
Sample Type: 3T

Dia. (in): 2.88 Ht. (in): 5.94
Height to Diameter Ratio: 2.06

Max Deviator Stress: 2.23 tsf
Strain at Failure (%): 8.42
Confining Pressure: 0.97 tsf

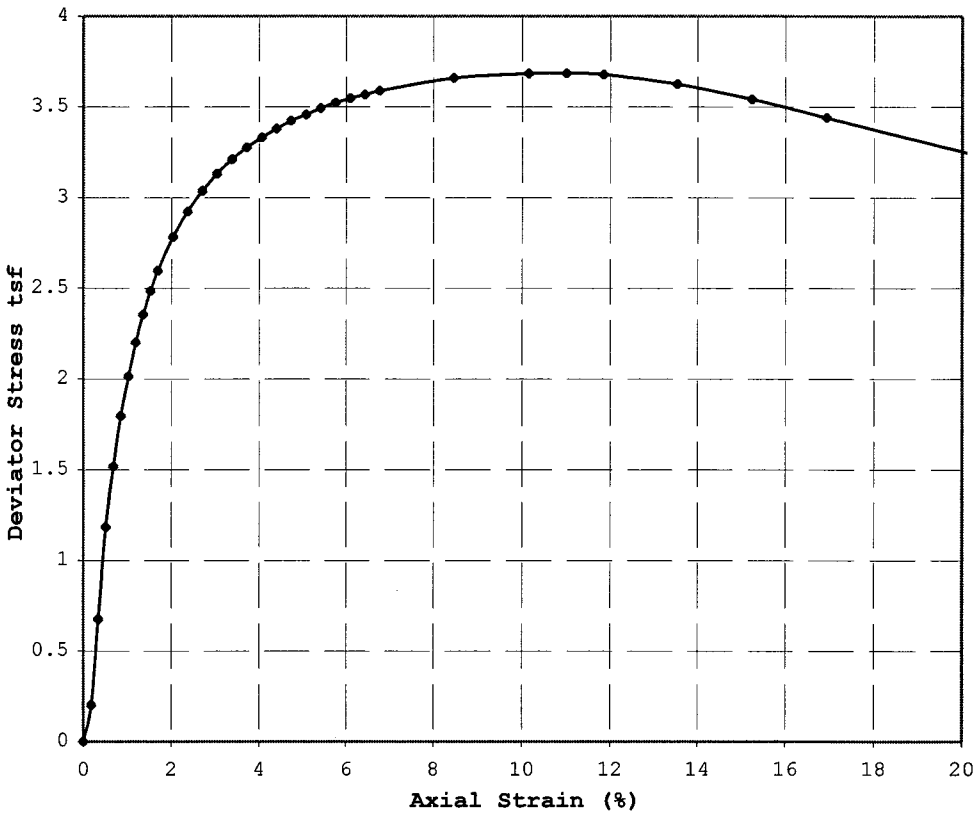
W.C. (%): 20.4
Yd (pcf): 107.8

Sketch of Specimen After Failure

9301 Bryant Ave. South, Suite 107 SOIL ENGINEERING TESTING, INC. Bloomington, Minnesota 55420-3436

Triaxial U-U Stress/Strain Curves

Project: Lewis & Clark Ground Storage Reservoirs — Job: 6210
Client: Geotek Engineering & Testing Services, Inc. — Date: 8/28/07
Remarks:



Boring: SB-34 — Depth: 49 - 51 (Top)
Sample #:

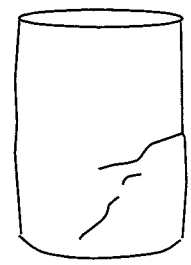
Soil Type: Sandy Lean Clay w/a Little Gravel (CL)

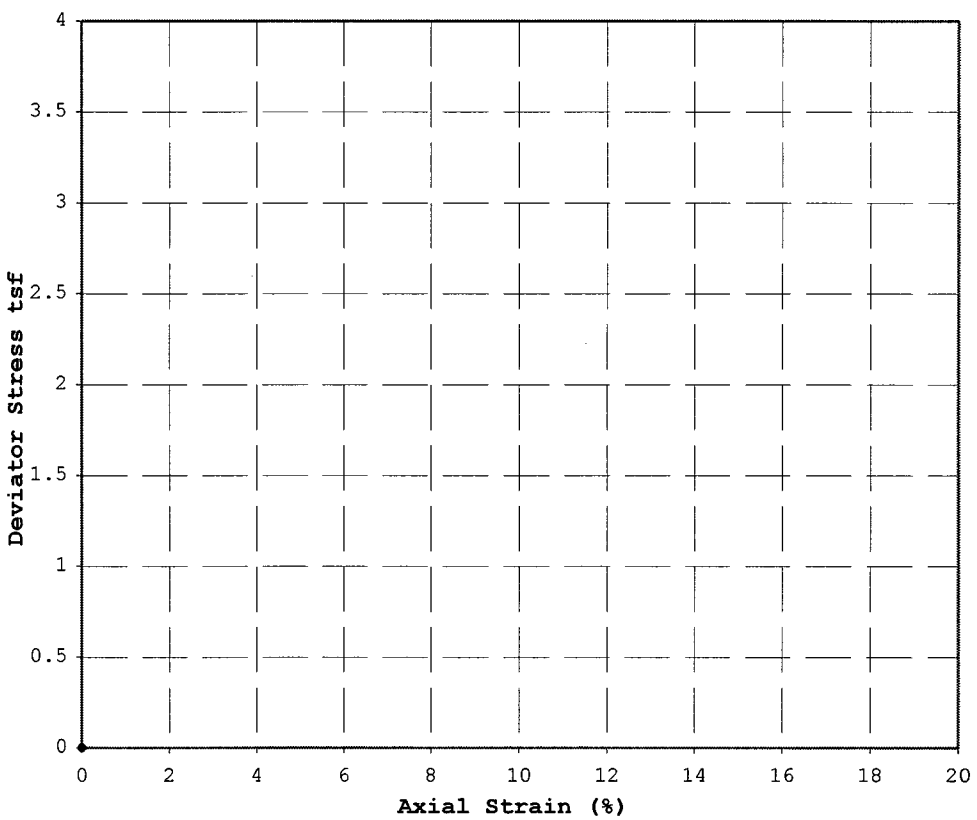
Strain Rate (in/min): 0.050
Sample Type: 3T
Dia. (in) 2.86 — Ht. (in) 5.91
Height to Diameter Ratio: 2.07

Max Deviator Stress: 3.69 tsf
Strain at Failure (%): 11.00
Confining Pressure: 1.78 tsf

W.C. (%) 18.7
Yd (pcf): 110.3

Sketch of Specimen After Failure





Boring: — Depth:
Sample #:

Soil Type:

Strain Rate (in/min):
Sample Type:

Dia. (in): — Ht. (in):
Height to Diameter Ratio:

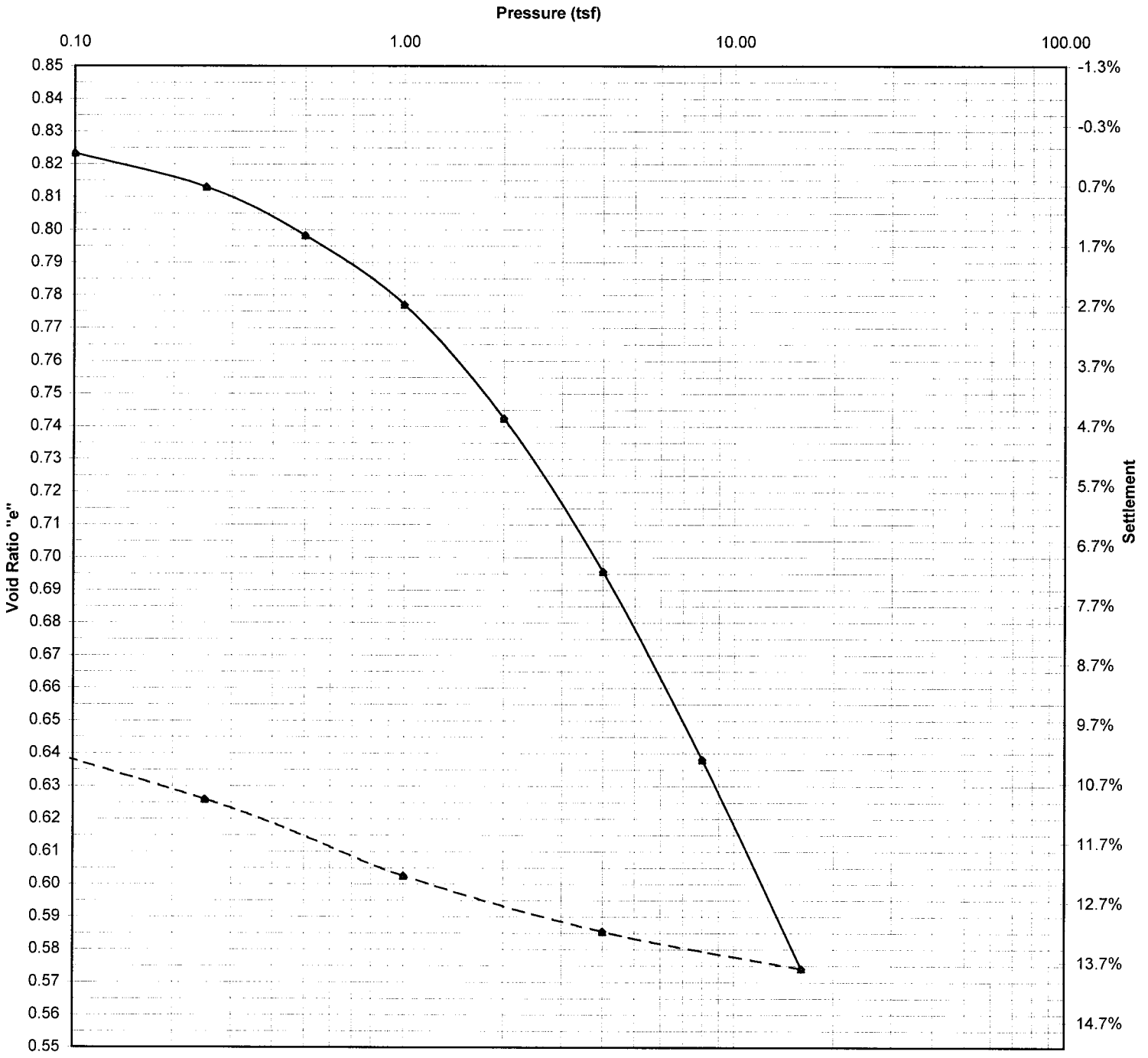
Max Deviator Stress: tsf
Strain at Failure (%):
Confining Pressure: tsf

W.C. (%):
Yd (pcf):

Sketch of Specimen After Failure

9301 Bryant Ave. South, Suite 107 — GEOTECHNICAL ENGINEERING TESTING, INC. — Bloomington, Minnesota 55420-3436

Void Ratio and % Settlement vs. Log of Pressure



Project: Proposed Ground Storage Water Reservoirs - Lewis & Clark Rural Water Systems -Near Tea, SD			Date: 6/28/07
Sample #:	Boring #: SB-15	Depth ft: 6-8.5 (Top)	Job #: 6110
Soil Type: Lean Clay (CL)			
Initial W/C (%): 29.3	Dry Density (pcf): 93.6	LL: 43.8 PL: 20.8 PI: 23.0	Gs: 2.74 (Assumed)
Organic Content (%):	Initial Height (in.): 0.750	Diameter (in.): 2.506	e_o= 0.827
Preconsolidation Pressure (Pc): 1.7 tsf	Compression Index (Cc): 0.20	Recompression Index (Cr): ≅ 0.03	
Remarks:			

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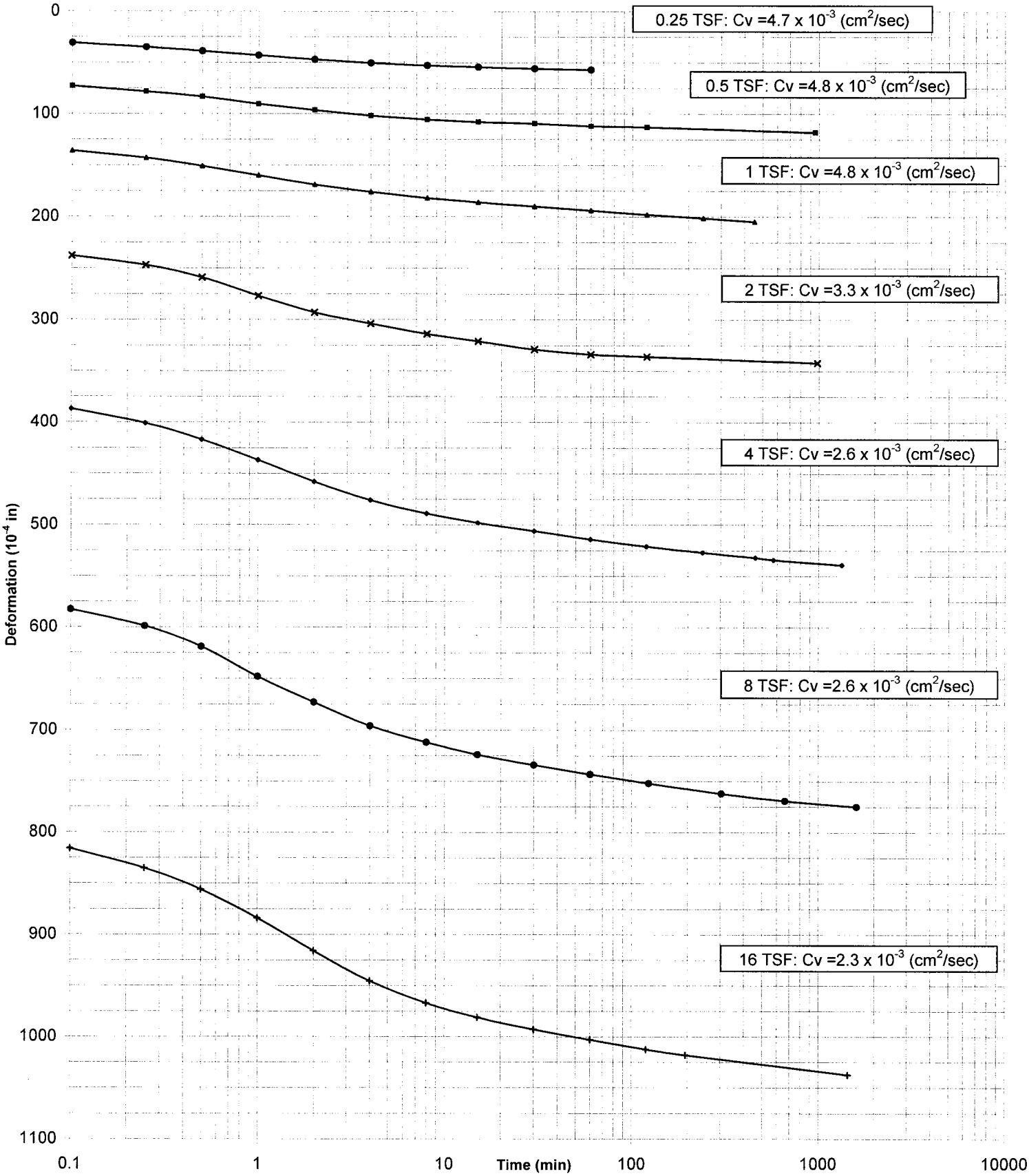
SOIL ENGINEERING TESTING, INC.

Bloomington, Minnesota 55420-3436

Consolidation Log of Time Curves



Project: Proposed Ground Storage Water Reservoirs - Lewis & Clark Rural Water Systems -Near Tea, SI			Date: 6/28/07
Sample #:	Boring #: SB-15	Depth ft: 6-8.5 (Top)	Job #: 6110

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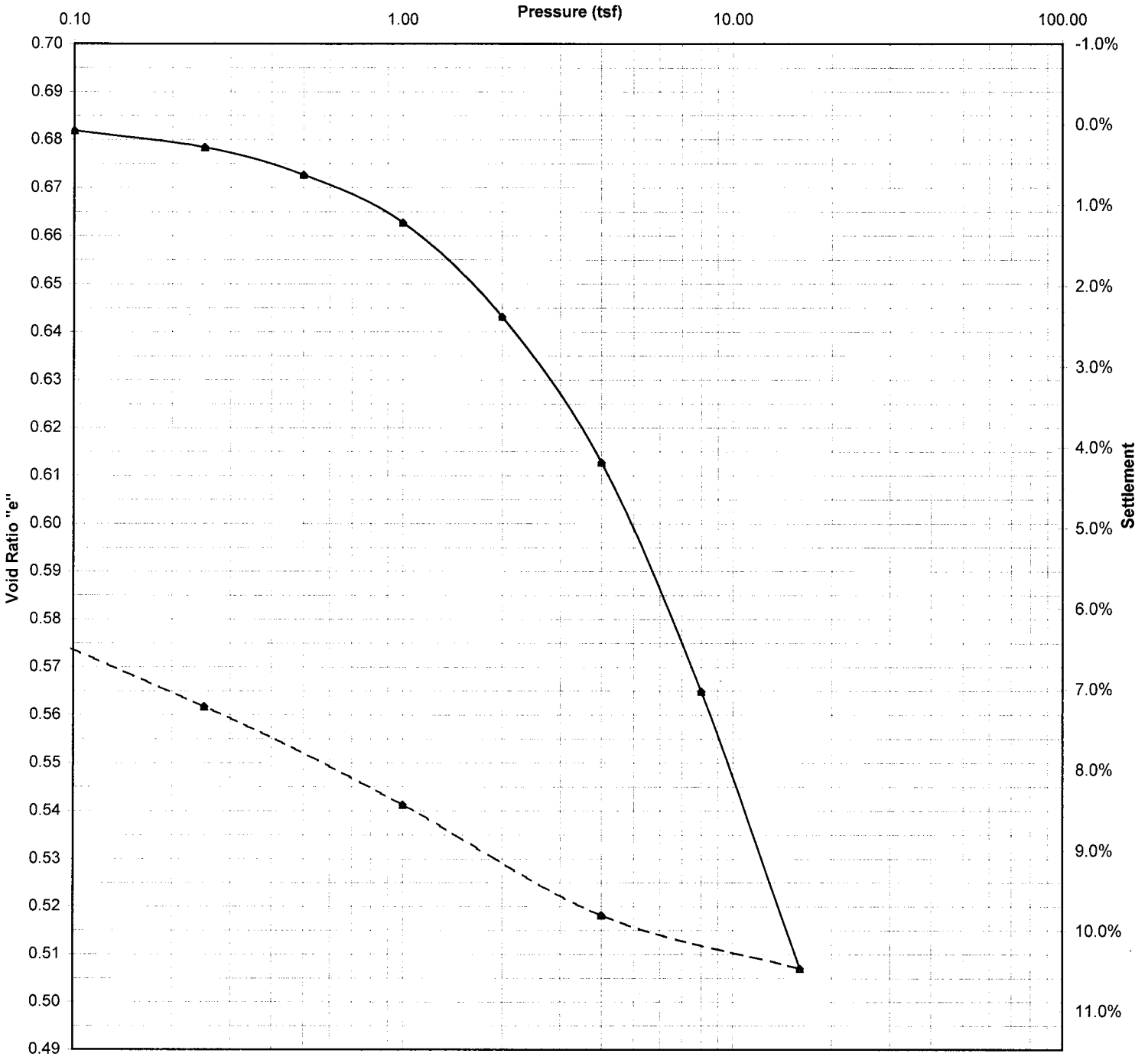
SOIL ENGINEERING TESTING, INC.

Bloomington, Minnesota 55420-3436

Void Ratio and % Settlement vs. Log of Pressure



Project: Proposed Ground Storage Water Reservoirs - Lewis & Clark Rural Water Systems -Near Tea, SD			Date: 6/28/07
Sample #:	Boring #: SB-15	Depth ft: 12-15.5 (Top)	Job #: 6110
Soil Type: Lean Clay (CL)			
Initial W/C (%): 24.8	Dry Density (pcf): 99.1	LL: 42.9 PL: 19.1 PI: 23.7	Gs: 2.67
Organic Content (%):	Initial Height (in.): 0.765	Diameter (in.): 2.505	e_o= 0.683
Preconsolidation Pressure (Pc): 2.3 tsf	Compression Index (Cc): 0.17	Recompression Index (Cr):	≅ 0.03
Remarks:			

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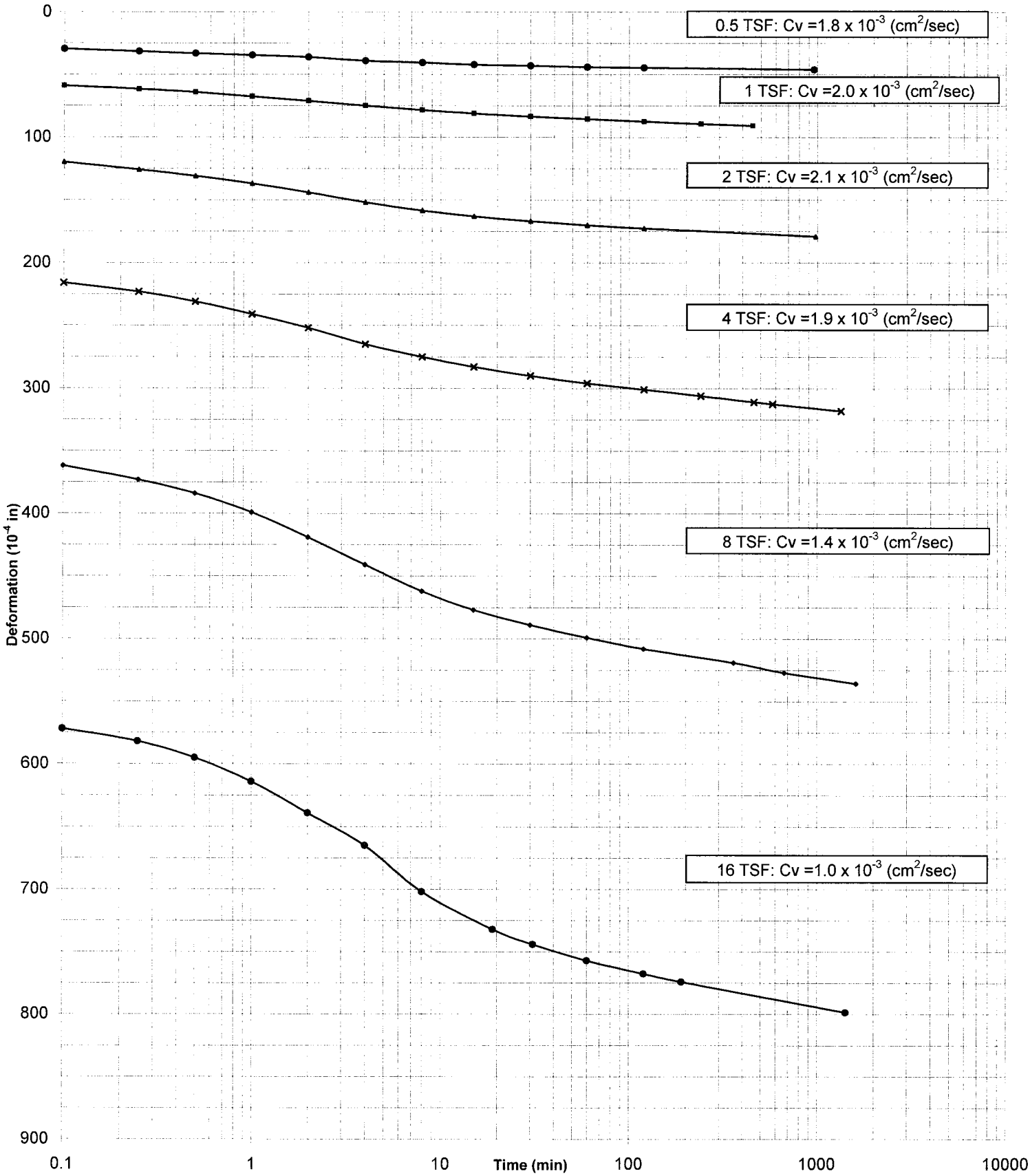
Bloomington, Minnesota 55420-3436

Consolidation Log of Time Curves



Project: Proposed Ground Storage Water Reservoirs - Lewis & Clark Rural Water Systems -Near Tea, SD			Date: 6/28/07
Sample #:	Boring #: SB-15	Depth ft: 12-15.5 (Top)	Job #: 6110

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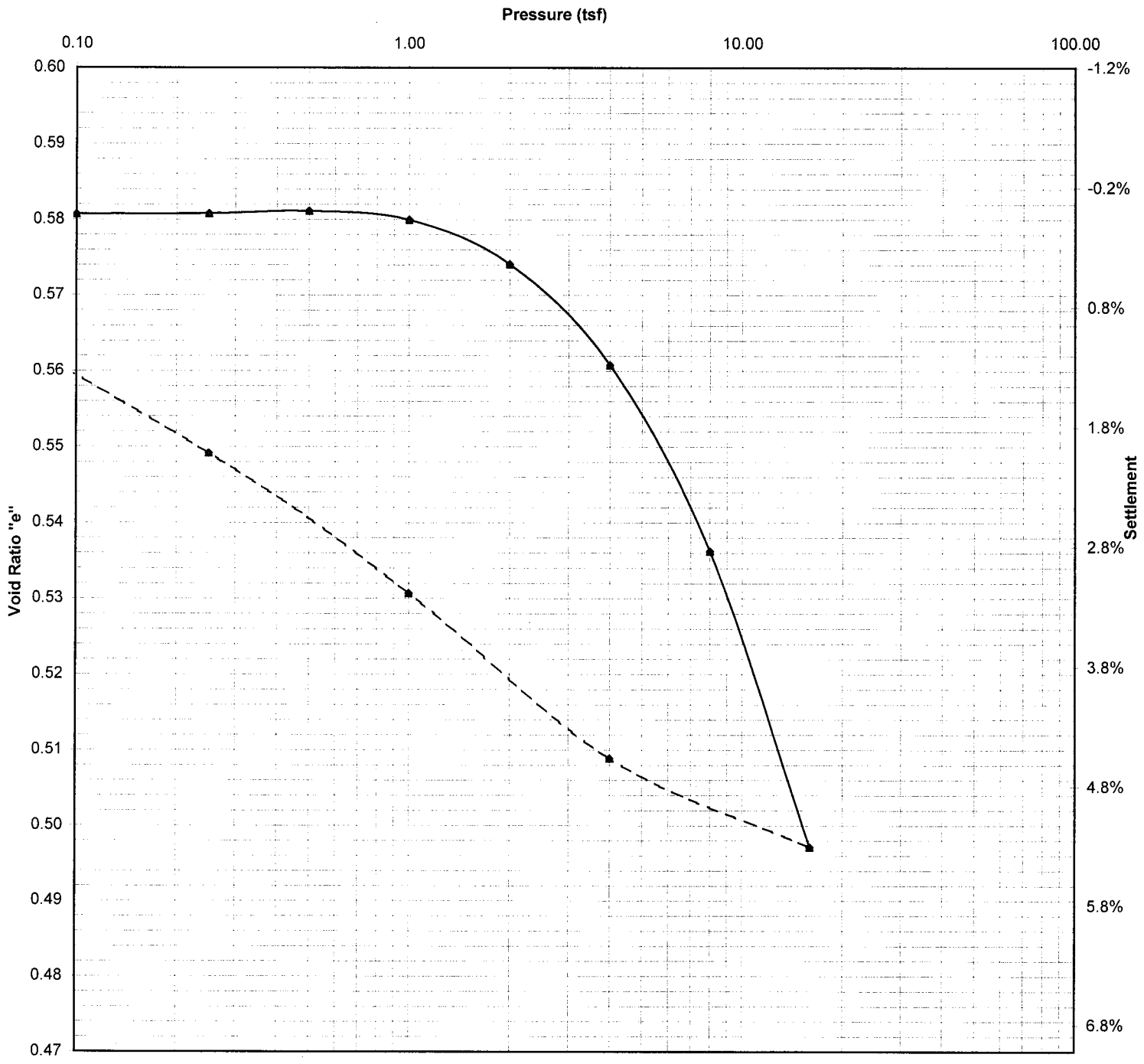
SOIL ENGINEERING TESTING, INC.

Bloomington, Minnesota 55420-3436

Void Ratio and % Settlement vs. Log of Pressure



Project: Proposed Ground Storage Water Reservoirs - Lewis & Clark Rural Water Systems -Near Tea, SD				Date: 6/28/07
Sample #:	Boring #: SB-15	Depth ft: 20-22 (Top)		Job #: 6110
Soil Type: Sandy Lean Clay w/a little gravel (CL)				
Initial W/C (%): 20.9	Dry Density (pcf): 107.0	LL: 42.4 PL: 17.5 PI: 24.9		Gs: 2.71 (Assumed)
Organic Content (%):	Initial Height (in.): 0.754	Diameter (in.): 2.507	e_o= 0.581	
Preconsolidation Pressure (Pc): 4.1 tsf	Compression Index (Cc): 0.125	Recompression Index (Cr): ≅ 0.015		
Remarks:				

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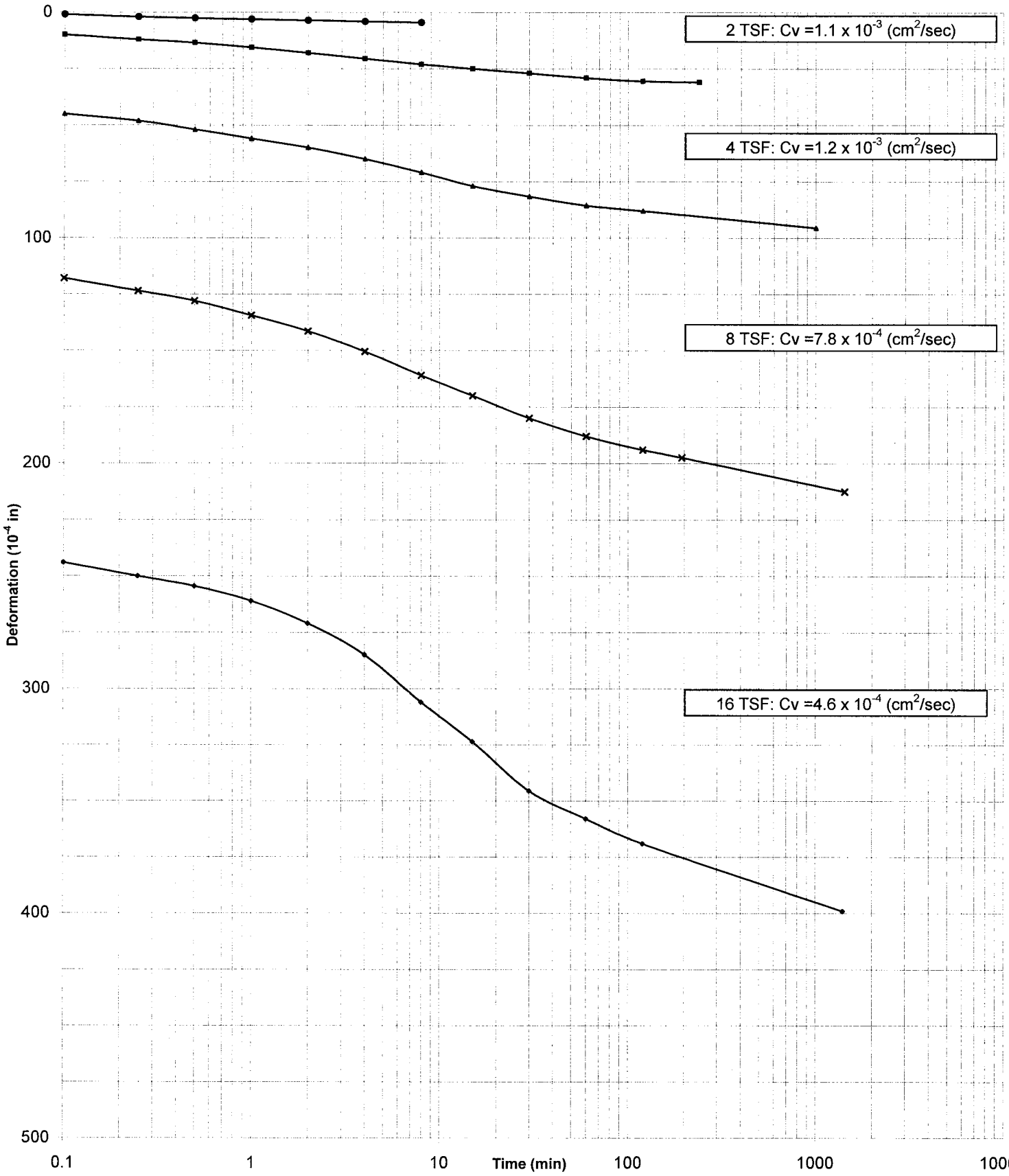
Bloomington, Minnesota 55420-3436

Consolidation Log of Time Curves



Project: Proposed Ground Storage Water Reservoirs - Lewis & Clark Rural Water Systems -Near Tea, SI			Date: 6/28/07
Sample #:	Boring #: SB-15	Depth ft: 20-22 (Top)	Job #: 6110

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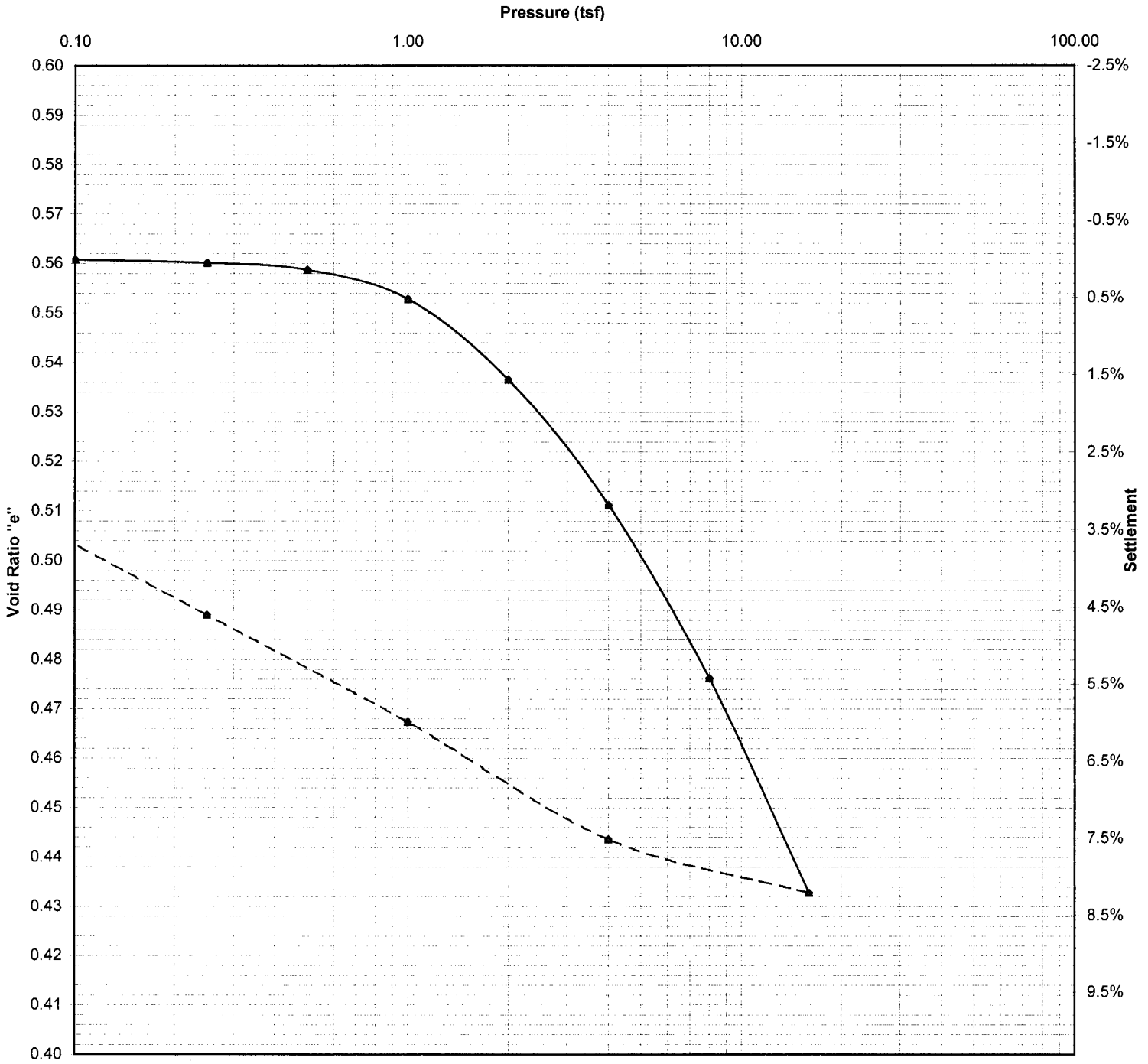
SOIL ENGINEERING TESTING, INC.

Bloomington, Minnesota 55420-3436

Void Ratio and % Settlement vs. Log of Pressure



Project: Proposed Ground Storage Water Reservoirs - Lewis & Clark Rural Water Systems -Near Tea, SD			Date: 6/28/07
Sample #:	Boring #: SB-15	Depth ft: 40-42.5 (Top)	Job #: 6110
Soil Type: Sandy Lean Clay w/a little gravel (CL)			
Initial W/C (%): 19.9	Dry Density (pcf): 107.9	LL: PL: PI:	Gs: 2.70
Organic Content (%):	Initial Height (in.): 0.747	Diameter (in.): 2.506	e_o= 0.561
Preconsolidation Pressure (Pc): 2.4 tsf	Compression Index (Cc): 0.14	Recompression Index (Cr):	≅ 0.02
Remarks:			

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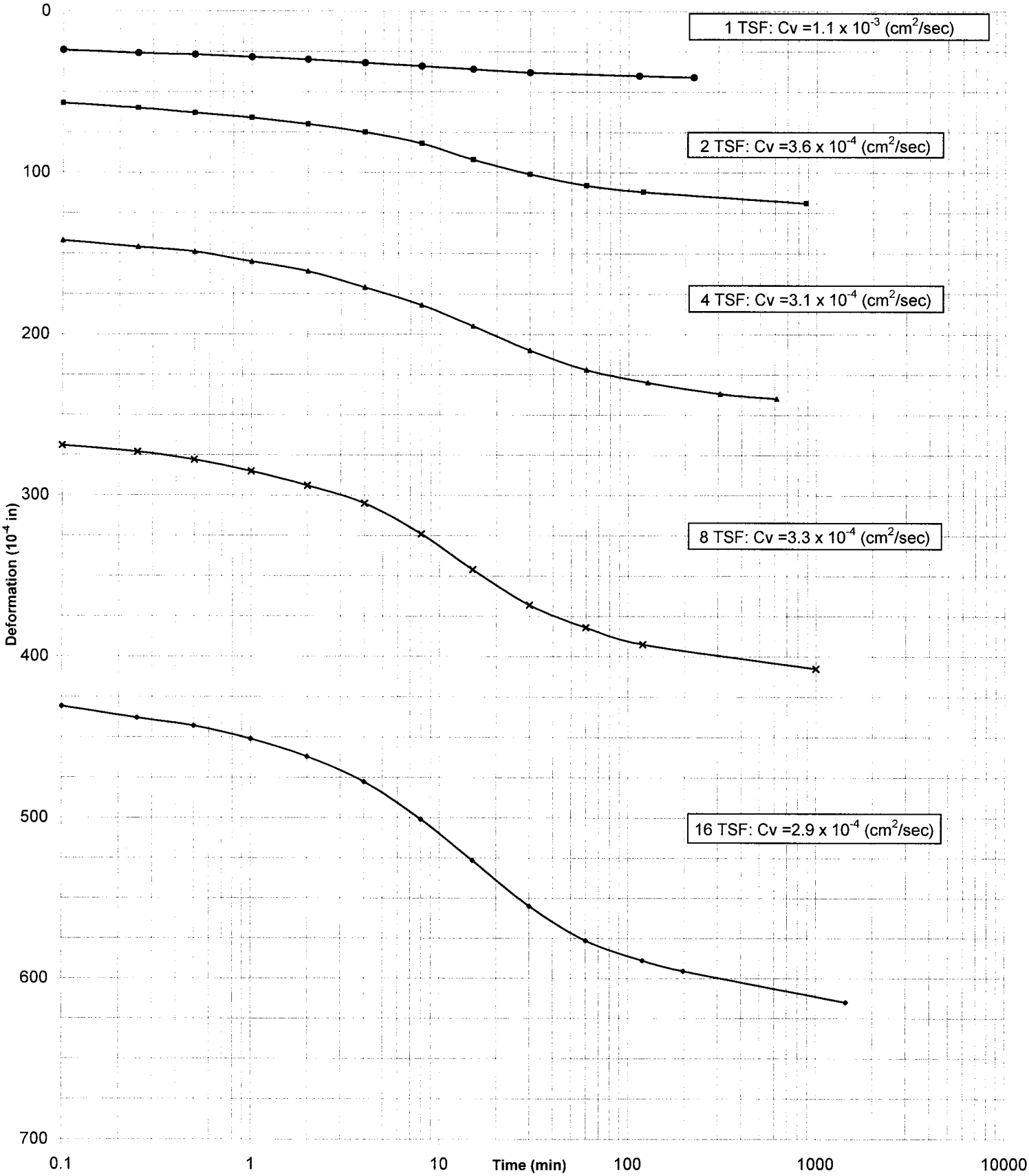
SOIL ENGINEERING TESTING, INC.

Bloomington, Minnesota 55420-3436

Consolidation Log of Time Curves



Project: Proposed Ground Storage Water Reservoirs - Lewis & Clark Rural Water Systems -Near Tea, SD			Date: 6/28/07
Sample #:	Boring #: SB-15	Depth ft: 40-42.5 (Top)	Job #: 6110

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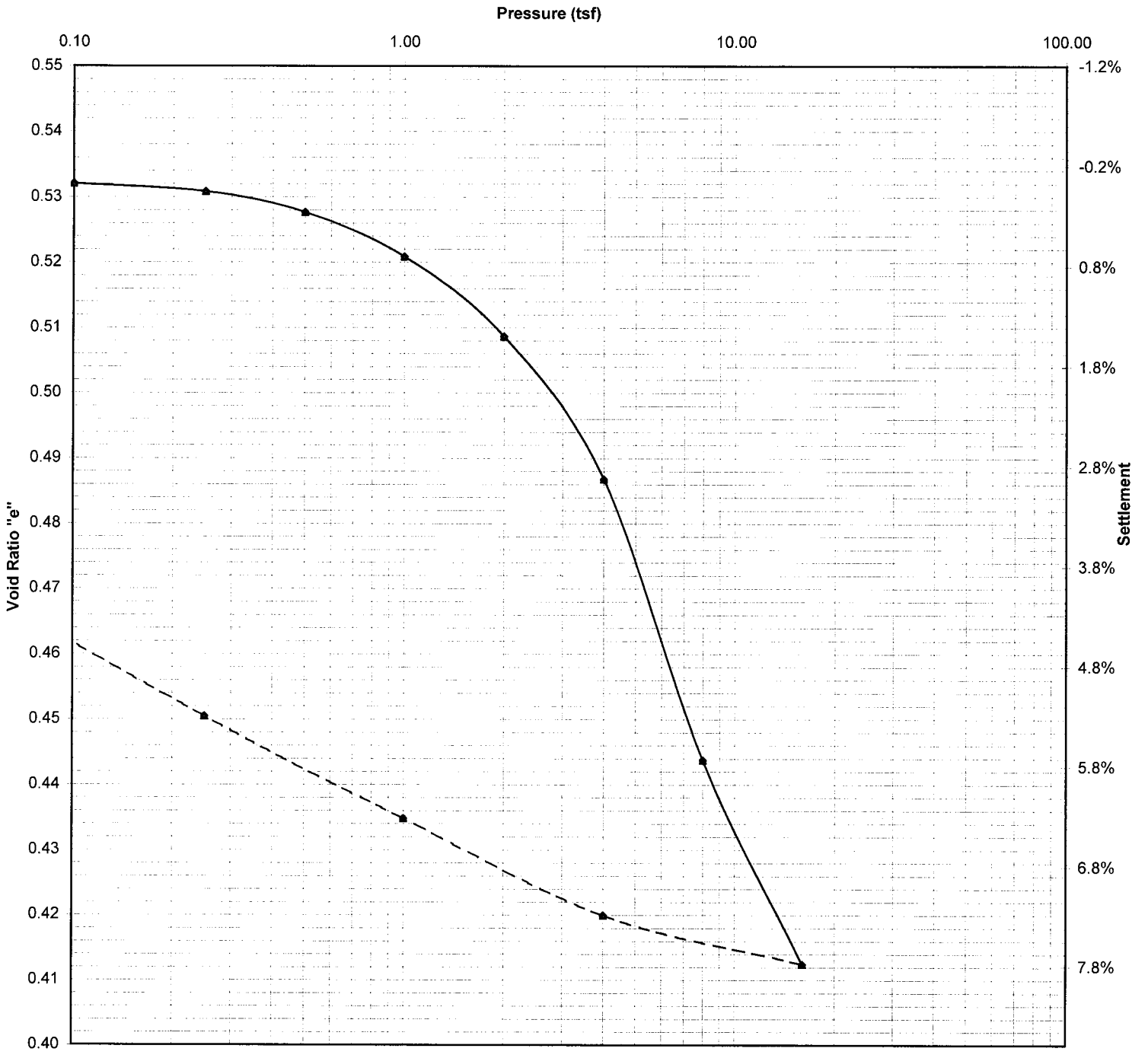
SOIL ENGINEERING TESTING, INC.

Bloomington, Minnesota 55420-3436

Void Ratio and % Settlement vs. Log of Pressure



Project: Proposed Ground Storage Water Reservoirs - Lewis & Clark Rural Water Systems -Near Tea, SD				Date: 6/28/07
Sample #:	Boring #: SB-25		Depth ft: 10-12.5 (Top)	Job #: 6110
Soil Type: Sandy Lean Clay w/a little gravel (CL)				
Initial W/C (%): 19.6	Dry Density (pcf): 108.8	LL:	PL: PI:	Gs: 2.67 (Assumed)
Organic Content (%):	Initial Height (in.): 0.753		Diameter (in.): 2.503	e_o= 0.532
Preconsolidation Pressure (Pc): 2.1 tsf		Compression Index (Cc): 0.124		Recompression Index (Cr): ≅ 0.015
Remarks:				

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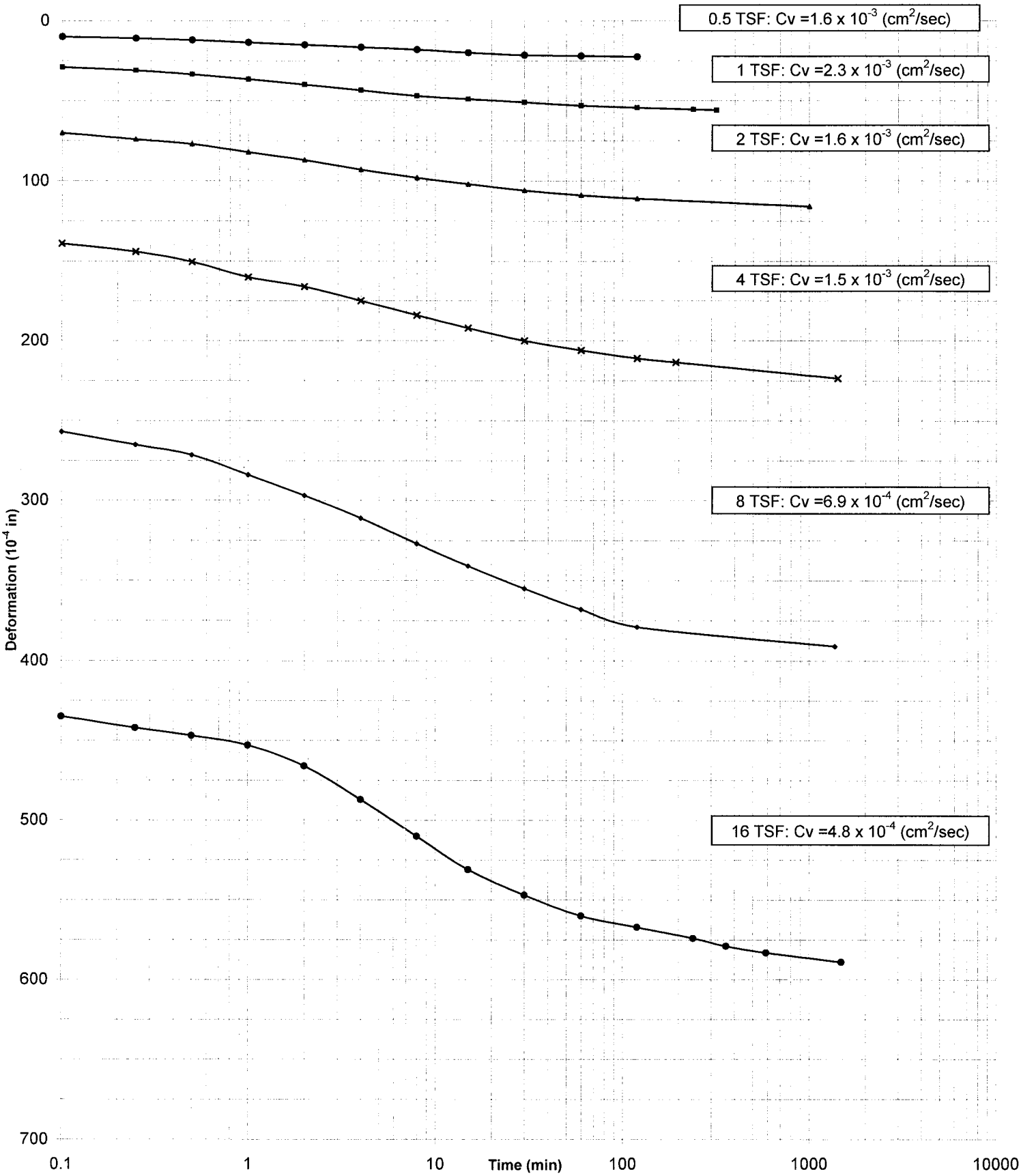
SOIL ENGINEERING TESTING, INC.

Bloomington, Minnesota 55420-3436

Consolidation Log of Time Curves



Project: Proposed Ground Storage Water Reservoirs - Lewis & Clark Rural Water Systems -Near Tea, SI			Date: 6/28/07
Sample #:	Boring #: SB-25	Depth ft: 10-12.5 (Top)	Job #: 6110

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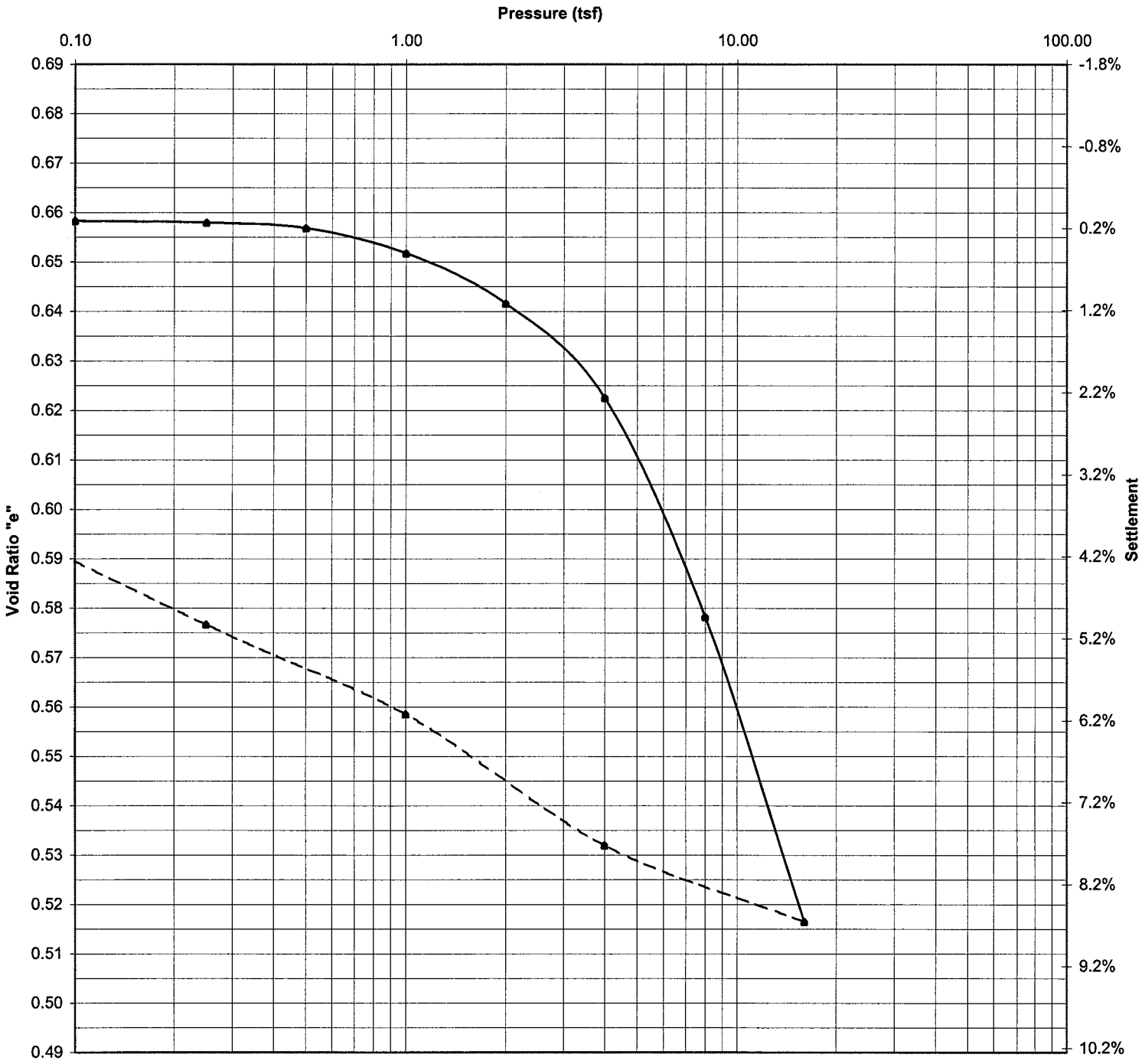
SOIL ENGINEERING TESTING, INC.

Bloomington, Minnesota 55420-3436

Void Ratio and % Settlement vs. Log of Pressure



Project: Lewis & Clark Ground Storage Reservoirs			Date: 8/31/07
Sample #:	Boring #: B-34	Depth ft: 14-16 (Mid)	Job #: 6210
Soil Type: Sandy Lean Clay w/a little gravel (CL)			
Initial W/C (%): 22.8	Dry Density (pcf): 101.9	LL: PL: PI:	Gs: 2.71 (Assumed)
Organic Content (%):	Initial Height (in.): 0.750	Diameter (in.): 2.503	e_o= 0.660
Preconsolidation Pressure (Pc): 4.0 tsf	Compression Index (Cc): 0.20	Recompression Index (Cr):	≅ 0.02
Remarks:			

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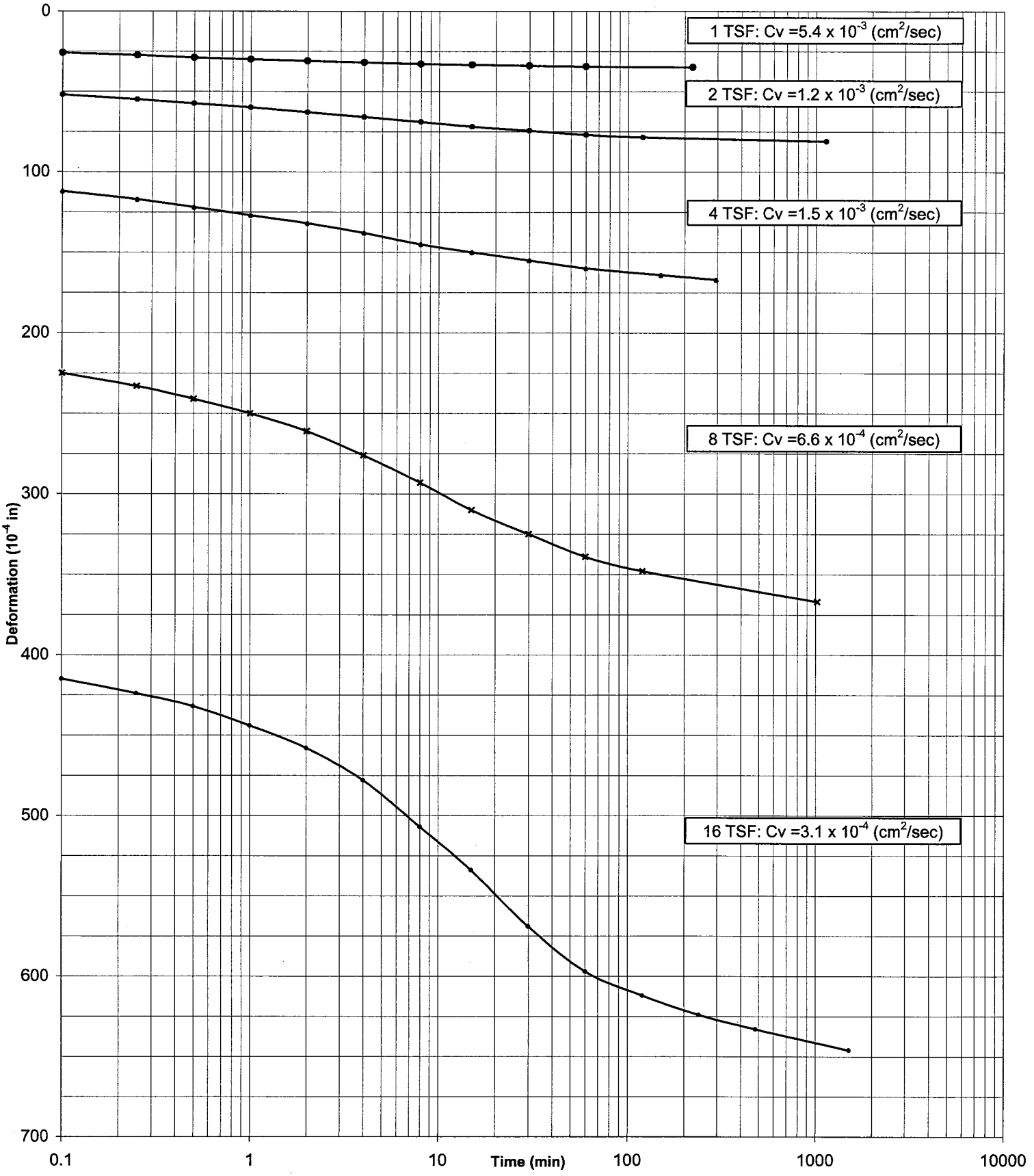
SOIL ENGINEERING TESTING, INC.

Bloomington, Minnesota 55420-3436

Consolidation Log of Time Curves



Project: Lewis & Clark Ground Storage Reservoirs			Date: 8/31/07
Sample #:	Boring #: B-34	Depth ft: 14-16 (Mid)	Job #: 6210

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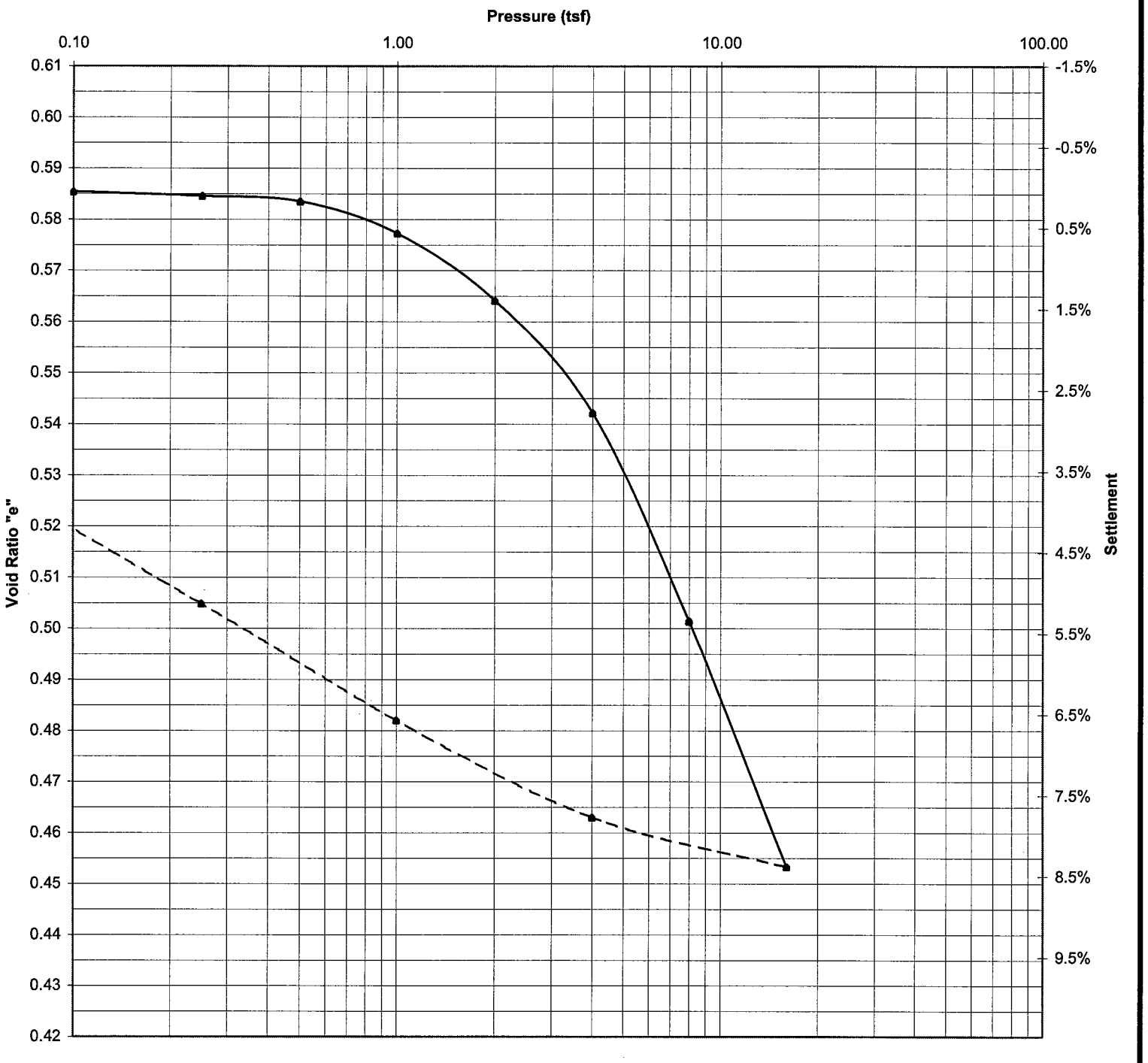
Void Ratio and % Settlement vs. Log of Pressure



Project: Lewis & Clark Ground Storage Reservoirs			Date: 8/31/07	
Sample #:	Boring #: SB-34	Depth ft: 24-26 (Mid)	Job #: 6210	
Soil Type: Lean Clay w/sand and a trace of gravel (CL)				
Initial W/C (%): 20.4	Dry Density (pcf): 106.7	LL: PL: PI:	Gs: 2.71	(Assumed)
Organic Content (%):	Initial Height (in.): 0.752	Diameter (in.): 2.506	e_o= 0.586	
Preconsolidation Pressure (Pc): 3.3 tsf	Compression Index (Cc): 0.16	Recompression Index (Cr): ≅ 0.02		
Remarks:				

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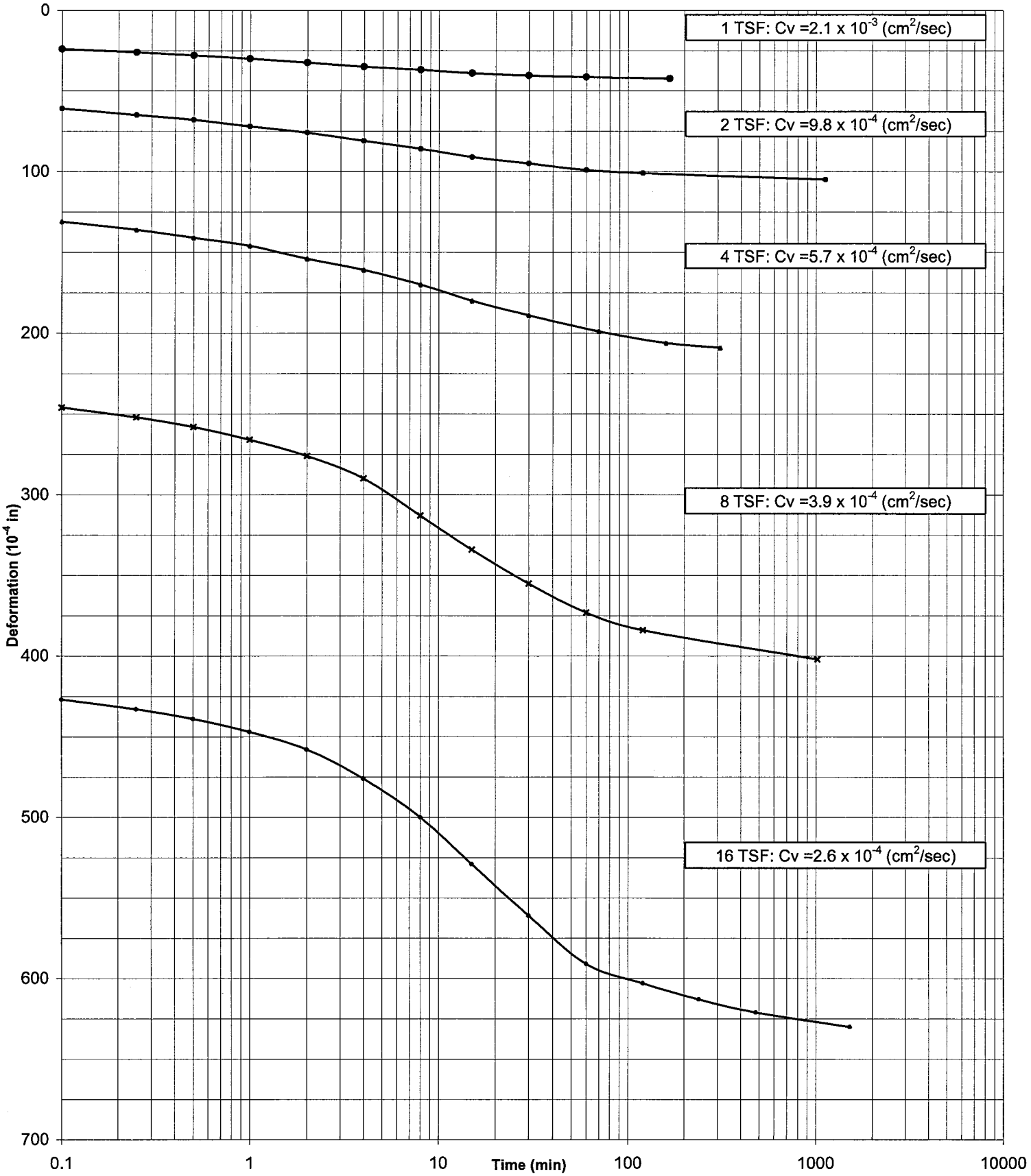
Consolidation Log of Time Curves



Project: Lewis & Clark Ground Storage Reservoirs			Date: 8/31/07
Sample #:	Boring #: SB-34	Depth ft: 24-26 (Mid)	Job #: 6210

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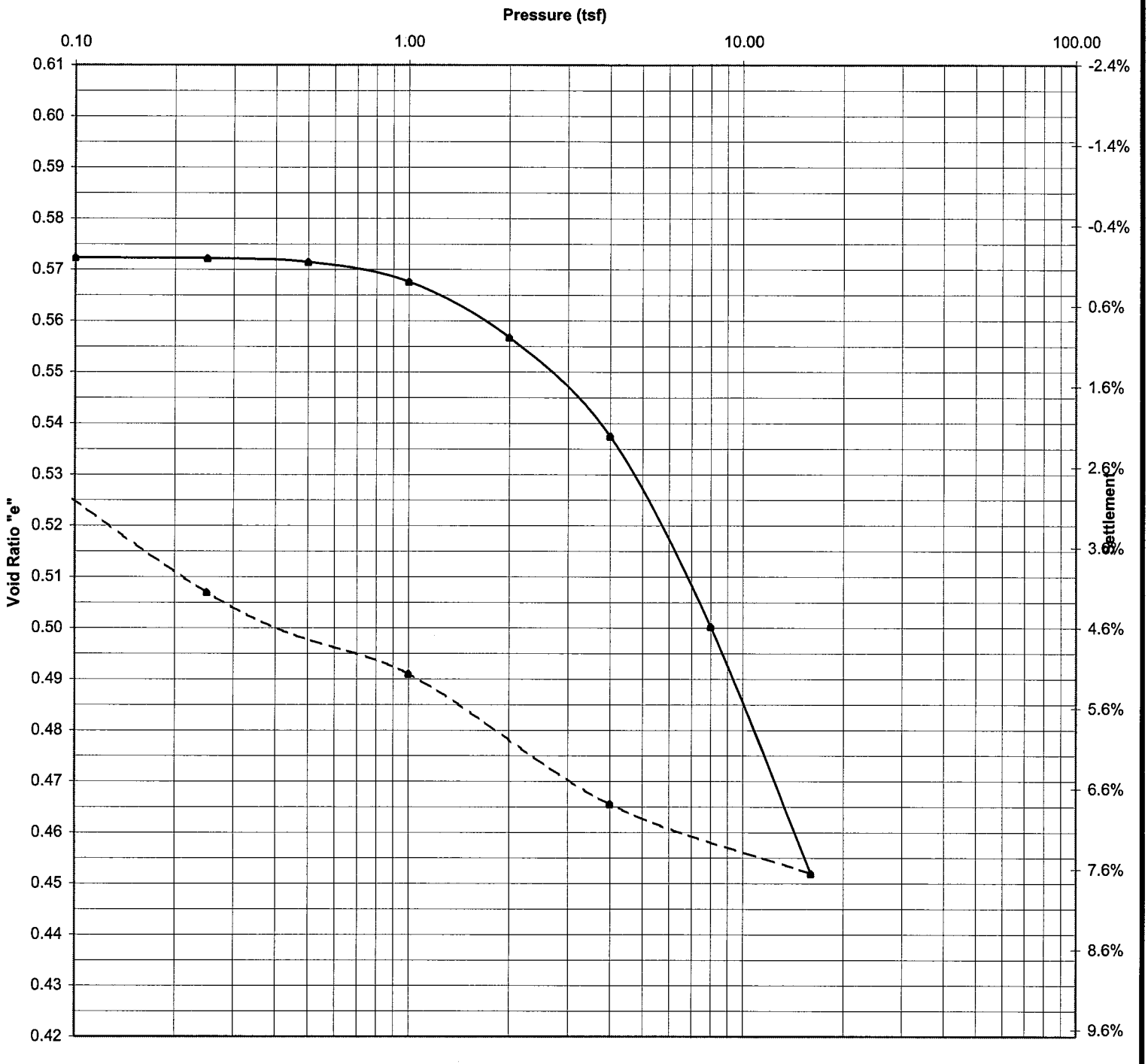
Void Ratio and % Settlement vs. Log of Pressure



Project: Lewis & Clark Ground Storage Reservoirs				Date: 8/31/07
Sample #:	Boring #: SB-34	Depth ft: 49-51 (Bot)		Job #: 6210
Soil Type: Sandy Lean Clay w/a little gravel (CL)				
Initial W/C (%): 20.2	Dry Density (pcf): 108.0	LL:	PL: PI:	Gs: 2.72 (Assumed)
Organic Content (%):	Initial Height (in.): 0.752	Diameter (in.): 2.503	e_o= 0.573	
Preconsolidation Pressure (Pc): 3.0 tsf	Compression Index (Cc): 0.15	Recompression Index (Cr): ≅ 0.02		
Remarks:				

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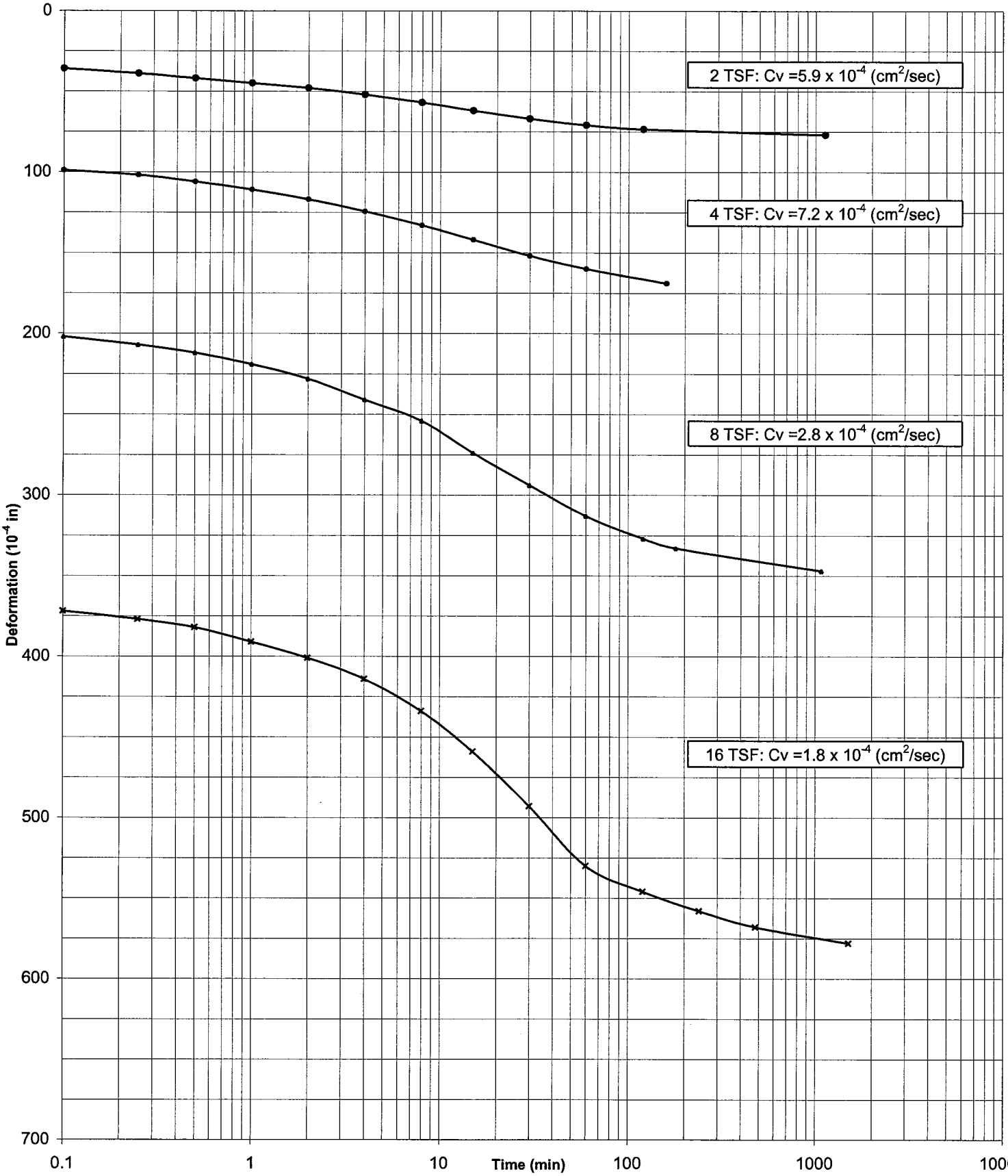
Consolidation Log of Time Curves



Project: Lewis & Clark Ground Storage Reservoirs			Date: 8/31/07
Sample #:	Boring #: SB-34	Depth ft: 49-51 (Bot)	Job #: 6210

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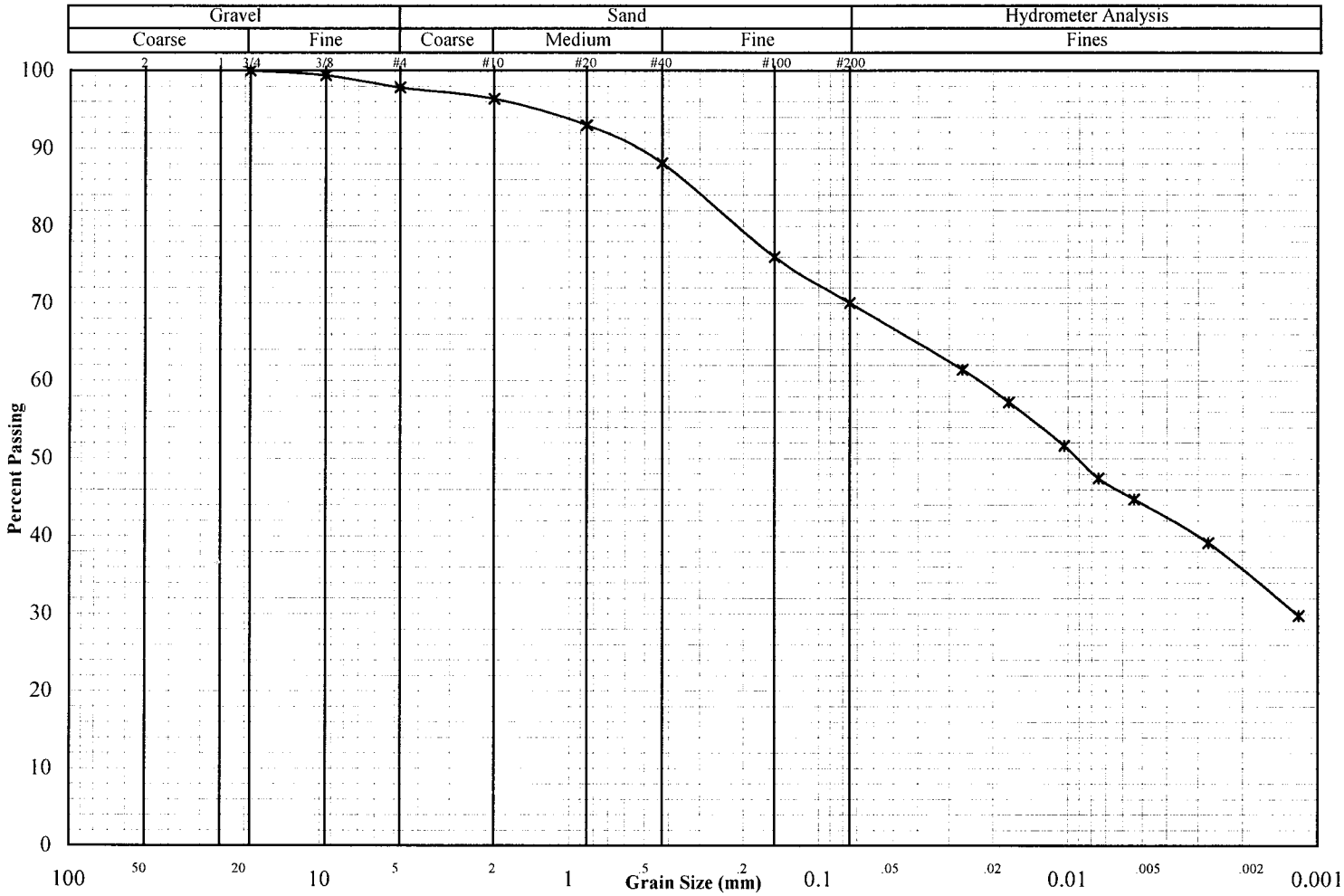
Grain Size Distribution ASTM D422

Job No. : **6110**

Project:	Proposed Ground Storage Water Reservoirs - Lewis & Clark Rural Water Systems -Near Tea, SD	Test Date:	6/21/07
Reported To:	Geotek Engineering & Testing Services, Inc.	Report Date:	6/26/07

	Location / Boring No.	Sample No.	Depth (ft)	Sample Type	Soil Classification
*	SB-9		5-7.5	3T	Sandy Lean Clay w/a trace of gravel (CL)
●					
◇					



Other Tests

	*	●	◇
Liquid Limit	48.5		
Plastic Limit	18.4		
Plasticity Index	30.1		
Water Content			
Dry Density (pcf)			
Specific Gravity	2.68*		
Porosity			
Organic Content			
pH			
Shrinkage Limit			
Penetrometer			
Qu (psf)			

(* = assumed)

Percent Passing

	*	●	◇
Mass (g)	388.8		
2"			
1.5"			
1"			
3/4"	100.0		
3/8"	99.4		
#4	97.8		
#10	96.4		
#20	93.0		
#40	88.1		
#100	76.0		
#200	70.0		

	*	●	◇
D_{60}			
D_{30}			
D_{10}			
C_U			
C_C			

Remarks:

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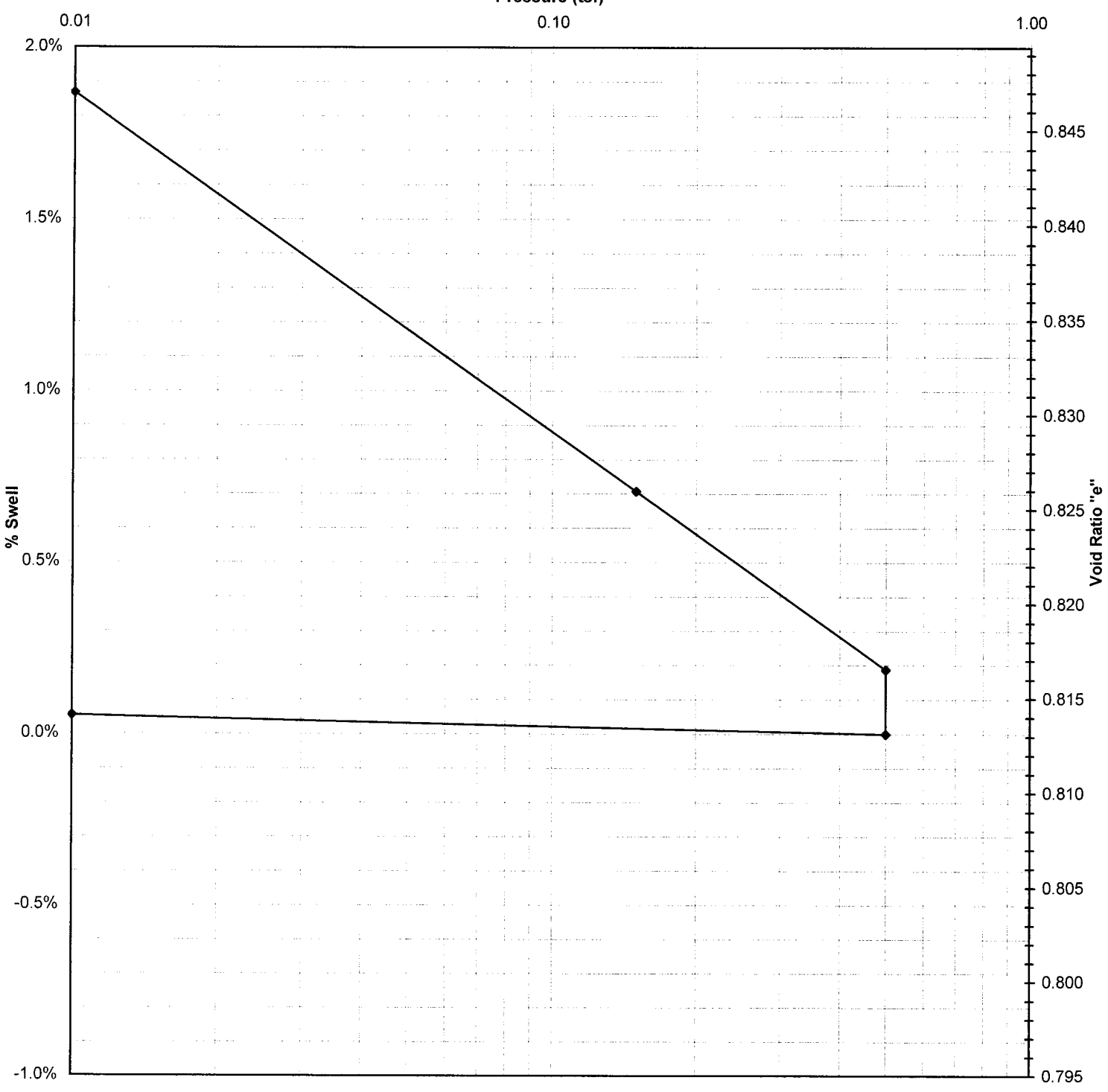
Percent Swell / Void Ratio vs. Log of Pressure



Project: Proposed Ground Storage Water Reservoir -Lewis & Clark Rural Water System					Date: 6/28/07
Sample #:	Type: 3T	Boring #: SB-2	Depth ft: 2-4.5 (Top)		Job #: 6110
Soil Type: Fat Clay (CH)					
W.C. (%): 29.97	γ dry (pcf): 92.2	e_o: 0.814	LL: 52.2 PL: 21.6 PI: 30.6	LI: 0.27	Gs: 2.68 (Assumed) O.C.(%):
Specimen Ht (in): 0.750	Dia. (in): 2.505	P_c:	C_c:	C_s:	Max. Swell Pressure (tsf):
Remarks:					

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