REPORT
2023012434

# AMEREN MISSOURI SIOUX ENERGY CENTER
# LOCATION RESTRICTIONS
# 40 CFR PART 257.60 to 257.64
# ST. CHARLES COUNTY, MISSOURI

Prepared for

Ameren MISSOURI

Prepared by

REITZ & JENS, INC.
CONSULTING ENGINEERS

October 2024

The Professional whose signature and personal seal appear hereon assumes responsibility only for what appears in the attached report and disclaims (pursuant to Section 327.411 RSMo) any responsibility for all other plans, estimates, specifications, reports, or other documents or instruments not sealed by the undersigned Professional relating to or intended to be used for any part or parts of the project to which this report refers.

# AMEREN MISSOURI SIOUX ENERGY CENTER
# LOCATION RESTRICTIONS
# 40 CFR PART 257.60 TO 257.64
# ST. CHARLES COUNTY, MISSOURI

## TABLE OF CONTENTS

Section Page



## LIST OF FIGURES



## LIST OF TABLES

**LIST OF APPENDICES**

**AMEREN MISSOURI SIOUX ENERGY CENTER**
**LOCATION RESTRICTIONS**
**ST. CHARLES COUNTY, MISSOURI**

# 1.0 INTRODUCTION

The Sioux Energy Center (SEC) is located in northeast St. Charles County, Missouri along the Mississippi River, approximately 14 miles upstream of the confluence with the Missouri River and approximately 3 miles east of Portage de Sioux, Missouri. The SEC has one active surface impoundment and one active landfill collectively used to manage coal combustion residuals (CCR) produced by the SEC. The active CCR surface impoundments is designated as SCPD (Gypsum Pond Cell 2). The active CCR landfill unit is designated as SCL4A (Cell 4A). A map showing the location, configuration, and features of each surface impoundment and the landfill unit is attached as Figure 1.

## 1.1 Purpose

The purpose of this report is to document evaluations and assessments completed for the Ameren Missouri Sioux Energy Center's active CCR Units as required by select sections within 40 CFR Part 257, the final rule to regulate the disposal of CCR as solid waste under Subtitle D of the Resource Conservation and Recovery Act (RCRA). Specifically Reitz & Jens completed assessments and evaluations of Location Restrictions required by:

A. §257.60, Placement Above the Uppermost Aquifer;
B. §257.61, Wetlands;
C. §257.62, Fault Areas;
D. §257.63, Seismic Impact Zones; and
E. §257.64, Unstable Areas

All five evaluations and assessments are required for all existing CCR surface impoundments. Only the evaluation and assessment of §257.64 Unstable Areas is required for existing CCR landfills.

# 2.0 SIOUX ENERGY CENTER CCR UNITS

## 2.1 SCPD (Gypsum Pond Cell 2)

Gypsum Pond Cell 2 was brought online in 2022. Cell 2 is permitted by the Missouri Department of Natural Resources Solid Waste Management Program (MDNR-SWMP) as a Solid Waste Disposal Area under Operating Permit Number 0918301. The impoundment has an approximate area of 40 acres. The SEC's Flue Gas Desulfurization (FGD) system produces gypsum as a byproduct that is pumped as a slurry to Cell 2 where it is managed for long-term or permanent storage. The pond does not receive any additional stormwater run-off outside its bounded area. The gypsum slurry discharges into the cell at the approximate midpoint of the west embankment. The gypsum settles out into the pond and the decant water flows into the Recycle Pond through a set of triple box culverts at the northwest corner of Cell 2. Water that accumulates in the Recycle Pond is then pumped back to the Sioux Energy Center for reuse in a closed loop system. Cell 2 and the Recycle Pond are separated by an embankment. The triple box culverts that connect Cell 2 with the Recycle Pond control the maximum normal water level in Cell 2 to el. 441.1. Cell 2 also has two emergency spillways on the north side of the impoundment at el. 445. The bottom and side slopes of Cell 2 are lined with a composite liner that includes an 80-mil HDPE liner over 24 inches of compacted clay. The Cell 2 upstream and downstream slopes have a steepness of 3H to 1V and the crest elevation is approximately 446 feet. The exterior embankment slopes are vegetated.

## 2.2 SCL4A (Cell 4A)

Cell 4A is permitted as a utility waste landfill by St. Charles County, Missouri, and as a Solid Waste Disposal Area by MDNR-SWMP under Operating Permit Number 0918301. The permitted footprint for the entire Solid Waste Disposal Area covers approximately 183.5 acres which will be developed in multiple phases. Phase II includes the development of SCL4A, which has a disposal area of approximately 14.5 acres.

# 3.0 §257.60 PLACEMENT ABOVE THE UPPERMOST AQUIFER

New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must be constructed with a base that is located no less than 1.52 meters (five feet) above the upper limit of the uppermost aquifer, or must demonstrate that there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the CCR unit and the uppermost aquifer due to normal fluctuations in groundwater elevations (including the seasonal high water table). The owner or operator must demonstrate that the CCR unit meets the minimum requirements for placement above the uppermost aquifer.

The SEC is about twelve miles west-northwest of the confluence of the Mississippi and Missouri rivers in an alluvial setting of water-deposited soils in the floodplains. The stratigraphy at the site is comprised of alluvium with a thin, underlying residual/colluvial unit immediately on top of bedrock. The typical total soil thickness is about one hundred to one hundred twenty feet. The uppermost alluvial units are flood basin deposits comprised of five to ten feet of very fine-grained clays with some silt. Underlying the flood basin deposits are flood plain deposits consisting of silts and clays interbedded or intermixed with fine to medium sand. Beneath the flood plain deposits are natural levee deposits consisting of medium to fine sand and channel deposits consisting of fine to coarse sands with occasional interlayering silt and fine gravel fragments. Construction activities have removed much of the uppermost fine-grained flood basin deposits at the locations of the CCR units. The uppermost aquifer is, therefore, an unconfined gravity aquifer with little to no aquitard impeding flow to the natural ground surface.

As part of the detailed site investigation for SCPD and SCL4A, fifty-seven piezometers were installed to evaluate the hydrology of the southern portion of the site for twelve consecutive months from August 2005 to July 2006 and demonstrated that, during the monitoring period, the groundwater elevation ranged from elevation 411 to 417. Additionally, the historic and recent river levels were analyzed to determine the effect of the Missouri and Mississippi Rivers on the groundwater levels at the SEC. Groundwater flow is controlled primarily by the Mississippi River levels and slightly by the Missouri River levels, which controlled localized or seasonal variations. Therefore, the normal groundwater levels can be estimated from the adjacent river levels which have inundated the site above the natural ground surface elevation. Without a continuous, low permeability, fine-grained stratum above the sandy alluvial deposits, the elevation of the uppermost aquifer is the natural ground surface prior to construction.

## 3.1 SCPD

SCPD is permitted as a Utility Waste Landfill in the State of Missouri that is operated as a surface impoundment with a composite liner consisting of an 80-mil HDPE liner over 24 inches of compacted clay. Construction of SCPD included the placement of a separation layer consisting of 5 feet of clay fill to elevate the base of the clay liner a minimum of 5 feet above the lowest site elevation prior to construction and the top of coarse-grain soil observed in the historical boring logs or during construction. Therefore, the upper limit of the uppermost aquifer is lower than the current bottom of SCPD, which meets the requirements of 40 CFR Part §257.60.

**40 CFR Part 257.60**
**Placement Above the Uppermost Aquifer**

New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must be constructed with a base that is located no less than 1.52 meters (five feet) above the upper limit of the uppermost aquifer, or must demonstrate that there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the CCR unit and the uppermost aquifer due to normal fluctuations in groundwater elevations (including the seasonal high water table). An assessment of active CCR surface impoundment SCPD (Cell 2) at the Sioux Energy Center was conducted to determine if a demonstration could be made showing that the CCR units meet the requirements of 40 CFR Part §257.60.

| CCR Unit | Meets Minimum Requirement of 40 CFR Part §257.60 |
| --- | --- |
| SCPD | Yes |

**Engineer's Seal**


Jeff Bertel, P.E.
License: PE-2010025265
Date: October 31, 2024

# 4.0 §257.61 WETLANDS

New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in wetlands as defined in §232.2, unless the owner or operator demonstrates that the CCR unit meets the requirements of §257.61(a)(1) through (5). The term *wetland* means those areas that are inundated or saturated by surface or groundwater at a frequency and duration to support a prevalence of vegetation typically adapted for life in saturated soil conditions. Potential wetlands at the SEC have been identified from aerial imagery by the U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) Mapper or delineated by the United States Army Corps of Engineers (USACE) in a jurisdictional determination issued in 2006. Wastewater detention and retention basins are excluded from the definition of "*Waters of the United States*." The NWI Mapper is used as a screening tool for identifying wetlands.

The existing CCR units at the SEC where evaluated to determine whether jurisdictional wetlands were located in proximity to each CCR unit and that the operation of the CCR Unit will not cause or contribute to significant wetland degradation. Engineering and biological assessments performed in 2016 and 2018, along with weekly inspections and effluent limitations contained in the facility's water operating permit, confirm that CCR Units at the SEC are not causing or contributing to significant degradation of the wetlands adjacent to the CCR units. The CCR Units located closest to wetlands (SCPA and SCPB) are closed.

## 4.1 SCPD

The original design of SCPD avoided wetlands identified in a jurisdictional determination completed by the United States Army Corps of Engineers (USACE). As a result, the USACE St. Louis District issued a "No Department of the Army Permit Required" letter to Ameren on December 30, 2005. A copy of that letter is attached in Appendix A.

Water in SCPD discharges into the Recycle Pond where it is pumped back to the SEC for reuse in a closed loop system. There is no NPDES outfall for SCPD.

The SEC also has a Dust Control Plan to minimize CCR from becoming airborne and potentially causing or contributing to significant degradation of surrounding wetlands. The Dust Control Plan includes controls for managing fugitive dusts originating from CCR units, roads and other CCR management and material handling activities from becoming airborne. The Dust Control Plan is a condition of Ameren's Title V Air Permit for the SEC that is also administered by MDNR. The primary controls used to minimize fugitive dust include system design, maintenance programs, traffic control, watering, and covering and handling procedures for the CCR materials.

The SCPD is incised with an earthen embankment circling the perimeter of the CCR unit. Reitz & Jens' Structural Integrity Criteria & Hydrologic/Hydraulic Capacity Assessment of the SEC determined that SCPD meets or exceeds the minimum stability factors of safety specified in 40 CFR Part §257.73(e)(1), Safety Factor Assessment. The perimeter embankment is also maintained with vegetative slopes to prevent erosion of the exterior embankment material. The perimeter embankment is designed and maintained to prevent catastrophic release, migration of CCR, and/or erosion of embankment material from potentially causing or contributing to significant degradation of surrounding wetlands. In the remote chance that the earthen embankment circling the perimeter of the SCPD were to fail it could impact adjacent wetlands. However, the associated environmental impacts would be minimal.

Ameren also completed a comprehensive evaluation of surface and groundwater data that demonstrates that there are no adverse impacts resulting from coal ash management practices at the SEC on human health or the environment (Haley & Aldrich, 2018).

**40 CFR Part 257.61**
**Wetlands**

New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in wetlands as defined in §232.2, unless the owner or operator demonstrates that the CCR unit meets the requirements of §257.61(a)(1) through (5). An assessment of active CCR surface impoundments SCPD (Cell 2) at the Sioux Energy Center was conducted to determine if a demonstration could be made showing that the CCR units meet the requirements of 40 CFR Part §257.61.

| CCR Unit | Meets Minimum Requirement of 40 CFR Part §257.61 |
|---|---|
| SCPD | Yes |

**Engineer's Seal**


Jeff Bertel, P.E.
License: PE-2010025265
Date: October 31, 2024

## 5.0 §257.62 FAULT AREAS

New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located within 60 meters (200 feet) of the outermost damage zone of a fault that has had displacement in Holocene time unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that an alternative setback distance of less than 60 meters (200 feet) will prevent damage to the structural integrity of the CCR unit. A fault is defined in §257.53 as a fracture or zone of fractures which strata on one side have been displaced with respect to the other side.

The SEC CCR surface impoundments are not located within 200 feet of the outermost damage zone of a fault that has had displacement in Holocene time. The closest fault is the Cap au Gres, which is located about 1.6 miles north of the SEC as shown in Figure 2. The Cap au Gres fault has not undergone any displacements in Holocene time. The Cap au Gres fault is related to the Lincoln Fold, and both features are related to the Ozark uplift. A major uplift event brought the Ozark Dome out of the sea near the end of the Ordovician Period (about 443 million years ago) (Cole, 1961).

**40 CFR Part 257.62**
**Fault Areas**

New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located within 60 meters (200 feet) of the outermost damage zone of a fault that has had displacement in Holocene time unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that an alternative setback distance of less than 60 meters (200 feet) will prevent damage to the structural integrity of the CCR unit.  An assessment of active CCR surface impoundments SCPD (Cell 2) at the Sioux Energy Center was conducted to determine if a demonstration could be made showing that the CCR units meet the requirements of 40 CFR Part §257.62.

| CCR Unit | Meets Minimum Requirement of 40 CFR Part §257.62 |
|---|---|
| SCPD | Yes |

**Engineer's Seal**


Jeff Bertel, P.E.
License: PE-2010025265
Date: October 31, 2024

# 6.0 §257.63 SEISMIC IMPACT ZONES

New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in seismic impact zones unless the owner or operator demonstrates that all structural components including liners, leachate collection and removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site. The maximum horizontal acceleration in lithified earth material is defined in §257.53 as the maximum horizontal acceleration at the ground surface as depicted on a seismic hazard map, with a 98% or greater probability that the acceleration will not be exceeded in 50 years, or the maximum expected horizontal acceleration based on a site-specific seismic risk assessment. Seismic impact zones are defined in §257.53 as an area having a 2% or greater probability that the maximum expected horizontal acceleration, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10g in 50 years.

The seismic acceleration determined for the SEC was based upon the USGS 2014 seismic hazard maps for a Peak Horizontal Ground Acceleration (PHGA) for seismic loading event with a 2% probability of exceedance in 50 years. The PHGA was factored for the seismic site class in accordance with ASCE 7 "Minimum Design Loads for Buildings and Other Structures, International Building Code." The published 2014 USGS hazard map for the SEC is reproduced in Figure 3. The probabilistic PHGA for the design earthquake at the Sioux site is 0.187g (that is, 18.7% of standard gravity acceleration of 32.2 feet/sec$^2$). This value takes into account attenuation of bedrock shaking with distance from the probable sources and general soil interactions such as damping for a hypothetical soil profile. This value is meant to be a conservative estimate. Based upon the data, the most probable earthquake magnitudes (Mw) for these accelerations are between 7.0 and 8.0. We applied a multiplier of 1.434 to the base PHGA to account for the soil profile at the SEC to obtain a site specific PHGA of 0.268g. Based on this finding, the SEC is located in a seismic impact zone.

The existing CCR surface impoundment at the SEC was evaluated under seismic loading to determine if the CCR unit design is adequate to prevent harmful release of CCR, leachate, and contaminants both during and after the design seismic event. In order to demonstrate the adequacy of the design we evaluated both liquefaction potential and slope stability. The Ameren Missouri Sioux Energy Center Construction Permit Modification for Permitted Utility Waste Landfill (Permit NO. 0918301), St. Charles County, Missouri, Revised Geotechnical Engineering Report dated January 24, 2020, provides additional details regarding the seismic design of SCPD and is presented in Appendix B.

**Liquefaction Potential**

Liquefaction occurs when ground shaking is sufficient to produce cyclic particle movements that cause excess pore water pressures to build to the point that nearly all the strength of the soil is lost. After ground shaking has stopped, the soil will potentially reconsolidate to denser configuration, which results in settlement. Liquefaction is most problematic in loose sandy soils with less than about 35 percent fines (soils which are finer than standard sieve size #200), but liquefaction can occur in very loose soils with up to 50 percent fines and soils up to the size of fine gravel.

Factors of Safety (FS) against liquefaction were calculated for both CPT and SPT borings using the cyclic stress approach outlined in Idriss and Boulanger (2008). The SPT borings were analyzed using N-values for clean sand which were corrected for vertical overburden stress, termed $(N_1)_{60\text{-}cs}$, and the fines contents of the soils were determined from laboratory grain size tests. The CPT soundings were analyzed using the cone tip pressure, which was corrected for overburden pressure and fines content, termed $q_{c1Ncs}$.

Liquefaction settlement for the SPT borings was determined using the procedure outlined in Idriss and Boulanger 2008, which determines the post-liquefaction volumetric strain based upon the corrected-normalized N-value $(N_1)_{60}$ and the calculated factor of safety against liquefaction. For CPT soundings, volumetric strain was determined using the procedure outlined in Zhang et. al. (2004) which uses the corrected-normalized-clean sand equivalent-point resistance ($q_{c1Ncs}$).

**Seismic Slope Stability**

Seismic slope stability analyses of CCR units was based upon the estimated lateral deformation or spreading that may occur, rather than a factor of safety against failure with a pseudo-static seismic load (MDNR-SWMP and Stark, 1998). The procedure described by MDNR-SWMP and Stark is to calculate a yield acceleration ($k_y$) for the landfill geometry for which the pseudo-static seismic load results in a minimum factor of safety against slope failure of 1.0. Stability analyses were completed to determine the yield acceleration ($k_y$) for each CCR unit using SLIDE 8.0. The $k_y$ was then compared to the ground accelerations in a time-history. When the ground acceleration exceeded the $k_y$ the associated lateral displacement was calculated using the empirical relationship developed by Makdisi and Seed (1978). The lateral displacements were cumulated over the time-history assuming that all of the displacements occurred in the same direction. When the calculated $k_y$ is greater than the ground acceleration in the time-history (PHGA), there is no deformation. The procedure, developed by Newmark (1965), was analyzed using the SHAKE2000 and SLIDE 8.0 programs.

At the locations where the liquefaction analyses indicated a high potential for liquefaction in existing soil strata, residual cohesive shear strengths were input for the liquefied soil strata to analyze the post-earthquake load case. The residual cohesive shear strengths were interpolated from the empirical relationships recommended by H. Bolton Seed (1987), Seed and Harder (1990), and Olson and Stark (2002), based on corrected N-values with corrections for fines content.

## 6.1 SCPD

Geotechnical investigations in 2005 for SCPD document the natural foundation materials of this CCR Unit. The uppermost stratum is generally clays and silty clays with scattered seams and layers of low plastic silt, underlain by silts. The thickness of these fine-grain deposits ranged from 0 to 24 feet, but generally between about 5 to 10 feet. Clay soils are almost all high plastic. The fine-grain soils are firm to stiff, with undrained cohesive shear strengths of 500 psf to over 2000 psf. Most of these fine-grain materials were removed during construction and used to construct the clay liner under SCPC.

The upper fine-grain soils are underlain by sandy silts, silty fine sands, and fine sands, generally to a depth of 30 feet. These upper sandy soils are generally loose to medium-dense. The upper sandy soils are underlain by fine to coarse, poorly graded sands and well-graded sands, with some silty sands and gravelly sands at greater depths. Limestone bedrock is at a depth of about 115 feet. The lower sands generally ranged from medium dense to very dense, increasing in density with increasing depth.

Construction of SCPD included the placement of separation layer or 5 feet of clay fill to elevate the base of the clay liner a minimum of 5 feet above the lowest site elevation prior to construction and the top of coarse-grain soil observed in the historical boring logs or during construction.

Embankment fill consists of compacted layers of clay and silt with varying amounts of sand. Fill material was compacted to a minimum of 95% of the maximum dry unit weight determined from the Standard Proctor Moisture-Density Test (ASTM D698). Fill placement was monitored, and moisture-density tests were obtained during construction. The upstream and downstream slopes have a steepness of 3H to 1V. The crest elevation of the embankment for SCPD is approximately elevation 446 feet.

The bottom of SCPD and the upstream slopes are covered with 2 feet of compacted clay liner that has a maximum hydraulic conductivity of $1x10^{-7}$ cm/sec. Clay for the liner was obtained on site. The compaction criteria for the clay liner were developed using the "Daniel Method." Fill placement was monitored and moisture-density tests were obtained during construction.

**6.1.1 Liquefaction Analyses**

A high risk of liquefaction is pervasive on the site at the natural ground surface. The risk of liquefaction will be beyond the perimeter berms where the existing vertical effective stress will not be increased by the placement of CCR in the cells. The liquefiable strata are the silty sand or poorly graded sand below the upper cohesive soils and silts. The potential consequences of liquefaction are loss of shear strength and settlement. The loss of shear strength would impact the stability of slopes, and therefore is addressed under that section of this report. Potential settlement due to liquefaction may occur beneath the cells and under the perimeter berms at least until the level of the CCR exceeds about 40 feet. The magnitude of the settlement due to liquefaction is estimated using the empirical relationship between volumetric strain, ASR and (N1)60 developed by Tokimatsu and Seed (1987).

The maximum estimated settlement due to liquefaction is about 7 inches in the vicinity of Boring B-95 either outside the cells or beneath 20 feet or less of CCR. Across the UWL the settlement due to liquefaction beneath 20 feet or less of CCR averages about 4 inches. Below about 30 feet of CCR, the estimated settlement due to liquefaction is about 2 inches or less. Tokimatsu and Seed estimate that the predicted strain is accurate to +25%, so an estimated settlement of 5 inches is probably reasonable. So, the risk of damage to the composite liner and final cover due to liquefaction is minimal.

**6.1.2 Slope Stability Analyses**

The slope stability analyses were performed using the computer program SLIDE 8. This program uses the Spencer method, which resolves the static forces on each vertical slice of soil profile along randomly generated failure surfaces. Two methods are used. The first method is to assume circular failure surfaces. A grid of possible centers for the circular failure surface is specified, as well as the possible bottom elevation of the failure surface. The program searches for the minimum factor of safety (FS) against slope failure for each center point in the grid by incrementally varying the radius of the failure surface. The plotted results from the program show the minimum FS, the center and radius of the failure surface with the minimum FS. The output of the program also plots contours of equal FS within the grid of possible center points. The second method is based upon a multi-linear failure surface. This method is used where there is a plane of weak shear strengths, such as along a composite liner or dual liner. The analyses are the same, that is searching for a configuration of a multi-linear failure surface which results in a minimum factor of safety. All of the results are presented graphically in Appendix B. Stability analyses were performed at each section for initial and final stages of construction and using short-term (undrained) properties and long-term properties as appropriate. Stability analyses were also performed for the pseudoseismic loading, and the post-seismic static conditions where liquefaction exists in the natural soil strata below the groundwater table where there is a high risk.

Figure B-1 in Appendix B shows the locations of cross sections analyzed for the SCPD. The results of slope stability analyses for the critical section are presented in Table 1. Shown in the table is the factor of safety from the pseudo-static analyses at the design acceleration, the yield acceleration, the estimated lateral displacement and the post-earthquake factor of safety. Graphical depictions of the slope stability analyses are presented in Figure B-2 to B-4 in Appendix B.

**Table 1 - Seismic Slope Stability Analyses Results for the SCPD Critical Section**

| Section | Psuedo-Static Factor of Safety | Yield Acceleration (g) | Lateral Displacement (in) | Minimum Post-Earthquake Factor of Safety | Post-Earthquake Factor of Safety |
|---|---|---|---|---|---|
| **E-E** | 1.01 | 0.271 | NA | 1.20 | 1.74 |

### 6.1.3 SCPD Seismic Impacts

Our analyses estimated probable maximum deformations as the result of seismic acceleration or liquefaction induced settlement to be approximately 6 inches. This magnitude of deformation has the potential to require immediate pool draw down, emergency repairs, work stoppage and plant stoppage; however, it is not expected that these deformations will cause a catastrophic release of CCR. The SCPD design is adequate to prevent harmful release of CCR, leachate, and contaminants both during and after the design seismic event.

**40 CFR Part 257.63**
**Seismic Impact Zones**

New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in seismic impact zones unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that all structural components including liners, leachate collection and removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site. An assessment of active CCR surface impoundment SCPD (Cell 2) at the Sioux Energy Center was conducted to determine if a demonstration could be made showing that the CCR units meet the requirements of 40 CFR Part §257.63.

| CCR Unit | Meets Minimum Requirement of 40 CFR Part §257.63 |
|---|---|
| SCPD | Yes |

**Engineer's Seal**


Jeff Bertel, P.E.
License: PE-2010025265
Date: October 31, 2024

# 7.0 §257.64 UNSTABLE AREAS

An existing or new CCR landfill, existing or new CCR surface impoundment, or any lateral expansion of a CCR unit must not be located in an unstable area unless the owner or operator demonstrates that recognized and generally accepted good engineering practices have been incorporated into the design of the CCR unit to ensure that the integrity of the structural components of the CCR unit will not be disrupted. An unstable area is defined in §257.53 as, "a location that is susceptible to natural or human-induced events or forces capable of impairing the integrity, including structural components of some or all of the CCR unit that are responsible for preventing releases from such unit. Unstable areas can include poor foundation conditions, areas susceptible to mass movements, and karst terrains."

The SEC is located in an alluvial plain between the Mississippi and Missouri Rivers. The subsurface conditions include a heterogeneous deposit of alluvial soils consisting of 5 to 15 feet of clays and silts underlain by sand deposits which generally become more coarse with depth. The uppermost bedrock underlying the thick alluvium, at a depth of about 115 feet, is limestone and dolomite of the Mississippian-age Salem Formation. Outcrops of the Salem Formation exist in the bluffs on the north side of the Mississippi River. The Salem Formation is reported to be 60 feet thick, and is underlain by the Warsaw Formation. The Warsaw Formation principally consists of shale and finely-crystalline dolomitic mudstone.

The CCR units at the SEC were evaluated to determine if they were located in an unstable area using data from existing geotechnical investigations and relevant information including maps showing regional bedrock geology, karst features, mines and other potential unstable features. There are no known springs, caves, sinkholes or rock outcrops within the alluvial plain. No other potentially significant geologic or geomorphic features have been identified at the SEC. No significant on-site or local human-made features or events, either surface or subsurface are in evidence at the SEC within the footprints of the CCR units.

The global stability and settlement of the CCR units were evaluated during design or after construction based on the as-built conditions. These evaluations show that the CCR units are not susceptible to significant differential settling or mass movement.

Based on the information reviewed during this evaluation, the CCR units at the SEC are not located in unstable areas and comply with §257.64.

**40 CFR Part 257.64**
**Unstable Areas**

An existing or new CCR landfill, existing or new CCR surface impoundment, or any lateral expansion of a CCR unit must not be located in an unstable area unless the owner or operator demonstrates that recognized and generally accepted good engineering practices have been incorporated into the design of the CCR unit to ensure that the integrity of the structural components of the CCR unit will not be disrupted. An assessment of active CCR surface impoundment SCPD (Cell 2), and active landfill SCL4A (Cell 4A) at the Sioux Energy Center was conducted to determine if a demonstration could be made showing that the CCR units meet the requirements of 40 CFR Part §257.64.

| CCR Unit | Meets Minimum Requirement of 40 CFR Part §257.64 |
|---|---|
| SCPD | Yes |
| SCL4A | Yes |

**Engineer's Seal**


Jeff Bertel, P.E.
License: PE-2010025265
Date: October 31, 2024

## 8.0 REFERENCES

Cole, V.G., 1961, The Cap au Gres Fault, Missouri Geologic Survey and Illinois Geologic Survey.

Haley and Aldrich, Inc., Human Health and Ecological Assessment of the Sioux Energy Center, Ameren Missouri, File No. 130182-004, Boston, Massachusetts.

Idriss, I.M. and R.W. Boulanger (2008). Soil Liquefaction During Earthquakes. Earthquake Engineering Research Institute (EERI), Monograph MNO-12. 237 pp.

Makdisi, F. and H. Seed (1978), "Simplified Procedure for Estimating Dam and Embankment Earthquake-Induced Deformations," Journal of Geotechnical Engineering, ASCE, Vol. 104, No. 7, pp. 849 – 867.

McCracken, M., 1971, Structural Features of Missouri, Missouri Geological Survey Report of Investigation Number 49.

Newmark, N.M. (1965), "Effects of Earthquakes on Dams and Embankments," Geotechnique, Vol. 15, No. 2, pp. 139 – 160.

Seed, H. Bolton (1987), "Design Problems in Soil Liquefaction," Journal of Geotechnical Engineering, ASCE, Vol. 113, No. 8, pp. 827 – 845.

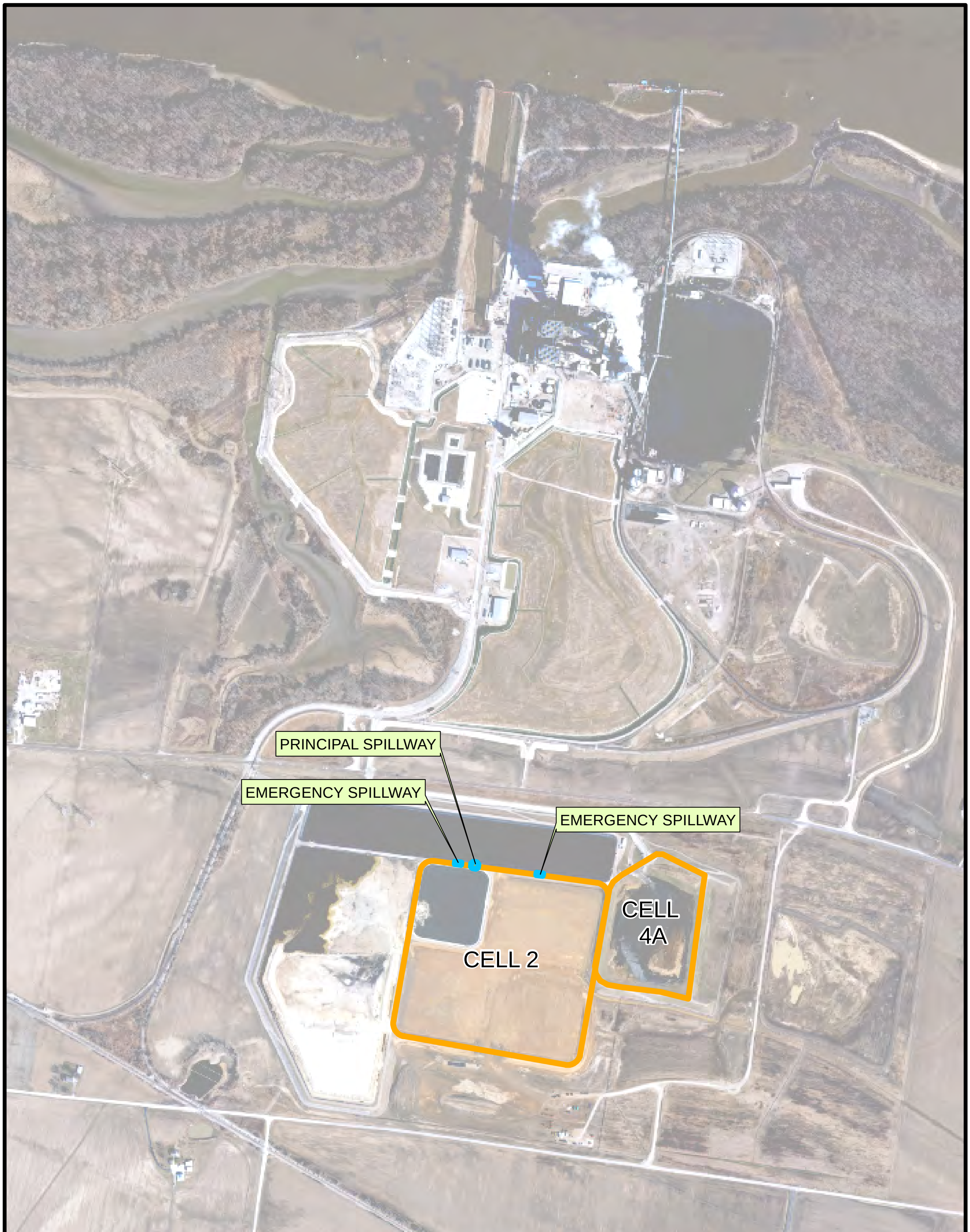
Seed, R.B. and L.F. Harder (1990), "SPT-Based Analysis of Cyclic Pore Pressure Generation and Undrained Residual Strength," Proceedings H.B. Seed Memorial Symposium, Bi-Tech Publishing Ltd., Vol. 2, pp. 351 – 376.

Solid Waste Management Program and Timothy D. Stark (1998), "Draft Technical Guidance Document on Static and Seismic Slope Stability for Solid Waste Containment Facilities,' Division of Environmental Quality, Missouri Department of Natural Resources.

Tokimatsu, Kohji and H. Bolton Seed (1987), "Evaluation of Settlements in Sands Due to Earthquake Shaking," Journal of Geotechnical Engineering, ASCE, Vol. 113, No. 8, pp. 861 – 878.

Unklesbay, A.G., Vineyard, J.D., 1992, Missouri Geology: Three Billion Years of Volcanoes, Seas, Sediments, and Erosion.

Van der Pluijm, B., Ctacosinos, P., 1996, Basement and Basins of Eastern North America, Geological Society of America Special Paper 308, pgs. 174-176.




Legend
Embankment
Spillway

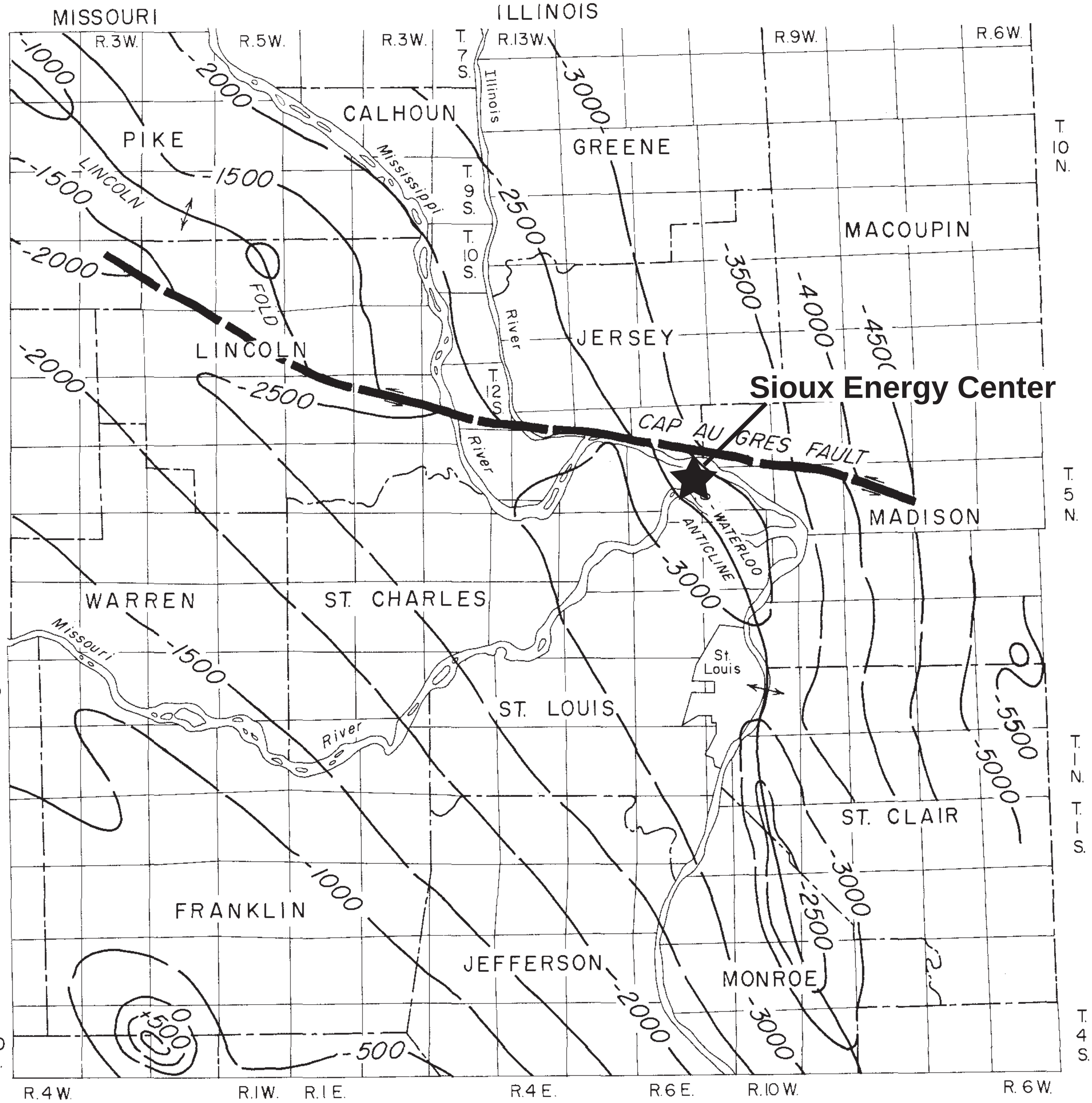
N

0 500 1,000 Feet

AMEREN MISSOURI
SIOUX ENERGY CENTER
ACTIVE CCR SURFACE IMPOUNDMENT
FIGURE 1

Ameren MISSOURI
REITZ & JENS, INC. CONSULTING ENGINEERS

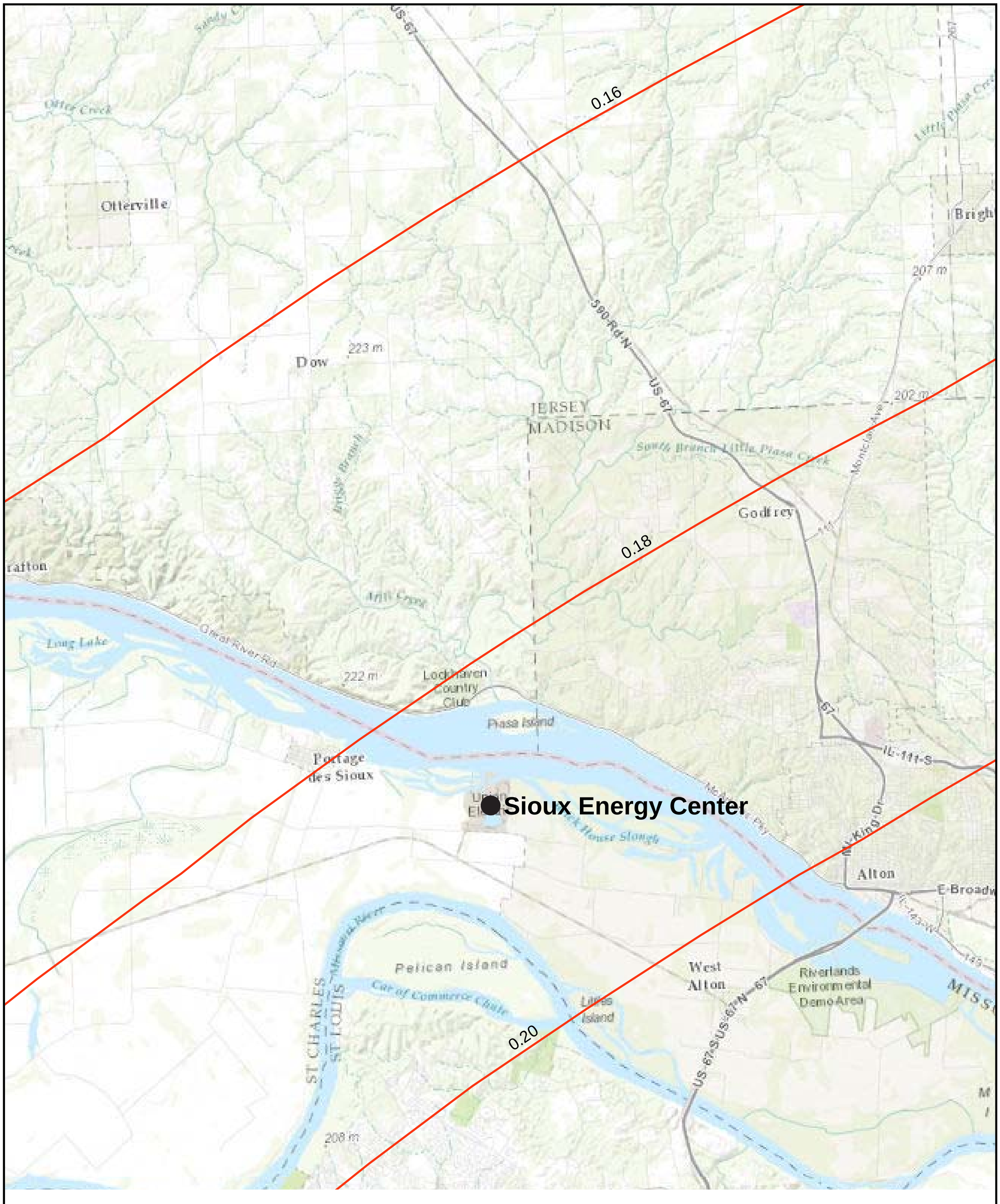
Document Path: P:\Amerenuel\2023012434\dwg\Figure 1 CCR Reports\gis\AMRN-SIOUX-FIGURE 1 - Cell4.mxd




Cap au Gres Fault Area.

(Cole, 1961)

Ameren Missouri
Sioux Energy Center
Cap au Gres Fault Map




**2% Probability of Exceedance in 50 Years Map of Peak Ground Acceleration**

Ameren Missouri: Sioux Energy Center
2014 USGS Seismic Hazard Map

# APPENDIX A

# 2006 SIOUX UTILITY WASTE LANDFILL WETLAND PERMIT

**DEPARTMENT OF THE ARMY**
**ST. LOUIS DISTRICT, CORPS OF ENGINEERS**
**1222 SPRUCE STREET**
**ST. LOUIS, MISSOURI 63103-2833**

REPLY TO
ATTENTION OF:

December 30, 2005

Regulatory Branch
File Number: 2005-45414

RECEIVED
JAN - 3 2006
REITZ & JENS, INC.

Mr. Carl Rezsonya, P.E.
Ameren
1901 Chouteau Ave.
P.O. Box 66149
St. Louis, MO 63166-6149

Dear Mr. Rezsonya:

This letter provides information regarding a jurisdictional wetland delineation conducted on agricultural lands designated as the Ameren - Sioux Plant Utility Waste Landfill (UWLF) site. Your consultant, Reitz & Jens, Inc., requested an official Corps of Engineers wetland delineation to evaluate the potential presence of wetlands and other waters of the United States on an approximate 212-acre tract. The tract, listed by the Natural Resources Conservation Service as Farm Tract T-4361, is located in U.S. Survey 1838, Township 48 North, Range 6 East, near Portage Des Sioux, St. Charles County, Missouri. Runoff generated by the site flows into unnamed drainage sources of the Mississippi and Missouri River.

Section 404 of the Clean Water Act assigns responsibility to the Secretary of the Army to administer a permit program to regulate the excavation or placements of dredged or fill material in waters of the United States. The excavation or placement of any dredged or fill material in waters of the United States below ordinary high water elevation or in wetlands, must be authorized by a Section 404 permit.

The Natural Resources Conservation Service provided a wetland delineation report for the same tract of land by letter dated October 17, 2005. The NRCS delineation is applicable for all agricultural related activities. A conversion to non-agricultural uses requires the performance of a wetland delineation in accordance with the Corps of Engineers 1987 Wetland Delineation Manual. This requirement is based on the rescission of a Memorandum of Agreement between the Department of Agriculture and the Corps of Engineers.

On October 11, 2005, I had the opportunity to conduct a delineation on the 212-acre parcel in accordance with the Corps of Engineers 1987 Wetland Delineation manual. The majority of the tract consists of slightly rolling agricultural lands with adequate drainage characteristics. The soil profiles depict past depositional features that likely resulted from infrequent high river events. The vegetation within the majority of the agricultural land contained crop stubble or crop residue. The three wetland areas designated by the NRCS were the only areas which met the criteria to be designated as jurisdictional emergent wetland under the Corps of Engineers 1987 Wetland Delineation manual. Each of the three emergent wetland areas, 0.03, 0.06 and 0.09 acre, were low quality sites that formed as a result of constructed farm access routes or modified drainages.

An additional jurisdictional area is situated near the southwest corner of the subject tract. The jurisdictional feature is a scour hole created by flood events in 1993. The scour hole contains a jurisdictional wetland fringe surrounding the jurisdictional open water area. The specific acreage of this feature was not calculated at the time of the delineation. No other jurisdictional areas were found within the delineated tract.

By letter dated December 16, 2005, Reitz & Jens, Inc., submitted documentation describing the development of the UWLF within portions of the delineated tract. A borrow pit and the UWLF site would be constructed in areas avoiding the three jurisdictional emergent wetlands and the scour hole. As such, no jurisdictional areas regulated by the U.S. Army Corps of Engineers would be impacted. No Department of the Army permit would be required to construct the UWLF development as submitted.

This **jurisdictional determination** is considered an **approved** jurisdictional determination in accordance with final regulations published on March 28, 2000 (65 FR 16485-16503). Enclosed is a *Notification of Administrative Appeal Options and Process and Request for Appeal* for your consideration and use. This determination can be appealed. This **jurisdictional determination** is valid for a period of five years from the date of this letter unless new information warrants revision of this determination before the expiration date.

You are reminded that this approved jurisdictional determination is based on your submitted information and plans; any revisions to your proposal may be subject to further review and permitting requirements.

If you have any questions, please contact me at (314) 331-8583. Include the identification number 2005-45414 with any future inquiries regarding this project.

Sincerely,

Charles Frerker

Charles Frerker, PM
Rivers Unit Team Leader
Regulatory Branch

Copy Furnished:

Mr. Paul Reitz
Reitz & Jens, Inc.
1055 Corporate Square Drive
St. Louis, MO 63132

## NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

| | | | |
|---|---|---|---|
| Applicant: **Ameren** | | File Number: **2005-45414** | Date: **12-30-2005** |
| Attached is: | | | See Section below |
| | INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission) | | A |
| | PROFFERED PERMIT (Standard Permit or Letter of permission) | | B |
| | PERMIT DENIAL | | C |
| X | APPROVED JURISDICTIONAL DETERMINATION | | D |
| | PRELIMINARY JURISDICTIONAL DETERMINATION | | E |

**SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at http://usace.army.mil/inet/functions/cw/cecwo/reg or Corps regulations at 33 CFR Part 331.**

### A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.

- OBJECT: If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Your objections must be received by the district engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

### B: PROFFERED PERMIT: You may accept or appeal the permit

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.

- APPEAL: If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

**C: PERMIT DENIAL:** You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

### D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- ACCEPT: You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice, means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.

- APPEAL: If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

**E: PRELIMINARY JURISDICTIONAL DETERMINATION:** You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

## SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT

REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)

ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

## POINT OF CONTACT FOR QUESTIONS OR INFORMATION:

| If you have questions regarding this decision and/or the appeal process you may contact: | If you only have questions regarding the appeal process you may also contact: |
|---|---|
| Charles F. Frerker, PM<br>River/Corps Unit, CO-F<br>US Army Corps of Engineers<br>St. Louis District<br>1222 Spruce Street<br>St. Louis, MO 63103-2833<br>Phone: (314) 331-8583 Fax: (314) 331-8741 | Martha S. Chieply, Administrative Appeals Review Officer<br>Mississippi Valley Division<br>P.O. Box 80<br>Vicksburg, MS 39181-0080<br>Phone: (601) 634-5820 Fax: (601) 634-5816 |

RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15 day notice of any site investigation, and will have the opportunity to participate in all site investigations.

| _______________________<br>Signature of appellant or agent. | Date: | Telephone number: |
|---|---|---|

REITZ & JENS, INC.
CONSULTING ENGINEERS

1055 corporate square drive
st. louis, mo 63132
phone: 314.993.4132
fax: 314.993.4177
www.reitzjens.com

December 16, 2005

Charles Frerker
Regulatory Branch, St. Louis District Corps of Engineers
1222 Spruce Street
St. Louis, MO 63103-2833

Re: Ameren – Sioux Plant Utility Waste Landfill
No Permit Required Determination

Dear Mr. Frerker,

The following will summarize our discussions over the last two months regarding the impacts to areas jurisdictional under Section 404 of the Clean Water Act caused by Ameren's proposed wet flue gas desulfurization (scrubber) system and associated Utility Waste Landfill (UWLF) at the Sioux Power Plant in St. Charles County, Missouri. The scrubber system will be constructed in the areas immediately east and south of the existing power plant, on the north side of Highway 94. The byproduct from the scrubbing operations will be slurried in enclosed pipes to the UWLF site on the south side of Highway 94 for storage and disposal. All of these improvements will be made on property that is currently owned by Ameren.

The maximum footprint of the UWLF has been established at 212 acres. The limits of the UWLF footprint are shown in the attached drawing. Ameren may also need to borrow soils from a 55 acre area to construct both the UWLF and fills for the scrubber system. The extent of this borrow area is also shown on the attached drawing. Fill will also need to be placed near the plant for the scrubber system and associated support operations. The extent of this fill is still being determined. Once the extent of this fill has been finalized, Ameren will contact you to determine if it impacts any jurisdictional areas and, if so, will apply for the appropriate Department of the Army permits.

The UWLF and borrow area will be located in an area that has historically been cultivated in corn and soybeans. Crops were last harvested from this area in the fall of 2005. On June 10 of this year, Ameren requested that the National Resource Conservation Service (NRCS) complete a Certified Wetland Determination/Delineation of the agricultural areas in the vicinity of the UWLF. Specifically, the request was for Farm Tract T-4361 in St. Charles County. David Skaer of the NRCS visited the site on July 7 and October 13, 2005 to complete this delineation. The results of the NRCS' delineation were submitted to Ameren and the St. Louis District Corps of Engineers on October 17, 2005. The conclusion reached by the NRCS was that, while they found three areas (0.03, 0.06 and 0.09 acre) that had crop failure, they were of Minimal Effect and consequently Plot 1 (the entire 439.9 acre Farm Tract) did not have the required indicators to be classified as a wetland and is considered Prior Converted (PC) for FSA purposes.

As we discussed previously, the NRCS wetland delineation is only valid for proposed agricultural uses of the land. The Corps of Engineers requires the use of the 1987

Wetland Delineation Manual for any proposed land use conversion not related to agriculture. On October 11, 2005 you and I visited the site to complete a wetland delineation of Farm Tract T-4361 in accordance with the Corps 1987 Wetland Delineation Manual. During this visit, we reviewed the entire Tract to determine the presence of jurisdictional wetlands and other Waters of the United States. After this review, you concurred with the NRCS's designation that only three jurisdictional wetlands, approximately 0.03, 0.06 and 0.09 acre in size, exist on this Tract. The location of each of the wetlands is identified in the NRCS's October 17, 2005, wetland delineation packet and shown on the attached drawing. You also determined that there is a jurisdictional scour hole, created by the 1993 Flood, near the southwest corner of the Tract. The specific acreage of the scour hole was not calculated at the time of our visit.

The UWLF and borrow area limits were specifically established to avoid the three jurisdictional wetland areas delineated by the NRCS and the Corps of Engineers on October 11. Consequently**, it is our opinion that no Department of the Army Permits are required for either the UWLF or borrow area.**

Before proceeding with design of the Utility Waste Landfill, Ameren requests your written confirmation that no Department of the Army permits are required for developing either the Utility Waste Landfill or the borrow pit on Farm Tract T-4361 as shown on the enclosed plan. Ameren understands that Department of the Army permits will be required if fill for the scrubber system and associated support operations impact jurisdictional areas, or if the decision is made to fill the scour hole on Farm Tract T-4361, and will submit applications for these permits in the future once the scope of the scrubber project has been finalized.

If you do not agree with our opinion, or need additional information before issuing a No Permit Required letter, please contact me at (314)-993-4132, ext 224 or preitz@reitzjens.com.

If possible, we would like to receive your No Permit Required letter by the end of December, 2005.

Very truly yours,
Reitz & Jens, Inc.

PAUL H. REITZ, P.E.
Principal

Cc: C. Rezsonya/Ameren
T. Gredell/GER
P. Miner/S&L

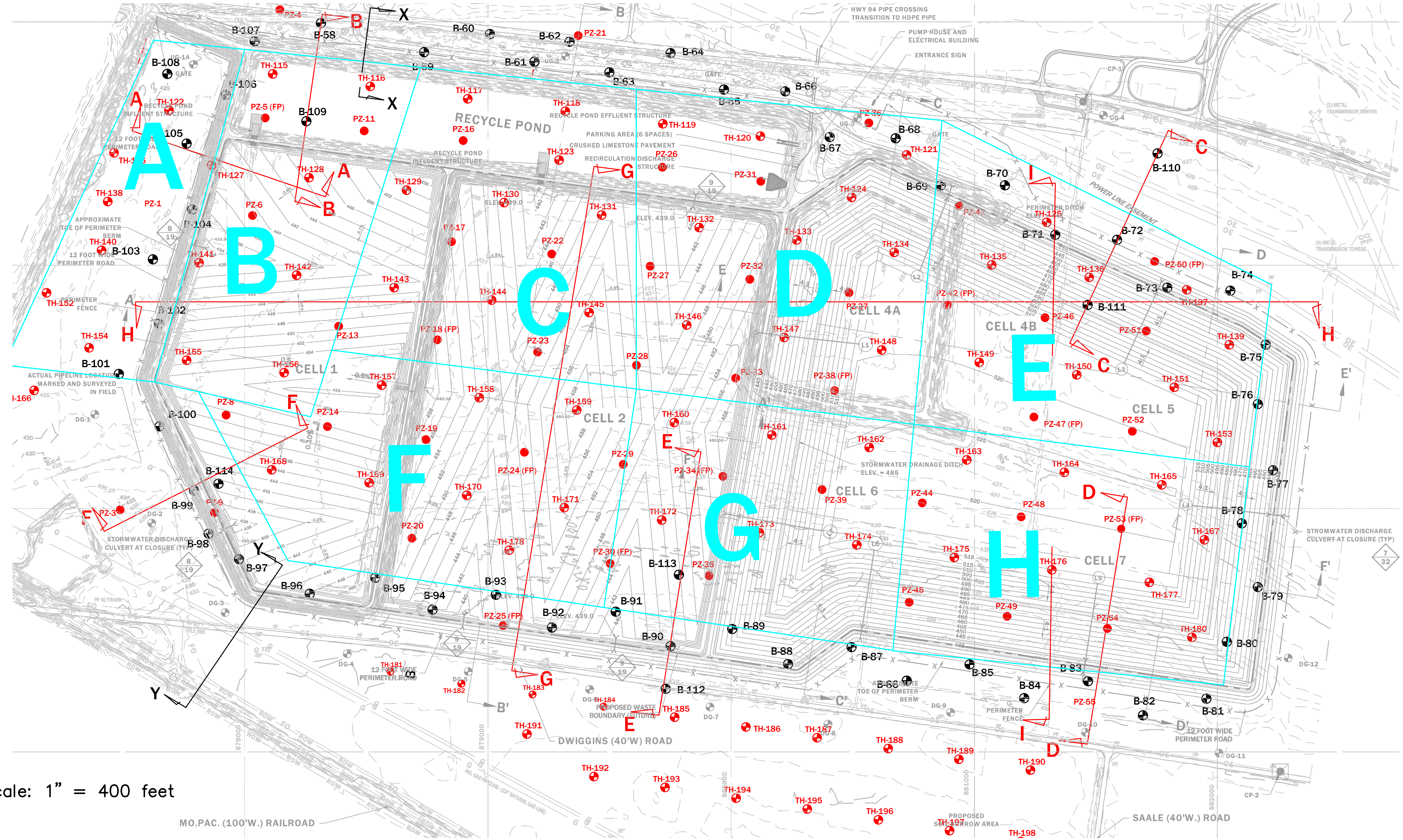
\\server\projects\amerenue\2005012477\wetlands-404\121605 sioux uwlf usace npr ltr.doc dwg\study\lf-site\wetlands 12/08/2005


| | | | | |
|---|---|---|---|---|
| SHEET 1 OF 1 | Sioux Utility Waste Landfill<br>USACE WETLANDS<br>2005012477 | Ameren UE | Designed p.h.r. Checked p.h.r.<br>Drawn p.h.r. Issued 12/08/2005 | REITZ & JENS, INC.<br>CONSULTING ENGINEERS<br>1055 CORPORATE SQUARE DRIVE<br>ST. LOUIS MISSOURI 63132<br>(314) 993-4132 |

# APPENDIX B

## SEISMIC IMPACT ZONES - SCPD

## AMEREN MISSOURI SIOUX ENERGY CENTER CONSTRUCTION PERMIT MODIFICATION FOR PERMITTED UTILITY WASTE LANDFILL (PERMIT NO. 0918301), ST. CHARLES COUNTY, MISSOURI, REVISED GEOTECHNICAL ENGINEERING REPORT, JANUARY 24, 2020



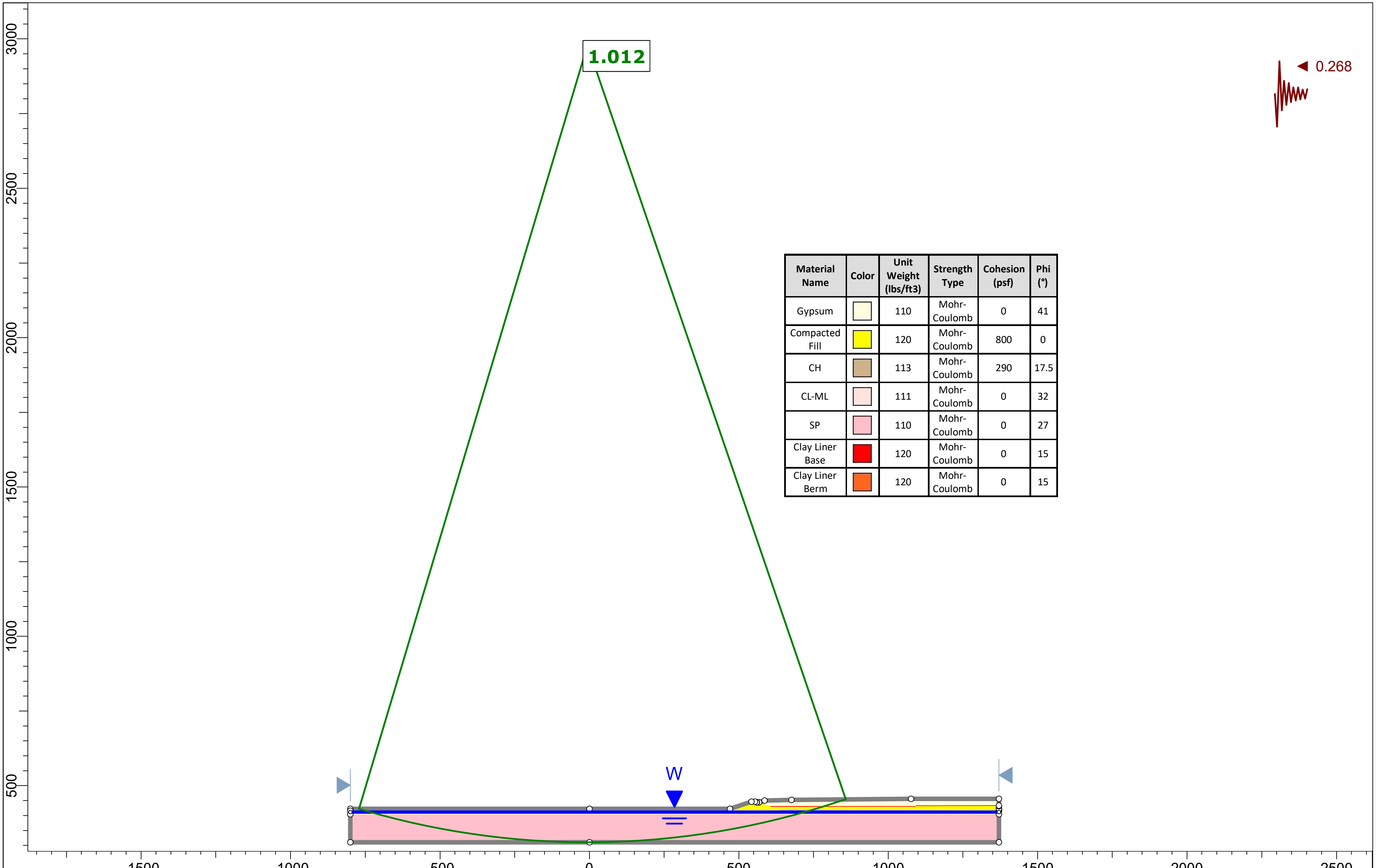

Scale: 1" = 400 feet

Note: Sections A–A through F–F for stability analyses shown in red. Sections G–G through I–I for settlement profiles shown in red. Sections X–X and Y–Y refer to erosion protection calculations in Appendix 11. Other sections in gray are for permit drawings.

Ameren Missouri Sioux Energy Center UWL
PLAN OF SECTIONS AND BORING COMPOSITE AREAS

REITZ & JENS, INC.

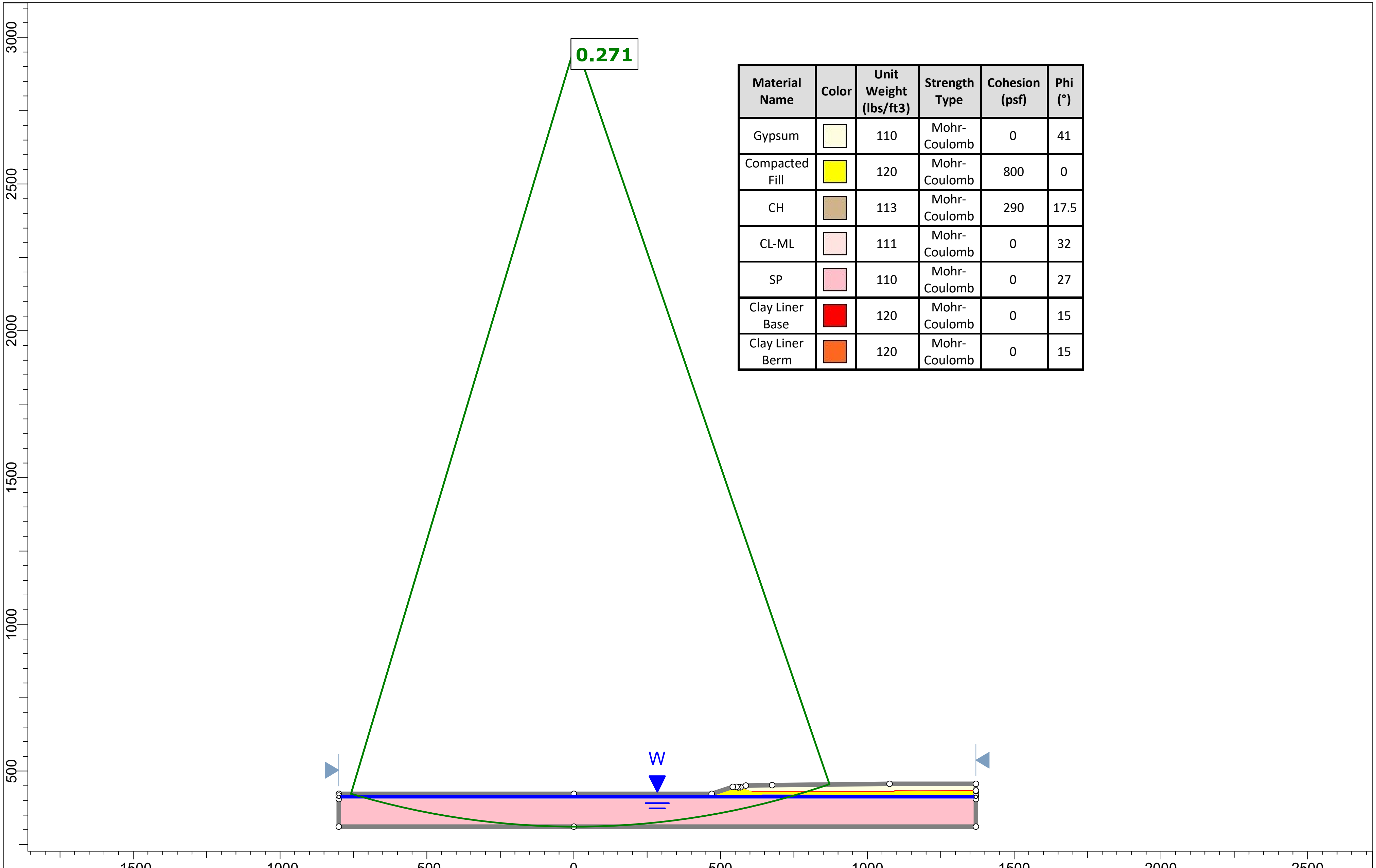
Figure B-1




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (°) |
|---|---|---|---|---|---|
| Gypsum | | 110 | Mohr-Coulomb | 0 | 41 |
| Compacted Fill | | 120 | Mohr-Coulomb | 800 | 0 |
| CH | | 113 | Mohr-Coulomb | 290 | 17.5 |
| CL-ML | | 111 | Mohr-Coulomb | 0 | 32 |
| SP | | 110 | Mohr-Coulomb | 0 | 27 |
| Clay Liner Base | | 120 | Mohr-Coulomb | 0 | 15 |
| Clay Liner Berm | | 120 | Mohr-Coulomb | 0 | 15 |

| | |
|---|---|
| Project Name: Sioux UWL | Client: Ameren |
| Section Location: E-E As-Built | Load Case: Seismic |

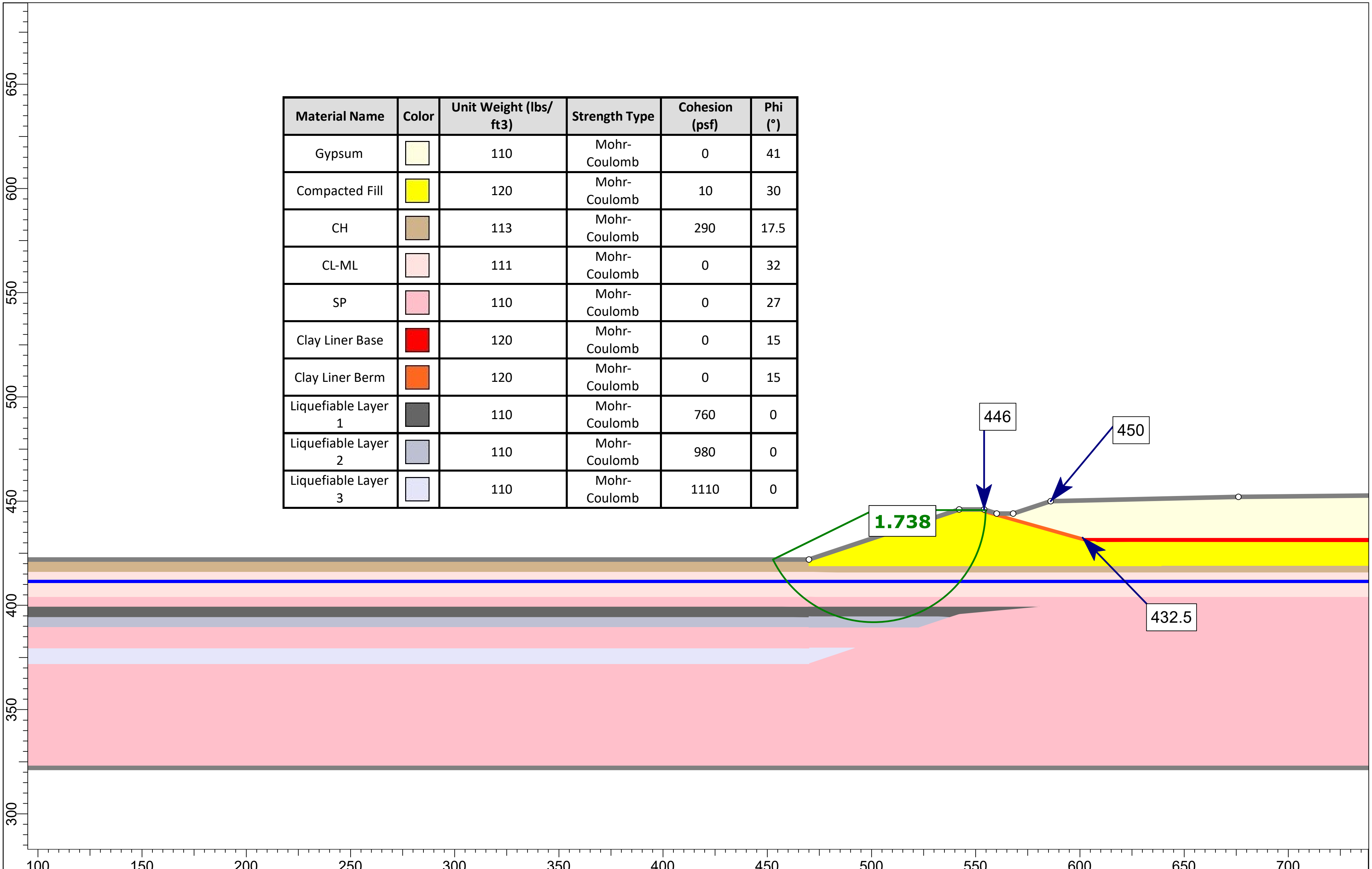
| | | | |
|---|---|---|---|
| Project Number: 2019012439 | Analysis By: C. Cook | Checked By: J. Fouse | Figure: B-2 |




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (°) |
|---|---|---|---|---|---|
| Gypsum | | 110 | Mohr-Coulomb | 0 | 41 |
| Compacted Fill | | 120 | Mohr-Coulomb | 800 | 0 |
| CH | | 113 | Mohr-Coulomb | 290 | 17.5 |
| CL-ML | | 111 | Mohr-Coulomb | 0 | 32 |
| SP | | 110 | Mohr-Coulomb | 0 | 27 |
| Clay Liner Base | | 120 | Mohr-Coulomb | 0 | 15 |
| Clay Liner Berm | | 120 | Mohr-Coulomb | 0 | 15 |

| | | | |
|---|---|---|---|
| Project Name: Sioux UWL | | Client: Ameren | |
| Section Location: E-E As-Built | | Load Case: Seismic - Yield Acceleration | |
| Project Number: 2019012439 | Analysis By: C. Cook | Checked By: J. Fouse | Figure: B-3 |

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (°) |
|---|---|---|---|---|---|
| Gypsum | | 110 | Mohr-Coulomb | 0 | 41 |
| Compacted Fill | | 120 | Mohr-Coulomb | 10 | 30 |
| CH | | 113 | Mohr-Coulomb | 290 | 17.5 |
| CL-ML | | 111 | Mohr-Coulomb | 0 | 32 |
| SP | | 110 | Mohr-Coulomb | 0 | 27 |
| Clay Liner Base | | 120 | Mohr-Coulomb | 0 | 15 |
| Clay Liner Berm | | 120 | Mohr-Coulomb | 0 | 15 |
| Liquefiable Layer 1 | | 110 | Mohr-Coulomb | 760 | 0 |
| Liquefiable Layer 2 | | 110 | Mohr-Coulomb | 980 | 0 |
| Liquefiable Layer 3 | | 110 | Mohr-Coulomb | 1110 | 0 |




| | |
|---|---|
| Project Name: Sioux UWL | Client: Ameren |
| Section Location: E-E As-Built | Load Case: Liquefaction |

Project Number: 2019012439 | Analysis By: C. Cook | Checked By: J. Fouse | Figure: B-4

REPORT
2019012439

# AMEREN MISSOURI SIOUX ENERGY CENTER CONSTRUCTION PERMIT MODIFICATION FOR PERMITTED UTILITY WASTE LANDFILL (PERMIT NO. 0918301) ST. CHARLES COUNTY, MISSOURI

## REVISED GEOTECHNICAL ENGINEERING REPORT

Prepared for

Ameren MISSOURI

Prepared by

REITZ & JENS, INC.
CONSULTING ENGINEERS

STATE OF MISSOURI
JEFFREY LYNN FOUSE
NUMBER E-21043
REGISTERED PROFESSIONAL ENGINEER
1/24/2020

January 24, 2020

The Professional whose signature and personal seal appear hereon assumes responsibility only for what appears in the attached report and disclaims (pursuant to Section 327.411 RSMo) any responsibility for all other plans, estimates, specifications, reports, or other documents or instruments not sealed by the undersigned Professional relating to or intended to be used for any part or parts of the project to which this report refers.

**AMEREN MISSOURI SIOUX ENERGY CENTER**
**CONSTRUCTION PERMIT MODIFICATION FOR**
**PERMITTED UTILITY WASTE LANDFILL**
**SOLID WASTE DISPOSAL AREA (PERMIT NUMBER 0918301)**
**ST. CHARLES COUNTY, MISSOURI**

**REVISED GEOTECHNICAL ENGINEERING REPORT**

## TABLE OF CONTENTS

Section | Page

## TABLE OF CONTENTS (cont.)



## List of Tables



## List of Figures

## TABLE OF CONTENTS (cont.)

### List of Figures (cont.)



### List of Sub-Appendices

**AMEREN MISSOURI SIOUX ENERGY CENTER**
**CONSTRUCTION PERMIT MODIFICATION FOR**
**PERMITTED UTILITY WASTE LANDFILL**
**SOLID WASTE DISPOSAL AREA (PERMIT NUMBER 0918301)**
**ST. CHARLES COUNTY, MISSOURI**

**REVISED GEOTECHNICAL ENGINEERING REPORT**

# 1.0 HISTORY OF GEOTECHNICAL INVESTIGATION

## 1.1 Previous Revisions and Amendments

Reitz & Jens, Inc. (R&J) completed a geotechnical investigation for the design of the Utility Waste Landfill (UWL) for the Ameren Missouri Sioux Energy Center (SEC), located on Hwy. 94 in St. Charles County, Missouri. R&J was part of a design team for the UWL that included Gredell Engineering Resources, Inc. (GER) and Ardaman & Associates, Inc. (A&A). The principal component of the waste in the original UWL was gypsum, to be deposited in six wet stacks or cells. The gypsum is the by-product of the wet flue gas desulphurization (WFGD) scrubbers installed at the SEC. R&J's scope of work included: 1) field boring and laboratory testing programs to characterize the geotechnical engineering properties of the subsurface soils strata, 2) global stability analyses of the gypsum stack and the perimeter berm, 3) settlement analyses of the consolidation of the foundation soils, 4) liquefaction analyses of the foundation soils, 5) design of the perimeter berm, and 6) recommendations for the earthwork construction of the UWL. Because the wet gypsum stacks were to exceed 35 feet, the UWL was permitted as an industrial dam by the Missouri Department of Natural Resources – Dam and Reservoir Safety Program (MDNR-DRSP). Part of R&J's scope was compliance with the MDNR-DRSP regulations. The design of the gypsum stack – including the internal stability, drainage, liner, and operation – was the responsibility of A&A and was covered in a separate report. This geotechnical report pertains to R&J's scope of work. The original Geotechnical Report was included as Appendix K of the Construction Permit Application (CPA) submitted to the MDNR – Solid Waste Management Program (MDNR-SWMP) on January 29, 2007, and revised in September 2007. Construction Permit No. 0918301 was issued on March 28, 2008. Cell 1 and the Recycle Pond were constructed in 2008 and 2009, and began operation in 2010.

A modification to the original CPA was first submitted in June 2010 to change future gypsum Cells 4, 5 and 6 to be reconfigured as Cells 4, 5, 6 and 7 for the storage of dry Coal Combustion Residuals (CCRs) from the SEC. R&J's Geotechnical Report was revised accordingly in February 2011, August 2011, November 2011, and finally amended in August 2014. The August 2014 amendment has been incorporated into this revised Geotechnical Report. The modified Construction Permit No. 0918301 was approved in February 2013.

Construction of the western half of Cell 4 (designated "Cell 4A") was completed in November 2013. The third phase of the construction of Cell 4A was the initial filling with CCR (fly ash) to resist potential hydrostatic uplift on the bottom liner due to flooding. R&J submitted a Construction Quality Assurance (CQA) Summary Report for Phase 3 on May 29, 2014. This report included the results of additional laboratory testing on the fly ash placed in Cell 4A and additional slope stability analyses in response to questions from MDNR-SWMP during Phase 3. Also, this report included calculations of the resistance to hydrostatic uplift in response to questions from MDNR-SWMP. These findings have been incorporated into this revised Geotechnical Report.

## 1.2 Summary of Revisions for 2020 CPM

The Amended 2014 Geotechnical Report has been revised in accordance with the proposed changes to the SEC UWL, specifically: 1) the gypsum cells will not be wet stacked but will be closed with the gypsum left in place; 2) wet gypsum Cells 2 and 3 will be combined to form a single Cell 2; 3) an "aquiclude" geomembrane will be constructed below the composite liners in the new cells to comply with the EPA CCR Rule; and 4) the permanent caps for closure of the wet gypsum Cells 1 and 2 and dry CCR Cells 4, 5, 6 and 7 will include a HDPE membrane on the top and side slopes to comply with the EPA CCR Rule. The overall footprint of the UWL will not be changed. Also, the approved height of the dry CCR cells will not be changed (top el. 525).

The wet gypsum cells will not exceed a height of 35 feet. Therefore, no portion of the UWL will require regulation by the MDNR-DRSP. Cell 1 was built under MDNR-DRSP Construction Permit C-426 (MO40160), which had to be renewed annually as Cell 1 would be "under construction" until it was closed. This permit is no longer required. The gypsum in Cell 1 was never "wet stacked" above the perimeter berm. The configuration of the closed Cell 1 as described in the 2020 CPM is analyzed for slope stability and settlement herein. The original Geotechnical Report addressed dam safety requirements – dam type and downstream environmental class, seismic analyses, precipitation and spillway capacity, and operations and maintenance. Because the gypsum cells are no longer regulated by the MDNR-DRSP, these sections have been removed except for the seismic analyses. The seismic analyses have been significantly revised as explained in Section 5.

### 1.2.1 Field Investigation

No additional geotechnical field investigation was required because the UWL will occupy the same footprint. The geotechnical investigation for the UWL was completed in two phases: Phase 1 for the Detailed Site Investigation, and Phase 2 for the construction permit application. The description of the geotechnical investigation from the original approved CPM is included herein.

### 1.2.2 Laboratory Testing

No additional laboratory testing of soils was completed for this revision. Additional laboratory testing on CCR (fly ash) was performed previously for the modification to the CPM in 2011 for the addition of the dry cells. Also, additional laboratory testing on CCR from Cell 4A was performed in response to questions from MDNR-SWMP on the Phase 3 CQA Report for Cell 4A. These additional tests are included in this revised report, as explained in Section 3.3.

### 1.2.3 Seismic Risk Assessment and Analyses

The original seismic analyses for the Sioux UWL was based upon the criterion established in the MDNR-DRSP regulations. The required design criterion for an industrial water retention dam over 50 feet high and a Class II downstream environment was 0.5 PMA or 0.10g. Because Ameren will not be wet-stacking the gypsum in Cells 1 and 2, the UWL will no longer be regulated by the MDNR-DRSP. Therefore, the seismic design criterion has been revised to comply with the EPA 2015 CCR Rule. The seismic acceleration was based upon the USGS 2014 seismic hazard maps for a Peak Horizontal Ground

Acceleration (PGA) for the geometric Maximum Credible Earthquake ($MCE_G$) with a 2% probability of exceedance in 50 years. The basis for the seismic analyses is presented in Section 5. The potential for liquefaction of the subsurface soil strata were analyzed for the revised PGA and are presented in Section 6.0.

### 1.2.4 Slope Stability Analyses

The stability of the side slopes of the perimeter berms and the CCR fill at six sections were analyzed which had varying geometries and subsurface soil profiles. Each section was analyzed for the short-term (end of construction) geometry and for the completed cell, and using the short-term and long-term shear strength properties as appropriate. The seismic loading conditions were also analyzed, as well as the post-seismic condition with liquefaction occurring in the subsurface soil strata where indicated by the liquefaction analyses. Potential sliding block failures along the interface with the composite liner and aquiclude and the stability of the final cover were also analyzed. All of these analyses demonstrate that the proposed design meets or exceeds the minimum factors of safety for slope stability in accordance with the MDNR-SWMP regulations, the *Draft Technical Guidance Document on Static and Seismic Slope Stability for Solid Waste Containment Facilities* by MDNR-SWMP and Dr. Timothy Stark, and the EPA CCR Rule. Because the factors of safety against slope failure under the design seismic event were all greater than 1.0 for the various sections, the potential lateral displacement would be minor. The potential lateral displacements due to the seismic load were not estimated.

### 1.2.5 Settlement Analyses

The consolidation of the subsurface soils and the resulting settlement of the final UWL was estimated using the data from the boring logs and data from Cone Penetrometer Test (CPT) soundings for the Sioux Energy Center. The analyses were done using the SETTLE3D. These results demonstrate that the composite liner will not be subjected to damaging strains due to settlement. Also, the top of the perimeter berms will not settle below the 100-year flood level. The estimated settlement was used for design of the leachate collection system for the dry cells. Potential settlement due to liquefaction was also considered.

### 1.2.6 Impacts Due to Flooding

Because the site of the UWL is located in a floodplain, the Missouri solid waste regulations require that the design of the UWL prevent damage to the composite liner that could result from hydrostatic uplift during the 100-year flood. This requirement is satisfied by the initial operation of the UWL, during which sufficient process water will be placed in the wet cells or CCR fill will be placed in each dry cell to resist the hydrostatic uplift. The design of the perimeter berms prevents flood water from contacting the CCR in the cells. Another potential consequence of flooding would be erosion of the west perimeter berm and a portion of the south perimeter berm for Cell 1 should there be a breach of the BNSF Railroad embankment to the south of the UWL such as occurred in 1993. Riprap erosion protection has been designed for such an occurrence.

### 1.3 Summary Conclusion

Other findings and recommendations in this Geotechnical Report pertain to the bearing capacity of subsurface soils, earthwork construction procedures, soil material requirements, and quality assurance. Our professional engineering judgment is that the Sioux Energy Center UWL design and operating procedures described in this report are in accordance with generally accepted engineering practice, utilizing conservative assumptions where necessary, and therefore meet or exceed all of the requirements of the Missouri Soil Waste Management Law and Regulations, MDNR-SWMP engineering guidelines, and the EPA CCR Rule.

## 2.0 GEOTECHNICAL INVESTIGATIONS

No additional geotechnical field investigation was required because the UWL will occupy the same footprint. Therefore, the following Section 2 has not changed. The geotechnical investigation for the UWL was completed in two phases: Phase 1 for the Detailed Site Investigation, and Phase 2 for the construction permit application.

### 2.1 Detailed Site Investigation (DSI)

The field investigation for the DSI consisted of 57 geologic test holes (PZ-1 through PZ-57), in which PVC standpipe piezometers were installed, and 57 geotechnical borings (B-58 through B-114). The locations of these test holes and borings are shown in Figure 1. Fifty of these borings, B-58 through B-107, were located along the proposed alignment of the perimeter berm at that time (Fall 2005). The borings were alternately staggered approximately 50 feet on either side of the proposed centerline of the berm to provide a broader coverage, and were spaced approximately 250 feet apart. Seven other borings were made on the inside and outside of the proposed berm, to provide cross-sections of the subsurface conditions for stability analyses and settlement calculations.

All but three of the borings were made to a minimum depth of 30 feet. Three borings (B-58, B-75 and B-113) were extended to auger refusal, primarily to obtain N-values from the Standard Penetration Test (SPT) for seismic site classification and liquefaction analyses. The shallow borings were extended beyond the minimum depth of 30 feet to a depth where the following two criteria were met: 1) the uncorrected N-value from the Standard Penetration Test (SPT) was a minimum of 12 blows/foot, and 2) the last 15 feet of soil was classified as sand or gravel (Unified Soil Classifications of SW, SP, SM, GW,GP, GP-SP). The actual depths of the shallow borings were all 31 to 31.5 feet; that is, the two criteria were met at the planned minimum depth. The three deep borings were extended to drilling or sampler refusal on bedrock. The final depths of the deep borings were: 114.15 feet in B-58, 115.5 feet in B-75, and 114.85 feet in B-113.

Details of the Phase 1 geotechnical investigation and the individual boring logs are included in Appendix 7 of the report "Detailed Geologic and Hydrologic Site Investigation Report for AmerenUE Sioux Power Plant Proposed Utility Waste Disposal Area, St. Charles County, Missouri," Volume 2, August 2006.

### 2.2 Phase 2 Investigation

Geotechnical samples were not taken from the geologic test holes. The Phase 1 geotechnical borings were limited to the proposed alignment of the perimeter berm. Additional samples were needed throughout the area of the UWL to quantify the soils on site that would be suitable for construction of the liner and final cover. Also, the potential borrow area south of Dwiggins Road and north of the right-of-ways for the buried petroleum pipelines ("South Borrow"), and the area between Ameren's railroad spur into the Sioux Plant and the proposed western edge of the UWL ("West Borrow"), had to be investigated. Therefore, a second field investigation was done over four days between October 17 through 24, 2006.

The Phase 2 investigation consisted of 90 test holes (TH-115 through TH-205, without TH-179), the approximate locations of which are shown in Figure 1. These tests holes were located between the geologic test holes to maximize coverage of the UWL area. Each test hole was "continuously" sampled using hydraulically-pushed 3-inch O.D. Shelby tubes. Each Shelby tube was pushed 24 inches, beginning at the ground surface. The test hole was cleaned with a 4-inch diameter continuous-flight auger after each sample was taken. The sampling was continued to approximately el. 420. The elevation at the ground surface was estimated from the topographic survey by Kuhlmann Design Group (K*d*G). The field work was directed by R&J's geotechnical engineer. All Shelby tubes were sealed with plastic caps and duct tape, and taken to R&J's lab.

## 3.0 LABORATORY TESTING

No additional laboratory testing was performed on soils for this revision. Additional laboratory testing on CCR (fly ash) was previously performed as explained in Section 3.3. The other portions of Section 3.0 have not been changed from the previous Appendix K.

### 3.1 Classification of Phase 2 Test Holes

All of the Phase 2 Shelby tube samples were extruded in R&J's lab. The soil samples were classified and logged by a senior soils technician in general accordance with ASTM D2487-00 "Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)" and D2488-00 "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)." The samples were sorted into five groups based upon the visual soil classification: 1) high plastic clay, 2) low plastic clay, 3) borderline silty clay or clayey silt, 4) non-plastic silt, and 5) sand. The non-plastic silt and sand were discarded because these soils would not be suitable for the liner or final cover. Moisture content and dry unit weight were measured on selected samples, to develop shrinkage factors for construction. The results of the classification of the samples are presented in the table in Appendix A.

### 3.2 Tests on Natural Soil Deposits

The general purpose of the Phase 1 testing program was to obtain soil properties for the determination of: bearing capacity, short-term and long-term slope stability, seepage characteristics of the top stratum fine-grain soils and the underlying sand strata, grain-size analyses for liquefaction potential, settlement characteristics, and soil classifications for the potential use of soils for fill materials. The procedures for assigning lab tests and the results are presented in Appendix 8 of the above-referenced DSI report. Grain-size analyses (ASTM D422) were performed on selected cohesionless samples (Unified Soil Classifications of SW, SP, SM, GW, GP, GP-SP). If the percentage of fines (passing #200 U.S. sieve) was greater than 25%, then a hydrometer analysis would have been performed on the fine-grain portion of the sample. A total of 186 grain-size analyses were performed. No hydrometer analyses were run.

Unconsolidated-undrained (U-U) triaxial shear strength tests (ASTM D2850) were performed on selected Shelby tube samples from each major cohesive soil stratum. The U-U tests were performed at the estimated confining pressure of the sample in the field conditions, to measure the *in situ* shear strength of the soil. Twenty-six U-U tests were performed.

Series of consolidated-undrained (C-U) triaxial shear strength tests (ASTM D3080) were performed on each major cohesive soil stratum and at intervals around the proposed perimeter berm. The tests were performed with the measurement of internal pore water pressures so that the effective strength properties of the soil could be determined. Ten series of C-U tests were performed.

Four one-dimensional consolidation tests (ASTM D2435) were performed on selected relatively undisturbed Shelby tube samples from each major cohesive soil stratum beneath the UWL.

Six flexible-wall hydraulic conductivity tests (ASTM D5084) were performed on selected relatively undisturbed Shelby tube samples of the upper clays.

The results of the triaxial shear strength tests, consolidation tests and hydraulic conductivity tests are summarized in Table 1.

### 3.3 Tests on CCR from Sioux Plant

It was originally planned that ash from the Sioux Plant will be used for construction of at least a portion of the perimeter berm and possibly some interior dikes. R&J performed a study in 2002 of the geotechnical engineering properties of the ash stored in the pond at Sioux Plant for the construction of a railroad loop expansion at the plant. A description of the study and the results are reproduced in Appendix 2.

Two series of consolidated-undrained (CU) triaxial compression tests with pore pressure measurements were run on samples of the fly ash from the Sioux Plant, to obtain the effective cohesion (c') and effective internal friction angle ($\phi$') for new stability analyses. A bulk sample of the fly ash was obtained from the fly ash that Kolb Construction hauled into Cell 1 for the construction of the ring drain and access roads. Cylindrical test specimens of the fly ash were formed in two ways: Sample 1 was formed in a mold with as little compaction as possible so as to form a specimen that still could be prepared for testing; Sample 2 was compacted in a mold to 100% of the maximum dry unit weight ($\gamma_d$) based on the standard Proctor Moisture-Density tests performed on the fly ash for construction of the ring drain in Cell 1. The $\gamma_d$ of Sample 1 was 64.1 lbs/ft$^3$ (pcf). This represents the condition of the fly ash if it is placed in the dry cell with minimal compaction. In practice, some compaction of the fly ash will be necessary for the dozers,

Ameren Missouri Sioux Energy Center Utility Waste Landfill

Table 1: Geotechnical Properties of Samples from Phase 1 Borings

| Boring No. | Sample No. | Sample Depth | USCS Class. | Moisture Content % | Dry Unit Weight pcf | Liquid Limit % | Plasticity Index % | Undrained Shear Strength Properties: Cohesion c, psf | Undrained Shear Strength Properties: Friction Angle, $\phi$ | Effective Shear Strength Properties: Cohesion c', psf | Effective Shear Strength Properties: Friction Angle, $\phi'$ | Consolidation Properties: Pc psf | Consolidation Properties: Recomp. Index Cs | Consolidation Properties: Comp. Index Cc | Hydraulic Conduct. k cm/sec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-58 | ST-2 | 4 | CH | 34 | 85.2 | 71 | 62 | | | | | | | | 5.0E-08 |
| B-59 | ST-3 | 6.5 | CH | 30.9 | 82.4 | 74 | 51 | 640 | 0 | | | | | | |
| B-61 | ST-1 | 4 | CH | 33.4 | 84.2 | | | 1370 | 0 | | | | | | |
| B-62 | ST-2 | 4 | CH | 30 | 88.4 | | | 2090 | 0 | | | | | | |
| B-64 | ST-2 | 4 | CH | 32.2 | 85.4 | 84 | 61 | 2300 | 0 | | | | | | |
| B-66 | ST-1 | 1.5 | CH | 33.4 | 87.5 | 86 | 61 | 1780 | 0 | | | | | | |
| B-66 | ST-2 | 6.5 | CL | 32.9 | 87.6 | | | 960 | 0 | | | | | | |
| B-70 | ST-2 | 4 | CH | 43 | 77.3 | 99 | 70 | 470 | 14.5 | 330 | 24.4 | | | | |
| B-70 | ST-4 | 9 | CH | 35.2 | 84.4 | | | 1120 | 0 | | | | | | 2.3E-06 |
| B-71 | ST-2 | 4 | CH | 37.9 | 80.6 | | | 1360 | 0 | | | | | | |
| B-72 | ST-2 | 4 | CH | 37.9 | 80.9 | | | 410 | 15.0 | 350 | 24.6 | | | | |
| B-73 | ST-3 | 6 | SM | 21.2 | 83.3 | 29 | 2 | | | | | 2940 | 0.01 | 0.18 | |
| B-76 | ST-1 | 1 | CH | 39.7 | 79.5 | | | 540 | 9.3 | 480 | 14.7 | | | | |
| B-76 | ST-4 | 8.5 | CL | 23.2 | 76.7 | 31 | 8 | | | | | 4260 | 0.01 | 0.11 | |
| B-77 | ST-2 | 4 | CH | 28 | 91.6 | | | 2330 | 0 | | | | | | |
| B-77 | ST-4 | 9 | CL-ML | 32.7 | 85.9 | | | 880 | 0 | | | | | | |
| B-81 | ST-3 | 6.5 | CH | 35.6 | 86.8 | 64 | 43 | 750 | 13.7 | 340 | 27.4 | | | | |
| B-82 | ST-1 | 1.5 | CH | 35.3 | 86.3 | | | 2050 | 0 | | | | | | |
| B-83 | ST-2 | 4 | CH | 35.5 | 84.9 | | | 1760 | 0 | | | | | | |
| B-84 | ST-1 | 1.5 | CH | 36.8 | 84.4 | | | 2790 | 0 | | | | | | |
| B-85 | ST-2 | 4 | CL | 40.6 | 79.5 | 48 | 23 | 1050 | 0 | | | | | | 6.6E-05 |
| B-86 | ST-1 | 1.5 | CH | 42.3 | 79.1 | | | | | | | | | | 5.0E-09 |
| B-87 | ST-2 | 4 | CH | 36.1 | 84.7 | 89 | 62 | 1560 | 0 | | | | | | |
| B-88 | ST-1 | 1.5 | CH | 31.9 | 88.4 | 75 | 24 | 360 | 20.6 | 300 | 39.8 | | | | |
| B-90 | ST-2 | 4 | CL | 36.4 | 81.4 | | | 1610 | 0 | | | | | | |
| B-91 | ST-1 | 1.5 | CH | 30.6 | 87.4 | | | 970 | 0 | | | | | | |
| B-96 | ST-2 | 4 | ML | 17.2 | 80.3 | 31 | 3 | 1740 | 0 | | | | | | |
| B-99 | ST-3 | 6.5 | ML | 27.8 | 89.8 | | | 130 | 41.2 | 360 | 34.4 | | | | |
| B-100 | ST-1 | 1 | CH | 27.9 | 92.4 | 60 | 32 | | | | | | | | 6.8E-08 |
| B-101 | ST-1 | 1.5 | CH | 33.9 | 86.3 | 59 | 38 | | | | | | | | 4.7E-08 |
| B-101 | ST-2 | 4 | ML | 11 | 88.9 | | | 4250 | 0 | | | | | | |
| B-103 | ST-2 | 4 | CH | 33.8 | 73.4 | 75 | 49 | 1480 | 0 | | | | | | |
| B-103 | ST-2 | 5.25 | CL-ML | 26.6 | 89.2 | | | 1190 | 0 | | | | | | |
| B-104 | ST-1 | 1.5 | CH | 32.6 | 86.9 | | | 1250 | 0 | | | | | | |
| B-105 | ST-2 | 4 | CH | 30.5 | 90.6 | 87 | 61 | 3112 | 0 | | | | | | |
| B-105 | ST-5 | 11 | CL-ML | 32.4 | 86.4 | | | 1450 | 0 | | | | | | |
| B-106 | ST-2 | 4 | CH | 26.8 | 95 | 88 | 63 | 3760 | 0 | | | | | | |
| B-109 | ST-2 | 4 | CH | 42.2 | 80.7 | | | 1410 | 0 | | | | | | |
| B-109 | ST-2 | 4 | CL-ML | 26.6 | 93 | | | 2410 | 0 | | | | | | |
| B-110 | ST-1 | 1.5 | CH | 26.5 | 92.4 | | | 1300 | 0 | | | | | | |
| B-111 | ST-2 | 3.5 | CH | 37 | 78.7 | 94 | 54 | | | | | 5100 | 0.07 | 0.36 | |
| B-112 | ST-1 | 1.5 | CH | 33.6 | 88.3 | 91 | 66 | 1780 | 0 | | | 3560 | 0.08 | 0.31 | |
| B-113 | ST-1 | 1.5 | CL | 28.9 | 91.7 | 42 | 16 | 820 | 10.0 | 420 | 25.0 | | | | |

trucks and other vehicles to traverse the dry cell. The $\gamma_d$ of Sample 2 was 78.9 pcf at a moisture content of 35.2%. The results of the two series of CU triaxial tests are presented in Appendix 2.1. Sample 1 had a $\phi$' of 19.4° and a c' of 200 psf. Sample 2 had a $\phi$' of 35.7° and a c' of 280 psf. A series of direct shear tests was also performed on a lightly-compacted sample of fly ash on a textured HDPE liner. The results are presented in Appendix 2.1. The interface friction angle measured 34.8˚.

Our CQA Report for Phase 2 of the construction of Cell 4A reported the field density testing of the perimeter soil berms and the CCR berm. The compaction criterion stated in Appendix K of the modified Construction Permit Application (CPM) was based upon standard Proctor moisture-density tests performed on CCR samples at the time of our analyses. However, the properties of the CCR are variable. We found after construction of the CCR berm began that the maximum dry unit weight of 79 pcf was greater than could be achieved with the CCR that had been excavated from the pond and stockpiled. This is explained in our response to Comment 22 in "Cell 4A Construction Quality Assurance (CQA) Report, Response to MDNR-SWMP Comments" dated November 27, 2013. Based on previous tests and additional standard Proctor tests on new samples of the CCR, the maximum dry unit weight for ponded CCR was changed to 68 pcf. The criterion was established to achieve the desired engineering properties of the perimeter CCR berms. The actual average moist unit weight of the compacted CCR in the temporary east berm of Cell 4A is 104.8 pcf.

In response to questions from MDNR-SWMP regarding the compaction of the CCR berm, and to develop a better understanding of the shear strength of ash placed at a dry unit weight less than initially specified, we molded a specimen of the CCR to a density of approximately 57.5 pcf for a consolidated-undrained (CU) triaxial compression test (ASTM D4767). The dry unit weight of the specimen was much less than that achieved in the field for either the CCR fill or the CCR berm. Therefore, the shear strength properties of the test specimen are less than that of the *in situ* CCR fill and CCR berm. The effective angle of internal friction ($\phi$') obtained from the triaxial compression test was 27º. A plot of the CU test results is presented in Appendix 2.2 from our Phase 3 CQA report for Cell 4A. The assumed shear strength properties of the CCR fill for design was $\phi' = 19^o$ and effective cohesion (c') of 200 psf.

## 3.4 Tests on Composite Samples

### 3.4.1 Formation of Composite Samples

The retained soil samples from the Phase 2 borings were designated as high plastic clay ("CH"), low plastic clay ("CL"), and borderline very silty clay and clayey silt ("MCL"), based on the initial visual classification. In order to maintain the aerial location of each class of soil sample, the 90 Phase 2 borings were divided between 11 sections. The plan of the sections ("A" through "K") is shown in Appendix 1. The samples with the same classification and in the same section were combined to form 11 composite samples of each of the three classes of soil. Atterberg liquid and plastic limits tests were performed on each of the three soil types from each section. These results are shown in Table 2. Grain-size analyses (sieve and hydrometer) were also performed on each sample. The results of the gain-size analyses are included in Appendix 3. Many of the samples that were visually classified as CL were actually high plastic, that is the samples had a liquid limit equal to 50% or higher. Based on the soil classifications and Atterberg limits, soil samples from several sections were combined to reduce the number of tests, resulting in 10 composite samples. These composite samples, Nos. 1 through 10, are listed in Table 2.

Atterberg liquid and plastic limits and standard Proctor moisture-density tests (ASTM D698) were performed on each of the 10 composite samples. The results of the Atterberg limit tests are presented in Table 3. A representative bulk sample of the upper silty sands and sandy silts was obtained, to mix with a composite clay sample for a hydraulic conductivity test. A standard Proctor was also performed on the sandy silt. The maximum dry unit weights ($\gamma_d$) and optimum moisture contents from the standard Proctor tests are shown in Table 3 and the test results are included in Appendix 4.

### 3.4.2 Hydraulic Conductivity Tests

Five test points were molded for each standard Proctor test. One of the compacted specimens from each of the 10 composite samples and the sandy silt was selected for a hydraulic conductivity test (ASTM D5084). The sample that was selected had a $\gamma_d$ about equal to 95% of the maximum $\gamma_d$ and compacted at a moisture content that was 0 to 4% above the optimum. Each selected compacted specimen was trimmed from the standard Proctor mold to have a diameter of 2 inches and a length of 3 to 4 inches. Because the specimen was trimmed from the center of the mold, the specimen had an initial $\gamma_d$ that was greater than 95% of the maximum $\gamma_d$. The initial $\gamma_d$ and moisture content of each specimen is shown in Table 3. Each specimen was placed in a triaxial cell with a flexible membrane and was then saturated under 70 psi pressure. Multiple pressure increment tests were performed to verify that the specimen was saturated. Then, the specimen was consolidated under a differential pressure of 5 psi. After consolidation, a differential pressure between the top of the sample and the bottom of the sample was applied to create a pressure gradient in accordance with the ASTM procedure. The results of the hydraulic conductivity tests are presented in Table 3 and the data and results are included in Appendix 5.

### 3.4.3 Triaxial Shear Strength Tests

Following the hydraulic conductivity test, the cell was broken down to apply side drains to the specimen, and then the triaxial cell was reassembled to run a consolidated-undrained (C-U) triaxial shear strength test with pore pressure measurements (ASTM D4767). The results of the C-U tests are included in Appendix 6.

## 4.0 DESCRIPTION OF SOILS

### 4.1 General Stratigraphy

The site of the UWL is located in the flood plains of the Mississippi River and the Missouri River, although now the embankment for the BNSF railroad track effectively separates the site from the Missouri River. Deposition of soils in a flood plain of a river is dependent on the velocity of the water – as the flood waters slow the larger size particles are deposited first, and then the finer particles. The velocities of the water vary over the flood plain and with each flood as the topography changes. Therefore, soil deposits in a flood plain ("alluvial" deposits) vary greatly both with depth and in horizontal extent. The borings and test holes in the site reveal a typical alluvial stratigraphy.

Ameren Missouri Sioux Energy Center Utility Waste Landfill

## Table 2 Summary of Classifications of Phase 2 Samples

| Composite Group # | R&J ID # | Composite Sample Number | % Passing #200 Sieve | % Silt | % Clay | LL | PL | PI |
|---|---|---|---|---|---|---|---|---|
| **1** | H-1 | H-CH | 96.9 | 16.4 | 80.5 | 80 | 21 | 59 |
| | E-1 | E-CH | 99.3 | 12.5 | 86.8 | 82 | 28 | 54 |
| **2** | G-1 | G-CH | 93.4 | 25.2 | 68.2 | 69 | 21 | 48 |
| | D-1 | D-CH | 99.2 | 19.7 | 79.5 | 76 | 31 | 45 |
| | F-1 | F-CH | 98.7 | 23.7 | 75.0 | 72 | 28 | 44 |
| | B-1 | B-CH | 99.0 | 25.1 | 73.9 | 71 | 27 | 44 |
| **3** | A-1 | A-CH | 98.7 | 19.4 | 79.3 | 69 | 26 | 43 |
| | E-2 | E-CL | 99.0 | 19.7 | 79.3 | 67 | 24 | 43 |
| | C-1 | C-CH | 99.0 | 27.1 | 71.9 | 62 | 20 | 42 |
| **4** | C-2 | C-CL | 97.9 | 36.9 | 61.0 | 52 | 19 | 33 |
| | D-2 | D-CL | 98.9 | 36.0 | 62.9 | 59 | 27 | 32 |
| | A-2 | A-CL | 97.9 | 38.2 | 59.7 | 52 | 21 | 31 |
| | G-2 | G-CL | 92.3 | 43.5 | 48.8 | 47 | 18 | 29 |
| | E-3 | E-MCL | 96.3 | 48.1 | 48.2 | 46 | 19 | 27 |
| **5** | H-2 | H-CL | 95.6 | 51.7 | 43.9 | 43 | 21 | 22 |
| | C-3 | C-MCL | 93.5 | 49.8 | 43.7 | 40 | 20 | 20 |
| | A-3 | A-MCL | 90.7 | 47.7 | 43.0 | 39 | 19 | 20 |
| | B-2 | B-CL | 90.0 | 49.7 | 40.3 | 41 | 22 | 19 |
| **6** | D-3 | D-MCL | 94.8 | 51.3 | 43.5 | 40 | 23 | 17 |
| | B-3 | B-MCL | 97.2 | 58.5 | 38.7 | 39 | 22 | 17 |
| | F-2 | F-CL | 85.3 | 41.5 | 43.8 | 39 | 22 | 17 |
| **7** | G-3 | G-MCL | 96.7 | 61.1 | 35.6 | 37 | 21 | 16 |
| | H-3 | H-MCL | 93.2 | 56.8 | 36.4 | 36 | 22 | 14 |
| | F-3 | F-MCL | 83.2 | 52.3 | 30.9 | 33 | 20 | 13 |
| **8** | J-1 | J-CH | 99.3 | 18.2 | 81.1 | 70 | 22 | 48 |
| | K-1 | K-CH | 99.3 | 17.5 | 81.8 | 75 | 29 | 46 |
| **9** | K-2 | K-CL | 98.1 | 30.8 | 67.3 | 60 | 22 | 38 |
| | I-1 | I-CH | 99.3 | 29.0 | 70.3 | 61 | 24 | 37 |
| | I-2 | I-CL | 98.0 | 32.7 | 65.3 | 55 | 20 | 35 |
| | J-2 | J-CL | 98.2 | 32.2 | 66.0 | 53 | 20 | 33 |
| **10** | I-3 | I-MCL | 95.7 | 42.7 | 53.0 | 44 | 19 | 25 |
| | K-3 | K-MCL | 95.8 | 51.0 | 44.8 | 37 | 22 | 15 |
| | J-3 | J-MCL | 95.5 | 58.1 | 37.4 | 34 | 21 | 13 |

Ameren Missouri Sioux Energy Center Utility Waste Landfill

## Table 3: Summary of Geotechnical Properties of Phase 2 Composite Samples

| | | | | Standard Proctor, ASTM D698 | | Permeability Sample | | | Shear Strength Properties | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Composite # | USCS Classification | Liquid Limit | Plastic Index | Maximum Dry Density, pcf | Optimum Moisture Content | Initial Dry Density, pcf | Initial Moisture Content | Hydraulic Conductivity k, cm/sec | Undrained Cohesion, c, psf | Undrained Friction Angle, ϕ | Effective Cohesion, c', psf | Effective Friction Angle, ϕ' |
| 1 | CH | 85 | 62 | 89.9 | 27.9% | 90.7 | 29.3% | 1.5E-09 | 500 | 14.8° | 600 | 20.9° |
| 2 | CH | 77 | 53 | 93.2 | 25.5% | 93.7 | 27.1% | 2.2E-09 | | | | |
| 3 | CH | 74 | 52 | 93.0 | 26.3% | 92.7 | 28.2% | 1.9E-09 | | | | |
| 4 | CH | 54 | 34 | 100.4 | 21.7% | 100.5 | 23.8% | 3.0E-09 | | | | |
| 5 | CL | 42 | 22 | 102.5 | 19.6% | 103.7 | 20.6% | 2.7E-08 | | | | |
| 6 | CL | 40 | 18 | 101.7 | 20.2% | 94.2 | 26.5% | 1.7E-08 | | | | |
| 7 | CL | 36 | 14 | 101.7 | 19.5% | 96.1 | 25.0% | 2.3E-07 | 160 | 19.4° | 200 | 26.9° |
| 8 | CH | 80 | 58 | 90.6 | 26.5% | 91.3 | 27.8% | 3.6E-09 | | | | |
| 9 | CH | 61 | 41 | 96.9 | 23.2% | 95.2 | 26.5% | 2.8E-09 | | | | |
| 10 | CL | 42 | 25 | 101.6 | 19.4% | 99.2 | 22.3% | 1.6E-08 | | | | |
| 70% Composite #7 plus 30% fine Sandy SILT | CL | 30 | 23 | 102.3 | 18.0% | 98.1 | 23.6% | 4.5E-07 | 130 | 21.3° | 100 | 29.7° |
| Fine Sandy SILT | ML | | | 99.6 | 16.9% | 99.7 | 19.1% | 2.5E-05 | | | | |

The generalized logs from the geotechnical borings around the perimeter berm are illustrated in the profiles in Figures 2 through 4. The surface soils are generally clays and silty clays with scattered seams and layers of low plastic silt, underlain by silts. The thicknesses of these fine-grain deposits ranged from 0 to 24 feet, but generally between about 5 to 10 feet. The large number of Atterberg liquid limit (LL) and plastic limit (PL) tests performed on the Phase 2 test holes reveal that the clay soils are almost all high plastic (with a LL $\geq$ 50%). The LL measured on samples from the Phase 1 geotechnical borings ranged from 2% to 77% and averaged 44%. The LL measured on the samples from the Phase 2 test holes similarly ranged from 33% to 80%. The Plasticity Indices (PI) from the Phase 1 geotechnical borings ranged from 27% to 100% and averaged 70%. The PI of samples from the Phase 2 test holes ranged from 13% to 59%. The fine-grain soils are firm to stiff, with undrained cohesive shear strengths of 500 psf to over 2000 psf.

The upper fine-grain soils are underlain by sandy silts, silty fine sands, and fine sands, generally to a depth of 30 feet. These upper sandy soils are generally loose to medium-dense. The upper sandy soils are underlain by fine to coarse, poorly-graded sands (SP) and well-graded sands (SW), with some silty sands (SM) and gravelly sands at greater depths. Limestone bedrock is at a depth of about 115 feet. These lower sands generally ranged from medium dense to very dense, increasing in density with increasing depth.

### 4.2 Materials for Bottom Liner

Soils for the bottom composite liner must have the following properties from 10 CSR 80-11.01(10):

- Have particles with 30% or more passing a #200 U.S. sieve
- Have a liquid limit $\geq$ 20%
- Have a plasticity index $\geq$ 10%
- USCS Soil Classification of CL, CH or SC

The results on the Phase 2 soil samples presented in Table 2 show that all of the soils tested meet these criteria for use in the liner.

The report on the design of the gypsum stack previously submitted to SWMP by GER and A&A stated that the compacted soils for the liner will have a maximum hydraulic conductivity (K) of $1x10^{-7}$ cm/sec. The measured K for composite samples #1 through #6 from the main area of the UWL, and samples #8 through #10 from the south borrow area, all met or exceeded this criterion. The only composite sample that had a greater K ($2.3x10^{-7}$ cm/sec) was the low plastic clay (#7). The mixture of low plastic clay and 30% by weight sandy silt had a K of $4.5x10^{-7}$ cm/sec. Therefore, the low plastic clay, or a mixture with up to 30% sandy silt, meets the requirement for the final cover, which is a K of $1x10^{-5}$ cm/sec or less.

The descriptions of the Phase 2 soil samples presented in Appendix 2 show that both the suitable and unsuitable soils have the same range of colors, from dark gray or brown, to medium gray or brown, except that the light tan soils are generally non-plastic silts or sands that are not suitable. The soils will have to be segregated in the field on the basis of plasticity – that is, soils with a LL of 40% or greater will be suitable for the liner. All of the soils be suitable for the final cover, although cohesive soils are recommended rather than non-plastic silts or sands.

The surface plowed zone, varying from 0 to 15 inches deep, contains roots and decaying organic matter from the agricultural use. The surface soils containing organic matter should be excluded from the materials to be used in the liner. Where corn has been planted, the top soil may contain an abundance of root balls; this material should not be used for fill. The soils containing fine roots and organic matter may be used for surface vegetative covers and for construction of the perimeter berm.

### 4.3 Materials for Aquiclude Soil Protection and Final Cover

After the Aquiclude Geomembrane has been placed, tested and surveyed, a 12-inch thick layer of silty clay or clayey silt will be placed and semi-compacted by tracking with a small wheeled compactor or a low-ground pressure tracked dozer. The soil used will not contain rocks or any objects which might damage the geomembrane. The type of equipment will be selected based upon the Test Pad. The protective soil layer will be compacted such that there will be no rutting or displacement by the compaction equipment for the compacted clay of the bottom composite liner. The semi-compacted soil protection layer will have an approximate unit weight of 120 lbs./$ft^3$ and a minimum interactive friction angle of 15˚ with the aquiclude membrane as assumed for the stability analyses. Laboratory testing will be required to verify these properties once the soils and membrane are proposed.

Similarly, the soil for the final cover will be silty clay or clayey silt. The final cover will be placed and semi-compacted similar to the aquiclude soil protection layer. The soil used will not contain rocks or any objects which might damage the geomembrane. The semi-compacted soil layer will have an approximate unit weight of 120 lbs./ft3 and a minimum interactive friction angle of 20.5˚ with the HDPE membrane for the final cover as assumed for the stability analyses. Laboratory testing will be required to verify these properties once the soils and membrane are proposed.

### 4.4 Materials for Berm Construction

The other excavated materials, silty clays, clayey silts, sandy clays and clayey sands will be suitable for the construction of the perimeter berm, interior dikes and other fills. Cohesionless, permeable soils (poorly-graded sands, fine sands and gravels) should not be used for perimeter berms because these soils are erodible and may permit the build-up of hydrostatic pressures below the interior composite liner. The properties of the compacted berm soils will have a minimum undrained cohesive strength ($s_u$) of 800 psf, and a minimum effective cohesion (c') of 10 psf and a minimum effective internal friction angle ($\phi$') of 30˚. Laboratory testing will be required to verify these properties.

## 5.0 SEISMIC ANALYSES

The original seismic analyses for the Sioux UWL was based upon the criterion established in the MDNR-DRSP regulations. The Probable Maximum Acceleration (PMA) of bedrock was defined as 20% of gravity (0.20g) for St. Charles county. The required design criterion for an industrial water retention dam over 50 feet high and a Class II downstream environment was 0.5 PMA or 0.10g. Because Ameren will not be wet-stacking the gypsum in Cells 1 and 2, the UWL will no longer be regulated by the MDNR-DRSP. Therefore, the seismic design criterion has been revised to comply with the EPA 2015 CCR Rule.

Typical cross-sections were analyzed for slope stability using a pseudo-static horizontal acceleration as a body force on the soil and CCR masses to calculate the minimum factors of safety for a design seismic event. The seismic acceleration was based upon the USGS 2014 seismic hazard maps for a Peak Horizontal Ground Acceleration (PGA) for the geometric Maximum Credible Earthquake ($MCE_G$) with a 2% probability of exceedance in 50 years. A portion of the 2014 map which includes the SEC is reproduced in Figure 5. The PGA is 0.187g. This PGA must be adjusted to account for the soil profile at the site. This adjustment was based upon the ASCE7-10 code. The adjustment ($F_{PGA}$) from Table 11.8-1 for Seismic Site Class E is 1.434. Therefore, the adjusted Peak Ground Acceleration for the site effects ($PGA_M$) is equal to $F_{PGA}$ x PGA = 0.268g. This $PGA_M$ was used for liquefaction analyses.

A seismic coefficient of 0.5 was applied to the $PGA_M$ to determine the pseudo-static horizontal acceleration for stability analyses. This is consistent with the Mine Safety and Health Administration (MSHA) 2009 *Engineering and Design Manual for Coal Refuse Disposal Facilities*, in particular Chapter 7, "Seismic Design: Stability and Deformation Analyses." The manual cites research by Hynes-Griffen and Franklin (1984) which found that for a seismic coefficient of 0.5 the probable deformations would be less than 3 feet for a factor of safety of 1.0. Therefore, the pseudo-static horizontal acceleration of 0.134g was used for stability analyses.

## 6.0 LIQUEFACTION ANALYSES

Each of the geotechnical borings within the UWL was analyzed for liquefaction potential. The potential of liquefaction in the sands and silty sands was estimated using the analysis developed by H. Bolton Seed and others (H. Bolton Seed, et al, 1985). Liquefaction is the loss of shear strength during an earthquake due to the build-up of pore pressures and the corresponding decrease in effective stress ($\sigma'$). Liquefaction generally occurs in loose to medium-dense clean sands or silty sands below the ground water table. The analysis uses corrected N-values, $(N_1)_{60}$, from the SPT to estimate the cyclic stress ratio (CSR) that will cause liquefaction. The CSR is compared to the applied stress ratio (ASR) from the design seismic acceleration. N-values are corrected for a number of factors, such as the type of SPT hammer, the length and size of the drill rods, the diameter of the hole, etc. in accordance with ASTM D6066. The factor of safety (FS) against liquefaction is equal to the ratio of (CSR/ASR). A FS $\leq$ 1.0 is considered a high risk of liquefaction; 1.0 < FS $\leq$ 1.28 is considered a moderate risk of liquefaction, and FS > 1.28 is considered a low risk. The liquefaction analyses are included in Appendix 7 and are summarized in Table 4. The studies of liquefaction show that it does not occur below 50 feet. Therefore, the result of the analyses shown in the tables in Appendix 7 is shown as "n.a." for not applicable.

The maximum acceleration for the analyses is 0.268g. The moment magnitude ($M_W$) of the earthquake was assumed to be 7.5 which is the peak from the New Madrid Seismic Zone. The depth of the ground water table is critical in the liquefaction analyses. The elevation of the ground water table during the year of monitoring for the DSI varied between about 411 and 417. The water table was assumed to be at el. 417 for these analyses, because the probability of a flood occurring simultaneous with the design earthquake was assumed to be low. The onset of liquefaction decreases with increasing vertical effective stress. Therefore, the risk of liquefaction will decrease as the CCR height increases. Table 4 summarizes the results of the liquefaction analyses at locations where analyses determined there is greater than a low risk of liquefaction; the risk of liquefaction at the other locations of the Phase 1 geotechnical borings was low.

Ameren Missouri Sioux Energy Center Utility Waste Landfill
Table 4 - Summary of Results of Liquefaction Analyses

| Boring No. | Depth(s) Where Liquefaction Occurs, feet | Risk With Existing Ground Surface | Risk Under 30 Feet of CCR | Risk Under 40 Feet of CCR |
|---|---|---|---|---|
| B-58 | 18.5, 29, 36, 49 | High | High | Low |
| B-59 | 24, 29 | High | Low | Low |
| B-60 | 15, 19, 24 | High | High | Low |
| B-61 | 19, 24, 29 | High | High | High |
| B-62 | 19, 29 | High | High | Low |
| B-63 | 10, 29 | High | High | High |
| B-64 | 14 | High | High | High |
| B-65 | 24, 29 | High | High | Low |
| B-66 | 10, 19, 24, 29 | High | High | High |
| B-67 | | High | Low | Low |
| B-68 | | Moderate | Low | Low |
| B-69 | 19, 29 | High | High | Low |
| B-70 | 29 | High | Low | Low |
| B-71 | 24 | High | High | High |
| B-72 | 29 | High | Low | Low |
| B-73 | 14, 19, 24, 29 | High | High | Low |
| B-74 | | Moderate | Moderate | Low |
| B-75 | 19, 39, 49 | High | High | Low |
| B-76 | 15, 20, 25, 29 | High | High | Low |
| B-77 | 25, 30 | High | Moderate | Low |
| B-78 | 20, 25, 30 | High | High | Low |
| B-79 | 20, 30 | High | High | Low |
| B-80 | 25, 30 | High | Moderate | Low |
| B-81 | 10 | High | High | High |
| B-82 | 15, 20, 30 | High | High | Moderate |
| B-83 | 19, 29 | High | High | Low |
| B-84 | 14, 19, 24 | High | High | Low |
| B-85 | 19, 24 | High | High | Low |
| B-86 | 19, 29 | High | High | Moderate |
| B-87 | 14, 24 | High | High | Low |
| B-88 | 14, 19 | High | High | Low |
| B-89 | 29 | High | Low | Low |
| B-90 | 14 | High | High | Low |
| B-91 | 19 | High | High | Low |
| B-92 | | Low | Low | Low |
| B-93 | 19, 24 | High | High | Low |
| B-94 | | Low | Low | Low |
| B-95 | 19, 24, 29 | High | High | Low |
| B-96 | 24, 29 | High | Moderate | Low |
| B-97 | 24, 29 | High | Moderate | Low |
| B-98 | 24, 29 | High | Moderate | Low |
| B-99 | | Moderate | Low | Low |
| B-100 | 29 | High | Moderate | Low |
| B-101 | 14, 19, 29 | High | High | Low |
| B-102 | 19 | High | High | Low |
| B-103 | 14, 24, 29 | High | High | Low |
| B-104 | | Moderate | Moderate | Low |
| B-105 | 19 | High | High | Low |
| B-106 | 29 | High | Low | Low |
| B-107 | 24 | High | Moderate | Low |
| B-108 | 24, 29 | High | Moderate | Low |
| B-109 | 29 | High | Low | Low |
| B-110 | 19, 24, 29 | High | High | Low |
| B-111 | 29 | High | High | Low |
| B-112 | 24, 29 | High | Moderate | Low |
| B-113 | 14, 24, 44 | High | High | Low |
| B-114 | 19, 29 | High | High | Low |

A high risk of liquefaction is pervasive on the site at the natural ground surface, as shown in Table 4. The risk of liquefaction will be beyond the perimeter berms where the existing vertical effective stress will not be increased by the placement of CCR in the cells. The liquefiable strata are the silty sand or poorly-graded sand below the upper cohesive soils and silts. The potential consequences of liquefaction are loss of shear strength and settlement. The loss of shear strength would impact the stability of slopes, and therefore is addressed under that section of this report. Potential settlement due to liquefaction may occur beneath the cells and under the perimeter berms at least until the level of the CCR exceeds about 40 feet. The magnitude of the settlement due to liquefaction is estimated using the empirical relationship between volumetric strain, ASR and $(N_1)_{60}$ developed by Tokimatsu and Seed (1987), which is reproduced in Figure 6. The estimated settlements are shown in the following table:

Table 5 – Estimate of Settlement Due to Liquefaction

| | | Liquefaction Settlement (in) | | |
|---|---|---|---|---|
| **Boring** | **Section** | **Outside of the UWL (in)** | **Under Berm and 20' of Ash** | **Under 30' of Ash** |
| B-108 | A | 4.8 | 4.3 | - |
| B-61 | B | 3.8 | 3.1 | - |
| B-110 | C | 4.7 | 4.3 | 1.8 |
| B-84 | D | 3.9 | 3.5 | 0.9 |
| B-113 | E | 3.2 | 1.9 | - |
| B-95 | F | 7.8 | 6.7 | - |

The maximum estimated settlement due to liquefaction is about 7 inches in the vicinity of Boring B-95 either outside the cells or beneath 20 feet or less of CCR, but averages about 4 inches. Below about 30 feet of CCR, the estimated settlement due to liquefaction is about 2 inches or less. Tokimatsu and Seed estimate that the predicted strain is accurate to ±25%, so an estimated settlement of 5 inches is probably reasonable. So, the risk of damage to the composite liner and final cover due to liquefaction is minimal.

The data from the borings were analyzed to determine the PGA above which the potential for liquefaction is "moderate" to "high" for $M_w$ between 5 and 7.5. For the natural ground surface outside of the UWL, the minimum PGA for the potential occurrence of liquefaction is 0.04g to 0.06g. Under the berms or 20 feet of CCR, the minimum PGA for the potential occurrence of liquefaction is the same. Ameren should complete a topographic survey of the tops of the perimeter berms following a seismic event with a PGA of 0.04g or greater to determine where there may be settlement that would make the top of the berm less than the design flood event. Also, there may be some subsidence of the outside of the perimeter berms which would need to be addressed.

## 7.0 CONSTRUCTION RECOMMENDATIONS

### 7.1 Field Classification of Soils

The field classification of soils will require full-time observation and testing by experience soils technicians due to the variability of the strata. If the soils from on site are used, then the results of the laboratory testing that are summarized in the report may be used. If soils are imported from offsite, then laboratory testing of those imported fill soils will have to be performed to verify that the shear strength properties and other properties of the compacted fills will meet or exceed the parameters used in analyses. Since such laboratory testing will take some time, it would be best if the fill soils are stockpiled on site prior to construction.

As stated previously, the top soil with organic matter must be stripped for use in fills other than the liner or stockpiled on site. Based on the Phase 2 borings, the depth of stripping to remove organics and surface non-plastic soil will vary from 0 to 1.4 feet, and may average about 0.6 feet. The compacted composite samples of fine-grain soils all had suitable permeabilities for use in the bottom composite liner (less than $1x10^{-7}$ cm/sec), except Sample 7 which was composed of the silty soils ("MCL") from Areas F, G and H (see Figure 8-0). These silty soils had fine sand contents up to 17%, clay contents less than 36%, and a liquid limit (LL) of 36%. Clays and silty clays with a liquid limit (LL) of 40% or greater may be used as liner material. The low plastic clay and silty clay, containing up to 30% silt or sandy silt, will be suitable for the final cover. The soils will have to be segregated on the basis of plasticity.

The natural moisture content of the clayey soils measured in the Phase 1 and Phase 2 borings ranged from about 24% to 43%, and averaged about 33%. The optimum moisture contents ranged from about 20% to 28%. So, these soils will have to be partially dried prior to placement. Soils may be dried by spreading the loose soil in lifts about 8 inches thick, and discing the soil using multiple passes.

Clays and silty clays that will be used for constructing the clay component of the bottom liner will be segregated and stockpiled prior to construction of the test pad or liner to provide sufficient time to test the homogeneity of the stockpile and to develop compaction criteria. The initial segregation soils for the liner will be based on ASTM D2488 "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)." This procedure will enable an experienced soils technician to segregate soils as they are excavated based on plasticity. Specifically, three simple hand procedures are used to describe the plasticity of the soil: dry strength, dilatancy and toughness. If a sample has low to medium strength upon drying, rapid dilatancy and low toughness, then the soil probably would not be suitable for the liner and therefore will be stockpiled separately. Also, if the soil has more than a trace of sand, then it also will be stockpiled separately.

The soils technician and construction superintendent will delineate an area of soil to be excavated that is suitable for liner material based on the plasticity of the exposed surface. Scrapers will load the soil cutting no more than 6 inches deep. The newly exposed surface will be evaluated and the limits of the area will be changed, if necessary, to separate unsuitable soil. In this way, the classification of the soils going to the stockpile of liner material can be controlled sufficiently.

The high plasticity clay probably will come out of the scrapers in “slabs.” A disc will be run over the newly-deposited material to break up the large pieces. A dozer will grade the newly-deposited material to form a loose lift about 12 inches thick. Then, a large soil stabilizer, such as a Caterpillar SS250 will make a pass over the newly-deposited material. A soil stabilizer is used to excavate the surface up to 18 inches deep, pulverize the high plastic clay, thoroughly mix a stabilizing chemical such as lime or fly ash with the soil, and redeposit a blended, homogeneous mix. The newly-deposited soil will be blended with the previous lift by limiting the thickness to 12 inches and cutting up to 18 inches deep. Bag samples will be collected randomly from each lift in the stockpile for subsequent testing in the lab, to verify the homogeneity of the stockpile.

### 7.2 Compaction Criteria

Bag samples from the stockpile of liner material will be tested for grain-size distribution (i.e. hydrometer test), and liquid and plastic limits. If any volume of the stockpile differs significantly in these index properties, then that volume can be delineated, and separate compaction criteria can be developed for that material, or it can be rejected as liner material. Compaction criteria for the blended liner material in the stockpile will be developed using the “Daniel Method.” Daniel and Benson (1990) have determined that compaction criterion as a percentage of the maximum dry unit weight alone is not sufficient to assure the required minimum hydraulic conductivity. They recommend performing a series of compaction tests and hydraulic conductivity tests on each soil type to determine the acceptable “window” of dry density and moisture content that will meet the hydraulic conductivity requirements.

The stability of the perimeter berm requires higher shear strength than for the liner, etc. Therefore, the compaction of the materials in the perimeter berm should be an average of 100% of the maximum dry unit weight determined by the standard Proctor moister-density test, with no tests less than 95% of the same maximum dry unit weight. The moisture content at the time of compaction should be at optimum or a maximum of 4% above optimum.

Fill supporting structures, such as the pump building, should be compacted to the same criterion for the perimeter berm. There are no limits on the moisture content at the time of compaction for fills outside of the perimeter berm except as necessary to achieve the required dry unit weight.

Fills should be placed in horizontal lifts not exceeding 8 inches in thickness and compacted by uniform coverage with a suitable compactor. Cohesive fill should be compacted using a heavy tapered-foot compactor, with or without vibration. The final lift of cohesive fill should be compacted by a smooth-drum roller. Cohesionless fill, such as the silty sand or fly ash, should be compacted by a heavy vibratory compactor.

### 7.3 Quality Assurance

#### 7.3.1 Test Pad

The plasticity indices of the bottom liner materials exceed 30%. Therefore, a test pad is required prior to construction to test the materials to be used for the liner, and the construction methods. The test pad must be large enough to accommodate the actual construction methods and equipment that will be used for the actual construction of the liner. The test pad should include a section on a 3(h)-to-1(v) slope to test the construction of the aquiclude membrane and protective soil layer on the interior berm slopes. This may be completed at the existing perimeter berm for Cell 1 or Cell 4A. The compaction criteria previously developed for the liner material will be used to construct the test pad. The geotechnical engineer is required to take undisturbed samples of the fill to measure the density and hydraulic conductivity. Bulk samples of the fill material must be taken to perform LL and PI tests and standard Proctor tests. Also, a minimum of two test pits are required to examine the interface between lifts of materials, to verify bonding of the lifts. A field permeability test is also required. A test pad is not necessary for the fill to be placed in other areas, such as the perimeter berm.

The proposed plastic membrane aquiclude will be placed on the suitable subgrade and then 12 inches of protective soil cover will be placed and lightly compacted on the membrane. Where the aquiclude membrane is on the floor of the cell, the protective soil cover may be a sand. However, sand is not acceptable on the 3(h)-to-1(v) side slope of the perimeter berm. A low plastic silty or sandy clay would be preferred.

### 7.3.2 QA During Construction

The successful completion of the test pad will verify the acceptable construction methods for the dual liner and the proposed high plastic clay for the composite liner. Field density tests must be made of each lift of fill during compaction. If this is accomplished using a nuclear density gauge, then the gauge must be checked regularly by taking undisturbed drive tube samples and measuring the dry unit weight and moisture content by laboratory tests. This is particularly true for the high plastic clays. MDNR-SWMP rules also require taking bulk samples of the fill material used in the liner, to perform LL and PI tests, standard Proctor tests, and a hydraulic conductivity tests for every 5000 cubic yards of liner placed.

Following the completion of the protective soil layer, the membrane installation subcontractor will perform a non-destructive survey of the aquiclude geomembrane to demonstrate that there are no leaks in the geomembrane. This survey may be a "spark" test or an electrical conductivity test or other method approved by the CQA Engineer. The same survey method may be used for the Test Pad.

## 8.0 STABILITY ANALYSES

Seven sets of slope stability analyses were performed on the proposed UWL profile. Generalized soil profiles were developed for widely-spaced sections, A through F, the locations of which are shown in Figure 8-0. The soil properties for the natural cohesive soils were estimated from the triaxial shear strength tests performed for the Phase 1 geotechnical investigation. The internal friction angle and unit weight of sands were estimated from the corrected N-values using standard empirical relationships. The soil properties of compacted fills were estimated from tests on compacted samples. The soil properties used in the slope stability analyses are shown on the profiles Appendix 8. <u>The stability analyses were completed based upon the design with the geomembrane aquiclude. If the design of the dry cells is changed to include the base fill below the bottom liner instead of the aquiclude, then the stability analyses will have to be recalculated for the permit modification based upon the properties of the soils used for the base fill.</u>

The slope stability analyses were performed using the computer program SLIDE 18. This program uses the Spencer method, which resolves the static forces on each vertical slice of soil profile along randomly generated failure surfaces. Two methods are used. The first method is to assume circular failure surfaces. A grid of possible centers for the circular failure surface is specified, as well as the possible bottom elevation of the failure surface. The program searches for the minimum factor of safety (FS) against slope failure for each center point in the grid by incrementally varying the radius of the failure surface. The plotted results from the program show the minimum FS, the center and radius of the failure surface with the minimum FS. The output of the program also plots contours of equal FS within the grid of possible center points. The second method is based upon a multi-linear failure surface. This method is used where there is a plane of weak shear strengths, such as along a composite liner or dual liner. The analyses are the same, that is searching for a configuration of a multi-linear failure surface which results in a minimum factor of safety. All of the results are presented graphically in Appendix 8. Stability analyses were performed at each section for initial and final stages of construction, and using short-term (undrained) properties and long-term properties as appropriate. Stability analyses were also performed for the pseudo-seismic loading, and the post-seismic static conditions were liquefaction exist in the natural soil strata below the groundwater table where there is a high risk. The results of the stability analyses are presented in the following Table 6.

Table 6 – Summary of Results of Stability Analyses

| | End of Initial Construction (Short-Term) | Completed, Full Cell Global Stability | Seismic (0.131g) Completed, Full Cell | Post-Seismic With Liquefied Strata |
|---|---|---|---|---|
| Required Min. FS | 1.4 | 1.5 | 1.0 | 1.0 |
| A) West Berm Cell 1 | 1.81 | 1.86 | 1.46 | 1.87 |
| B) North Brem Cell 2 | 2.46 | 1.83 | 2.06 | 1.88 |
| C) North Berms, Cells 4 & 5 | 2.94 | 1.85 | 1.15 | 1.33 |
| Temporary East Berm, Cell 4A | | 1.64 | 1.05 | |
| D) South Berms, Cells 6 & 7 | 2.68 | 1.71 | 1.03 | 1.83 |
| E) South Berm, Cell 2 | 1.80 | 1.84 | 1.47 | 1.74 |
| F) Southwest Berm, Cell 1 | 1.80 | 1.86 | 1.27 | 1.07 |

## 8.1 Stability of Perimeter Berm

The short-term stability of the perimeter berm was analyzed at each of the six sections using undrained shear strengths for the compacted clay of the berm. The berm may be constructed of clays, ash or non-plastic silts and sands. For the short-term stability analyses, a cohesive shear strength of 800 psf was used, assuming the berm is built entirely of high plasticity clay. This is not likely, but is the worst case for short-term stability. The height of the CCR was assumed to be el. 441 for the short-term stability analyses. The minimum FS ranged from 1.80 to 2.94, which exceed the required minimum of 1.4. The stability analyses for the Recycle Pond (Section B-B) were run with the pond at the lowest operating level (el. 435). When the Recycle Pond is drained after the UWL is closed, then the FS for the stability of the berm will be about 1.8 similar to the other berms.

## 8.2 Global Stability of Full Cells

The global stability of the full cells – gypsum and dry CCR – were analyzed using drained-strength properties. An internal friction angle, ϕ', of 30˚ was assumed for the perimeter berms because of the various materials which may be used. The average saturated weight of the gypsum was assumed to be 110 pcf based upon information from A&A. The average ϕ of the gypsum was assumed to be 41˚, also based on the recommendation from A&A. As summarized in Table 6, the FS varied from 1.64 to 1.86, which meet or exceeds the minimum required FS of 1.5.

The slope stability of the temporary east berm of Cell 4A, which was built with fly ash, was analyzed for the Addendum to the CPM that was submitted in February 2011 based upon new shear strength tests (see Appendix 2.1). The long-term FS was 1.64. The slope stability of the east berm was re-analyzed for the Phase 3 CQA report of Cell 4A based upon new properties of the fly ash placed in Cell 4A (see Appendix 2.2). The long-term FS was 1.73.

## 8.3 Seismic Slope Stability

Global stability analyses were also performed of the full cells for a seismic event using a pseudo-static horizontal acceleration of 0.134g. The FS for the various sections ranged from 1.03 to 2.06, which meets or exceeds the required FS of 1.0. The temporary east berm of Cell 4A was also re-analyzed for a pseudo-static horizontal acceleration of 0.134g and a full cell. The minimum FS is 1.05 (see Figure 8-13). This is conservative because Cell 4B should be built before Cell 4A is filled to capacity so that this condition will not occur.

## 8.4 Post-Seismic Event with Liquefaction

At the locations where the liquefaction analyses indicated a high potential for liquefaction in a stratum, a residual cohesive shear strength was input for the liquefied soil stratum. The residual cohesive shear strength was estimated from the empirical relationship recommended by H. Bolton Seed (1987). This relationship is reproduced in Figure 7. Both the global stability of the full cell and the stability of the perimeter berm were analyzed using the post-liquefied shear strength of the subject soil stratum and no applied horizontal acceleration in accordance with the draft technical guidance document from SWMP and Stark (1998). The FS for this condition ranged from 1.07 to 1.88, which meets or exceeds the required FS of 1.0.

## 8.5 Stability of the Final Cover

The final cover of each cell will consist of a double-textured HDPE geomembrane on top of the CCR, followed a non-woven geotextile and then 24 inches of soil cover. The first 18 inches of soil cover will consist of compacted silty clay or sandy clay, covered with 6 inches of semi-compacted vegetative soil cover. The initial slope of the sides of the gypsum stack will be 4(h)-to-1(h). The stability of the final cover was analyzed. The calculations are included in Appendix 8. The factor of safety against sliding of the cover is the minimum desired of 1.5 for the silty clay with properties given in Section 4.3. As stated in Section 4.3, these properties will be verified by laboratory testing with the proposed soil and HDPE geomembrane.

# 9.0 SETTLEMENT ANALYSES

## 9.1 Estimated Settlements

Settlement analyses were completed using the computer program SETTLE3D. Six subsurface profiles were developed from borings within the project area. These are depicted graphically in Appendix 10. The settlement values were calculated assuming that all cells had been filled to an average elevation of 520 ft. Consolidation coefficients ($C_C$ and $C_R$) for cohesive materials were obtained from load increment consolidation tests run on representative undisturbed samples from the Phase 1 borings. The stress-strain modulus ($E_S$) for granular materials was estimated using cone penetration test (CPT) data obtained from the WFGD project at the Sioux Energy Center. $E_S$ is approximately 3 times the measured CPT $q_c$-value of resistance (Bowles, 1997). It was assumed that using the CPT data for the proposed UWL site was valid because a plot of standard penetration test (SPT) N-values shows similar stratigraphy for both sites, and N-values obtained at the UWL are generally larger than those at the plant. A plot of the N-values for the Sioux Energy Center and at the UWL site is shown in Figure 8. The CPT data are almost continuous with depth and are more reliable than SPT data. Therefore, the CPT data should provide a better estimate of the $E_S$ for the granular materials. A comparison of the variation in computed Es with depth based on the corrected N-values and the CPT data is shown in Figure 9.

The estimated settlements were calculated for the full load of the cells assuming that all of the loads from the berms and the full cells are placed simultaneously. The pattern of the loading stress is depicted graphically from the SETTLE3D input in Appendix 10. This is conservative with regard to the consequences of settlement (deformations of the berms and strains on the HDPE membranes) because the settlement resulting from the construction of the existing berms, the filling of Cell 1, and the filling of Cell 4A have already occurred. The estimated settlements are depicted graphically in the plan in Appendix 10. The maximum total settlement occurs in the northwest corner of Cell 4A, and is about 22 inches.

The estimated settlements under the full cells on an east-west centerline section are plotted in Figure 10 (Section H-H in Figure 8-0). The maximum settlement along this section occurs in Cell 4A and is about 20 inches. The estimated settlements in the dry cells range from about 20 inches to 14.5 inches on the east side of Cell 5. The estimated settlements in Cells 1 and 2 vary with the height of the gypsum from about 5.5 inches to 8 inches. The estimated settlements at the berms between cells is about 6 inches except for the east berm of Cell 5 which is about 4.5 inches. The maximum differential settlement occurs along the west slope of Cell 4A, which is about 15 inches (20 inches minus 5 inches at the west berm).

The estimated settlements in a north-south section through the full dry CCR Cells 7 and 4B (Section I-I in Figure 8-0) are plotted in Figure 11. The estimated settlement in the interior of the full cells vary from about 14 inches to 18.2 inches.

The estimated settlements in a north-south section through the full Cell 2 are plotted in Figure 12 (Section G-G in Figure 8-0). The estimated settlement in the interior of the full cells vary from about 4.5 inches to 18.5 inches.

The consolidation of the foundation soils may result in up to 6 inches of settlement at the top of the perimeter beam when the CCR reaches the full height and extent. This will be a slow process, so the settlement will occur over a number of years. The top of the perimeter berm will be at el. 446, which is 7 feet above the 100-year flood level, and 5 feet above the 1993 flood level. Therefore, the estimated settlement will not reduce the top of the perimeter berm to below the flood levels. Monuments should be set in the top of the perimeter berm at about 300-foot centers, and the settlement of the top of the berm should be measured as the cells are filled. The measured settlement may be used to adjust the model for the estimated settlements. Also, if Ameren wants to maintain the top of the perimeter berm at el. 446, then it may be necessary in the future to build out the exterior toe of the berm in order to raise the top.

### 9.2 Strain of HDPE Liner

The estimated settlements will occur over long distances, such that the differential settlement will be small, at a slope of about 1%. The liner will undergo differential settlement 0.9 feet between the crest of the perimeter berm to the inside toe of the berm (a horizontal distance of 69 feet), and 15 inches from the inside toe of the berm to a point below the crest of the Cell 4A (over 190 feet). The increase in lengths of the slopes after full settlement has occurred compared to the initial lengths will be 0.007% and 0.004%, respectively. A strain of less than 1% is acceptable, because the yield strength of most HDPE liners occurs at more than 12%. Therefore, the strain in the HDPE liner resulting from the estimated differential settlements are acceptable.

### 9.3 Slopes of Leachate Collection Pipes

The design slope of the buried leachate collection pipes in the dry cells must be a minimum of 0.5%. The settlement under the central portion of the cells will be relatively uniform. There will be some differential settlement of the pipes from top of the 4(h)-to-1(v) side slope to the sump at the toe of the perimeter berm. The estimated differential settlement on the west side of Cell 4A is about 14.2 inches or a change in the slope of the pipe of about 0.3%. The estimated differential settlement on the north side of Cell 4B is about 11 inches or a change in the slope of the pipe of about 0.3%. Therefore, the constructed slope of the leachate collections pipes from the top of the 4(h)-to-1(v) side slope to the sump should be 0.8%, or preferably 1.0%, to maintain a slope of 0.5% after settlement.

## 10.0 BEARING CAPACITY

The only structure at the UWL will be the pump house at the Recycle Pond. The pump house will be founded on compacted fill, with the grade at el. 446. Therefore, the bearing capacity of the natural soils is not a concern. The bearing capacity of the natural high plastic clay, which would be the lowest of the natural soils, was analyzed using undrained shear strength of 800 psf, and using drained strength properties. The net allowable bearing pressure for the natural high plastic clay is 2500 psf for continuous or strip footings and 3000 psf for square footings. These values are for the undrained strength and a factor of safety of 2.0.

Using the drained strength properties and a factor of safety of 3.0, the net allowable bearing pressure for the natural high plastic clay is 2500 psf for strip footings and 3000 psf for square footings up to 10 feet in plan. A factor of safety of 3.0 is used for the drained or long-term case to control settlement. The allowable bearing capacity of shallow footings in compacted fill will also be the lowest where the high plastic clay is used; for example, box culverts over the compacted clay liner. Using the drained strength properties of the compacted sample and a factor of safety of 3.0, the net allowable bearing pressure for the natural high plastic clay is 5000 psf for strip footings and 6500 psf for square footings up to 10 feet in plan. The bearing capacity calculations are included in Appendix 8.

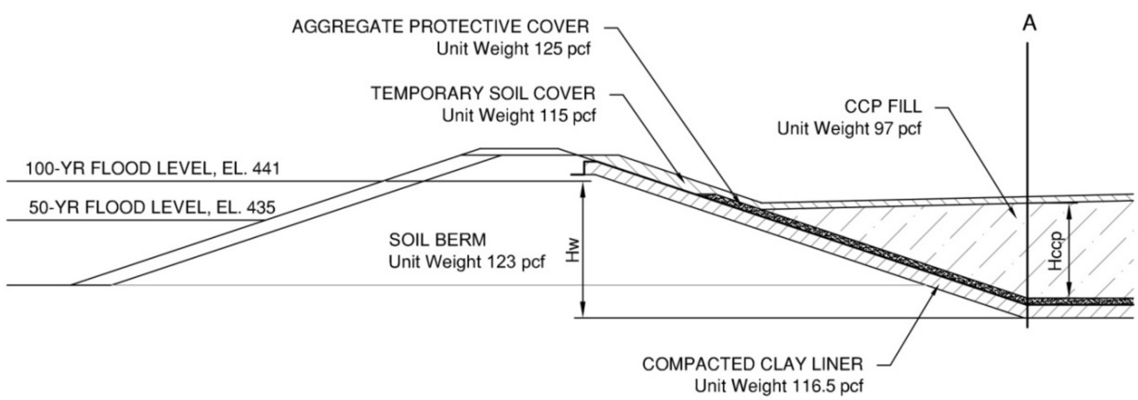
The bearing capacity of the natural soils below the perimeter berms and cells was analyzed using the SLIDE model as shown in Figure 8-28. The profile at Section F-F was selected as the worst case. The ultimate bearing capacity for the natural subgrade (consisting of primarily clayey silts, silty clays and sands, is 50,000 psf. This is applicable to the outside toe of the perimeter berms. This type of slope failure is included in the global slope stability analyses of the various sections in Appendix 8.

## 11.0 HYDROSTATIC PRESSURES

### 11.1 Liner

A flood condition surrounding the UWL would impose a hydrostatic uplift pressure on the bottom of the composite liner. This uplift pressure is initially only resisted by the weight of the composite liner, specifically the clay. To maintain a factor of safety of 1.5 against upward displacement and rupture of the liner, the 2 feet of clay can resist an upward pressure equal to about 2.5 feet of water. Therefore, the level of the water in the Recycle Pond and wet disposal cell must initially be no more than 2.5 feet below the level of the flood water surrounding the UWL.

The calculation of the FS against excess hydrostatic pressure (i.e. uplift) on the bottom liner in a dry cell during a flood is illustrated in the following diagram:




The Factor of Safety against uplift ($FS_{uplift}$) should be calculated at the lowest point which is the inside toe of the exterior soil berm (Point A in above section.)

$$FS_{uplift} = \frac{\text{Weight of Materials Above Bottom of the Aquiclude}}{\text{Hydrostatic Uplift Pressure}}$$

where the weight of materials is the sum of the weight of CCR fill, weight of temporary soil cover, 2 feet of compacted clay liner, the protective soil cover on the aquiclude membrane where present, and the weight of water in the cell, if any. The average or assumed moist unit weight of each material is shown in the above section.

The hydrostatic uplift pressure is the difference in elevation between the flood level and the level of the aquiclude (Hw) multiplied by the unit weight of water (62.4 PCF). For a dry cell where an aquiclude is present, the $FS_{uplift}$ is calculated by:

At Point A: $$FS_{uplift} = \frac{\text{Hccp x 97 PCF+(2 ft)(115 PCF)+(1 ft)(125 PCF)+(3 ft)(115 PCF)}}{\text{Hw x 62.4 PCF}} = \frac{\text{Hccp x 97 PCF+700 PSF}}{\text{Hw x 62.4 PCF}}$$

For example, if the aquiclude is at el. 426, then $H_W$ for the design flood is (441 – 426) = 15 feet of water. For a $FS_{uplift}$ = 1.1, the height of CCR in the cell must be 3.4 feet or at el. 433.4 to the top of the CCR. The construction for each new dry cell must require the initial filling of the dry cell as soon as it is operational with CCR to achieve the minimum $FS_{uplift}$ of 1.1.

### 11.2 Perimeter Berm

The perimeter berm will act as a flood protection levee to separate the UWL from potential flood water. Therefore, the perimeter berm will be designed in accordance with standard practice for flood protection levees. The recommended soil for the construction of the perimeter berms is presented in Section 4.4.

## 12.0 EROSION PROTECTION

The embankments for the BNSF railroad track and Ameren Missouri's spur track isolate the UWL from the flow of flood waters. Flood water surrounding the UWL will be backwater from the Mississippi River downstream, and therefore will have little flow that could cause erosion of the perimeter berm.

During the flood of 1993, the BNSF embankment separated the higher flood level of the Missouri River from the Mississippi River. Eventually, this differential hydrostatic pressure caused a failure at a weak point in the embankment, creating the scour hole shown in Figure 1. The existing elevation contours indicate that the flow from the scour hole extended across the site of the UWL and extended downstream to the southeast. If this event happened in the future, the UWL would block the flow from the scour hole. Such a failure would not necessarily occur at the same location, but this would be the most likely location even if the scour hole were filled. The surrounding topography and the UWL would create constrictions to the flow at Sections X and Y shown in Figure 8-0. The constrictions would increase the flow of the water and may cause erosion of the perimeter berm at these locations. Also, the reach of the perimeter berm facing the scour hole would be subject to the impact of the flow from the scour hole.

To analyze this emergency condition, several assumptions were made:

- a breach 160 feet wide occurs at the location of the scour hole, a repeat of the 1993 failure
- water on the Mississippi side ponds to el. 430.
- the water level on the Missouri River side is at el. 439.

- essentially all of the flow from the breach will flow through the south constriction (at Section Y).

The estimated flow from the breach is 9800 cu. ft/sec. The impact velocity on the southwest reach of the perimeter berm is 6.5 fps. The velocity of the flow through the south constriction is about 4 fps on the side of the berm. The calculations of the velocity of flow from the breach and the design of a riprap layer on the perimeter berm are included in Appendix 11. The riprap layer should be a minimum of 15 inches thick. The riprap should be sound limestone, ranging in size from 4 to 9 inches. The riprap layer should be placed on a 6-inch thick bedding layer of 2-inch minus crushed rock. The riprap should extend up to el. 439 on the perimeter berm. The riprap should extend from a point on the southern berm opposite the east boundary of Cell 1, to a point on the northern berm opposite the same east boundary of Cell 1. The profile of the riprap layer is shown in Figure 13.

## 13.0 REFERENCES

American Society of Civil Engineers (2013), *Minimum Design Loads for Building and Other Structures*, Standards ASCE/SEI 7-10, 3rd printing.

Bowles, Joseph E. (1977), *Foundation Analysis and Design*, 5th Edition, McGraw-Hill Companies, New York, pp. 1175.

David E. Daniels and Craig H. Benson (1990), "Water Content-Density Criteria for Compacted Soil Liners," *Journal of Geotechnical Engineering*, ASCE, Vol. 116, No. 12, December, pp. 1811 - 1830.

H. Bolton Seed, K. Tokimatsu, L.F. Harder and Riley M. Chung (1985), "Influence of SPT Procedures in Soil Liquefaction Resistance Evaluations," *Journal of Geotechnical Engineering*, ASCE, Vol. 111, No. 12, pp. 1425 – 1445.

Hynes-Griffen, M.E. and A.G. Franklin (1984), "Rationalizing the Seismic Coefficient Method," Miscellaneous Paper GL-84-13, U.S. Department of the Army, Corps of Engineers, Waterways Experiment Station, Vicksburg, MS.

Kohji Tokimatsu and H. Bolton Seed (1987), "Evaluation of Settlements in Sands Due to Earthquake Shaking," *Journal of Geotechnical Engineering*, ASCE, Vol. 113, No. 8, pp. 861 – 878.

Mine Safety and Health Administration (2010), *Engineering Design Manual, Coal Refuse Disposal Facilities*, Second Edition.

Seed, H. Bolton (1987), "Design Problems in Soil Liquefaction," *Journal of Geotechnical Engineering*, ASCE, Vol. 113, No. 8, pp. 827 – 845.

Solid Waste Management Program and Timothy D. Stark (1998), “Draft Technical Guidance Document on Static and Seismic Slope Stability for Solid Waste Containment Facilities,’ Division of Environmental Quality, Missouri Department of Natural Resources.

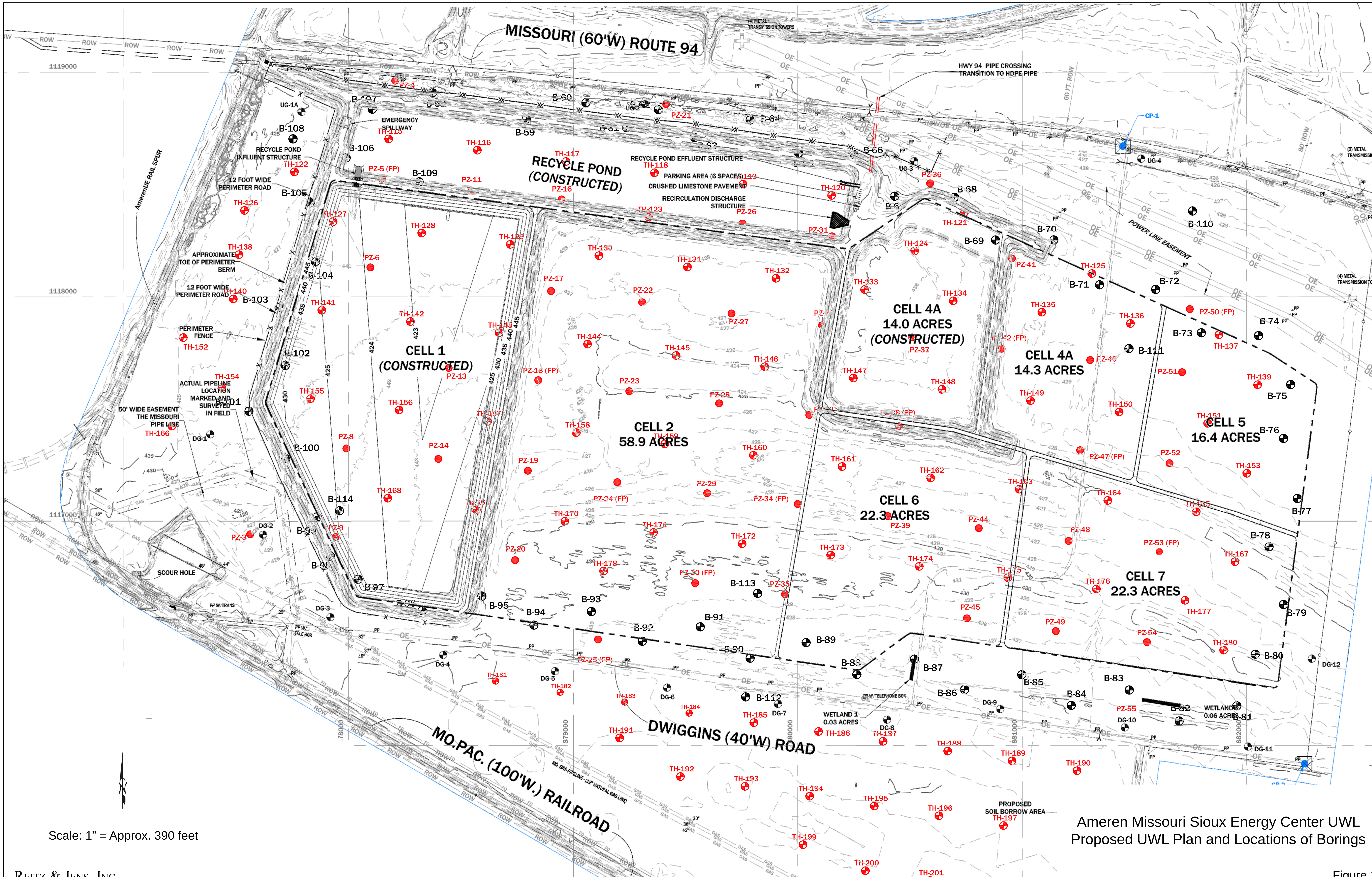
Stark, T.D. and G. Mesri (1992), “Undrained Shear Strength of Liquefied Sands for Stability Analysis,” *Journal of Geotechnical Engineering*, ASCE, Vol. 118, No. 11, pp. 1727 – 1747.

Swenty, Brian J. (1989), “Engineering Analysis of Dams,” Missouri Department of Natural Resources, Division of Geology and Land Survey, Dam and Reservoir Safety Program.

Terzaghi, Karl and Ralph B. Peck (1948), *Soil Mechanics in Engineering Practice*, John Wiley & Sons, New York, 729 pp.

Lambe, T. William and Robert V. Whitman (1969), *Soil Mechanics*, John Wiley & Sons, New York, 553 pp.

Li, K.S. (1995), Discussion “Foundation Uniform Pressure and Soil-Structure Interaction,” *Journal of Geotechnical Engineering*, ASCE, Vol. 121, No. 12, pg. 912.

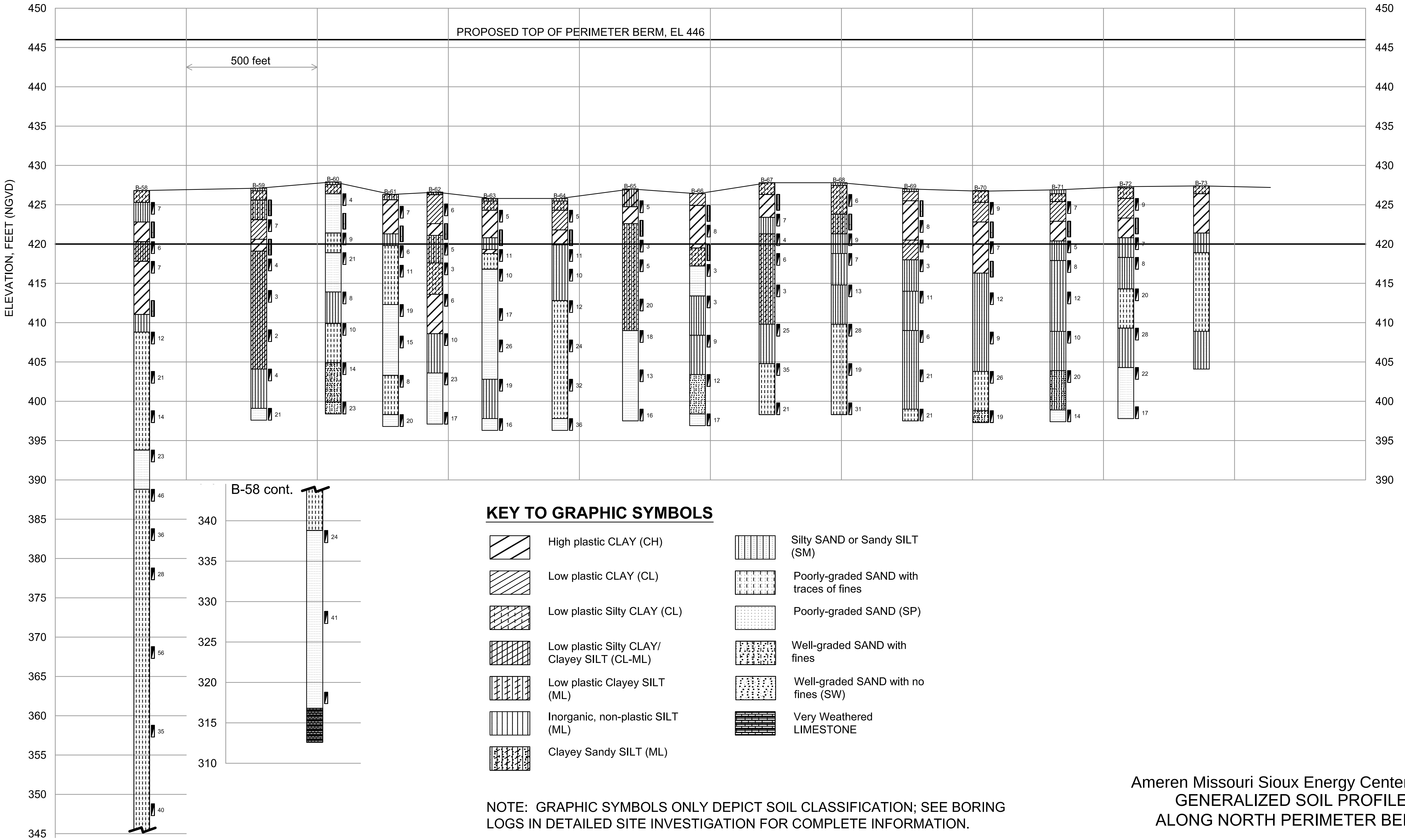



Scale: 1” = Approx. 390 feet

Ameren Missouri Sioux Energy Center UWL
Proposed UWL Plan and Locations of Borings

REITZ & JENS, INC.

Figure 1

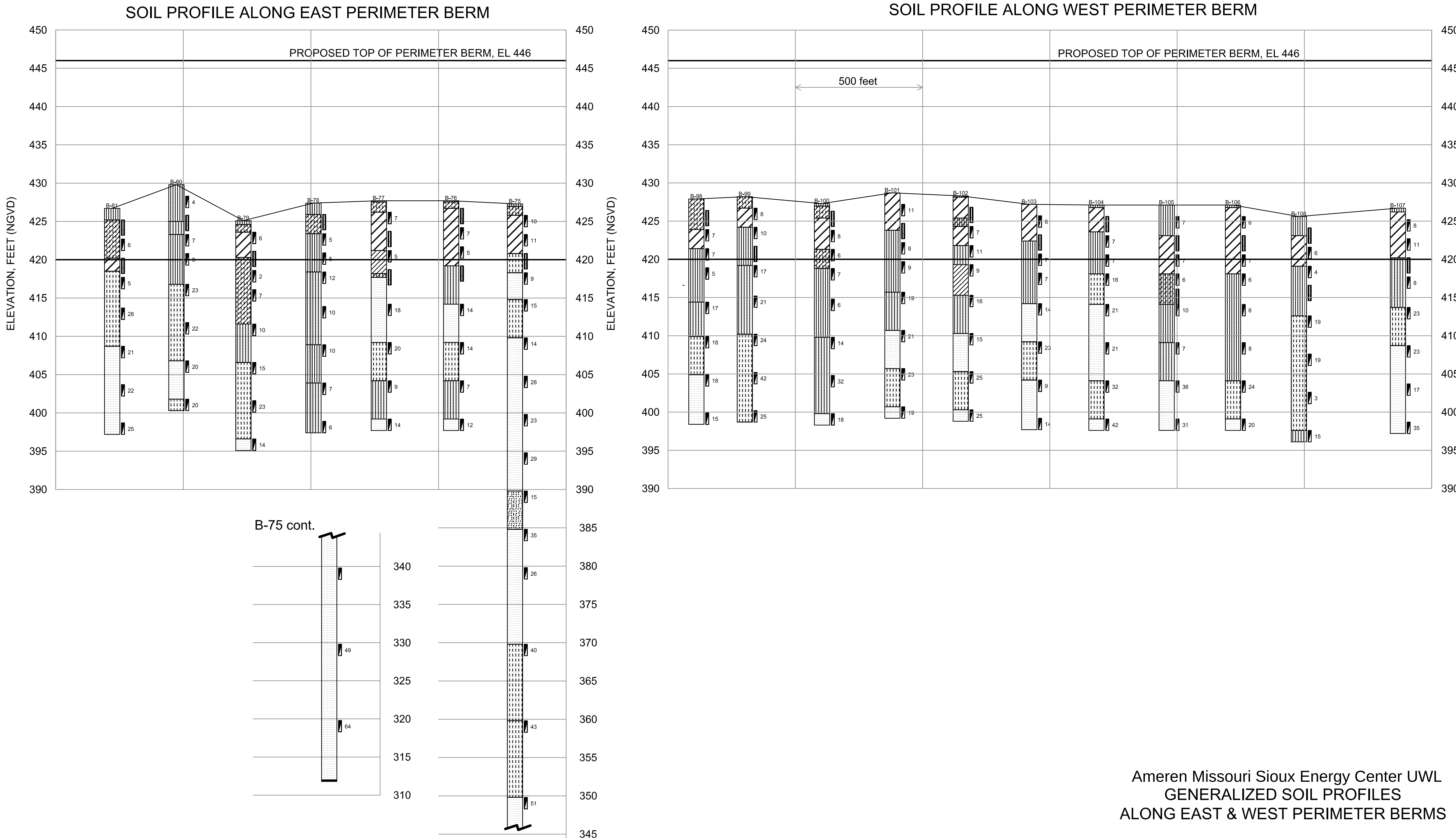



NOTE: GRAPHIC SYMBOLS ONLY DEPICT SOIL CLASSIFICATION; SEE BORING LOGS IN DETAILED SITE INVESTIGATION FOR COMPLETE INFORMATION.

Ameren Missouri Sioux Energy Center UWL
GENERALIZED SOIL PROFILE
ALONG NORTH PERIMETER BERM

REITZ & JENS, INC.

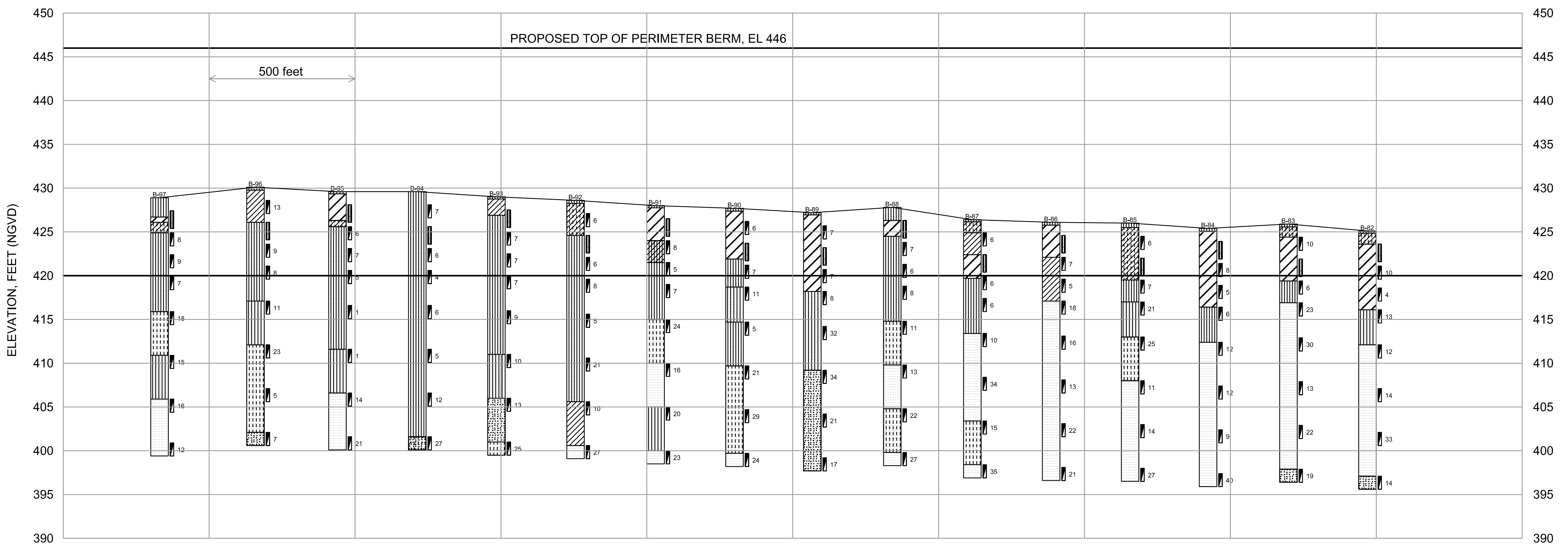
Figure 2




Ameren Missouri Sioux Energy Center UWL
GENERALIZED SOIL PROFILES
ALONG EAST & WEST PERIMETER BERMS

REITZ & JENS, INC.

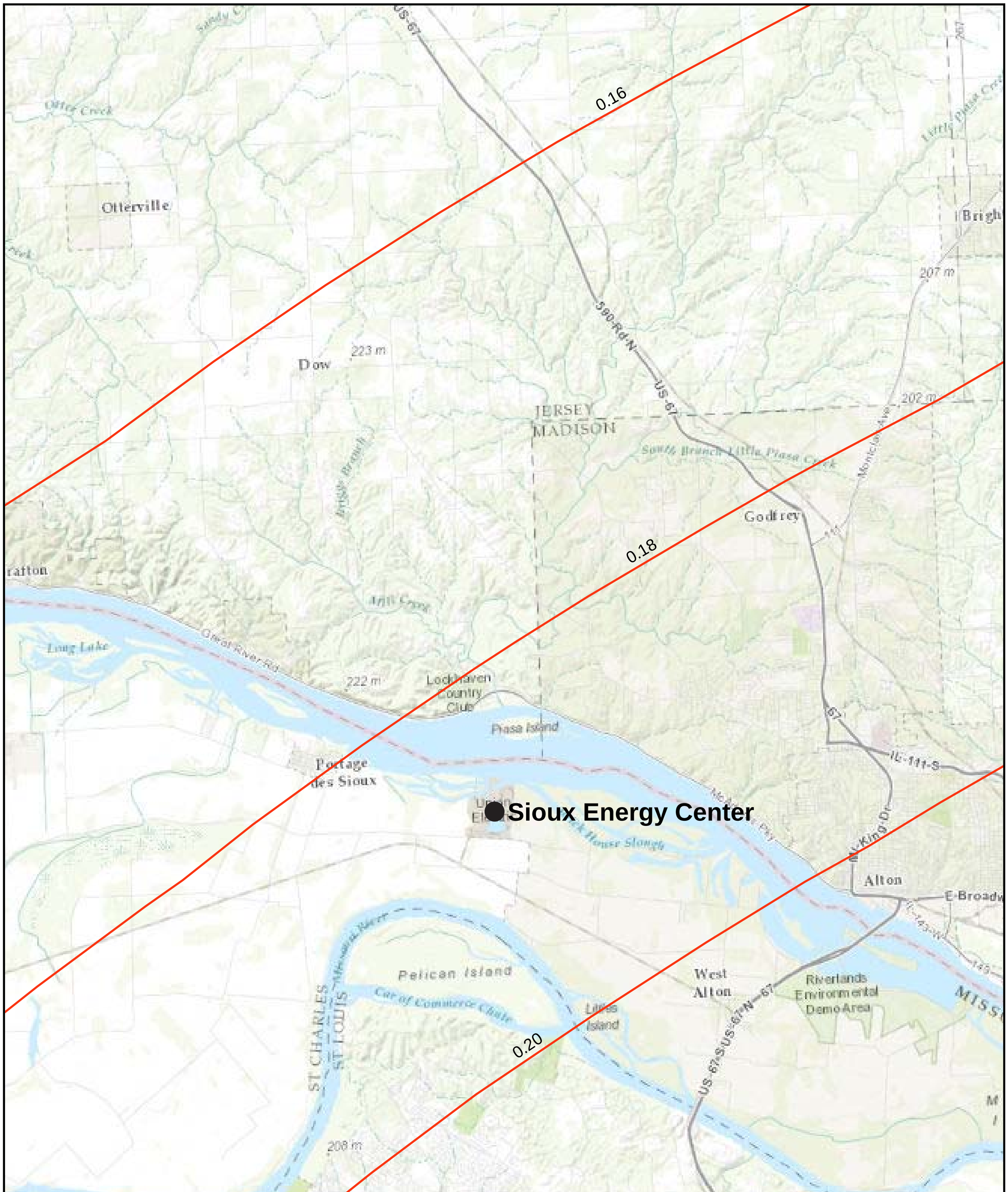
Figure 3




Ameren Missouri Sioux Energy Center UWL
GENERALIZED SOIL PROFILE
ALONG SOUTH PERIMETER BERM

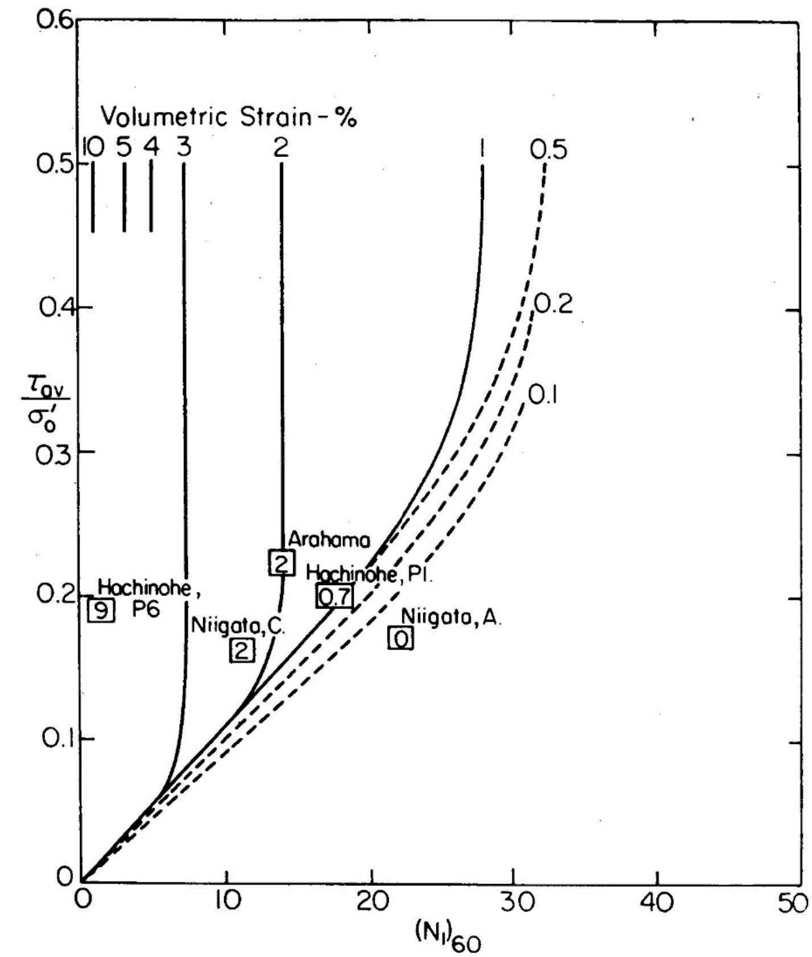
REITZ & JENS, INC.

Figure 4



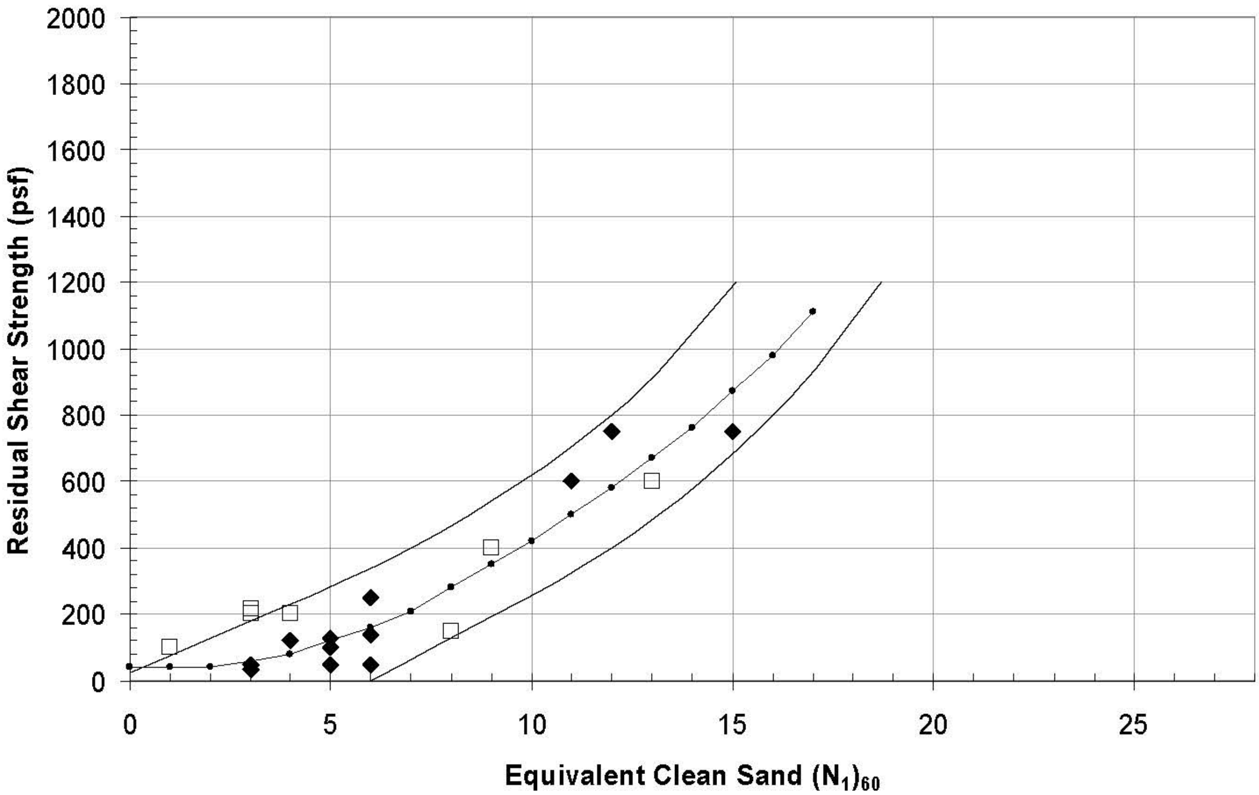

**2% Probability of Exceedance in 50 Years Map of Peak Ground Acceleration**

Ameren Missouri Sioux Energy Center UWL
2014 USGS Seismic Hazard Map




Earthquake Induced Settlements in Saturated Sands,
From Tokimatsu and Seed (1987)

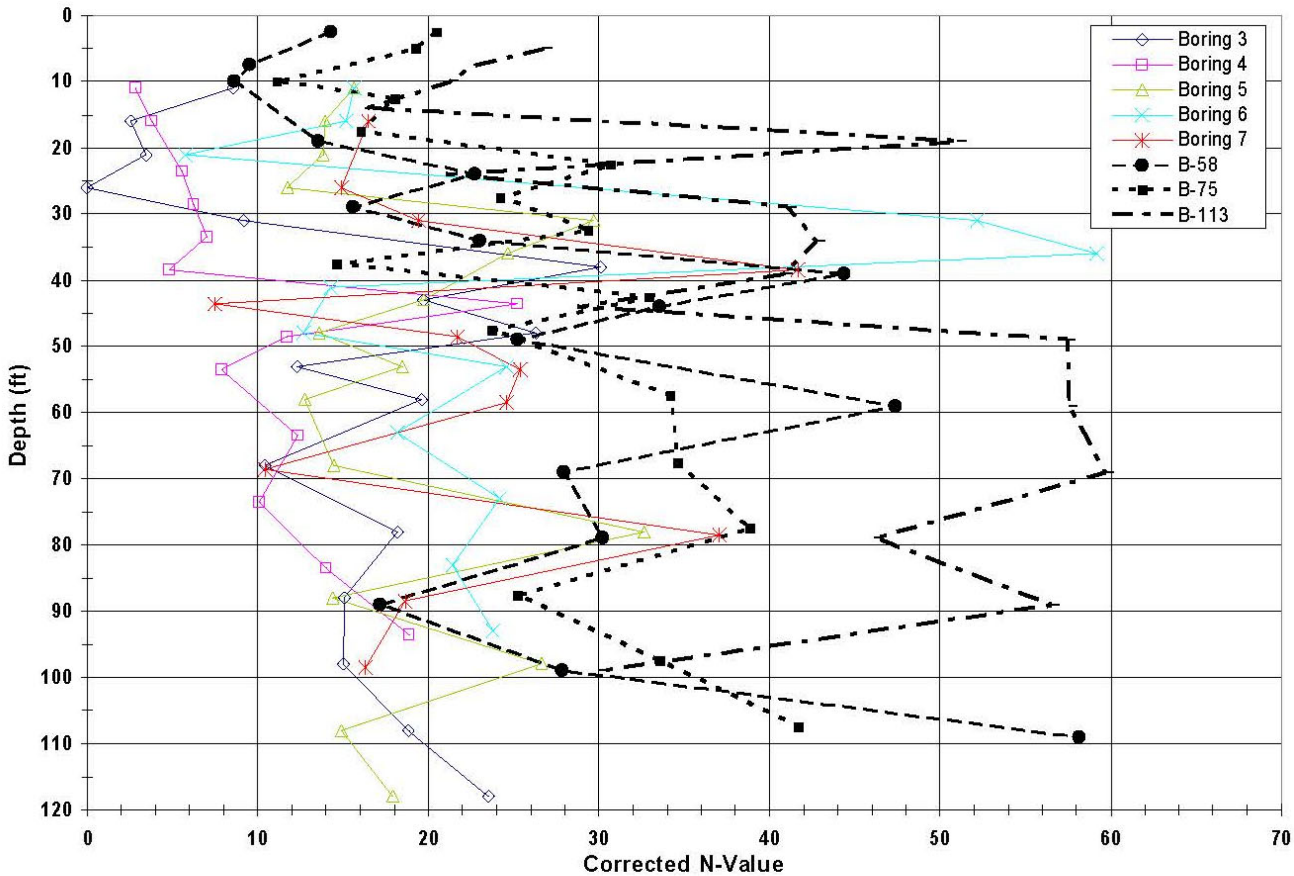
Ameren Missouri Sioux Energy Center UWL
RELATIIONSHIP FOR EARTHQUAKE
INDUCED SETTLEMENT



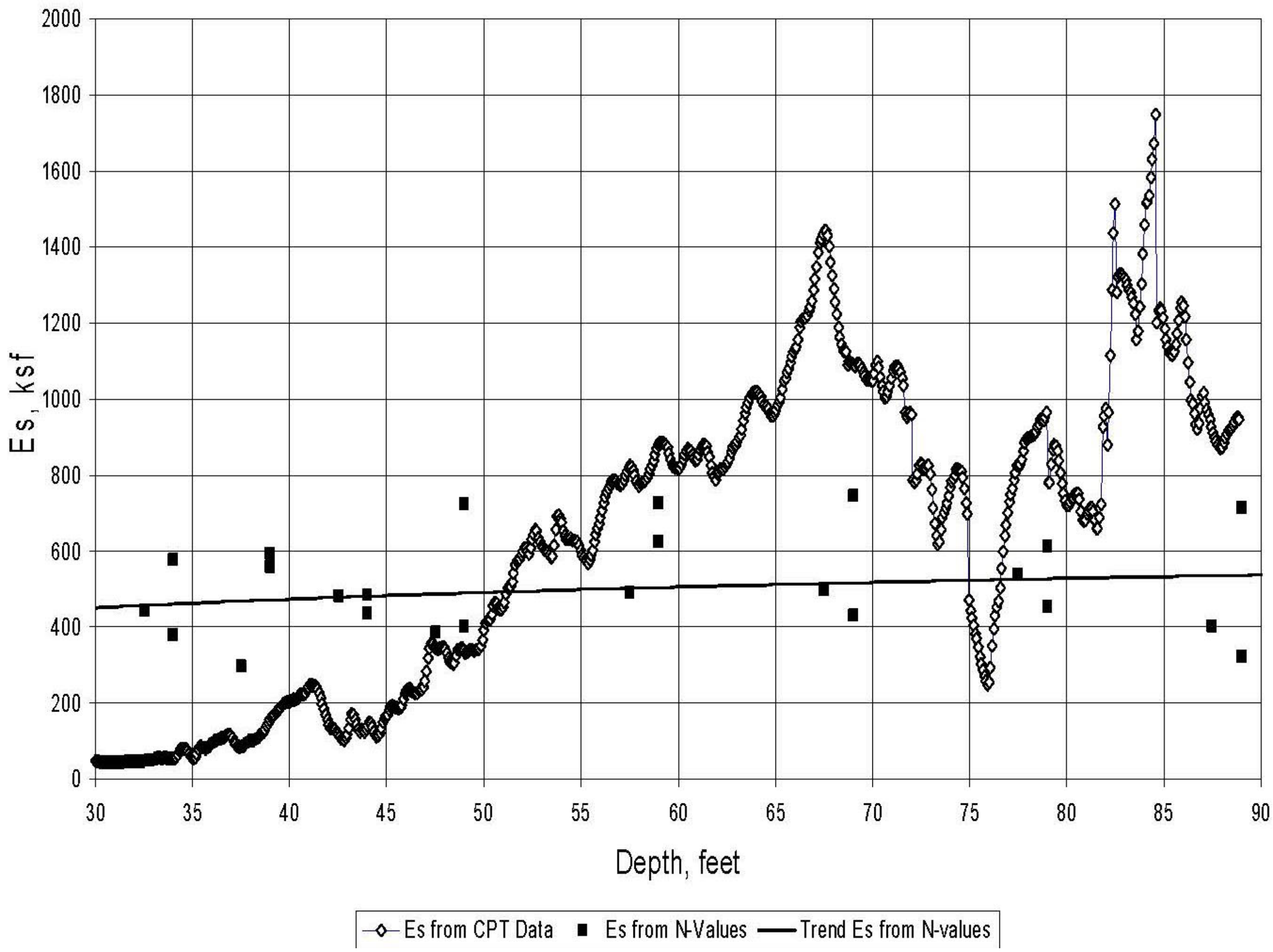

Residual Shear Strength of Liquefied Sand from Seed (1997)
And Stark and Mesri (1992)

Ameren Missouri Sioux Energy Center UWL
RELATIIONSHIP FOR LOSS OF SHEAR
STRENGTH DUE TO LIQUEFACTION

``



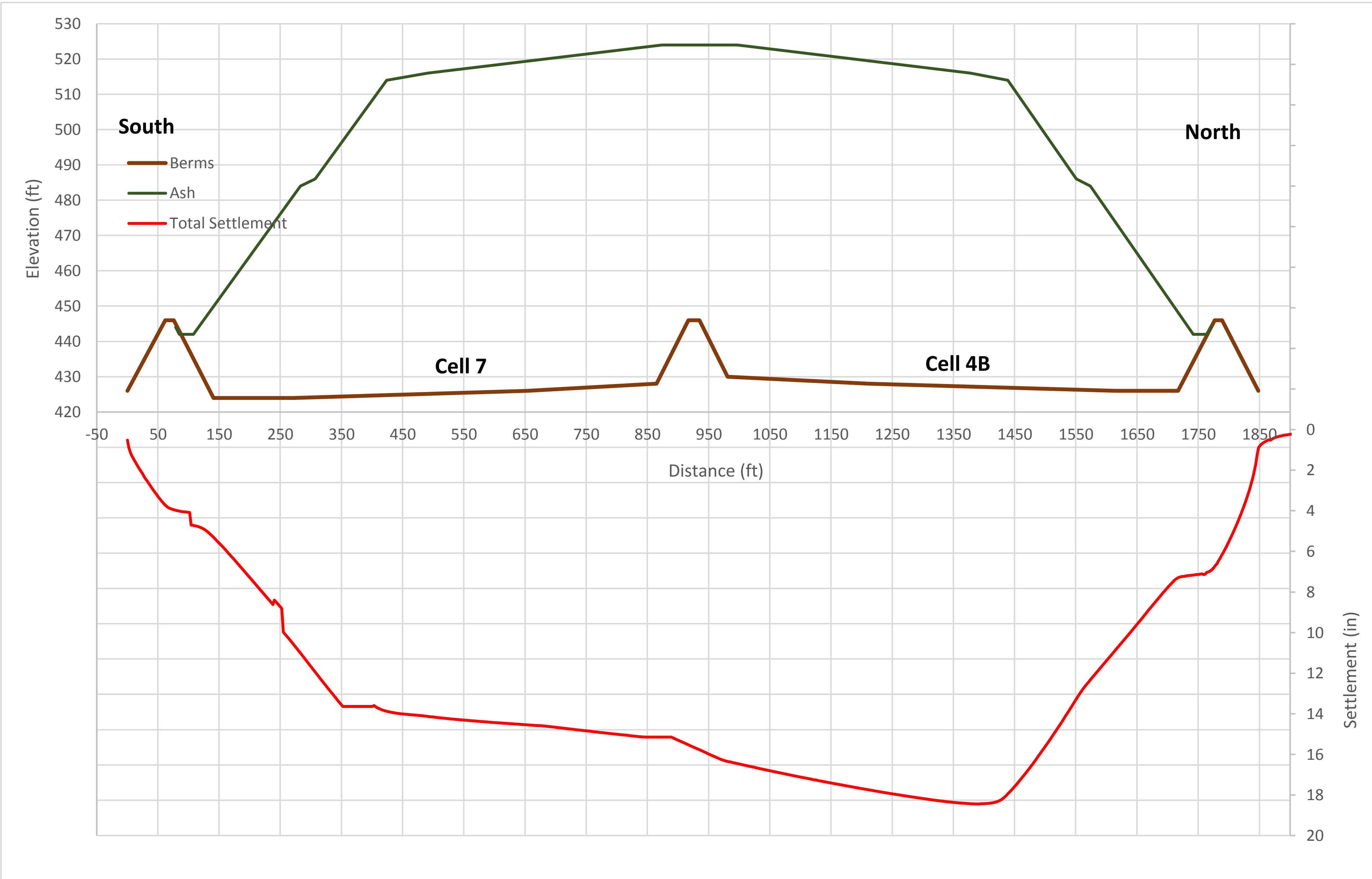

Ameren Missouri Sioux Energy Center UWL
COMPARISON OF CORRECTED N-VALUES
WITH DEPTH AT SIOUX ENERGY CENTER
AND UTILITY WASTE LANDFILL SITE



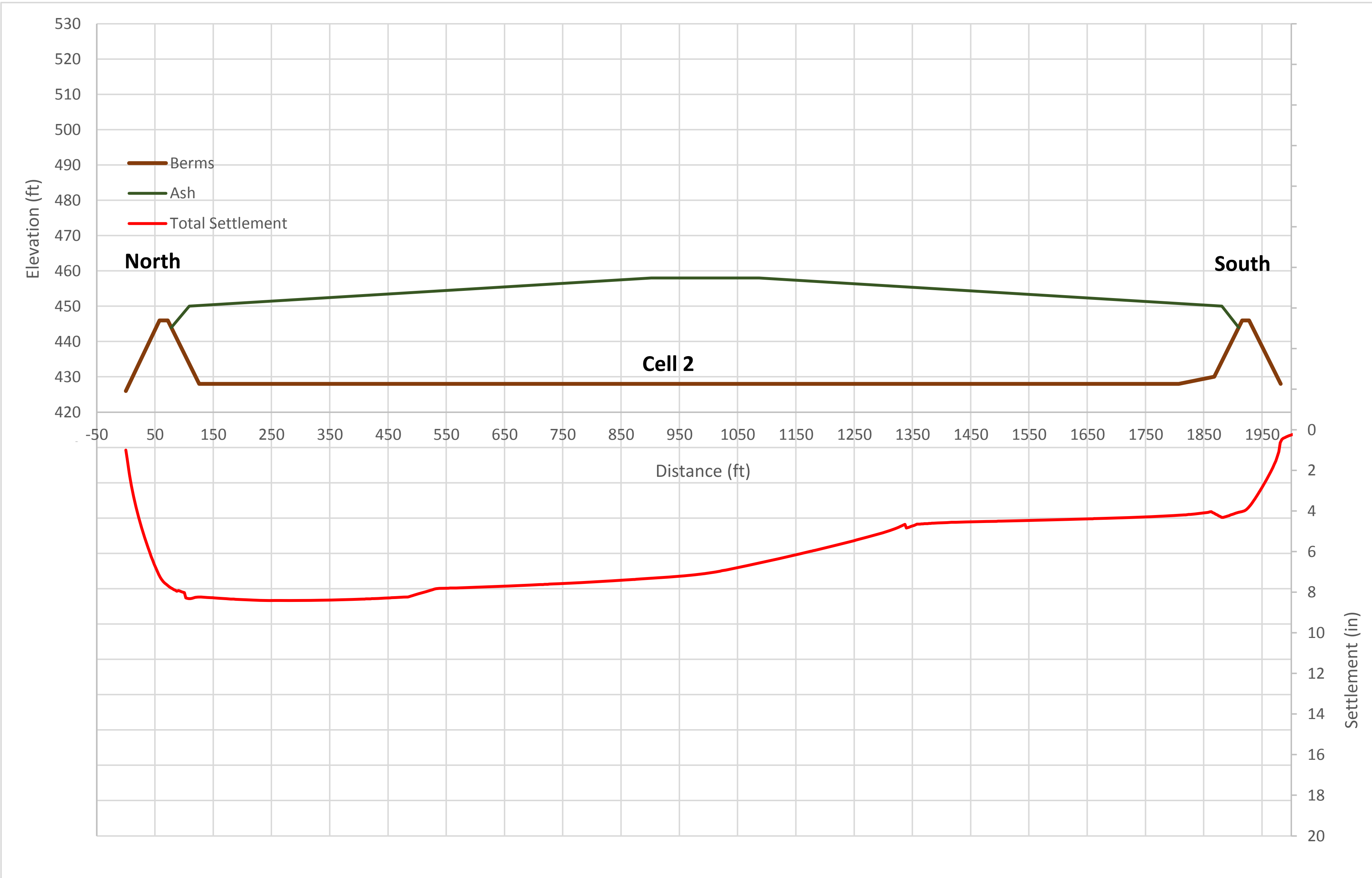

Ameren Missouri Sioux Energy Center UWL
COMPARISON OF ELASTIC SOIL MODULUS
(Es) OF SANDS VERSUS DEPTH

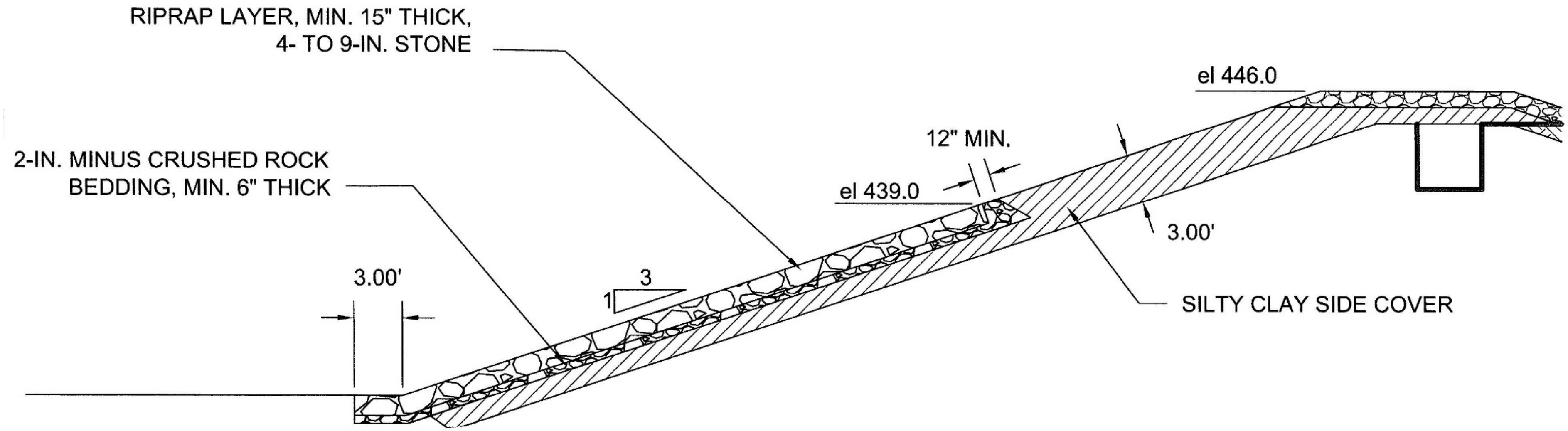
Ameren Missouri Sioux Energy Center Utility Waste Landfill
PROFILE OF ESTIMATED SETTLEMENT
EAST - WEST CENTERLINE

Ameren Missouri Sioux Energy Center Utility Waste Landfill
PROFILE OF ESTIMATED SETTLEMENT
NORTH-SOUTH THROUGH DRY CELLS 4B AND 7



Ameren Missouri Sioux Energy Center Utility Waste Landfill
PROFILE OF ESTIMATED SETTLEMENT
NORTH-SOUTH THROUGH CELL 2






Ameren Missouri Sioux Energy Center UWL
RIPRAP PROTECTION FOR CELL 1
PERIMETER BERMS

Figure 13

REITZ & JENS, INC.

**Appendix 1**

# LABORATORY CLASSIFICATION OF PHASE 2 SOIL SAMPLES

**Summary of Samples from Phase 2 Test Holes**

| Test Hole Number | Northing | Easting | Approx. Surface Elevation | Starting Depth (feet) | Starting Elevation | Ending Elevation | Thickness (feet) | Visually Classified | Moisture Content, % | Density, pcf | Description | Composite Sample Sector/Class |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 115 | 1118716.09 | 878138.69 | 426.0 | 0.0 | 426.0 | 424.6 | 1.4 | ML | | | SILT, dark brown, slightly clayey | Discarded |
| | | | 426.0 | 1.4 | 424.6 | 424.0 | 0.6 | CH | | | CLAY, brown, high plastic | B-CH |
| | | | 426.0 | 2.0 | 424.0 | 423.3 | 0.7 | CL | | | Silty CLAY, low plastic, brown | Discarded |
| | | | 426.0 | 2.7 | 423.3 | 422.3 | 1.1 | CH | | | CLAY, brown, high plastic | B-CH |
| | | | 426.0 | 3.8 | 422.3 | 422.0 | 0.3 | ML | | | Clayey SILT, brownish tan | Discarded |
| | | | 426.0 | 4.0 | 422.0 | 421.0 | 1.0 | CL | | | CLAY, gray-brown, high plastic | B-2 |
| | | | 426.0 | 5.0 | 421.0 | | | | | | | |
| 116 | 1118664.14 | 878545.38 | 426.5 | 0.0 | 426.5 | 425.8 | 0.8 | ML | | | Clayey SILT, dary grayish brown | B-MCL |
| | | | 426.5 | 0.8 | 425.8 | 425.4 | 0.3 | CL | | | Silty CLAY, brown | B-CL |
| | | | 426.5 | 1.1 | 425.4 | 424.5 | 0.9 | ML | | | Clayey SILT, tan | Discarded |
| | | | 426.5 | 2.0 | 424.5 | 424.0 | 0.5 | ML | | | SILT, tan | Discarded |
| | | | 426.5 | 2.5 | 424.0 | 422.5 | 1.5 | CH | | | CLAY, dark brown, high plastic | B-CH |
| | | | 426.5 | 4.0 | 422.5 | 420.5 | 2.0 | CH | | | CLAY, brown & gray, high plastic | B-CH |
| | | | 426.5 | 6.0 | 420.5 | | | MCL | | | Silty CLAY, brown | B-CL |
| 117 | 1118612.20 | 878952.08 | 426.5 | 0.0 | 426.5 | 425.7 | 0.8 | CL | | | Silty CLAY, dark brown | C-CL |
| | | | 426.5 | 0.8 | 425.7 | 424.8 | 0.9 | CL | 19.4 | 100.3 | CLAY, dark brown, low plastic | C-CL |
| | | | 426.5 | 1.8 | 424.8 | 423.9 | 0.8 | CL | 25.4 | 97.6 | Silty CLAY, dark brown/tan, low plasti | C-CL |
| | | | 426.5 | 2.6 | 423.9 | 421.8 | 2.2 | CL-ML | | | Clayey SILT/Silty CLAY, light brown | B-MCL |
| | | | 426.5 | 4.8 | 421.8 | 420.5 | 1.3 | ML | | | SILT, lt. brown/tan, very slightly claye | Discarded |
| | | | 426.5 | 6.0 | 420.5 | 420.2 | 0.3 | CL | | | CLAY, dark brown, low plastic | C-CL |
| | | | 426.5 | 6.3 | 420.2 | 419.6 | 0.6 | SM | | | SAND, light tan, fine | Discarded |
| | | | 426.5 | 6.9 | 419.6 | | | ML | | | Sandy SILT, brown | Discarded |
| 118 | 1118560.25 | 879358.78 | 426.5 | 0.0 | 426.5 | 425.8 | 0.8 | MCL | | | Dark Brown Sandy Silty Clay | Discarded |
| | | | 426.5 | 0.8 | 425.8 | 423.8 | 2.0 | CL | | | Dark Brown Clay | C-CL |
| | | | 426.5 | 2.8 | 423.8 | 423.0 | 0.8 | CH | | | Dark Black/Gray Clay | C-CH |
| | | | 426.5 | 3.5 | 423.0 | 422.2 | 0.8 | MCL | | | Dark Brown Silty Clay | C-MCL |
| | | | 426.5 | 4.3 | 422.2 | 420.0 | 2.2 | ML | | | Lt Tan/Brown Silt | Discarded |
| | | | 426.5 | 6.5 | 420.0 | 419.7 | 0.3 | ML | | | Lt Tan/Brown Silt | Discarded |
| | | | 426.5 | 6.8 | 419.7 | 418.6 | 1.1 | MCL | | | Gray/Brown Silty Clay | C-MCL |
| | | | 426.5 | 7.9 | 418.6 | | | MCL | | | Dark Brown slightly clayey Silt | C-MCL |
| 119 | 1118508.30 | 879765.47 | 426.5 | 0.0 | 426.5 | 426.3 | 0.2 | MCL | | | Dark Gray Silty Clay | D-MCL |
| | | | 426.5 | 0.2 | 426.3 | 425.5 | 0.8 | CH | | | Dark Black/Gray Clay | D-CH |
| | | | 426.5 | 1.0 | 425.5 | 425.3 | 0.3 | MCL | | | Lt Tan/Brown Silty Clay/Clayey Siilt | D-MCL |
| | | | 426.5 | 1.3 | 425.3 | 424.3 | 1.0 | CL | | | Dark Brown Clay w Trace Silt | C-CL |
| | | | 426.5 | 2.3 | 424.3 | 423.1 | 1.2 | CH | | | Dark Brown/Gray Clay | D-CH |
| | | | 426.5 | 3.4 | 423.1 | 421.8 | 1.3 | CH | | | Brown Gray Clay | D-CH |
| | | | 426.5 | 4.7 | 421.8 | 420.2 | 1.7 | CL | | | Gray Brown Clay | D-CL |
| | | | 426.5 | 6.3 | 420.2 | 420.0 | 0.2 | CL | | | Brown Clay | D-CL |
| | | | 426.5 | 6.5 | 420.0 | 419.8 | 0.2 | MCL | 32.5 | 89.1 | Gray/Brown Clayey Silt | D-MCL |
| | | | 426.5 | 6.7 | 419.8 | 419.2 | 0.7 | CL | | | Gray/Brown Clay | D-CL |
| | | | 426.5 | 7.3 | 419.2 | | | MCL | | | Gray/Brown Clayey Silt | D-MCL |
| 120 | 1118456.36 | 880172.17 | 427.5 | 0.0 | 427.5 | 425.3 | 2.3 | CL | | | Dark Brown/Gray Clay | D-CL |
| | | | 427.5 | 2.3 | 425.3 | 424.5 | 0.8 | CH | | | Dark Black Grey Clay | D-CH |
| | | | 427.5 | 3.0 | 424.5 | 423.7 | 0.8 | MCL | | | Dark Brown/Gray Silty Clay | D-MCL |
| | | | 427.5 | 3.8 | 423.7 | 423.1 | 0.6 | ML | | | Lt Tan Silt | Discarded |
| | | | 427.5 | 4.4 | 423.1 | 421.1 | 2.0 | ML | | | Lt Tan Silt | Discarded |
| | | | 427.5 | 6.4 | 421.1 | 420.7 | 0.4 | ML | | | Lt Tan Silt | Discarded |
| | | | 427.5 | 6.8 | 420.7 | | | MCL | | | Gray/Brown Silty Clay/Clayey Silt | D-MCL |
| 121 | 1118378.44 | 880782.21 | 427.0 | 0.0 | 427.0 | 426.6 | 0.4 | MCL | | | Dark Black/Gray Silty Clay | D-MCL |
| | | | 427.0 | 0.4 | 426.6 | 425.6 | 1.0 | CH | | | Dark Black/Gray Clay | D-CH |
| | | | 427.0 | 1.4 | 425.6 | 424.8 | 0.8 | CH | | | Dark Brown Clay | D-CH |
| | | | 427.0 | 2.3 | 424.8 | 422.8 | 2.0 | CH | | | Brown/Gray Clay | D-CH |
| | | | 427.0 | 4.3 | 422.8 | 420.8 | 2.0 | CH | | | Dark Brown Clay | D-CH |
| | | | 427.0 | 6.3 | 420.8 | 420.5 | 0.3 | CL | | | Dark Brown/Gray Clay | D-CL |
| | | | 427.0 | 6.5 | 420.5 | 419.7 | 0.8 | MCL | | | Dark Brown Silty Clay/Clayey Silt | D-MCL |
| | | | 427.0 | 7.3 | 419.7 | | | SM | | | Lt Tan Brown Very Fine Sandy Silt | Discarded |
| 122 | 1118564.69 | 877706.02 | 426.5 | 0.0 | 426.5 | 425.5 | 1.0 | SC | | | Brown Silty Clayey Fine Sand | Discarded |
| | | | 426.5 | 1.0 | 425.5 | 424.5 | 1.0 | CL | | | Dark Gray Brown Clay w Silt | A-CL |
| | | | 426.5 | 2.0 | 424.5 | 421.5 | 3.0 | CH | | | Dark Gray Brown Clay | A-CH |
| | | | 426.5 | 5.0 | 421.5 | 421.0 | 0.5 | MCL | | | Dark Gray Silty Clay | A-MCL |
| | | | 426.5 | 5.5 | 421.0 | 420.5 | 0.5 | CH | | | Dark Gray Brown Clay | A-CH |
| | | | 426.5 | 6.0 | 420.5 | 419.5 | 1.0 | CL | | | Dark Gray Brown Clay | A-CL |
| | | | 426.5 | 7.0 | 419.5 | | | MCL | | | Dark Brown Silty Clay | A-MCL |
| 123 | 1118356.90 | 879332.80 | 426.5 | 0.0 | 426.5 | 425.9 | 0.6 | MCL | | | Dark Gray/Brown Silty Clay | C-MCL |
| | | | 426.5 | 0.6 | 425.9 | 424.4 | 1.5 | CH | | | Dark Gray/Brown Clay | C-CH |
| | | | 426.5 | 2.1 | 424.4 | 422.3 | 2.2 | CH | | | Brown Clay | C-CH |
| | | | 426.5 | 4.3 | 422.3 | 421.5 | 0.8 | CL | | | Brown Clay | C-CL |
| | | | 426.5 | 5.0 | 421.5 | 421.3 | 0.3 | MCL | | | Brown/Gray Silty Clay | C-MCL |
| | | | 426.5 | 5.3 | 421.3 | 420.2 | 1.1 | SM | | | Lt Tan Sandy Silt - Silty Sand | Discarded |
| | | | 426.5 | 6.3 | 420.2 | | | SP | | | Lt Tan Fine Sand | Discarded |
| 124 | 1118201.06 | 880552.89 | 427.0 | 0.0 | 427.0 | 424.8 | 2.2 | CH | | | Dark Brown/Gray Clay | D-CH |
| | | | 427.0 | 2.2 | 424.8 | 423.9 | 0.9 | CH | | | Dark Brown Gray Clay | D-CH |
| | | | 427.0 | 3.1 | 423.9 | 422.9 | 1.0 | CL | | | Dark Brown Clay | D-CL |
| | | | 427.0 | 4.1 | 422.9 | 420.9 | 2.0 | CL | | | Gray/Brown Clay | D-CL |
| | | | 427.0 | 6.1 | 420.9 | 419.9 | 1.0 | MCL | | | Gary/Brown Silty Clay/Clayey Silt | D-MCL |
| | | | 427.0 | 7.1 | 419.9 | | | SP | | | Lt Tan/Brown Silt w Very Fine Sand | Discarded |
| | | | 426.5 | 0.0 | 426.5 | 426.3 | 0.2 | MCL | | | Dark Black/Gray Silty Clay | E-MCL |

**Summary of Samples from Phase 2 Test Holes**

| Test Hole Number | Northing | Easting | Approx. Surface Elevation | Starting Depth (feet) | Starting Elevation | Ending Elevation | Thickness (feet) | Visually Classified | Moisture Content, % | Density, pcf | Description | Composite Sample Sector/Class |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 125 | 1118097.17 | 881366.28 | 426.5 | 0.2 | 426.3 | 425.5 | 0.8 | CH | | | Dark Black/Gray Clay | E-CH |
| | | | 426.5 | 1.0 | 425.5 | 424.2 | 1.3 | CH | | | Brown Clay | E-CH |
| | | | 426.5 | 2.3 | 424.2 | 421.8 | 2.3 | CH | | | Brown Clay | E-CH |
| | | | 426.5 | 4.7 | 421.8 | 420.1 | 1.8 | CH | | | Dark Brown Clay | E-CH |
| | | | 426.5 | 6.4 | 420.1 | | | CL | | | Dark Brown Clay | E-CL |
| 126 | 1118387.31 | 877476.70 | 427.0 | 0.0 | 427.0 | 426.2 | 0.8 | MCL | | | Dark Gray Brown Sand/Silt/Clay | Discarded |
| | | | 427.0 | 0.8 | 426.2 | 425.8 | 0.3 | MCL | | | Dark Brown Silty Clay | A-MCL |
| | | | 427.0 | 1.2 | 425.8 | 425.5 | 0.3 | SP | | | Lt Tan Fine Sand | Discarded |
| | | | 427.0 | 1.5 | 425.5 | 424.5 | 1.0 | MCL | | | Dark Brown Gray Clay w Silt | A-MCL |
| | | | 427.0 | 2.5 | 424.5 | 423.8 | 0.7 | CH | | | Dark Brown Gray Clay | A-CH |
| | | | 427.0 | 3.2 | 423.8 | 422.3 | 1.6 | MCL | | | Dark Brown Gray Clay w Silt | A-MCL |
| | | | 427.0 | 4.8 | 422.3 | 420.8 | 1.5 | CH | 31.9 | 89.4 | Dark Brown Gray Clay | A-CH |
| | | | 427.0 | 6.3 | 420.8 | 419.7 | 1.1 | CH | | | Dark Brown Clay | A-CH |
| | | | 427.0 | 7.3 | 419.7 | | | SP | | | Brown/Gray Very Fine Sand | Discarded |
| 127 | 1118335.37 | 877883.39 | 427.0 | 0.0 | 427.0 | 426.3 | 0.8 | MCL | | | Dark Brown Sandy Silty Clay | B-MCL |
| | | | 427.0 | 0.8 | 426.3 | 424.8 | 1.5 | CH | | | Dark Gray/Brown Clay | B-CH |
| | | | 427.0 | 2.3 | 424.8 | 422.4 | 2.4 | CH | | | Dark Gray/Brown Clay | B-CH |
| | | | 427.0 | 4.7 | 422.4 | 420.3 | 2.1 | MCL | | | Lt Tan Silt w Dark Brown Clay | B-MCL |
| | | | 427.0 | 6.8 | 420.3 | 419.4 | 0.9 | CL | | | Brown Clay | B-CL |
| | | | 427.0 | 7.7 | 419.4 | | | SM | | | Brown/Tan Silt w Very Fine Sand | Discarded |
| 128 | 1118283.42 | 878290.09 | 427.0 | 0.0 | 427.0 | 426.2 | 0.8 | MCL | | | Dark Gray/Brown Silty Clay | B-MCL |
| | | | 427.0 | 0.8 | 426.2 | 425.0 | 1.2 | CH | | | Dark Gray Brown Clay | B-CH |
| | | | 427.0 | 2.0 | 425.0 | 423.3 | 1.8 | CH | | | Brown Clay | B-CH |
| | | | 427.0 | 3.8 | 423.3 | 423.0 | 0.3 | ML | | | Brown/Tan Silt w Clay | Discarded |
| | | | 427.0 | 4.0 | 423.0 | 421.0 | 2.0 | ML | | | Brown Tan Silt to Silty Clay | Discarded |
| | | | 427.0 | 6.0 | 421.0 | 420.8 | 0.2 | CL | | | Mottled Gray/Brown Clay | B-CL |
| | | | 427.0 | 6.2 | 420.8 | | | SM | | | Tan Slightly Silty Sand | Discarded |
| 129 | 1118231.47 | 878696.79 | 427.0 | 0.0 | 427.0 | 426.3 | 0.7 | MCL | 16.5 | 96.8 | Dark Brown Sandy Silty Clay | Discarded |
| | | | 427.0 | 0.7 | 426.3 | 424.8 | 1.5 | CL | | | Dark Brown Clay | C-CL |
| | | | 427.0 | 2.2 | 424.8 | 424.2 | 0.7 | CH | | | Dark Black/Grey Clay | C-CH |
| | | | 427.0 | 2.8 | 424.2 | 422.3 | 1.8 | CH | | | Brown Clay | C-CH |
| | | | 427.0 | 4.7 | 422.3 | 421.5 | 0.8 | CL | 30.1 | 82.6 | Brown Clay | C-CH |
| | | | 427.0 | 5.5 | 421.5 | 420.7 | 0.8 | MCL | | | Brown Silty Clay | C-MCL |
| | | | 427.0 | 6.3 | 420.7 | 420.3 | 0.4 | ML | | | Lt Tan Silt | Discarded |
| | | | 427.0 | 6.8 | 420.3 | 419.6 | 0.7 | ML | | | Lt Brown Clayey Silt | Discarded |
| | | | 427.0 | 7.4 | 419.6 | | | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| 130 | 1118179.53 | 879103.48 | 428.0 | 0.0 | 428.0 | 427.3 | 0.8 | MCL | | | Dark Brown Sandy Silty Clay | Discarded |
| | | | 428.0 | 0.8 | 427.3 | 425.8 | 1.5 | MCL | | | Dark Brown Lt Brown Silty Clay | C-MCL |
| | | | 428.0 | 2.3 | 425.8 | 425.3 | 0.5 | CH | | | Dark Black Grey Clay | C-CH |
| | | | 428.0 | 2.8 | 425.3 | 424.5 | 0.8 | CL | | | Dark Brown Clay w Silt Seams | C-CL |
| | | | 428.0 | 3.5 | 424.5 | 423.7 | 0.8 | MCL | | | Dark Brown Clay w Tan Silt | C-MCL |
| | | | 428.0 | 4.3 | 423.7 | 423.2 | 0.5 | CL | 7.2 | 82.1 | Dark Brown Clay | C-CL |
| | | | 428.0 | 4.8 | 423.2 | 421.6 | 1.6 | SM | | | Lt Tan Silt w Very Fine Sand | Discarded |
| | | | 428.0 | 6.4 | 421.6 | 420.0 | 1.6 | ML | | | Lt Tan/Brown Silt w Clay &Fine Sand | Discarded |
| | | | 428.0 | 8.0 | 420.0 | | | MCL | | | Dark Brown Silty Clay | C-MCL |
| 131 | 1118127.58 | 879510.18 | 427.5 | 0.0 | 427.5 | 426.8 | 0.7 | MCL | | | Dark Brown Silty Clay w Sand | Discarded |
| | | | 427.5 | 0.7 | 426.8 | 425.2 | 1.7 | CH | | | Dark Gray Brown Clay | C-CH |
| | | | 427.5 | 2.3 | 425.2 | 423.8 | 1.3 | CH | | | Dark Brown Clay | C-CH |
| | | | 427.5 | 3.7 | 423.8 | 422.8 | 1.0 | MCL | | | Lt Tan Silt w Brown Clay | C-MCL |
| | | | 427.5 | 4.7 | 422.8 | 421.0 | 1.8 | CH | | | Brown Clay | C-CH |
| | | | 427.5 | 6.5 | 421.0 | 420.4 | 0.6 | CL | | | Brown Clay | C-CL |
| | | | 427.5 | 7.1 | 420.4 | 420.1 | 0.3 | SM | | | Brown Silt w Fine Sand | Discarded |
| | | | 427.5 | 7.4 | 420.1 | 419.8 | 0.3 | CL | | | Brown Clay | C-CL |
| | | | 427.5 | 7.8 | 419.8 | | | SM | | | Brown Silt w Fine Sand | Discarded |
| 132 | 1118075.64 | 879916.87 | 427.5 | 0.0 | 427.5 | 426.5 | 1.0 | MCL | | | Dark Brown Silty Clay | D-MCL |
| | | | 427.5 | 1.0 | 426.5 | 424.0 | 2.5 | CH | | | Dark Brown/Gray Clay | D-CH |
| | | | 427.5 | 3.5 | 424.0 | 422.9 | 1.1 | CH | | | Gray/Brown Clay | D-CH |
| | | | 427.5 | 4.6 | 422.9 | 422.3 | 0.7 | CH | | | Gray/Brown Clay | D-CH |
| | | | 427.5 | 5.3 | 422.3 | 422.0 | 0.3 | CL | | | Dark Gray Clay w Silt Seams | D-CL |
| | | | 427.5 | 5.5 | 422.0 | 421.1 | 0.9 | SM | | | Lt Tan Silty Sand w Sandy Silt | Discarded |
| | | | 427.5 | 6.4 | 421.1 | 421.0 | 0.1 | CH | | | Dark Brown Gray Clay | D-CH |
| | | | 427.5 | 6.5 | 421.0 | 420.8 | 0.3 | SM | | | Lt Tan Silty Sand | Discarded |
| | | | 427.5 | 6.8 | 420.8 | 419.6 | 1.2 | MCL | | | Gray Brown Sitly Clay | D-MCL |
| | | | 427.5 | 7.9 | 419.6 | | | SM | | | Brown Very Fine Sand | Discarded |
| 133 | 1118023.69 | 880323.57 | 427.0 | 0.0 | 427.0 | 426.0 | 1.0 | CL | | | Dark Brown Gray Clay | D-CL |
| | | | 427.0 | 1.0 | 426.0 | 422.3 | 3.7 | CH | | | Dark Gray Brown Clay | D-CH |
| | | | 427.0 | 4.7 | 422.3 | 420.5 | 1.8 | CH | 30.5 | 88.89 | Dark Gray Brown Clay | D-CH |
| | | | 427.0 | 6.5 | 420.5 | 419.7 | 0.8 | CH | | | Gary Brown Mottled Clay | D-CH |
| | | | 427.0 | 7.3 | 419.7 | | | MCL | | | Brown Gray Clayey Silt | D-MCL |
| 134 | 1117971.74 | 880730.27 | 427.0 | 0.0 | 427.0 | 426.2 | 0.8 | MCL | | | Dark Brown Gray Silty Clay | D-MCL |
| | | | 427.0 | 0.8 | 426.2 | 424.8 | 1.4 | CH | | | Dark Black/Gray Clay | D-CH |
| | | | 427.0 | 2.2 | 424.8 | 422.5 | 2.3 | CL | | | Dark Brown Gray Clay | D-CL |
| | | | 427.0 | 4.5 | 422.5 | 422.3 | 0.3 | CL | | | Brown Gray Clay | D-CL |
| | | | 427.0 | 4.8 | 422.3 | 421.9 | 0.3 | ML | | | Lt Tan Silt w Clay Seam | Discarded |
| | | | 427.0 | 5.1 | 421.9 | 420.5 | 1.4 | CL | | | Brown Gray Clay | D-CL |
| | | | 427.0 | 6.5 | 420.5 | | | CL | | | Gray Brown Clay | D-CL |
| | | | 426.0 | 0.0 | 426.0 | 425.7 | 0.3 | MCL | | | Dark Black/Gray Slightly Silty Clay | E-MCL |

**Summary of Samples from Phase 2 Test Holes**

| Test Hole Number | Northing | Easting | Approx. Surface Elevation | Starting Depth (feet) | Starting Elevation | Ending Elevation | Thickness (feet) | Visually Classified | Moisture Content, % | Density, pcf | Description | Composite Sample Sector/Class |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 135 | 1117919.80 | 881136.96 | 426.0 | 0.3 | 425.7 | 423.5 | 2.2 | CH | | | Dark Black/Gray Clay | E-CH |
| | | | 426.0 | 2.5 | 423.5 | 422.6 | 0.9 | CH | | | Dark Black/Gray Clay | E-CH |
| | | | 426.0 | 3.4 | 422.6 | 421.5 | 1.1 | CH | | | Dark Gray/Brown Clay | E-CH |
| | | | 426.0 | 4.5 | 421.5 | | | CH | | | Dark Gray/Brown Clay | E-CH |
| 136 | 1117867.85 | 881543.66 | 427.0 | 0.0 | 427.0 | 426.3 | 0.8 | MCL | | | Dark Black/Gray Slightly Silty Clay | E-MCL |
| | | | 427.0 | 0.8 | 426.3 | 425.6 | 0.7 | CL | | | Dark Black/Gray Clay | E-CL |
| | | | 427.0 | 1.4 | 425.6 | 424.7 | 0.9 | CH | | | Dark Gray/Black Clay | E-CH |
| | | | 427.0 | 2.3 | 424.7 | 424.2 | 0.5 | CH | | | Dark Brown/Gray Clay | E-CH |
| | | | 427.0 | 2.8 | 424.2 | 422.5 | 1.7 | CH | | | Dark Brown Clay | E-CH |
| | | | 427.0 | 4.5 | 422.5 | 421.8 | 0.7 | CH | | | Dark Gray Brown Clay | E-CH |
| | | | 427.0 | 5.2 | 421.8 | 421.5 | 0.3 | MCL | | | Dark Brown Silty Clay | E-MCL |
| | | | 427.0 | 5.5 | 421.5 | 420.5 | 1.0 | SP | | | Tan Very Fine Silty Sand | Discarded |
| | | | 427.0 | 6.5 | 420.5 | | | SM | | | Tan Slightly Silty Fine Sand | Discarded |
| 137 | 1117815.90 | 881950.35 | 427.5 | 0.0 | 427.5 | 426.9 | 0.6 | MCL | | | Dark Black/Gray Slightly Silty Clay | E-MCL |
| | | | 427.5 | 0.6 | 426.9 | 425.5 | 1.4 | CL | | | Dark Brown Gray Clay | E-CL |
| | | | 427.5 | 2.0 | 425.5 | 422.9 | 2.6 | CH | | | Dark Brown Clay | E-CH |
| | | | 427.5 | 4.6 | 422.9 | 422.3 | 0.6 | CL | | | Dark Brown Clay | E-CL |
| | | | 427.5 | 5.2 | 422.3 | 421.8 | 0.5 | MCL | | | Dark Brown Silty Clay | E-MCL |
| | | | 427.5 | 5.7 | 421.8 | 421.2 | 0.7 | MCL | | | Lt Brown Clayey Silt w Trace Sand | E-MCL |
| | | | 427.5 | 6.3 | 421.2 | 420.8 | 0.4 | SP | | | Tan Fine Sand | Discarded |
| | | | 427.5 | 6.8 | 420.8 | | | SM | | | Brown Sand Silt | Discarded |
| 138 | 1118183.96 | 877450.73 | 426.0 | 0.0 | 426.0 | 425.5 | 0.5 | MCL | | | Dark Gray/Black Silty Clay | A-MCL |
| | | | 426.0 | 0.5 | 425.5 | 423.6 | 1.9 | CH | | | Dark Gray/Black Clay | A-CH |
| | | | 426.0 | 2.4 | 423.6 | 421.2 | 2.4 | CH | | | Dark Brown/Gray Clay | A-CH |
| | | | 426.0 | 4.8 | 421.2 | 421.0 | 0.2 | CH | | | Dark Brown/Gray Clay | A-CH |
| | | | 426.0 | 5.0 | 421.0 | | | CL | | | Dark Brown Clay | A-CL |
| 139 | 1117586.58 | 882127.73 | 427.5 | 0.0 | 427.5 | 427.3 | 0.2 | CL | | | Dark Black Grey Clay | E-CL |
| | | | 427.5 | 0.2 | 427.3 | 426.9 | 0.4 | CL | | | Dark Black Grey Clay | E-CL |
| | | | 427.5 | 0.6 | 426.9 | 425.4 | 1.5 | CL | | | Dark Black Grey Clay | E-CL |
| | | | 427.5 | 2.1 | 425.4 | 424.4 | 1.0 | CH | | | Dark Gray Brown Clay | E-CH |
| | | | 427.5 | 3.1 | 424.4 | 423.2 | 1.3 | CH | | | Dark Brown Clay | E-CH |
| | | | 427.5 | 4.3 | 423.2 | 422.3 | 0.8 | CH | | | Brown Clay | E-CH |
| | | | 427.5 | 5.2 | 422.3 | 421.3 | 1.1 | SM | | | Lt Tan Slightly Silty Sand w Silt | Discarded |
| | | | 427.5 | 6.3 | 421.3 | | | SP | | | Tan Fine Sand | Discarded |
| 140 | 1117980.62 | 877424.75 | 427.0 | 0.0 | 427.0 | 426.7 | 0.3 | MCL | | | Dark Gray/Brown Silty Clay | A-MCL |
| | | | 427.0 | 0.3 | 426.7 | 426.3 | 0.4 | MCL | | | Dark Brown Silty Clay | A-MCL |
| | | | 427.0 | 0.8 | 426.3 | 426.0 | 0.3 | CL | | | Dark Brown Clay | A-CL |
| | | | 427.0 | 1.1 | 426.0 | 424.8 | 1.2 | CH | | | Dark Gray/Brown Clay | A-CH |
| | | | 427.0 | 2.3 | 424.8 | 424.2 | 0.6 | CH | 15.3 | 87 | Dark Brown Clay | A-CH |
| | | | 427.0 | 2.8 | 424.2 | 423.3 | 0.9 | MCL | | | Lt Tan Silt w Dark Brown Clay | A-MCL |
| | | | 427.0 | 3.8 | 423.3 | 422.5 | 0.8 | ML | | | Lt Tan Silt | Discarded |
| | | | 427.0 | 4.5 | 422.5 | 422.0 | 0.5 | MCL | 12.2 | 88 | Lt Tan w Brown Clayey Silt | A-MCL |
| | | | 427.0 | 5.0 | 422.0 | 421.0 | 1.0 | ML | | | Lt Tan Silt | Discarded |
| | | | 427.0 | 6.0 | 421.0 | 420.5 | 0.5 | MCL | | | Lt Tannish Brown Silty Clay | A-MCL |
| | | | 427.0 | 6.5 | 420.5 | | | ML | | | Lt Tan Silt | Discarded |
| 141 | 1117928.67 | 877831.45 | 427.5 | 0.0 | 427.5 | 427.1 | 0.4 | MCL | | | Dark Gray/Brown Clayey Silt | B-MCL |
| | | | 427.5 | 0.4 | 427.1 | 426.6 | 0.5 | CL | | | Brown Clay | B-CL |
| | | | 427.5 | 0.9 | 426.6 | 425.5 | 1.1 | CH | 24.5 | 99.7 | Brown/Gray Clay | B-CH |
| | | | 427.5 | 2.0 | 425.5 | 425.0 | 0.5 | CH | | | Brown Clay | B-CH |
| | | | 427.5 | 2.5 | 425.0 | 423.5 | 1.5 | ML | | | Tan Silt | Discarded |
| | | | 427.5 | 4.0 | 423.5 | 423.0 | 0.5 | ML | | | Tan Silt | Discarded |
| | | | 427.5 | 4.5 | 423.0 | 422.9 | 0.1 | MCL | | | Brown Clay Silty | B-MCL |
| | | | 427.5 | 4.6 | 422.9 | 422.1 | 0.8 | ML | | | Tan Silt | Discarded |
| | | | 427.5 | 5.4 | 422.1 | 421.8 | 0.3 | CH | | | Brown Clay | B-CH |
| | | | 427.5 | 5.8 | 421.8 | 421.5 | 0.3 | SM | | | Brown/Gray Fine Sandy Silt | Discarded |
| | | | 427.5 | 6.0 | 421.5 | 421.0 | 0.5 | MCL | | | Tan Clayey Silt | B-MCL |
| | | | 427.5 | 6.5 | 421.0 | 420.9 | 0.1 | MCL | | | Brown Clayey silt | B-MCL |
| | | | 427.5 | 6.6 | 420.9 | 420.8 | 0.2 | SP | | | Tan Fine Sand | Discarded |
| | | | 427.5 | 6.8 | 420.8 | 420.3 | 0.4 | MCL | | | Brown Silty Clay | B-MCL |
| | | | 427.5 | 7.2 | 420.3 | | | SM | | | Tan Silty Fine Sand | Discarded |
| 142 | 1117876.72 | 878238.14 | 428.0 | 0.0 | 428.0 | 427.4 | 0.6 | MCL | | | Dark Gray/Brown Clayey Silt | B-MCL |
| | | | 428.0 | 0.6 | 427.4 | 427.2 | 0.3 | MCL | | | Dark Gray/Brown Clayey Silt | B-MCL |
| | | | 428.0 | 0.8 | 427.2 | 426.0 | 1.2 | CH | | | Brown Clay | B-CH |
| | | | 428.0 | 2.0 | 426.0 | 425.3 | 0.8 | SM | | | Tan Very Fine Silty Sand | Discarded |
| | | | 428.0 | 2.8 | 425.3 | 424.0 | 1.3 | SP | | | Tan Very Fine Sand | Discarded |
| | | | 428.0 | 4.0 | 424.0 | 422.6 | 1.4 | MCL | | | Brown/Gray clayey silt | B-MCL |
| | | | 428.0 | 5.4 | 422.6 | 422.0 | 0.6 | SM | | | Tan Slightly Silty Sand | Discarded |
| | | | 428.0 | 6.0 | 422.0 | 421.2 | 0.8 | MCL | | | Gray Brown Clayey Silty w Fine Sand | Discarded |
| | | | 428.0 | 6.8 | 421.2 | 420.5 | 0.7 | SP | | | Tan Fine Sand | Discarded |
| | | | 428.0 | 7.5 | 420.5 | | | MCL | | | Gray/Brown Clayey Silt to silty Clay | B-MCL |
| 143 | 1117824.78 | 878644.84 | 428.5 | 0.0 | 428.5 | 427.9 | 0.6 | MCL | | | Dark Brown/Brown Silty Clay | C-MCL |
| | | | 428.5 | 0.6 | 427.9 | 426.9 | 1.0 | CH | | | Dark Black/Gray Clay | C-CH |
| | | | 428.5 | 1.6 | 426.9 | 426.2 | 0.8 | ML | | | Lt Tan Silt | Discarded |
| | | | 428.5 | 2.3 | 426.2 | 425.3 | 0.9 | MCL | | | Dark Brown/Brown Silty Clay | C-MCL |
| | | | 428.5 | 3.3 | 425.3 | 424.1 | 1.2 | SP | | | Lt Tan Fine Sand | Discarded |
| | | | 428.5 | 4.4 | 424.1 | 422.2 | 1.9 | SM | | | Lt Tan Silty Sand | Discarded |
| | | | 428.5 | 6.3 | 422.2 | 421.7 | 0.5 | MCL | | | Brown/Tan Clayey Silt/Silty Clay | C-MCL |

**Summary of Samples from Phase 2 Test Holes**

| Test Hole Number | Northing | Easting | Approx. Surface Elevation | Starting Depth (feet) | Starting Elevation | Ending Elevation | Thickness (feet) | Visually Classified | Moisture Content, % | Density, pcf | Description | Composite Sample Sector/Class |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 428.5 | 6.8 | 421.7 | | | SP | | | Lt Tan Fine Sand | Discarded |
| 144 | 1117772.83 | 879051.54 | 428.5 | 0.0 | 428.5 | 428.3 | 0.3 | MCL | | | Dark Brown Siilty Clay | C-MCL |
| | | | 428.5 | 0.3 | 428.3 | 427.0 | 1.3 | CL | | | Dark Gray Brown/Black Clay | C-CL |
| | | | 428.5 | 1.5 | 427.0 | 426.8 | 0.2 | MCL | | | Dark Brown w Tan Silty Clay | C-MCL |
| | | | 428.5 | 1.7 | 426.8 | 426.1 | 0.8 | ML | | | Lt Tan Silt | Discarded |
| | | | 428.5 | 2.4 | 426.1 | 425.5 | 0.6 | MCL | | | Dark Brown Silty Clay/Clayey Silt | C-MCL |
| | | | 428.5 | 3.0 | 425.5 | 425.1 | 0.4 | SM | | | Lt Tan Very Fine Sandy Silt | Discarded |
| | | | 428.5 | 3.4 | 425.1 | 424.7 | 0.4 | CL | | | Dark Brown/Gray Clay | C-CL |
| | | | 428.5 | 3.8 | 424.7 | 423.9 | 0.8 | SP | | | Lt Tan Very Fine Sand | Discarded |
| | | | 428.5 | 4.6 | 423.9 | 422.6 | 1.3 | ML | | | Lt Tan Silt | Discarded |
| | | | 428.5 | 5.9 | 422.6 | 421.8 | 0.8 | MCL | | | Brown Clayey Silt | C-MCL |
| | | | 428.5 | 6.7 | 421.8 | | | ML | | | Lt Tan w Brown Silt w Clay w Sand | Discarded |
| 145 | 1117720.89 | 879458.23 | 429.0 | 0.0 | 429.0 | 428.2 | 0.8 | MCL | | | Dark Brown Silty Clay | C-MCL |
| | | | 429.0 | 0.8 | 428.2 | 427.4 | 0.8 | CL | | | Dark Brown Clay | C-CL |
| | | | 429.0 | 1.6 | 427.4 | 426.4 | 1.0 | MCL | | | Dark Brown Lt Tan Silty Clay | C-MCL |
| | | | 429.0 | 2.6 | 426.4 | 424.3 | 2.1 | MCL | | | Lt Brown Clayey Silt w Silty Clay | C-MCL |
| | | | 429.0 | 4.7 | 424.3 | 423.0 | 1.3 | MCL | | | Lt Tan Brown Clayey Silt | C-MCL |
| | | | 429.0 | 6.0 | 423.0 | 422.7 | 0.3 | CL | | | Dark Brown Clay | C-CL |
| | | | 429.0 | 6.3 | 422.7 | 422.1 | 0.6 | SP | | | Lt Tan Fine Sand | Discarded |
| | | | 429.0 | 6.9 | 422.1 | | | SM | | | Brown Sandy Silt | Discarded |
| 146 | 1117668.94 | 879864.93 | 428.5 | 0.0 | 428.5 | 426.3 | 2.3 | CL | | | Dark Brown Slightly Silty Clay | D-CL |
| | | | 428.5 | 2.3 | 426.3 | 426.0 | 0.3 | CL | | | Dark Brown Slightly Silty Clay | D-Cl |
| | | | 428.5 | 2.5 | 426.0 | 425.3 | 0.7 | MCL | | | Lt Tan Clayey Silt | D-MCL |
| | | | 428.5 | 3.2 | 425.3 | 424.8 | 0.6 | CL | | | Dark Brown Gray Clay | D-CL |
| | | | 428.5 | 3.8 | 424.8 | 423.6 | 1.2 | CL | | | Dark Brown Gray Clay | D-CL |
| | | | 428.5 | 4.9 | 423.6 | 423.4 | 0.2 | CL | | | Dark Brown Gray Clay | D-CL |
| | | | 428.5 | 5.1 | 423.4 | 423.0 | 0.4 | MCL | | | Lt Tan Slightly Clayey Silt | D-MCL |
| | | | 428.5 | 5.5 | 423.0 | 422.2 | 0.8 | SM | | | Lt Tan Very Fine Sand Silt/Silty Sand | Discarded |
| | | | 428.5 | 6.3 | 422.2 | 421.8 | 0.3 | SM | | | Lt Brown Very Fine Sandy Silt | Discarded |
| | | | 428.5 | 6.7 | 421.8 | 421.4 | 0.4 | SM | | | Lt Tan Very Slightly Silty Sand | Discarded |
| | | | 428.5 | 7.1 | 421.4 | 420.8 | 0.7 | SM | | | Lt Tan Very Fine Sandy Silt | Discarded |
| | | | 428.5 | 7.8 | 420.8 | 419.9 | 0.8 | MCL | | | Dark Brown Clayey Silt | D-MCL |
| | | | 428.5 | 8.6 | 419.9 | 419.3 | 0.6 | SM | | | Lt Tan Very Fine Silty Sand | Discarded |
| | | | 428.5 | 9.2 | 419.3 | 419.1 | 0.3 | MCL | | | Brown Slightly Clayey Silt | D-MCL |
| | | | 428.5 | 9.4 | 419.1 | | | SM | | | Lt Tan Very Fine Sandy Silt/Silty Sand | Discarded |
| 147 | 1117616.99 | 880271.62 | 429.0 | 0.0 | 429.0 | 427.0 | 2.0 | MCL | | | Dark Brown/Gray Silty Sandy Clay | D-MCL |
| | | | 429.0 | 2.0 | 427.0 | 425.8 | 1.2 | MCL | | | Brown Silty Clay/Clayey Silt | D-MCL |
| | | | 429.0 | 3.2 | 425.8 | 424.8 | 1.0 | MCL | 7.3 | 87.93 | Lt Tan Very Sllightly Clayey Silt w Ver | D-MCL |
| | | | 429.0 | 4.2 | 424.8 | 424.7 | 0.2 | MCL | | | Lt Tan Clayey Silt/ Silty Clay | D-MCL |
| | | | 429.0 | 4.3 | 424.7 | 424.2 | 0.5 | SM | | | Lt Tan Silt w Very Fine Sand | Discarded |
| | | | 429.0 | 4.8 | 424.2 | 422.3 | 1.8 | CH | 26.4 | 87.32 | Brown/Gray Clay | D-CH |
| | | | 429.0 | 6.7 | 422.3 | 420.3 | 2.1 | SM | | | Lt Tan Very Fine Sandy Silt | Discarded |
| | | | 429.0 | 8.8 | 420.3 | 420.0 | 0.3 | SM | | | Lt Brown Very Fine Sandy Silt | Discarded |
| | | | 429.0 | 9.0 | 420.0 | 419.7 | 0.3 | MCL | | | Gray/Brown Silty Clay/Clayey Silt | D-MCL |
| | | | 429.0 | 9.3 | 419.7 | | | SM | | | Lt Brown Very Fine Sandy Silt | Discarded |
| 148 | 1117565.05 | 880678.32 | 430.0 | 0.0 | 430.0 | 429.8 | 0.2 | MCL | | | Dary Gray/Brown Silty Clay | D-MCL |
| | | | 430.0 | 0.2 | 429.8 | 428.6 | 1.3 | CH | | | Dark Brown/Gray Clay | D-CH |
| | | | 430.0 | 1.4 | 428.6 | 427.5 | 1.1 | CL | | | Dark Brown Gray Clay | D-CL |
| | | | 430.0 | 2.5 | 427.5 | 425.5 | 2.0 | ML | | | Lt Tan Silt | Discarded |
| | | | 430.0 | 4.5 | 425.5 | 425.0 | 0.5 | ML | | | Lt Tan Silt | Discarded |
| | | | 430.0 | 5.0 | 425.0 | 424.5 | 0.5 | MCL | | | Gray/Brown Clayey Silt | D-MCL |
| | | | 430.0 | 5.5 | 424.5 | 423.5 | 1.0 | CL | | | Brown Gray Clay | D-CL |
| | | | 430.0 | 6.5 | 423.5 | 421.6 | 1.9 | CH | 37 | 86.1 | Gray/Brown Clay | D-CH |
| | | | 430.0 | 8.4 | 421.6 | | | CH | 34.6 | 84.4 | Gray/Brown Clay | D-CH |
| 149 | 1117513.10 | 881085.02 | 429.0 | 0.0 | 429.0 | 428.8 | 0.2 | MCL | | | Dark Brown/Gray Silty Clay | E-MCL |
| | | | 429.0 | 0.2 | 428.8 | 427.5 | 1.3 | CH | | | Dark Brown/Gray Clay | E-CH |
| | | | 429.0 | 1.5 | 427.5 | 426.5 | 1.0 | CL | | | Dark Brown Clay | E-CL |
| | | | 429.0 | 2.5 | 426.5 | 425.8 | 0.8 | CH | | | Dark Black Grey Clay | E-CH |
| | | | 429.0 | 3.3 | 425.8 | 425.2 | 0.6 | MCL | | | Lt Tan Clayey Silt | E-MCL |
| | | | 429.0 | 3.8 | 425.2 | 424.1 | 1.1 | MCL | 14.9 | 96.1 | Lt Tan Silt & Dark Brown Clay | E-MCL |
| | | | 429.0 | 4.9 | 424.1 | 422.8 | 1.3 | CL | | | Brown w Trace Tan Clay | E-CL |
| | | | 429.0 | 6.3 | 422.8 | 422.0 | 0.8 | CL | 31.5 | 89.6 | Brown Clay | E-CL |
| | | | 429.0 | 7.0 | 422.0 | 420.6 | 1.4 | MCL | | | Brown w Grey Silty Clay | E-MCL |
| | | | 429.0 | 8.4 | 420.6 | 420.3 | 0.3 | CL | | | Dark Brown Clay | E-CL |
| | | | 429.0 | 8.8 | 420.3 | 419.8 | 0.4 | MCL | | | Dark Brown/Gray Clayey Silt/Silty Clay | E-MCL |
| | | | 429.0 | 9.2 | 419.8 | | | SP | | | Lt Tan Sand | Discarded |
| 150 | 1117461.15 | 881491.71 | 428.0 | 0.0 | 428.0 | 427.0 | 1.0 | MCL | | | Dark Black Silty Loose Clay | E-MCL |
| | | | 428.0 | 1.0 | 427.0 | 424.1 | 2.9 | CH | | | Dark Brown/Gray Clay | E-CH |
| | | | 428.0 | 3.9 | 424.1 | 423.4 | 0.7 | MCL | | | Dark Gray/Brown Silty Clay | E-MCL |
| | | | 428.0 | 4.6 | 423.4 | 422.8 | 0.6 | CH | | | Brown Clay | E-CH |
| | | | 428.0 | 5.2 | 422.8 | 421.8 | 1.1 | MCL | | | Brown Silty Clay | E-MCL |
| | | | 428.0 | 6.3 | 421.8 | 421.3 | 0.5 | CL | | | Dark Brown Clay w Silt Seams | E-CL |
| | | | 428.0 | 6.8 | 421.3 | | | MCL | | | Dark Brown Silty Clay | E-MCL |
| 151 | 1117409.21 | 881898.41 | 427.5 | 0.0 | 427.5 | 427.2 | 0.3 | MCL | | | Dark Black/Gray Silty Clay | E-MCL |
| | | | 427.5 | 0.3 | 427.2 | 425.2 | 2.0 | CH | | | Dark Brown Clay | E-CH |
| | | | 427.5 | 2.3 | 425.2 | 422.6 | 2.6 | CH | | | Dark Gray/Brown Clay | E-CH |
| | | | 427.5 | 4.9 | 422.6 | 421.7 | 0.9 | CL | | | Brown Grey Clay | E-CL |

**Summary of Samples from Phase 2 Test Holes**

| Test Hole Number | Northing | Easting | Approx. Surface Elevation | Starting Depth (feet) | Starting Elevation | Ending Elevation | Thickness (feet) | Visually Classified | Moisture Content, % | Density, pcf | Description | Composite Sample Sector/Class |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 427.5 | 5.8 | 421.7 | 421.3 | 0.4 | MCL | | | Lt Grey/Tan Clayey Silt | E-MCL |
| | | | 427.5 | 6.3 | 421.3 | | | CL | | | Brown Clay w Silt Seams | E-CL |
| 152 | 1117803.24 | 877195.43 | 428.0 | 0.0 | 428.0 | 426.7 | 1.3 | MCL | | | Dark Gary/Brown Silty Clay | A-MCL |
| | | | 428.0 | 1.3 | 426.7 | 426.3 | 0.4 | CL | | | Dark Brown Clay | A-CL |
| | | | 428.0 | 1.8 | 426.3 | 425.5 | 0.8 | CH | | | Dark Gray/Brown Clay | A-CH |
| | | | 428.0 | 2.5 | 425.5 | 424.8 | 0.8 | CH | | | Dark Gray/Brown Clay | A-CH |
| | | | 428.0 | 3.3 | 424.8 | 424.2 | 0.6 | CH | | | Dark Brown Clay | A-CH |
| | | | 428.0 | 3.8 | 424.2 | 423.7 | 0.5 | MCL | | | Lt Tan/Dark Brown Silt & Clay | A-MCL |
| | | | 428.0 | 4.3 | 423.7 | 423.2 | 0.5 | MCL | | | Dark Brown Clay & Lt Tan Silt | A-MCL |
| | | | 428.0 | 4.8 | 423.2 | 421.8 | 1.4 | ML | | | Lt. Tan Silt | Discarded |
| | | | 428.0 | 6.3 | 421.8 | 420.8 | 0.9 | ML | | | Lt. Tan Silt | Discarded |
| | | | 428.0 | 7.2 | 420.8 | | | SM | | | Lt. Tan Silt w Very Fine Sand | Discarded |
| 153 | 1117179.89 | 882075.78 | 428.0 | 0.0 | 428.0 | 427.3 | 0.8 | CL | | | Dark Black/Gray Clay | E-CL |
| | | | 428.0 | 0.8 | 427.3 | 425.8 | 1.4 | CL | | | Dark Gray/Brown Clay | E-CL |
| | | | 428.0 | 2.2 | 425.8 | 425.0 | 0.8 | CH | | | Dark Brown/Gray Clay | E-CH |
| | | | 428.0 | 3.0 | 425.0 | 424.3 | 0.8 | MCL | | | Lt Brown/Dark Brown Silty Clay/Claye | E-MCL |
| | | | 428.0 | 3.8 | 424.3 | 423.8 | 0.5 | CL | | | Dark Black Grey Clay | E-CL |
| | | | 428.0 | 4.3 | 423.8 | 422.8 | 1.0 | CH | | | Brown Clay | E-CH |
| | | | 428.0 | 5.3 | 422.8 | 421.7 | 1.1 | CL | | | Brown Clay | E-CL |
| | | | 428.0 | 6.3 | 421.7 | | | MCL | | | Brown Silty Clay | E-MCL |
| 154 | 1117573.92 | 877372.81 | 429.0 | 0.0 | 429.0 | 427.8 | 1.3 | MCL | | | Dark Black/Gray Silty Clay w Sand | Discarded |
| | | | 429.0 | 1.3 | 427.8 | 426.5 | 1.3 | MCL | | | Lt Brown Silty Clay | E-MCL |
| | | | 429.0 | 2.5 | 426.5 | 426.2 | 0.3 | MCL | | | Dark Gray/Brown Silty Clay | E-MCL |
| | | | 429.0 | 2.8 | 426.2 | 425.5 | 0.7 | CH | | | Dark Gray/Brown Clay | A-CH |
| | | | 429.0 | 3.5 | 425.5 | 424.0 | 1.5 | CH | | | Dark Brown Clay | A-CH |
| | | | 429.0 | 5.0 | 424.0 | 423.8 | 0.2 | MCL | | | Dark Black/Gray Silty Clay | A-MCL |
| | | | 429.0 | 5.2 | 423.8 | 423.5 | 0.3 | MCL | | | Lt. Brown Clayey Silt | A-MCL |
| | | | 429.0 | 5.5 | 423.5 | 422.5 | 1.0 | ML | | | Lt. Tan Silt | Discarded |
| | | | 429.0 | 6.5 | 422.5 | 420.3 | 2.3 | MCL | | | Lt. Tan Silty Clayey Silt w Very Fine S | Discarded |
| | | | 429.0 | 8.8 | 420.3 | | | MCL | | | Lt. Tan/Brown Silty Clay Clayey Silt | A-MCL |
| 155 | 1117521.97 | 877779.50 | 428.5 | 0.0 | 428.5 | 427.9 | 0.6 | SM | | | Dark Brown/Gray Sandy Silty Clay | Discarded |
| | | | 428.5 | 0.6 | 427.9 | 427.1 | 0.8 | CH | | | Dark Gray/Brown Clay | B-CH |
| | | | 428.5 | 1.4 | 427.1 | 426.1 | 1.0 | MCL | | | Tan Slightly Clayey Silt | B-MCL |
| | | | 428.5 | 2.4 | 426.1 | 425.4 | 0.7 | MCL | | | Tan Slightly Clayey Silt | B-MCL |
| | | | 428.5 | 3.1 | 425.4 | 424.3 | 1.2 | CH | | | Dark Brown Clay | B-CH |
| | | | 428.5 | 4.3 | 424.3 | 423.3 | 0.9 | CH | | | Dark Gray/Brown Clay | B-CH |
| | | | 428.5 | 5.2 | 423.3 | 423.2 | 0.2 | CL | | | Brown/Tan Slightly Silty Clay | B-CL |
| | | | 428.5 | 5.3 | 423.2 | 422.2 | 1.0 | SM | | | Lt Tan Sandy Silt | Discarded |
| | | | 428.5 | 6.3 | 422.2 | 421.5 | 0.7 | MCL | | | Brown Silty Clay w Clayey Silt | B-MCL |
| | | | 428.5 | 7.0 | 421.5 | 420.9 | 0.6 | CL | | | Brown Slightly Silty Clay | B-CL |
| | | | 428.5 | 7.6 | 420.9 | 420.5 | 0.4 | MCL | | | Brown Silty Clay/Clayey Silt | B-MCL |
| | | | 428.5 | 8.0 | 420.5 | 420.0 | 0.5 | SM | | | Lt Tan Slightly Silty Sand | Discarded |
| | | | 428.5 | 8.5 | 420.0 | 419.6 | 0.4 | MCL | | | Brown Silty Clay/Clayey Silt | B-MCL |
| | | | 428.5 | 8.9 | 419.6 | | | SM | | | Lt Brown Slightly Silty Sand | Discarded |
| 156 | 1117470.03 | 878186.20 | 430.0 | 0.0 | 430.0 | 428.8 | 1.2 | CL | | | Dark Brown Slightly Silty Clay | B-CL |
| | | | 430.0 | 1.2 | 428.8 | 428.5 | 0.3 | ML | | | Brown Clayey silt w silty clay | Discarded |
| | | | 430.0 | 1.5 | 428.5 | 428.1 | 0.4 | CL | 10.2 | 103.29 | Tan Silt | B-CL |
| | | | 430.0 | 1.9 | 428.1 | 427.8 | 0.3 | MCL | | | Dark Brown Silty Clay | B-MCL |
| | | | 430.0 | 2.3 | 427.8 | 427.0 | 0.8 | MCL | | | Brown Silty Clay | B-MCL |
| | | | 430.0 | 3.0 | 427.0 | 426.6 | 0.4 | ML | | | Lt Tan Silt | Discarded |
| | | | 430.0 | 3.4 | 426.6 | 425.7 | 0.9 | CL | | | Brown Clay | B-CL |
| | | | 430.0 | 4.3 | 425.7 | 425.4 | 0.3 | MCL | | | Lt Tan Slighly Clayey Silt | B-MCL |
| | | | 430.0 | 4.6 | 425.4 | 424.3 | 1.2 | CH | 36.7 | 86.18 | Brown Clay | B-CH |
| | | | 430.0 | 5.8 | 424.3 | 423.6 | 0.7 | SP | | | Brown Sand | Discarded |
| | | | 430.0 | 6.4 | 423.6 | | | SP | | | Lt Brown Sand | Discarded |
| 157 | 1117418.08 | 878592.89 | 426.0 | 0.0 | 426.0 | 425.3 | 0.8 | SM | | | Dark Gray Sandy Silty Clay | Discarded |
| | | | 426.0 | 0.8 | 425.3 | 423.7 | 1.6 | CH | 32.1 | 89.5 | Dark Gray/Brown Clay | F-CH |
| | | | 426.0 | 2.3 | 423.7 | 423.5 | 0.2 | CH | | | Dark Gray Clay | F-CH |
| | | | 426.0 | 2.5 | 423.5 | 423.4 | 0.1 | ML | | | Lt Tan Silt Seam | Discarded |
| | | | 426.0 | 2.6 | 423.4 | 422.5 | 0.9 | CH | | | Dark Gray Clay | F-CH |
| | | | 426.0 | 3.5 | 422.5 | 421.8 | 0.7 | ML | | | Tan Brown/Gray Silt | Discarded |
| | | | 426.0 | 4.2 | 421.8 | 421.5 | 0.3 | CL | | | Dark Brown Clay | F-CL |
| | | | 426.0 | 4.5 | 421.5 | | | SP | | | Lt Tan Silt w Very Fine Sand | Discarded |
| 158 | 1117366.08 | 879000.00 | 426.0 | 0.0 | 426.0 | 425.7 | 0.3 | SM | | | Dark Brown/Gray Sandy Silty Clay | Discarded |
| | | | 426.0 | 0.3 | 425.7 | 425.1 | 0.6 | CL | | | Dark Brown Gary Clay | F-CL |
| | | | 426.0 | 0.9 | 425.1 | 423.8 | 1.3 | CH | | | Dark Gray Brown Clay | F-CH |
| | | | 426.0 | 2.3 | 423.8 | 423.2 | 0.6 | CH | | | Dark Gray Brown Clay | F-CH |
| | | | 426.0 | 2.8 | 423.2 | 422.3 | 0.9 | MCL | | | Lt Tan/Gray Silty Clay, Clayey Silt | F-MCL |
| | | | 426.0 | 3.8 | 422.3 | 421.4 | 0.9 | SP | | | Lt Tan Silt w Very Fine Sand | Discarded |
| | | | 426.0 | 4.6 | 421.4 | 421.2 | 0.2 | CH | | | Dark Brown/Gray Clay | F-CH |
| | | | 426.0 | 4.8 | 421.2 | 420.9 | 0.3 | CL | | | Brown Clay | F-CL |
| | | | 426.0 | 5.1 | 420.9 | 420.1 | 0.8 | SM | | | Lt Tan Slightly Sandy Silt | Discarded |
| | | | 426.0 | 5.9 | 420.1 | | | MCL | | | Brown Clayey Silt/Silty Clay | F-MCL |
| 159 | 1117314.19 | 879406.29 | 426.5 | 0.0 | 426.5 | 425.5 | 1.0 | CL | | | Dark Brown/Gray Slightly Silty Clay | F-CL |
| | | | 426.5 | 1.0 | 425.5 | 423.5 | 2.0 | CH | | | Dark Gray Clay | F-CH |
| | | | 426.5 | 3.0 | 423.5 | 423.3 | 0.2 | CL | | | Dark Gray Silty Clay | F-CL |
| | | | 426.5 | 3.2 | 423.3 | 421.8 | 1.6 | SM | | | Lt Tan Slightly Sandy Silt | Discarded |

**Summary of Samples from Phase 2 Test Holes**

| Test Hole Number | Northing | Easting | Approx. Surface Elevation | Starting Depth (feet) | Starting Elevation | Ending Elevation | Thickness (feet) | Visually Classified | Moisture Content, % | Density, pcf | Description | Composite Sample Sector/Class |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 426.5 | 4.8 | 421.8 | 419.9 | 1.8 | SM | | | Lt Tan Very Fine Sandy Silt/Silty Sand | Discarded |
| | | | 426.5 | 6.6 | 419.9 | 419.1 | 0.8 | SM | | | Lt Tan Very Fine Silty Sane/Sandy Silt | Discarded |
| | | | 426.5 | 7.4 | 419.1 | | | SM | | | Brown/Gray Silty Clay/Clayey Silt | Discarded |
| 160 | 1117262.24 | 879812.98 | 426.0 | 0.0 | 426.0 | 425.8 | 0.3 | MCL | | | Dark Gray Sandy Silty Clay | G-MCL |
| | | | 426.0 | 0.3 | 425.8 | 425.3 | 0.4 | CL | | | Dark Brown/Gray Silty Sandy Clay | G-CL |
| | | | 426.0 | 0.7 | 425.3 | 423.8 | 1.5 | CH | | | Dark Brown/Gray Clay | G-CH |
| | | | 426.0 | 2.2 | 423.8 | 421.7 | 2.2 | CH | | | Dark Gray/Brown Clay | G-CH |
| | | | 426.0 | 4.3 | 421.7 | 421.3 | 0.3 | CH | | | Dark Gray Clay | G-CH |
| | | | 426.0 | 4.7 | 421.3 | | | MCL | | | Lt Brown Silty Clay Clayey Silt | G-MCL |
| 161 | 1117210.30 | 880219.68 | 426.0 | 0.0 | 426.0 | 424.5 | 1.5 | CH | | | Dark Gray Clay | G-CH |
| | | | 426.0 | 1.5 | 424.5 | 421.4 | 3.1 | CH | | | Dark Brown/Gray Clay | G-CH |
| | | | 426.0 | 4.6 | 421.4 | 421.0 | 0.4 | CH | | | Dark Brown/Gray Clay | G-CH |
| | | | 426.0 | 5.0 | 421.0 | 420.5 | 0.5 | MCL | | | Lt Brown Silty Clay Clayey Silt | G-MCL |
| | | | 426.0 | 5.5 | 420.5 | | | ML | | | Lt Tan Brown Silt | Discarded |
| 162 | 1117158.35 | 880626.37 | 427.5 | 0.0 | 427.5 | 426.9 | 0.6 | CH | | | Dark Black/Gray Clay | G-CH |
| | | | 427.5 | 0.6 | 426.9 | 425.3 | 1.6 | CH | 31.6 | 89.4 | Dark Black/Gray Clay | G-CH |
| | | | 427.5 | 2.2 | 425.3 | 424.5 | 0.8 | CH | | | Dark Gray Clay | G-CH |
| | | | 427.5 | 3.0 | 424.5 | 424.0 | 0.5 | MCL | | | Black/Gray Clay w Clayey Silt | G-MCL |
| | | | 427.5 | 3.5 | 424.0 | 423.0 | 1.0 | ML | | | Lt Tan Silt | Discarded |
| | | | 427.5 | 4.5 | 423.0 | 422.3 | 0.7 | MCL | | | Lt Brown Silty Clay/Clayey Silt | G-MCL |
| | | | 427.5 | 5.2 | 422.3 | 421.1 | 1.3 | ML | | | Lt Tan Silt | Discarded |
| | | | 427.5 | 6.4 | 421.1 | 420.2 | 0.9 | SM | 28.9 | 89.6 | Lt Brown Silt w Very Fine Sand | Discarded |
| | | | 427.5 | 7.3 | 420.2 | | | MCL | | | Lt Brown/Gray Silty Clay/Clayey Silt | G-MCL |
| 163 | 1117106.40 | 881033.07 | 427.5 | 0.0 | 427.5 | 425.5 | 2.0 | CL | | | Dark Gray Clay w Fine Sand | H-CL |
| | | | 427.5 | 2.0 | 425.5 | 424.8 | 0.8 | CH | | | Dark Gray Clay | H-CH |
| | | | 427.5 | 2.8 | 424.8 | 424.3 | 0.5 | MCL | | | Dark Gray Sandy Silty Clay | H-MCL |
| | | | 427.5 | 3.3 | 424.3 | 423.3 | 1.0 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| | | | 427.5 | 4.3 | 423.3 | 421.3 | 2.0 | SM | 18.2 | 81.3 | Lt Tan Silt w Fine Sand | Discarded |
| | | | 427.5 | 6.3 | 421.3 | 420.5 | 0.8 | CL | | | Brown/Gray Clay | H-CL |
| | | | 427.5 | 7.0 | 420.5 | | | ML | | | Lt Tan Silt | Discarded |
| 164 | 1117054.46 | 881439.77 | 426.0 | 0.0 | 426.0 | 425.7 | 0.3 | MCL | | | Dark Brown Silty Clayey Sand | H-MCL |
| | | | 426.0 | 0.3 | 425.7 | 425.4 | 0.3 | SP | | | Lt Tan Sand | Discarded |
| | | | 426.0 | 0.6 | 425.4 | 423.7 | 1.8 | CH | | | Dark Black/Gray Clay | H-CH |
| | | | 426.0 | 2.3 | 423.7 | 421.3 | 2.4 | CH | | | Dark Brown/Gray Clay | H-CH |
| | | | 426.0 | 4.8 | 421.3 | 420.3 | 0.9 | CH | | | Dark Brown/Gray Clay | H-CH |
| | | | 426.0 | 5.7 | 420.3 | | | SM | | | Lt Tan Silt w Very Fine Sand | Discarded |
| 165 | 1117002.51 | 881846.46 | 426.5 | 0.0 | 426.5 | 424.7 | 1.8 | CH | | | Dark Gray Clay | H-CH |
| | | | 426.5 | 1.8 | 424.7 | 422.3 | 2.3 | CH | 33.5 | 83.5 | Dark Brown/Gray Clay | H-CH |
| | | | 426.5 | 4.2 | 422.3 | 421.7 | 0.6 | CH | | | Dark Brown/Gray Clay | H-CH |
| | | | 426.5 | 4.8 | 421.7 | 421.5 | 0.2 | ML | | | Lt Tan Silt | Discarded |
| | | | 426.5 | 5.0 | 421.5 | 421.0 | 0.5 | CL | | | Dark Gray/Brown Clay | H-CL |
| | | | 426.5 | 5.5 | 421.0 | 420.1 | 0.9 | ML | | | Lt Tan Silt | Discarded |
| | | | 426.5 | 6.4 | 420.1 | 418.9 | 1.2 | CL | | | Dark Gray/Brown Clay | H-CL |
| | | | 426.5 | 7.6 | 418.9 | 418.5 | 0.4 | SM | | | Dark Brown/Gray Slightly Sandy Silt | Discarded |
| | | | 426.5 | 8.0 | 418.5 | | | MCL | | | Dark Gray/Brown Silty Clay | H-MCL |
| 166 | 1117396.55 | 877143.48 | 429.0 | 0.0 | 429.0 | 427.8 | 1.3 | MCL | | | Dark Brown Gray Silty Clay | H-MCL |
| | | | 429.0 | 1.3 | 427.8 | 426.7 | 1.1 | CL | | | Dark Brown Clay | A-CL |
| | | | 429.0 | 2.3 | 426.7 | 426.2 | 0.5 | CL | 30.9 | 89.8 | Dark Gary/Brown Clay | A-CL |
| | | | 429.0 | 2.8 | 426.2 | 424.5 | 1.7 | CL | | | Brown Clay | A-CL |
| | | | 429.0 | 4.6 | 424.5 | 424.3 | 0.2 | CL | | | Dark Brown/Gray Clay | A-CL |
| | | | 429.0 | 4.8 | 424.3 | 422.5 | 1.8 | SM | | | Lt. Tan Sandy Silt | Discarded |
| | | | 429.0 | 6.5 | 422.5 | 421.7 | 0.8 | MCL | | | Brown Silty Clay | A-MCL |
| | | | 429.0 | 7.3 | 421.7 | 420.3 | 1.4 | SM | | | Lt. Tan Silt w Very Fine Sand | Discarded |
| | | | 429.0 | 8.8 | 420.3 | 419.3 | 1.0 | SM | | | Lt Tan Very Fine Sandy Silt w Clay Se | Discarded |
| | | | 429.0 | 9.8 | 419.3 | | | SM | | | Lt Tan Very Fine Silty Sand | Discarded |
| 167 | 1116773.19 | 882023.84 | 425.0 | 0.0 | 425.0 | 424.3 | 0.7 | CH | | | Black/Gray Clay | H-CH |
| | | | 425.0 | 0.7 | 424.3 | 422.9 | 1.4 | CH | 32.4 | 89.4 | Brown/Gray Clay | H-CH |
| | | | 425.0 | 2.1 | 422.9 | 420.7 | 2.3 | ML | 8.8 | 78.9 | Lt Tan Silt | Discarded |
| | | | 425.0 | 4.3 | 420.7 | 418.7 | 2.0 | SM | | | Lt Tan Fine Silt w Fine Sand | Discarded |
| | | | 425.0 | 6.3 | 418.7 | 417.5 | 1.2 | MCL | 30.1 | 86.2 | Brown Silty Clay/Clayey Silt | H-MCL |
| | | | 425.0 | 7.5 | 417.5 | | | ML | | | Lt Tan Silt | Discarded |
| 168 | 1117065.14 | 878134.48 | 429.0 | 0.0 | 429.0 | 428.3 | 0.8 | CL | | | Dark Gray/Brown Clayey Silt | F-CL |
| | | | 429.0 | 0.8 | 428.3 | 426.8 | 1.5 | CH | | | Dark Brown/Gray Clay | F-CH |
| | | | 429.0 | 2.3 | 426.8 | 424.3 | 2.4 | CH | | | Dark Black/Gray Clay | F-CH |
| | | | 429.0 | 4.7 | 424.3 | 424.3 | 0.1 | CL | | | Dark Black/Gray Clay | F-CL |
| | | | 429.0 | 4.8 | 424.3 | 422.4 | 1.8 | SP | | | Lt Tan Silt Very Fine Sand | Discarded |
| | | | 429.0 | 6.6 | 422.4 | 421.4 | 1.0 | CL | | | Lt Tan Very Sandy Silt | F-CL |
| | | | 429.0 | 7.6 | 421.4 | 421.1 | 0.3 | CL | | | Dark Brown Clay | F-CL |
| | | | 429.0 | 7.9 | 421.1 | 420.5 | 0.6 | ML | | | Lt Tan Silt | Discarded |
| | | | 429.0 | 8.5 | 420.5 | 419.8 | 0.8 | CL | 33.3 | 87.11 | Tan Silt w Trace Clay | F-CL |
| | | | 429.0 | 9.3 | 419.8 | 419.1 | 0.7 | MCL | | | Tan Slightly Silty Clay | F-MCL |
| | | | 429.0 | 9.9 | 419.1 | | | MCL | | | Tannish Brown Very Slightly Clayey S | F-MCL |
| 169 | 1117011.39 | 878540.95 | 427.0 | 0.0 | 427.0 | 425.6 | 1.4 | MCL | 13.6 | 101.7 | Dark Gray/Brown Sandy Clay | F-MCL |
| | | | 427.0 | 1.4 | 425.6 | 424.8 | 0.8 | MCL | | | Brown Silty Clay | F-MCL |
| | | | 427.0 | 2.2 | 424.8 | 424.2 | 0.7 | SM | | | Lt Tan Firm Silt w Trace Fine Sand | Discarded |
| | | | 427.0 | 2.8 | 424.2 | 422.3 | 1.9 | CH | | | Dark Brown/Gray Clay | F-CH |
| | | | 427.0 | 4.8 | 422.3 | 421.8 | 0.4 | CL | | | Dark Gray/Brown Silty Clay | F-CL |

**Summary of Samples from Phase 2 Test Holes**

| Test Hole Number | Northing | Easting | Approx. Surface Elevation | Starting Depth (feet) | Starting Elevation | Ending Elevation | Thickness (feet) | Visually Classified | Moisture Content, % | Density, pcf | Description | Composite Sample Sector/Class |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 427.0 | 5.2 | 421.8 | 420.5 | 1.3 | CH | | | Dark Brown/Gray Clay | F-CH |
| | | | 427.0 | 6.5 | 420.5 | 420.3 | 0.3 | MCL | | | Lt Gray/Brown Clayey Silt | F-MCL |
| | | | 427.0 | 6.8 | 420.3 | 420.0 | 0.3 | ML | | | Lt Tan Silt | Discarded |
| | | | 427.0 | 7.0 | 420.0 | | | MCL | | | Lt Gray/Brown Clayey Silt | F-MCL |
| 170 | 1116959.44 | 878947.64 | 429.5 | 0.0 | 429.5 | 429.3 | 0.2 | CL | | | Dark Brown/Gray Loose Clay | F-CL |
| | | | 429.5 | 0.2 | 429.3 | 428.4 | 0.9 | CL | 20.5 | 100.6 | Dark Brown/Gray Clay | F-CL |
| | | | 429.5 | 1.1 | 428.4 | 427.0 | 1.4 | MCL | | | Lt Brown/Gray Silty Clay | F-MCL |
| | | | 429.5 | 2.5 | 427.0 | 424.6 | 2.4 | SM | | | Lt Tan Very Fine Sandy Silt | Discarded |
| | | | 429.5 | 4.9 | 424.6 | 422.8 | 1.8 | SM | | | Lt Tan Silt w Very Fine Sand | Discarded |
| | | | 429.5 | 6.8 | 422.8 | 421.1 | 1.7 | SM | | | Lt Tan w Trace Fine Sandy Silt | Discarded |
| | | | 429.5 | 8.4 | 421.1 | 420.7 | 0.4 | SM | | | Lt Tan Silt w Very Fine Sand | Discarded |
| | | | 429.5 | 8.8 | 420.7 | 420.2 | 0.5 | MCL | | | Dark Brown Silty Clay | F-MCL |
| | | | 429.5 | 9.3 | 420.2 | 419.8 | 0.4 | SM | | | Lt Tan Silt w Very Fine Sand | Discarded |
| | | | 429.5 | 9.8 | 419.8 | 419.5 | 0.3 | MCL | | | Dark Brown Silty Clay | F-MCL |
| | | | 429.5 | 10.0 | 419.5 | | | SM | | | Lt Tan Very Fine Sandy Silt | Discarded |
| 171 | 1116907.49 | 879354.34 | 430.0 | 0.0 | 430.0 | 429.9 | 0.1 | MCL | | | Dark Gray Sandy Silty Clay | F-MCL |
| | | | 430.0 | 0.1 | 429.9 | 429.5 | 0.4 | CH | | | Dary Gray Clay | F-CH |
| | | | 430.0 | 0.5 | 429.5 | 429.2 | 0.3 | MCL | | | Gray Brown Clayey Sand | F-MCL |
| | | | 430.0 | 0.8 | 429.2 | 428.7 | 0.5 | CL | | | Gray/Brown Slightly Sandy Silty Clay | F-CL |
| | | | 430.0 | 1.3 | 428.7 | 428.4 | 0.3 | CH | | | Dark Gray/Brown Clay | F-CH |
| | | | 430.0 | 1.6 | 428.4 | 427.5 | 0.9 | MCL | | | Brown Silty Clay | F-MCL |
| | | | 430.0 | 2.5 | 427.5 | 427.1 | 0.4 | CL | | | Dark Gray/Brown Slightly Silty Clay | F-CL |
| | | | 430.0 | 2.9 | 427.1 | 426.6 | 0.5 | ML | | | Lt Brown Silt | Discarded |
| | | | 430.0 | 3.4 | 426.6 | 425.6 | 1.0 | SM | | | Lt Tan Very Fine Sandy Silt | Discarded |
| | | | 430.0 | 4.4 | 425.6 | 424.4 | 1.2 | SM | | | Lt Tan Silt Very Fine Sand | Discarded |
| | | | 430.0 | 5.6 | 424.4 | 423.3 | 1.2 | MCL | | | Brown Silty Clay | F-MCL |
| | | | 430.0 | 6.8 | 423.3 | 422.5 | 0.8 | SP | | | Lt Tan Silt w Very Fine Sand | Discarded |
| | | | 430.0 | 7.5 | 422.5 | 421.5 | 1.0 | MCL | | | Dark Brown Silty Clay | F-MCL |
| | | | 430.0 | 8.5 | 421.5 | 421.0 | 0.5 | SM | | | Lt Brown/Tan Silt w Fine Sand | Discarded |
| | | | 430.0 | 9.0 | 421.0 | 420.7 | 0.3 | MCL | | | Tan/Gray Silty Clay/Clayey Silt | F-MCL |
| | | | 430.0 | 9.3 | 420.7 | | | SM | | | Tan/Gray Very Fine Sandy Silt | Discarded |
| 172 | 1116855.55 | 879761.04 | 430.0 | 0.0 | 430.0 | 429.8 | 0.3 | CL | | | Dark Gray Clay | G-CL |
| | | | 430.0 | 0.3 | 429.8 | 429.0 | 0.8 | CL | | | Dark Gray Slightly Silty Clay | G-CL |
| | | | 430.0 | 1.0 | 429.0 | 428.5 | 0.5 | CH | | | Dark Brown/Gray Clay | G-CH |
| | | | 430.0 | 1.5 | 428.5 | 428.0 | 0.5 | CL | 26 | 94.5 | Brown Slightly Silty Clay | G-CL |
| | | | 430.0 | 2.0 | 428.0 | 427.8 | 0.3 | CH | | | Dark Gray Clay | G-CH |
| | | | 430.0 | 2.3 | 427.8 | 425.3 | 2.4 | ML | | | Lt Tan Silt | Discarded |
| | | | 430.0 | 4.7 | 425.3 | 424.8 | 0.6 | MCL | | | Lt Tan Silty Clay/Clayey Silt | G-MCL |
| | | | 430.0 | 5.3 | 424.8 | 423.9 | 0.8 | CH | | | Lt Gray/Brown Clay | G-CH |
| | | | 430.0 | 6.1 | 423.9 | 423.5 | 0.4 | ML | | | Lt Tan Silt | Discarded |
| | | | 430.0 | 6.5 | 423.5 | 421.3 | 2.2 | SM | | | Lt Tan Silt w Very Fine Sand | Discarded |
| | | | 430.0 | 8.7 | 421.3 | 420.3 | 1.1 | SM | | | Lt Tan Very Fine Sandy Siilt | Discarded |
| | | | 430.0 | 9.8 | 420.3 | | | MCL | | | Lt Tan Silty Clay/Clayey Silt | G-MCL |
| 173 | 1116803.60 | 880167.73 | 430.0 | 0.0 | 430.0 | 429.8 | 0.2 | MCL | | | Dark Gray Sandy Silty Clay | G-MCL |
| | | | 430.0 | 0.2 | 429.8 | 429.4 | 0.4 | CH | | | Dark Gray Clay | G-CH |
| | | | 430.0 | 0.6 | 429.4 | 429.0 | 0.4 | CH | | | Dark Gray/Brown Clay | G-CH |
| | | | 430.0 | 1.0 | 429.0 | 427.8 | 1.2 | CL | 19.9 | 99.3 | Brown Silty Clay | G-CL |
| | | | 430.0 | 2.2 | 427.8 | 425.4 | 2.4 | SM | 9.8 | 80.8 | Lt Tan Silt w Very Fine Sand | Discarded |
| | | | 430.0 | 4.6 | 425.4 | 424.7 | 0.8 | ML | | | Lt Tan Silt | Discarded |
| | | | 430.0 | 5.3 | 424.7 | 424.5 | 0.2 | CL | | | Dark Gray/Brown Slightly Silty Clay | G-CL |
| | | | 430.0 | 5.5 | 424.5 | 423.3 | 1.2 | SM | | | Lt Tan Silt w Very Fine Sand | Discarded |
| | | | 430.0 | 6.7 | 423.3 | 421.6 | 1.7 | SM | | | Lt Tan Silt w Very Fine Sand | Discarded |
| | | | 430.0 | 8.4 | 421.6 | | | ML | | | Lt Tan/Brown/Gray Slightly Clayey Silt | Discarded |
| 174 | 1116751.65 | 880574.43 | 430.0 | 0.0 | 430.0 | 429.0 | 1.0 | CL | | | Dark Brown/Gray Silty Clay | G-CL |
| | | | 430.0 | 1.0 | 429.0 | 428.5 | 0.5 | CH | 24.8 | 97.2 | Dark Gray Clay | G-CH |
| | | | 430.0 | 1.5 | 428.5 | 427.7 | 0.8 | ML | | | Lt Tan Silt | Discarded |
| | | | 430.0 | 2.3 | 427.7 | 427.0 | 0.7 | ML | 8.3 | 86 | Lt Tan Silt | Discarded |
| | | | 430.0 | 3.0 | 427.0 | 425.5 | 1.5 | CL | | | Black/Gray Clay Brick | Discarded |
| | | | 430.0 | 4.5 | 425.5 | 425.2 | 0.3 | | | | Brick & Debris | Discarded |
| | | | 430.0 | 4.8 | 425.2 | 424.6 | 0.6 | CL | | | Lt Brown Slightly Silty Clay | G-CL |
| | | | 430.0 | 5.4 | 424.6 | 423.5 | 1.1 | ML | | | Lt Tan Silt | Discarded |
| | | | 430.0 | 6.5 | 423.5 | 421.3 | 2.2 | ML | | | Lt Tan Silt | Discarded |
| | | | 430.0 | 8.7 | 421.3 | 420.5 | 0.8 | | | | Misc Silt Clay Brick etc | Discarded |
| | | | 430.0 | 9.5 | 420.5 | | | MCL | | | Lt Tan Silt/Silty Clay w Clay | G-MCL |
| 175 | 1116699.71 | 880981.12 | 430.0 | 0.0 | 430.0 | 429.8 | 0.2 | SM | | | Dark Brown Slightly Sandy Silt | Discarded |
| | | | 430.0 | 0.2 | 429.8 | 428.0 | 1.8 | CL | | | Dark Brown/Gray Clay | H-CL |
| | | | 430.0 | 2.0 | 428.0 | 427.6 | 0.4 | CL | | | Dark Brown/Gray Clay | H-CL |
| | | | 430.0 | 2.4 | 427.6 | 426.9 | 0.7 | CL-CH | | | Dark Brown/Gray Clay | H-CL-CH |
| | | | 430.0 | 3.1 | 426.9 | 426.4 | 0.5 | ML | | | Lt Brown Silt | Discarded |
| | | | 430.0 | 3.6 | 426.4 | 426.0 | 0.4 | SM | | | Lt Brown Fine Silt w Very Fine Sand | Discarded |
| | | | 430.0 | 4.0 | 426.0 | 425.4 | 0.6 | MCL | | | Brown Silty Clay | H-MCL |
| | | | 430.0 | 4.6 | 425.4 | 425.0 | 0.4 | CL | | | Lt Gray/Brown Clay | H-CL |
| | | | 430.0 | 5.0 | 425.0 | 423.5 | 1.5 | ML | | | Lt Brown Silt | Discarded |
| | | | 430.0 | 6.5 | 423.5 | 422.9 | 0.6 | MCL | | | Lt Brown Silty Clay/Clayey Silt | H-MCL |
| | | | 430.0 | 7.1 | 422.9 | 422.5 | 0.4 | SM | | | Lt Brown Silt w Very Fine Sand | Discarded |
| | | | 430.0 | 7.5 | 422.5 | 422.0 | 0.5 | SM | | | Dark Brown slightly clayey Silt | Discarded |
| | | | 430.0 | 8.0 | 422.0 | 421.3 | 0.7 | SM | | | Brown Silt w Fine Sand | Discarded |

**Summary of Samples from Phase 2 Test Holes**

| Test Hole Number | Northing | Easting | Approx. Surface Elevation | Starting Depth (feet) | Starting Elevation | Ending Elevation | Thickness (feet) | Visually Classified | Moisture Content, % | Density, pcf | Description | Composite Sample Sector/Class |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 430.0 | 8.7 | 421.3 | 421.1 | 0.2 | CL | | | Dark Brown Clay | H-CL |
| | | | 430.0 | 8.9 | 421.1 | 420.8 | 0.3 | SP | | | Lt Tan Fine Sand | Discarded |
| | | | 430.0 | 9.2 | 420.8 | 420.1 | 0.8 | SM | | | Brown Silt w Fine Sand | Discarded |
| | | | 430.0 | 9.9 | 420.1 | | | SM | | | Gray/Brown Fine Sandy Silt | Discarded |
| | | | 428.5 | 0.0 | 428.5 | 428.3 | 0.3 | SM | | | Brown Slightly Sandy Silt | Discarded |
| | | | 428.5 | 0.3 | 428.3 | 427.5 | 0.8 | SM | | | Brown Slightly Sandy Silt | Discarded |
| | | | 428.5 | 1.0 | 427.5 | 427.0 | 0.5 | SM | | | Lt Tan Very Fine Slightly Sandy Silt | Discarded |
| | | | 428.5 | 1.5 | 427.0 | 426.5 | 0.5 | SM | | | Lt Tan Very Fine Silty Sand | Discarded |
| | | | 428.5 | 2.0 | 426.5 | 426.3 | 0.2 | SM | | | Brown Very Fine Sandy Silt | Discarded |
| | | | 428.5 | 2.2 | 426.3 | 424.8 | 1.6 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| | | | 428.5 | 3.8 | 424.8 | 424.5 | 0.3 | CL-CH | | | Dark Brown/Gray Clay | H-CL-CH |
| 176 | 1116647.76 | 881387.82 | 428.5 | 4.0 | 424.5 | 424.3 | 0.3 | ML | | | Lt Brown Silt | Discarded |
| | | | 428.5 | 4.3 | 424.3 | 423.7 | 0.6 | CL | | | Dark Brown Clay w Very Fine Sand | H-CL |
| | | | 428.5 | 4.8 | 423.7 | 423.2 | 0.5 | SM | | | Lt Very Fine Sandy Silt | Discarded |
| | | | 428.5 | 5.3 | 423.2 | 422.5 | 0.7 | SM | | | Lt Tan Very Fine Slightly Silty Sand | Discarded |
| | | | 428.5 | 6.0 | 422.5 | 422.3 | 0.2 | SM | | | Tan Silty Fine Sand | Discarded |
| | | | 428.5 | 6.2 | 422.3 | 421.8 | 0.5 | CL | | | Dark Brown Clay w Slightly Clayey Silt | H-CL |
| | | | 428.5 | 6.7 | 421.8 | 421.3 | 0.5 | SM | | | Lt Tan Very Fine Sandy Silt | Discarded |
| | | | 428.5 | 7.2 | 421.3 | 420.7 | 0.6 | CL | | | Dark Gray Clay | H-CL |
| | | | 428.5 | 7.8 | 420.7 | | | SM | | | Lt Tan Very Slightly Silty Sand | Discarded |
| | | | 427.0 | 0.0 | 427.0 | 425.0 | 2.0 | CH | | | Dark Gray/Brown Clay | H-CH |
| | | | 427.0 | 2.0 | 425.0 | 424.0 | 1.0 | CH | | | Dark Brown/Gray Clay | H-CH |
| | | | 427.0 | 3.0 | 424.0 | 423.4 | 0.6 | MCL | | | Brown/Gray Silty Clay | H-MCL |
| 177 | 1116595.82 | 881794.52 | 427.0 | 3.6 | 423.4 | 423.0 | 0.4 | ML | 9.4 | 78.9 | Lt Tan Silt | Discarded |
| | | | 427.0 | 4.0 | 423.0 | 422.8 | 0.3 | CH | | | Dark Black/Gray Clay | H-CH |
| | | | 427.0 | 4.3 | 422.8 | 420.3 | 2.5 | SM | | | Lt Tan Silt w Very Fine Sand | Discarded |
| | | | 427.0 | 6.8 | 420.3 | | | SM | | | Lt Tan Silt w Very Fine Sand | Discarded |
| | | | 430.0 | 0.0 | 430.0 | 429.3 | 0.7 | CL | 17.3 | 93.8 | Dark Brown/Gray Slightly Silty Clay | F-CL |
| | | | 430.0 | 0.7 | 429.3 | 428.8 | 0.5 | CL/CH | 22.8 | 102.2 | Dark Brown/Gray Clay | F-CL/CH |
| | | | 430.0 | 1.2 | 428.8 | 428.3 | 0.5 | MCL | | | Brown Clayey Silt/Silty Clay | F-MCL |
| | | | 430.0 | 1.7 | 428.3 | 427.4 | 0.9 | ML | | | Lt Brown Silt | Discarded |
| | | | 430.0 | 2.6 | 427.4 | 425.6 | 1.8 | ML | | | Lt Tan w some Brown Silt | Discarded |
| 178 | 1116730.12 | 879125.02 | 430.0 | 4.4 | 425.6 | 423.4 | 2.2 | ML | | | Lt Tan Silt | Discarded |
| | | | 430.0 | 6.6 | 423.4 | 422.8 | 0.6 | ML | | | Lt Brown Clayey Silt | Discarded |
| | | | 430.0 | 7.2 | 422.8 | 422.4 | 0.4 | ML | | | Lt Brown Clayey Silt | Discarded |
| | | | 430.0 | 7.6 | 422.4 | 421.0 | 1.4 | CL | | | Brown/Gray Clay | F-CL |
| | | | 430.0 | 9.0 | 421.0 | 420.3 | 0.7 | SM | | | Lt Tan Very Fine Sandy Silt | Discarded |
| | | | 430.0 | 9.7 | 420.3 | | | SM | | | Lt Tan Very Fine Silty Sand | Discarded |
| 179 | 1116574.28 | 880345.11 | 427.0 | | 427.0 | 430.0 | -3.0 | | | | | G- |
| | | | 430.0 | 0.0 | 430.0 | 429.9 | 0.1 | ML | | | Brown Silt | Discarded |
| | | | 430.0 | 0.1 | 429.9 | 428.9 | 1.0 | CH | | | Dark Gray Clay | H-CH |
| | | | 430.0 | 1.1 | 428.9 | 427.8 | 1.2 | MCL | | | Dark Gray/Brown Silty Clay | G-MCL |
| | | | 430.0 | 2.3 | 427.8 | 425.4 | 2.3 | SM | | | Lt Brown Silt w Fine Sand | Discarded |
| 180 | 1116366.50 | 881971.89 | 430.0 | 4.6 | 425.4 | 425.2 | 0.2 | SP | | | Lt Tan Sand | Discarded |
| | | | 430.0 | 4.8 | 425.2 | 424.8 | 0.4 | MCL | | | Dark Brown Silty Clay | G-MCL |
| | | | 430.0 | 5.3 | 424.8 | 423.6 | 1.2 | SM | | | Gray/Brown Silt w Very Fine Sand | Discarded |
| | | | 430.0 | 6.4 | 423.6 | 421.4 | 2.2 | CL | 30.8 | 89.5 | Tan Grey Clay w Silt Seams | H-CL |
| | | | 430.0 | 8.6 | 421.4 | 420.9 | 0.5 | CL | | | Dark Brown Clay | H-CL |
| | | | 430.0 | 9.1 | 420.9 | | | ML | | | Lt Brown Silt | Discarded |
| | | | 429.5 | 0.0 | 429.5 | 429.0 | 0.5 | MCL | | | Dark Brown Silty Clay | I-MCL |
| | | | 429.5 | 0.5 | 429.0 | 428.5 | 0.5 | CL | | | Dark Brown Clay | I-CL |
| | | | 429.5 | 1.0 | 428.5 | 427.1 | 1.4 | MCL | | | Brown Silty Clay | I-MCL |
| | | | 429.5 | 2.4 | 427.1 | 424.9 | 2.2 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| 181 | 1116224.69 | 878629.75 | 429.5 | 4.6 | 424.9 | 424.8 | 0.2 | CL | | | Dark Brown Clay Seam | I-CL |
| | | | 429.5 | 4.8 | 424.8 | 423.0 | 1.8 | SM | | | Lt Tan Very Fine Silty Sand/Sandy Silt | Discarded |
| | | | 429.5 | 6.5 | 423.0 | 422.5 | 0.5 | ML | | | Lt Tan Very Slightly Clayey Silt | Discarded |
| | | | 429.5 | 7.0 | 422.5 | 421.6 | 0.9 | MCL | 31.5 | 89.7 | Lt Gray Tan Silty Clay | I-MCL |
| | | | 429.5 | 7.9 | 421.6 | 420.8 | 0.8 | CH | 28.6 | 89.4 | Lt Gray Tan Clay | I-CH |
| | | | 429.5 | 8.8 | 420.8 | | | CL | | | Brown Clay | I-CL |
| | | | 429.0 | 0.0 | 429.0 | 428.3 | 0.8 | MCL | | | Dark Brown/Gray Silty Clay | I-MCL |
| | | | 429.0 | 0.8 | 428.3 | 427.8 | 0.5 | CL | | | Dark Brown Clay | I-CL |
| | | | 429.0 | 1.3 | 427.8 | 426.5 | 1.3 | CH | | | Dark Brown Clay | I-CH |
| | | | 429.0 | 2.5 | 426.5 | 425.8 | 0.8 | MCL | | | Dark Brown/Tan Silty Clay | I-MCL |
| 182 | 1116173.11 | 878925.49 | 429.0 | 3.3 | 425.8 | 424.4 | 1.3 | ML | | | Lt Tan Silt | Discarded |
| | | | 429.0 | 4.6 | 424.4 | 422.4 | 2.0 | ML | | | Lt Tan Silt w Clay Seam | Discarded |
| | | | 429.0 | 6.6 | 422.4 | 421.9 | 0.5 | MCL | | | Tan/Dark Brown Silty Clay/Clayey Silt | I-MCL |
| | | | 429.0 | 7.1 | 421.9 | 420.7 | 1.3 | CL | 38.1 | 83.5 | Brown Clay | I-CL |
| | | | 429.0 | 8.3 | 420.7 | | | CL | | | Brown Clay | I-CL |
| | | | 429.0 | 0.0 | 429.0 | 428.7 | 0.3 | MCL | | | Dark Gray/Brown Silty Clay | I-MCL |
| | | | 429.0 | 0.3 | 428.7 | 428.3 | 0.4 | CL | | | Dark Gray/Brown Clay | I-CL |
| | | | 429.0 | 0.8 | 428.3 | 427.6 | 0.7 | CH | | | Dark Brown Clay | I-CH |
| | | | 429.0 | 1.4 | 427.6 | 426.7 | 0.9 | MCL | | | Brown Silty Clay | I-MCL |
| | | | 429.0 | 2.3 | 426.7 | 425.9 | 0.8 | ML | | | Dark Brown Clayey Silt | Discarded |
| | | | 429.0 | 3.1 | 425.9 | 424.5 | 1.4 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| | | | 429.0 | 4.5 | 424.5 | 424.1 | 0.4 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| 183 | 1116128.04 | 879222.11 | 429.0 | 4.9 | 424.1 | 423.8 | 0.3 | MCL | | | Dark Brown Silty Clay/Clayey Silt | I-MCL |
| | | | 429.0 | 5.3 | 423.8 | 422.8 | 1.0 | SM | | | Lt Tan Fine Sandy Silt | Discarded |

**Summary of Samples from Phase 2 Test Holes**

| Test Hole Number | Northing | Easting | Approx. Surface Elevation | Starting Depth (feet) | Starting Elevation | Ending Elevation | Thickness (feet) | Visually Classified | Moisture Content, % | Density, pcf | Description | Composite Sample Sector/Class |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 429.0 | 6.3 | 422.8 | 421.8 | 1.0 | MCL | | | Brown/Tan Silty Clay/Clayey Silt w Sa | I-MCL |
| | | | 429.0 | 7.3 | 421.8 | 420.2 | 1.6 | SM | | | Lt Tan Fine Sandy Silt | Discarded |
| | | | 429.0 | 8.8 | 420.2 | 419.9 | 0.3 | MCL | | | Dark Brown Silty Clay | I-MCL |
| | | | 429.0 | 9.1 | 419.9 | 419.3 | 0.6 | SM | | | Brown Silt w Fine Sand | Discarded |
| | | | 429.0 | 9.7 | 419.3 | | | MCL | | | Brown Silty Clay/Clayey Silt | I-MCL |
| | | | 429.0 | 0.0 | 429.0 | 428.7 | 0.3 | MCL | | | Dark Brown/Gray Silty Clay | I-MCL |
| | | | 429.0 | 0.3 | 428.7 | 428.3 | 0.3 | MCL | | | Dary Gray/Brown Silty Clay | I-MCL |
| | | | 429.0 | 0.7 | 428.3 | 427.9 | 0.4 | CL | | | Dark Black/Gray Clay | I-CL |
| | | | 429.0 | 1.1 | 427.9 | 426.5 | 1.4 | CH | 32.3 | 90.8 | Dark Black/Gray Clay | I-CH |
| | | | 429.0 | 2.5 | 426.5 | 425.2 | 1.3 | MCL | | | Dark Brown Silty Clay | I-MCL |
| | | | 429.0 | 3.8 | 425.2 | 424.3 | 0.9 | SM | | | Lt Tan Fine Sandy Silt | Discarded |
| 184 | 1116077.44 | 879517.98 | 429.0 | 4.8 | 424.3 | 424.0 | 0.3 | MCL | | | Dark Brown Silty Clay | I-MCL |
| | | | 429.0 | 5.0 | 424.0 | 422.3 | 1.7 | SM | | | Lt Tan Fine Sandy Silt | Discarded |
| | | | 429.0 | 6.7 | 422.3 | 421.5 | 0.8 | CL | | | Dark Brown Clay | I-CL |
| | | | 429.0 | 7.5 | 421.5 | 420.4 | 1.1 | SM | | | Dark Brown Fine Sandy Silt | Discarded |
| | | | 429.0 | 8.6 | 420.4 | 420.0 | 0.4 | SM | | | Lt Brown Silt w Fine Sand | Discarded |
| | | | 429.0 | 9.0 | 420.0 | 419.3 | 0.8 | MCL | | | Dark Brown Silty Clay | I-MCL |
| | | | 429.0 | 9.8 | 419.3 | | | MCL | | | Dark Brown Clayey Silt | I-MCL |
| | | | 429.0 | 0.0 | 429.0 | 428.6 | 0.4 | MCL | | | Dark Brown/Gray Silty Clay | I-MCL |
| | | | 429.0 | 0.4 | 428.6 | 428.3 | 0.3 | CL | | | Dark Brown Clay | I-CL |
| | | | 429.0 | 0.8 | 428.3 | 426.4 | 1.8 | CH | | | Dark Brown/Gray Clay | I-CH |
| | | | 429.0 | 2.6 | 426.4 | 425.7 | 0.8 | MCL | | | Dark Brown Silty Clay | I-MCL |
| 185 | 1116033.48 | 879814.76 | 429.0 | 3.3 | 425.7 | 424.3 | 1.4 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| | | | 429.0 | 4.8 | 424.3 | 424.0 | 0.3 | ML | | | Lt Tan Silt | Discarded |
| | | | 429.0 | 5.0 | 424.0 | 422.4 | 1.6 | SM | | | Lt Tan Silty Sand/Sandy Silt | Discarded |
| | | | 429.0 | 6.6 | 422.4 | 420.5 | 1.9 | SM | | | Lt Tan Silty Fine Sand | Discarded |
| | | | 429.0 | 8.5 | 420.5 | 419.6 | 0.9 | MCL | | | Dark Brown Silty Clay | I-MCL |
| | | | 429.0 | 9.4 | 419.6 | | | SM | | | Lt Tan Slightly Silty Fine Sand | Discarded |
| | | | 429.0 | 0.0 | 429.0 | 428.0 | 1.0 | MCL | | | Dark Brown Silty Clay | J-MCL |
| | | | 429.0 | 1.0 | 428.0 | 426.6 | 1.4 | CH | | | Dark Brown Clay | J-CH |
| | | | 429.0 | 2.4 | 426.6 | 424.4 | 2.2 | CH | | | Dark Brown Clay | J-CH |
| | | | 429.0 | 4.6 | 424.4 | 424.0 | 0.4 | CH | | | Dark Brown Clay | J-CH |
| | | | 429.0 | 5.0 | 424.0 | 423.5 | 0.5 | MCL | | | Dark Brown/Tan Silty Clay | J-MCL |
| 186 | 1115992.84 | 880112.00 | 429.0 | 5.5 | 423.5 | 422.3 | 1.2 | SM | | | Lt Tan Fine Sandy Silt | Discarded |
| | | | 429.0 | 6.7 | 422.3 | 421.6 | 0.7 | SM | | | Lt Tan Slightly Silty Fine Sand | Discarded |
| | | | 429.0 | 7.4 | 421.6 | 420.5 | 1.1 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| | | | 429.0 | 8.5 | 420.5 | 420.3 | 0.3 | SM | | | Lt Brown Silty Sand/Sandy Silt | Discarded |
| | | | 429.0 | 8.8 | 420.3 | 419.3 | 0.9 | MCL | | | Brown/Gray Silty Clay | J-MCL |
| | | | 429.0 | 9.7 | 419.3 | | | SM | | | Lt Tan Slightly Silty Fine Sand | Discarded |
| | | | 428.5 | 0.0 | 428.5 | 428.0 | 0.5 | MCL | | | Dark Black/Gray Slightly Silty Clay | J-MCL |
| | | | 428.5 | 0.5 | 428.0 | 426.9 | 1.1 | CL | | | Dark Gray/Brown Clay | J-CL |
| | | | 428.5 | 1.6 | 426.9 | 426.0 | 0.9 | CH | | | Dark Brown Clay | J-CH |
| 187 | 1115947.77 | 880408.62 | 428.5 | 2.5 | 426.0 | 423.8 | 2.2 | CL | | | Dark Brown Clay w Silt Seams | J-CL |
| | | | 428.5 | 4.7 | 423.8 | 421.9 | 1.9 | CH | | | Dark Brown Clay | J-CH |
| | | | 428.5 | 6.6 | 421.9 | 419.8 | 2.1 | MCL | | | Brown/Tan Silty Clay | J-MCL |
| | | | 428.5 | 8.7 | 419.8 | | | MCL | | | Dark Brown Silty Clay | J-MCL |
| | | | 428.5 | 0.0 | 428.5 | 428.3 | 0.2 | MCL | | | Dark Brown Slightly Silty Clay | J-MCL |
| | | | 428.5 | 0.2 | 428.3 | 427.9 | 0.4 | CL | | | Dark Brown Clay | J-CL |
| | | | 428.5 | 0.6 | 427.9 | 427.4 | 0.5 | CH | | | Dark Brown Clay | J-CH |
| | | | 428.5 | 1.1 | 427.4 | 426.2 | 1.3 | MCL | | | Brown Silty Clay/Clayey Silt | J-MCL |
| | | | 428.5 | 2.3 | 426.2 | 425.5 | 0.7 | SM | | | Lt Tan Clayey Silt w Fine Sand | Discarded |
| | | | 428.5 | 3.0 | 425.5 | 425.0 | 0.5 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| 188 | 1115902.70 | 880705.25 | 428.5 | 3.5 | 425.0 | 424.0 | 1.0 | SM | | | Lt Tan Silty Fine Sand | Discarded |
| | | | 428.5 | 4.5 | 424.0 | 423.6 | 0.4 | ML | | | Lt Brown Silt | Discarded |
| | | | 428.5 | 4.9 | 423.6 | 421.9 | 1.7 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| | | | 428.5 | 6.6 | 421.9 | 421.5 | 0.4 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| | | | 428.5 | 7.0 | 421.5 | 420.0 | 1.5 | MCL | | | Lt Brown/Tan Silty Clay/Clayey Silt | J-MCL |
| | | | 428.5 | 8.5 | 420.0 | 418.5 | 1.5 | MCL | | | Brown/Tan Silty Clay/Clayey Silt | J-MCL |
| | | | 428.5 | 10.0 | 418.5 | | | MCL | | | Lt Brown/Tan Slightly Clayey Silt w Fi | J-MCL |
| | | | 427.5 | 0.0 | 427.5 | 427.1 | 0.4 | SM | | | Dark Gray/Brown Silty Slightly Sandy | Discarded |
| | | | 427.5 | 0.4 | 427.1 | 426.7 | 0.4 | CL | | | Dark Black/Gray Clay | K-CL |
| | | | 427.5 | 0.8 | 426.7 | 425.1 | 1.6 | CH | | | Dark Black/Gray Clay | K-CH |
| | | | 427.5 | 2.4 | 425.1 | 423.0 | 2.1 | CH | | | Dark Brown/Gray Clay | K-CH |
| 189 | 1115857.92 | 881000.00 | 427.5 | 4.5 | 423.0 | 422.3 | 0.8 | CH | | | Dark Brown/Black Clay | K-CH |
| | | | 427.5 | 5.3 | 422.3 | 421.3 | 0.9 | MCL | | | Lt Tan/Gray Silty Clay, Clayey Silt | K-MCL |
| | | | 427.5 | 6.2 | 421.3 | 420.5 | 0.8 | SM | | | Lt Tan Silty Sand/Sandy Silt | Discarded |
| | | | 427.5 | 7.0 | 420.5 | 419.7 | 0.8 | MCL | | | Brown Silty Clay | K-MCL |
| | | | 427.5 | 7.8 | 419.7 | | | SP | | | Lt Tan Very Fine Sand | Discarded |
| | | | 428.0 | 0.0 | 428.0 | 427.7 | 0.3 | MCL | | | Dark Gray/Brown Sandy Silty Clay | K-MCL |
| | | | 428.0 | 0.3 | 427.7 | 427.3 | 0.3 | CL | | | Dark Brown/Gray Clay | K-CL |
| | | | 428.0 | 0.7 | 427.3 | 425.7 | 1.7 | CH | | | Dark Gray/Brown Clay | K-CH |
| | | | 428.0 | 2.3 | 425.7 | 425.0 | 0.7 | CH | | | Dark Brown/Gray Clay | K-CH |
| 190 | 1115812.57 | 881298.50 | 428.0 | 3.0 | 425.0 | 424.5 | 0.5 | MCL | 10.6 | 88.8 | Lt Tan Silty Clay | K-MCL |
| | | | 428.0 | 3.5 | 424.5 | 423.5 | 1.0 | ML | | | Lt Tan Silt w Clay Seam | Discarded |
| | | | 428.0 | 4.5 | 423.5 | 423.3 | 0.3 | ML | | | Lt Tan/Brown Silt | Discarded |
| | | | 428.0 | 4.8 | 423.3 | 423.0 | 0.3 | CL | | | Dark Brown/Gray Clay | K-CL |
| | | | 428.0 | 5.0 | 423.0 | 421.5 | 1.5 | ML | 15.8 | 81.6 | Lt Tan/Brown Silt w clay seams | Discarded |

**Summary of Samples from Phase 2 Test Holes**

| Test Hole Number | Northing | Easting | Approx. Surface Elevation | Starting Depth (feet) | Starting Elevation | Ending Elevation | Thickness (feet) | Visually Classified | Moisture Content, % | Density, pcf | Description | Composite Sample Sector/Class |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 428.0 | 6.5 | 421.5 | | | ML | | | Lt Tan/Brown Silt | Discarded |
| 191 | 1115963.24 | 879198.81 | 428.0 | 0.0 | 428.0 | 427.5 | 0.5 | MCL | | | Dark Gray/Brown Silty Clay | I-MCL |
| | | | 428.0 | 0.5 | 427.5 | 425.8 | 1.7 | CH | | | Dark Gray/Brown Clay | I-CH |
| | | | 428.0 | 2.2 | 425.8 | 425.5 | 0.3 | CH | | | Dark Gray/Brown Clay | I-CH |
| | | | 428.0 | 2.5 | 425.5 | 425.3 | 0.3 | ML | | | Lt Brown Clayey Silt | Discarded |
| | | | 428.0 | 2.8 | 425.3 | 423.3 | 1.9 | ML | | | Lt Tan Silt | Discarded |
| | | | 428.0 | 4.7 | 423.3 | 422.5 | 0.8 | ML | | | Lt Tan/Brown Slightly Clayey Silt | Discarded |
| | | | 428.0 | 5.5 | 422.5 | 422.3 | 0.2 | ML | | | Brown Clayey Silt | Discarded |
| | | | 428.0 | 5.7 | 422.3 | 422.1 | 0.2 | CL | | | Dark Brown Clay | I-CL |
| | | | 428.0 | 5.9 | 422.1 | 421.1 | 1.0 | MCL | | | Brown Silty Clay | I-MCL |
| | | | 428.0 | 6.9 | 421.1 | | | MCL | | | Brown Silty Clay | I-MCL |
| 192 | 1115785.72 | 879477.97 | 428.5 | 0.0 | 428.5 | 428.2 | 0.3 | MCL | | | Dark Brown Silty Clay | I-MCL |
| | | | 428.5 | 0.3 | 428.2 | 427.8 | 0.4 | CL | | | Dark Gray/Brown Clay | I-CL |
| | | | 428.5 | 0.8 | 427.8 | 426.1 | 1.7 | MCL | | | Dark Gray/Brown Silty Clay | I-MCL |
| | | | 428.5 | 2.4 | 426.1 | 426.0 | 0.1 | CH | | | Dark Brown/Gray Clay | I-CH |
| | | | 428.5 | 2.5 | 426.0 | 423.6 | 2.4 | ML | | | Lt Tan Silt | Discarded |
| | | | 428.5 | 4.9 | 423.6 | 421.8 | 1.8 | SM | | | Lt Tan Fine Sandy Silt | Discarded |
| | | | 428.5 | 6.7 | 421.8 | | | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| 193 | 1115740.66 | 879774.60 | 427.5 | 0.0 | 427.5 | 427.2 | 0.3 | MCL | | | Dark Brown Silty Clay | I-MCL |
| | | | 427.5 | 0.3 | 427.2 | 425.1 | 2.1 | CL | 30.9 | 92.3 | Dark Brown Gray Clay | I-CL |
| | | | 427.5 | 2.4 | 425.1 | 423.5 | 1.6 | MCL | | | Dark Brown/Tan Silty Clay | I-MCL |
| | | | 427.5 | 4.0 | 423.5 | 423.0 | 0.5 | ML | | | Lt Tan Silt | Discarded |
| | | | 427.5 | 4.5 | 423.0 | 422.5 | 0.5 | MCL | | | Lt Tan Clayey Silt/ Silty Clay | I-MCL |
| | | | 427.5 | 5.0 | 422.5 | 421.2 | 1.3 | CL | | | Dark Brown Clay | I-CL |
| | | | 427.5 | 6.3 | 421.2 | 420.8 | 0.4 | MCL | | | Brown Silty Clay/Clayey Silt | I-MCL |
| | | | 427.5 | 6.8 | 420.8 | | | ML | | | Lt Tan Silt | Discarded |
| 194 | 1115695.59 | 880071.22 | 427.5 | 0.0 | 427.5 | 427.1 | 0.4 | MCL | | | Dark Black/Gray Slightly Silty Clay | J-MCL |
| | | | 427.5 | 0.4 | 427.1 | 426.8 | 0.3 | CL | | | Dark Black/Gray Clay | J-CL |
| | | | 427.5 | 0.7 | 426.8 | 425.2 | 1.7 | CH | | | Dark Brown Clay | J-CH |
| | | | 427.5 | 2.3 | 425.2 | 423.2 | 2.0 | MCL | | | Dark Brown/Tan Silty Clay | J-MCL |
| | | | 427.5 | 4.3 | 423.2 | 422.5 | 0.7 | MCL | | | Dark Brown w Trace Tan Silty Clay | J-MCL |
| | | | 427.5 | 5.0 | 422.5 | 421.2 | 1.3 | SM | | | Lt Tan Fine Sandy Silt | Discarded |
| | | | 427.5 | 6.3 | 421.2 | | | MCL | | | Dark Brown/Tan Silty Clay | J-MCL |
| 195 | 1115650.52 | 880367.85 | 429.0 | 0.0 | 429.0 | 428.8 | 0.3 | MCL | | | Dark Black/Gray Silty Clay | J-MCL |
| | | | 429.0 | 0.3 | 428.8 | 428.3 | 0.5 | CL | | | Dark Black/Gray Clay | J-CL |
| | | | 429.0 | 0.8 | 428.3 | 426.8 | 1.4 | CH | | | Dark Brown Clay | J-CH |
| | | | 429.0 | 2.2 | 426.8 | 426.0 | 0.8 | CL | | | Dark Gray/Brown Clay w Silt Seam | J-CL |
| | | | 429.0 | 3.0 | 426.0 | 424.6 | 1.4 | MCL | | | Brown Clayey Silt | J-MCL |
| | | | 429.0 | 4.4 | 424.6 | 424.2 | 0.4 | MCL | | | Dark Brown Silty Clay | J-MCL |
| | | | 429.0 | 4.8 | 424.2 | 422.4 | 1.8 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| | | | 429.0 | 6.6 | 422.4 | 420.5 | 1.9 | MCL | 26.2 | 82.1 | Lt Tan/Brown Clayey Silt | J-MCL |
| | | | 429.0 | 8.5 | 420.5 | 420.3 | 0.3 | MCL | | | Brown Silty Clay | J-MCL |
| | | | 429.0 | 8.8 | 420.3 | 419.8 | 0.4 | SM | | | Lt Tan Sandy Silt | Discarded |
| | | | 429.0 | 9.2 | 419.8 | | | SM | | | Lt Tan Silty Sand | Discarded |
| 196 | 1115605.45 | 880664.48 | 429.0 | 0.0 | 429.0 | 428.8 | 0.3 | MCL | | | Dark Brown Silty Clay | J-MCL |
| | | | 429.0 | 0.3 | 428.8 | 427.9 | 0.8 | CH | | | Dark Black/Gray Clay | J-CH |
| | | | 429.0 | 1.1 | 427.9 | 427.0 | 0.9 | MCL | | | Dark Brown Silty Clay | J-MCL |
| | | | 429.0 | 2.0 | 427.0 | 426.8 | 0.3 | MCL | | | Dark Gray/Brown Silty Clay | J-MCL |
| | | | 429.0 | 2.3 | 426.8 | 425.7 | 1.1 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| | | | 429.0 | 3.3 | 425.7 | 424.8 | 0.9 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| | | | 429.0 | 4.3 | 424.8 | 422.5 | 2.3 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| | | | 429.0 | 6.5 | 422.5 | 421.6 | 0.9 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| | | | 429.0 | 7.4 | 421.6 | 420.6 | 1.0 | MCL | | | Lt Brown Clayey Silt/Silty Clay | J-MCL |
| | | | 429.0 | 8.4 | 420.6 | 419.8 | 0.8 | MCL | | | Brown Silty Clay/Clayey Silt | J-MCL |
| | | | 429.0 | 9.3 | 419.8 | 419.0 | 0.8 | MCL | | | Brown Silty Clay/Clayey Silt | J-MCL |
| | | | 429.0 | 10.0 | 419.0 | | | SM | | | Lt Tan Silty Sand | Discarded |
| 197 | 1115560.39 | 880961.11 | 429.0 | 0.0 | 429.0 | 428.6 | 0.4 | CL | | | Black/Gray Clay | K-CL |
| | | | 429.0 | 0.4 | 428.6 | 428.3 | 0.3 | CL | | | Dark Brown/Gray Clay | K-CL |
| | | | 429.0 | 0.8 | 428.3 | 426.7 | 1.6 | CH | | | Dark Brown/Gray Clay | K-CH |
| | | | 429.0 | 2.3 | 426.7 | 426.3 | 0.3 | CH | | | Dark Brown/Gray Clay | K-CH |
| | | | 429.0 | 2.7 | 426.3 | 425.8 | 0.6 | MCL | 18.3 | 86.2 | Dark Brown/Tan Silty Clay | K-MCL |
| | | | 429.0 | 3.3 | 425.8 | 424.5 | 1.3 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| | | | 429.0 | 4.5 | 424.5 | 422.5 | 2.0 | ML | | | Lt Tan Silt w Clay Seam | Discarded |
| | | | 429.0 | 6.5 | 422.5 | 420.5 | 2.0 | SM | | | Lt Tan Silt w Very Fine Sand | Discarded |
| | | | 429.0 | 8.5 | 420.5 | | | MCL | | | Brown/Gray Silty Clay | K-MCL |
| 198 | 1115515.32 | 881257.73 | 428.5 | 0.0 | 428.5 | 428.3 | 0.2 | MCL | | | Dark Brown/Gray Sandy Silty Clay | K-MCL |
| | | | 428.5 | 0.2 | 428.3 | 428.0 | 0.3 | CL | | | Dark Brown/Gray Slightly Silty Clay | K-CL |
| | | | 428.5 | 0.5 | 428.0 | 426.0 | 2.0 | CH | | | Dark Brown/Gray Clay | K-CH |
| | | | 428.5 | 2.5 | 426.0 | 425.0 | 1.0 | MCL | | | Lt Tan Silt w Brown Clay | K-MCL |
| | | | 428.5 | 3.5 | 425.0 | 424.1 | 0.9 | SM | | | Lt Tan Slightly Silty Very Fine Sand | Discarded |
| | | | 428.5 | 4.4 | 424.1 | 424.0 | 0.1 | SM | | | Lt Tan Silty Sand/Sandy Silt | Discarded |
| | | | 428.5 | 4.5 | 424.0 | 423.8 | 0.3 | CL | | | Dark Gray Clay Seam | K-CL |
| | | | 428.5 | 4.8 | 423.8 | 423.1 | 0.7 | SM | | | Lt Tan Slightly Silty Sand | Discarded |
| | | | 428.5 | 5.4 | 423.1 | 421.7 | 1.4 | SM | | | Lt Tan Very Fine Sandy Silt/Silty Sand | Discarded |
| | | | 428.5 | 6.8 | 421.7 | 421.0 | 0.7 | SM | | | Lt Brown w Sandy Silt | Discarded |
| | | | 428.5 | 7.5 | 421.0 | 419.8 | 1.2 | SM | | | Lt Tan Slightly Silty Sand | Discarded |
| | | | 428.5 | 8.7 | 419.8 | 419.6 | 0.2 | SM | | | Lt Tan Very Fine Sandy Silt | Discarded |

**Summary of Samples from Phase 2 Test Holes**

| Test Hole Number | Northing | Easting | Approx. Surface Elevation | Starting Depth (feet) | Starting Elevation | Ending Elevation | Thickness (feet) | Visually Classified | Moisture Content, % | Density, pcf | Description | Composite Sample Sector/Class |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 428.5 | 8.9 | 419.6 | | | MCL | | | Brown Silty Clay/Clayey Silt | K-MCL |
| 199 | 1115472.83 | 880040.59 | 428.0 | 0.0 | 428.0 | 427.5 | 0.5 | MCL | | | Dark Black/Gray Silty Clay | J-MCL |
| | | | 428.0 | 0.5 | 427.5 | 427.0 | 0.5 | CL | | | Dark Black/Gray Clay | J-CL |
| | | | 428.0 | 1.0 | 427.0 | 425.7 | 1.3 | CH | | | Dark Gray/Brown Clay | J-CH |
| | | | 428.0 | 2.3 | 425.7 | 423.5 | 2.2 | MCL | | | Dark Brown Silty Clay | J-MCL |
| | | | 428.0 | 4.5 | 423.5 | 421.5 | 2.0 | MCL | | | Dark Brown/Tan Silty Clay | J-MCL |
| | | | 428.0 | 6.5 | 421.5 | | | MCL | | | Brown Clayey Silt | J-MCL |
| 200 | 1115353.27 | 880327.08 | 428.0 | 0.0 | 428.0 | 427.6 | 0.4 | MCL | | | Dark Black/Gray Slightly Silty Clay | J-MCL |
| | | | 428.0 | 0.4 | 427.6 | 427.1 | 0.5 | CL | | | Dark Black/Gray Clay | J-CL |
| | | | 428.0 | 0.9 | 427.1 | 425.5 | 1.6 | CH | 27.9 | 95.8 | Dark Black/Gray Clay | J-CH |
| | | | 428.0 | 2.5 | 425.5 | 423.6 | 1.9 | CH | 35.1 | 84 | Dark Brown Clay | J-CH |
| | | | 428.0 | 4.4 | 423.6 | 423.2 | 0.4 | MCL | | | Dark Brown Silty Clay | J-MCL |
| | | | 428.0 | 4.8 | 423.2 | 423.1 | 0.1 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| | | | 428.0 | 4.9 | 423.1 | 421.5 | 1.6 | MCL | | | Dark Brown Silty Clay | J-MCL |
| | | | 428.0 | 6.5 | 421.5 | 421.3 | 0.2 | MCL | | | Brown Slightly Clayey Silt | J-MCL |
| | | | 428.0 | 6.7 | 421.3 | 421.0 | 0.3 | SP | | | Lt Tan Sand | Discarded |
| | | | 428.0 | 7.0 | 421.0 | | | MCL | | | Brown w Tan Clayey Silt/Silty Clay | J-MCL |
| 201 | 1115308.21 | 880623.71 | 427.0 | 0.0 | 427.0 | 426.6 | 0.4 | MCL | | | Dark Brown Slightly Silty Clay | J-MCL |
| | | | 427.0 | 0.4 | 426.6 | 426.1 | 0.5 | CL | | | Dark Brown Gray Clay | J-CL |
| | | | 427.0 | 0.9 | 426.1 | 424.5 | 1.6 | CH | | | Dark Brown Clay | J-CH |
| | | | 427.0 | 2.5 | 424.5 | 422.4 | 2.1 | CH | | | Dark Brown Clay | J-CH |
| | | | 427.0 | 4.6 | 422.4 | 420.5 | 1.9 | MCL | 14.3 | 92.9 | Brown/Gray clayey silt | J-MCL |
| | | | 427.0 | 6.5 | 420.5 | | | SM | 14.6 | 88.5 | Lt Tan Fine Sandy Silt | Discarded |
| 202 | 1115263.14 | 880920.33 | 426.5 | 0.0 | 426.5 | 426.3 | 0.3 | SM | | | Dark Brown/Gray Silty Sandy Clay | Discarded |
| | | | 426.5 | 0.3 | 426.3 | 424.1 | 2.2 | CH | | | Dark Gray Clay | K-CH |
| | | | 426.5 | 2.4 | 424.1 | 421.8 | 2.3 | CH | 32.6 | 86.7 | Brown/Gray Mottled Clay | K-CH |
| | | | 426.5 | 4.8 | 421.8 | 421.5 | 0.3 | CH | | | Dark Brown/Gray Clay | K-CH |
| | | | 426.5 | 5.0 | 421.5 | 421.0 | 0.5 | MCL | | | Brown/Gray Silty Clay/Clayey Silt | K-MCL |
| | | | 426.5 | 5.5 | 421.0 | 420.3 | 0.7 | CL | | | Dark Brown Clay | K-CL |
| | | | 426.5 | 6.2 | 420.3 | 420.2 | 0.2 | MCL | | | Brown Slightly Clayey Silt w Fine Sand | K-MCL |
| | | | 426.5 | 6.3 | 420.2 | | | CL | | | Brown/Gray Clay | K-CL |
| 203 | 1115218.07 | 881216.96 | 427.0 | 0.0 | 427.0 | 426.3 | 0.8 | SM | | | Dark Brown/Gray Sandy Silty Clay | Discarded |
| | | | 427.0 | 0.8 | 426.3 | 424.8 | 1.5 | CH | | | Dark Gray/Brown Mottled Clay | K-CH |
| | | | 427.0 | 2.3 | 424.8 | 423.9 | 0.8 | CL | | | Dark Brown/Gray Clay | K-CL |
| | | | 427.0 | 3.1 | 423.9 | 422.5 | 1.4 | MCL | 27.7 | 80.7 | Dark Brown Silty Clay | K-MCL |
| | | | 427.0 | 4.5 | 422.5 | 422.0 | 0.5 | CL | | | Dark Brown/Gray Clay w Silt Seams | K-CL |
| | | | 427.0 | 5.0 | 422.0 | 420.3 | 1.7 | SM | | | Lt Tan Silty Sand/Sandy Silt | Discarded |
| | | | 427.0 | 6.7 | 420.3 | 419.8 | 0.5 | MCL | | | Brown Silty Clay | K-MCL |
| | | | 427.0 | 7.2 | 419.8 | 418.9 | 0.9 | CH | | | Dark Brown Clay | K-CH |
| | | | 427.0 | 8.1 | 418.9 | | | SM | | | Lt Tan Very Fine Sandy Silt | Discarded |
| 204 | 1115058.87 | 880891.85 | 427.5 | 0.0 | 427.5 | 427.3 | 0.3 | SM | | | Dark Brown/Gray Sandy Silty Clay | Discarded |
| | | | 427.5 | 0.3 | 427.3 | 426.3 | 0.9 | CH | | | Dark Brown/Gray Clay | K-CH |
| | | | 427.5 | 1.2 | 426.3 | 425.1 | 1.3 | CL | | | Brown/Gray Slightly Silty Clay | K-CL |
| | | | 427.5 | 2.4 | 425.1 | 424.8 | 0.3 | CL | | | Brown/Gray Clay | K-CL |
| | | | 427.5 | 2.8 | 424.8 | 423.3 | 1.5 | SM | | | Tan Silt w Very Fine Sand | Discarded |
| | | | 427.5 | 4.3 | 423.3 | 422.8 | 0.4 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| | | | 427.5 | 4.7 | 422.8 | 422.7 | 0.1 | CH | | | Dark Brown/Gray Clay | K-CH |
| | | | 427.5 | 4.8 | 422.7 | 420.8 | 1.9 | SM | | | Lt Tan Silt w Very Fine Sand | Discarded |
| | | | 427.5 | 6.8 | 420.8 | | | SM | | | Lt Tan Very Fine Sandy Silt w Clay Se | Discarded |
| 205 | 1114920.82 | 881176.19 | 427.0 | 0.0 | 427.0 | 426.3 | 0.8 | SM | | | Dark Brown/Gray Sandy Silty Clay | Discarded |
| | | | 427.0 | 0.8 | 426.3 | 426.0 | 0.3 | CL | | | Dark Brown/Gray Clay | K-CL |
| | | | 427.0 | 1.0 | 426.0 | 424.6 | 1.4 | CH | | | Dark Brown/Gray Clay | K-CH |
| | | | 427.0 | 2.4 | 424.6 | 423.6 | 1.0 | CH | | | Dark Brown/Gray Clay | K-CH |
| | | | 427.0 | 3.4 | 423.6 | 422.3 | 1.3 | CH | | | Dark Brown/Gray Clay | K-CH |
| | | | 427.0 | 4.7 | 422.3 | 420.3 | 2.1 | CL | 24 | 97.4 | Dark Gray/Brown Clay | K-CL |
| | | | 427.0 | 6.8 | 420.3 | | | MCL | | | Brown Clayey Silt | K-MCL |

**Appendix 2**

# STUDY OF GEOTECHNICAL ENGINEERING PROPERTIES OF ASH FROM SIOUX POWER PLANT

## ENGINEERING PROPERTIES OF FLYASH

### Test Pits

Fifteen tests pits were made in the flyash pond in November 2001. The approximate locations of the test pits are shown in Figure B-1. The water level in the pond had been lowered as much as possible. The tests pits were dug by Energy Resources, Inc., using a tracked Bobcat with a small backhoe. The Bobcat had to use 4'x8' plywood mats to move around most areas of the pond. The locations of the test pits were selected by Reitz & Jens. Our Senior Soils Technician directed the excavations, logged the test pits, and collected bulk samples. Bag samples were obtained at intervals of 1 foot in each test pit. The depths of the test pits were between 6 and 8 feet. Some test pits would stand open while digging, and others caved soon after digging began. We also obtained relatively undisturbed samples of the flyash by driving a thin-wall tube sampler by hand. The tube samples could only be obtained from depths up to 18 inches because they were done by hand.

Normally, sediment in a pond is sorted by grain size, with larger particles settling first and finer particles staying in suspension longer. As the pond fills, the sediments become finer with depth. However, channels have been dug through the deposited flyash near the discharge pipes at the north end to keep the pond operational. Therefore, the grain-size distribution of the flyash appeared to vary randomly by location and with depth in the pond.

### Laboratory Tests on Test Pit Samples

The moisture content and dry unit weight of the tube samples were measured in the lab. These are summarized in Table B-1. The dry unit weights ranged from 53 to 77 lbs/ft$^3$, and averaged about 65 lbs/ft$^3$. The dry unit weights generally increased with depth over the 18 inches that were sampled. Moisture contents ranged from 42% to 57% in the flyash, and 31% to 43% in the coarser economizer ash.

Table B-1 – Moisture Contents and Dry Unit Weights of Flyash Samples

| Test No. | Sample Location | Sample Depth, in. | Wet Unit Weight, pcf | Moisture Content, % | Dry Unit Weight, pcf |
|---|---|---|---|---|---|
| 1 | Discharge | 3 – 9 | 100.2 | 51.0 | 69.5 |
| 2 | TP-2 | 0 – 6 | 88.0 | 57.2 | 56.0 |
| 3 | TP-2 | 6 – 12 | 101.8 | 51.7 | 67.1 |
| 4 | TP-5 | 0 – 6 | 96.5 | 52.1 | 63.4 |
| 5 | TP-5 | 8 – 14 | 109.6 | 42.5 | 76.9 |
| 6 | TP-8 | 0 – 6 | 100.0 | 57.5 | 63.5 |
| 7 | TP-8 | 6 – 12 | 104.8 | 49.6 | 70.1 |
| 8 | TP-11 | 3 – 9 | 108.1 | 45.4 | 74.4 |
| 9 | Economizer | 0 – 6 | 83.7 | 31.1 | 63.9 |
| 10 | Economizer | 12 – 18 | 93.7 | 42.6 | 65.7 |
| 11 | Economizer | 0 – 6 | 87.4 | 35.8 | 64.4 |
| 12 | TP-13 | 0 – 6 | 92.0 | 44.2 | 63.8 |
| 13 | TP-14 | 0 – 6 | 80.4 | 51.9 | 52.9 |
| 14 | TP-15 | 0 – 6 | 96.5 | 56.9 | 61.5 |

We ran several hydrometer tests to obtain the grain-size distribution of the flyash. Generally, there were slightly-cemented conglomerates of flyash mixed throughout each sample. Most of these conglomerates were easily crushed by hand. We tried not to crush the conglomerates since these will occur in the flyash fill. Therefore, instead of deflocculating the samples, we ran hydrometer tests on 50-gram and 100-gram samples, to determine the affect on the results. We ran hydrometer tests on samples at 1-foot and 2-foot depths from Test Pit 5. The results are shown in Figure B-2. The differences between the 50-gram and 100-gram samples were not significant. The sample at 2-foot depth was coarser than the sample at 1-foot. The sample at 2-foot depth may be classified as a sandy silt or a silty sand. The sample at 1-foot depth may be classified as a clayey silt.

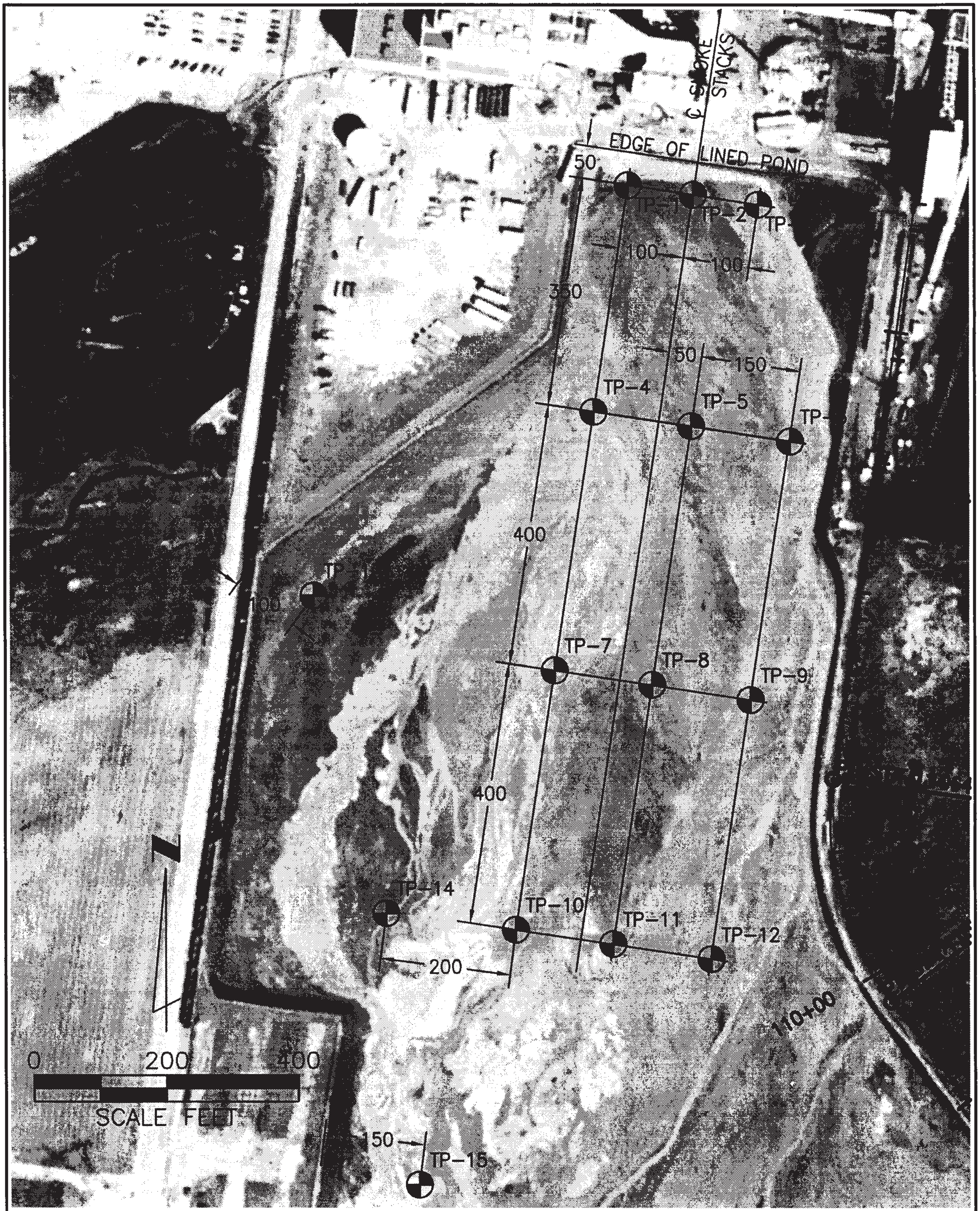
We combined the flyash samples from Test Pits 4, 5 and 6, and from Test Pits 10, 11 and 12, for two standard Proctor compaction tests (ASTM D-698). The results are shown in Figures B-3 and B-4, respectively. From Test Pits 4-6, the maximum dry unit weight ($\gamma_{d,max}$) was 73.8 lbs/ft$^3$ and the optimum moisture content was 39%. From Test Pits 10-12, $\gamma_{d,max}$ was 77.3 lbs/ft$^3$ and the optimum moisture content was 29%.

We ran four series of unconsolidated-undrained triaxial tests to determine the shear strength characteristics of the compacted flyash. Three samples were compacted in a miniature mold at 99% of $\gamma_{d,max}$ for each series. We ran two series on a combined sample from Test Pits 4, 5 and 6 – one series compacted wet of optimum and one series compacted dry of optimum. Similarly, we ran two series on a combined sample from Test Pits 10, 11 and 12. Confining pressures of 3, 6 and 9 psi were used. comparable to the stresses that we expect in the field. The results from each series of tests are shown in Figures B-5 through B-8, and are summarized in the following table.

Table B-2 – Results of Triaxial Shear Strength Tests on Compacted Flyash Samples

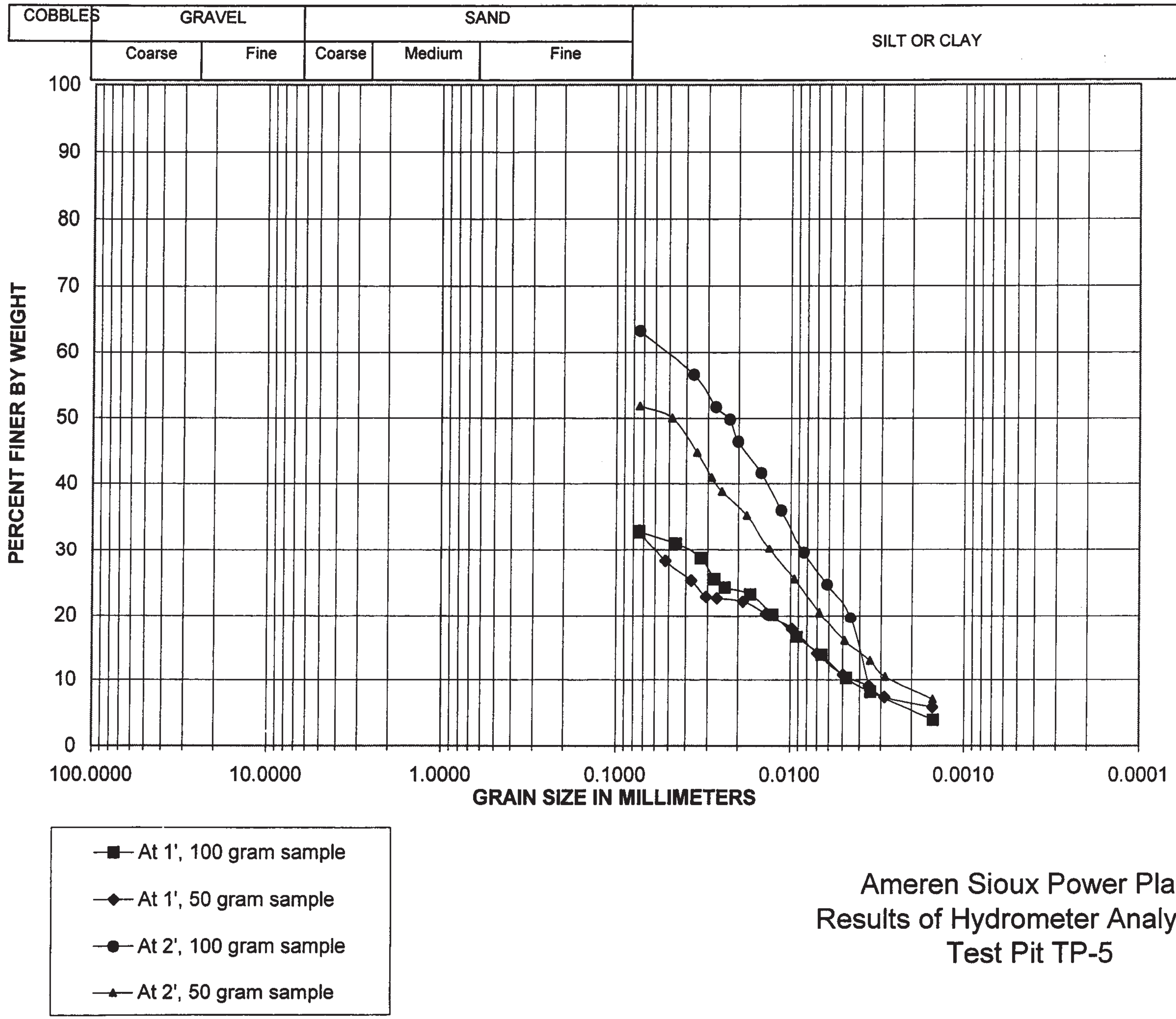
| Test Pits | Moisture Content | Friction Angle (ϕ') | Cohesion c', psf | Initial Tangent Modulus k, psi |
|---|---|---|---|---|
| 4, 5, 6 | 45% (wet) | 18° | 960 | 500 – 1000 |
| | 30% (dry) | 34° | 2100 | 5500 |
| 10, 11, 12 | 40% (wet) | 35° | 1400 | 1000 – 4600 |
| | 23% (dry) | 43° | 1800 | 5200 – 6000 |

We also performed flexible-wall hydraulic conductivity tests (ASTM D-5084) on combined samples from Test Pits 4, 5 and 6 and Test Pits 10, 11 and 12. The samples were compacted in a miniature mold to 98% of the corresponding $\gamma_{d,max}$ and at moisture contents of 45% and 40%, respectively. At a hydraulic gradient of 3% and net confining pressure of 2.5 psi, the measured permeability (K) was $1.8 \times 10^{-4}$ cm/sec for the sample from Test Pits 4-6, and $9.9 \times 10^{-5}$ cm/sec for the sample from Test Pits 10-12.




Ameren Sioux Power Plant
APPROXIMATE LOCATIONS OF
TEST PITS IN FLYASH POND

Figure B-1

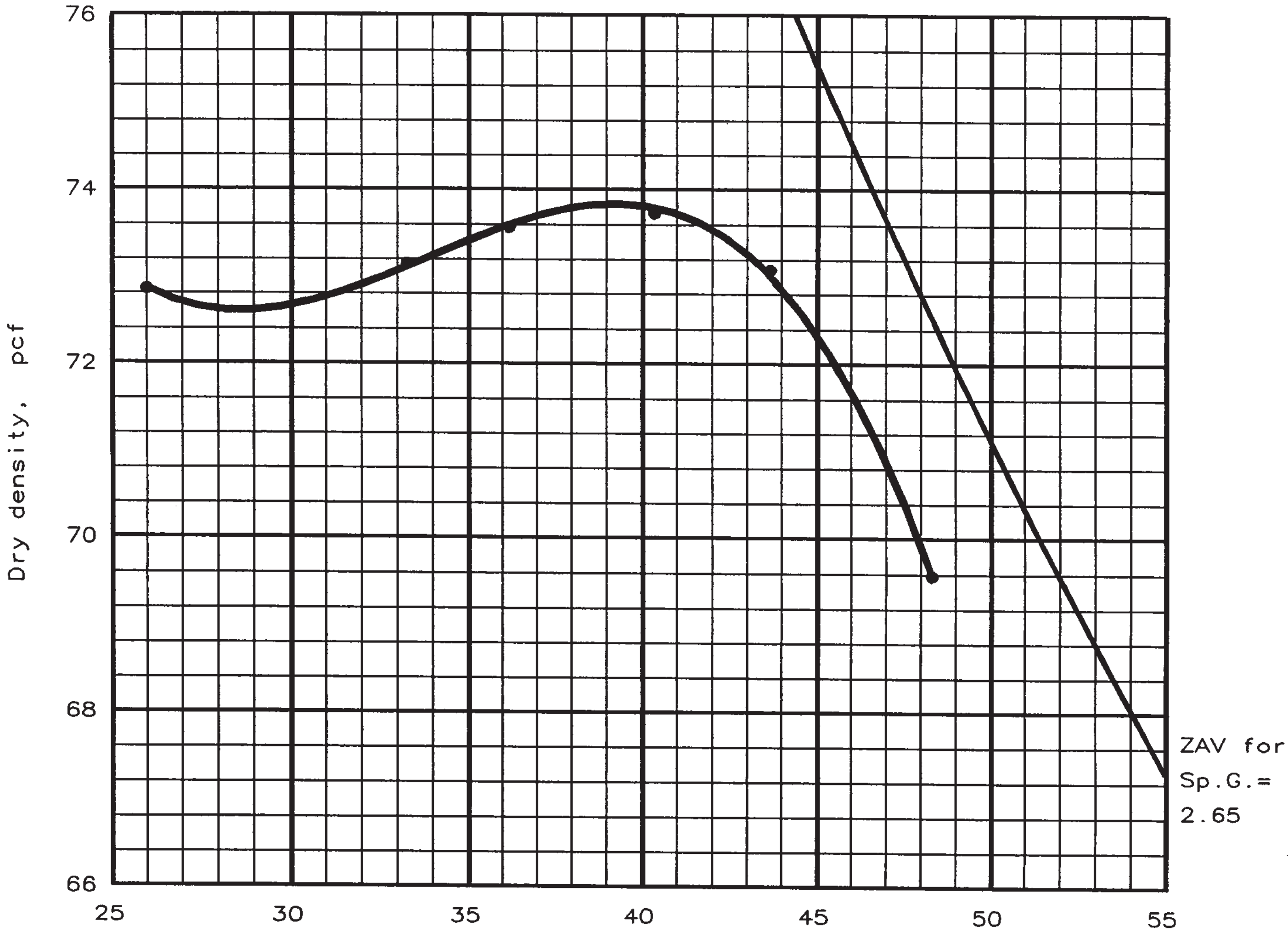



Ameren Sioux Power Plant
Results of Hydrometer Analysis
Test Pit TP-5

Figure B-2

REITZ & JENS, INC.

# RESULTS OF MOISTURE-DENSITY TEST




Test specification: ASTM D 698-91 Procedure A, Standard

| Elev/ Depth | Classification | | Nat. Moist. | Sp.G. | LL | PI | % > No.4 | % < No.200 |
|---|---|---|---|---|---|---|---|---|
| | USCS | AASHTO | | | | | | |
| | | | | | | | | 62 % |

| TEST RESULTS | MATERIAL DESCRIPTION |
|---|---|
| Maximum dry density = 73.8 pcf<br>Optimum moisture = 39.2 % | Type F Flyash |

Project No.: 2001012413

Project: Ameren Sioux Power Plant Railroad Loop

Location: Test Pits 4, 5, 6

Date: 1-22-1902

Remarks:

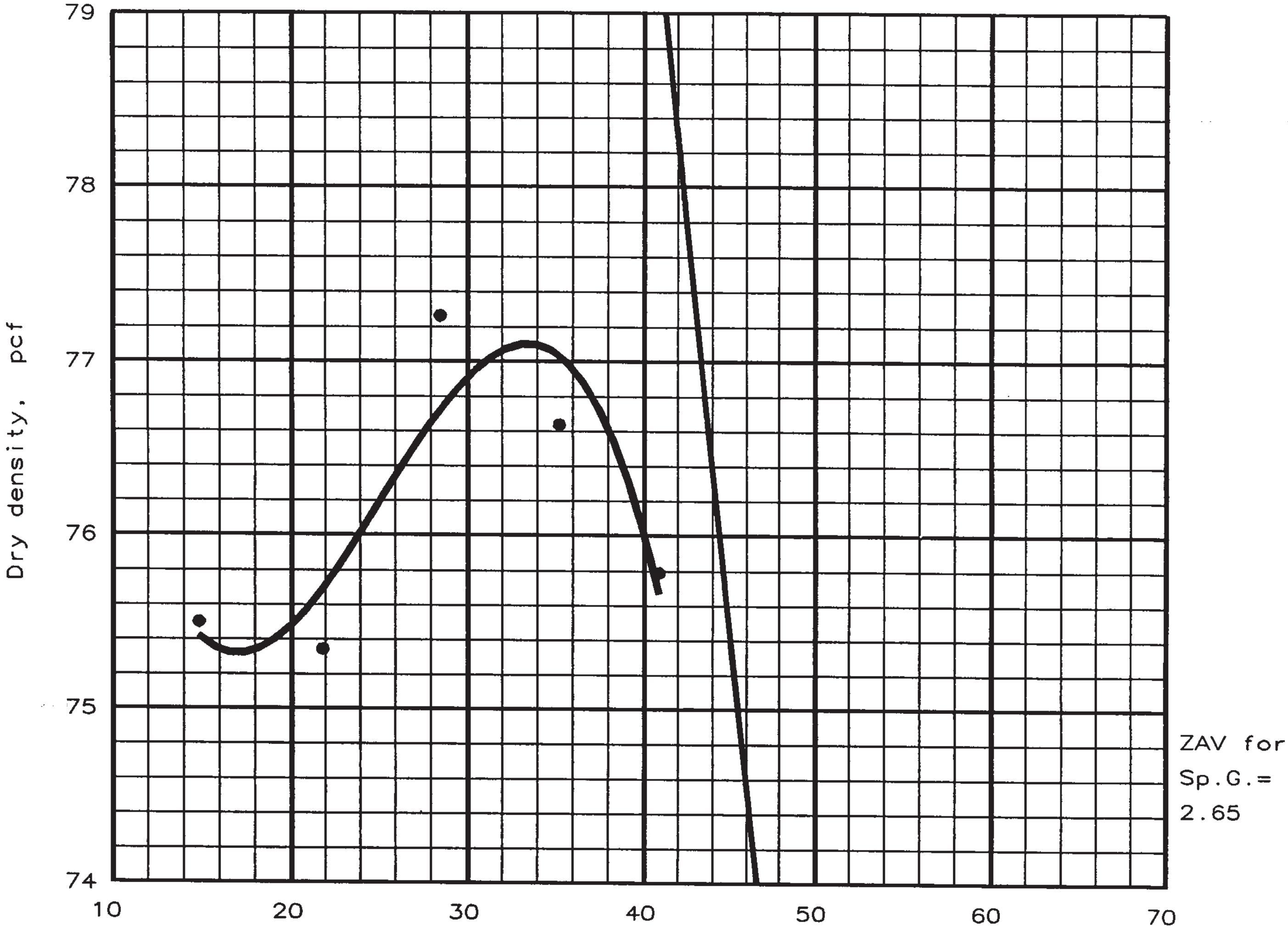
Combined sample

RESULTS OF MOISTURE-DENSITY TEST

REITZ & JENS, Inc.

Fig. No. B-3

# RESULTS OF MOISTURE-DENSITY TEST




Test specification: ASTM D 698-91 Procedure A, Standard

| Elev/ Depth | Classification USCS | Classification AASHTO | Nat. Moist. | Sp.G. | LL | PI | % > No.4 | % < No.200 |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

| TEST RESULTS | MATERIAL DESCRIPTION |
|---|---|
| Maximum dry density = 77.3 pcf<br>Optimum moisture = 28.5 % | Type F Flyash |

Project No.: 2001012413

Project: Ameren Sioux Power Plant Railroad Loop

Location: Test Pits 10, 11, 12

Date: 1-22-1902

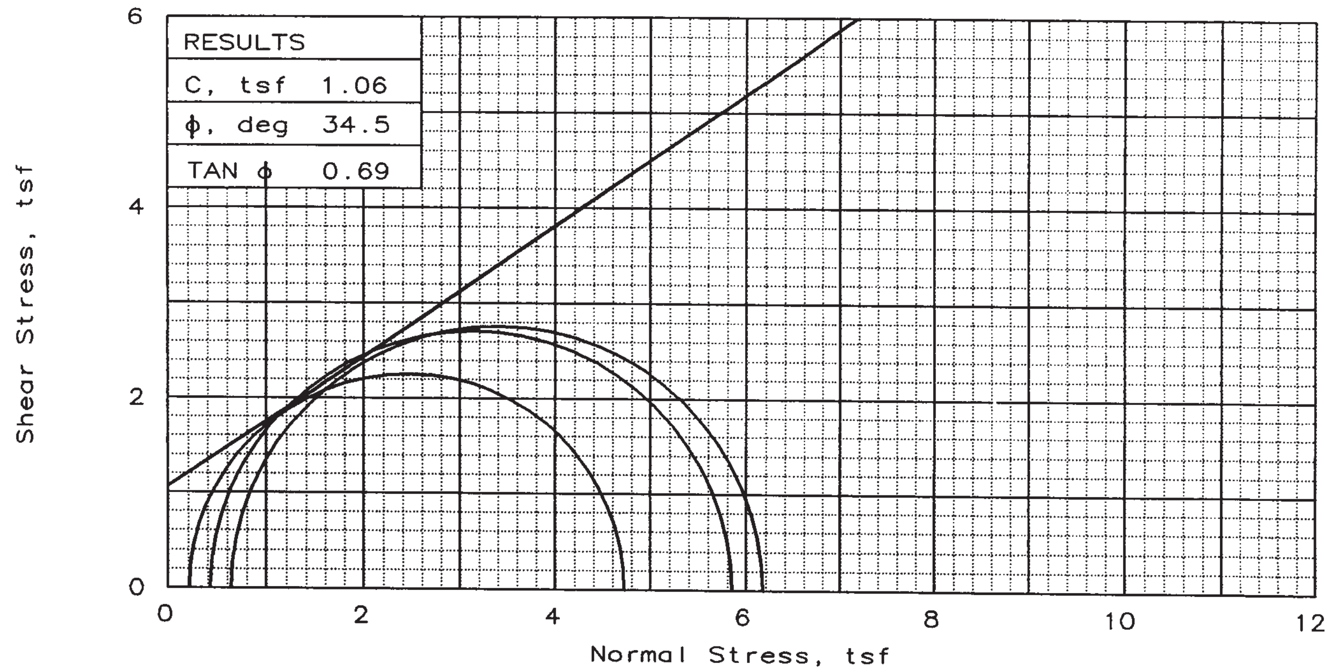
Remarks:

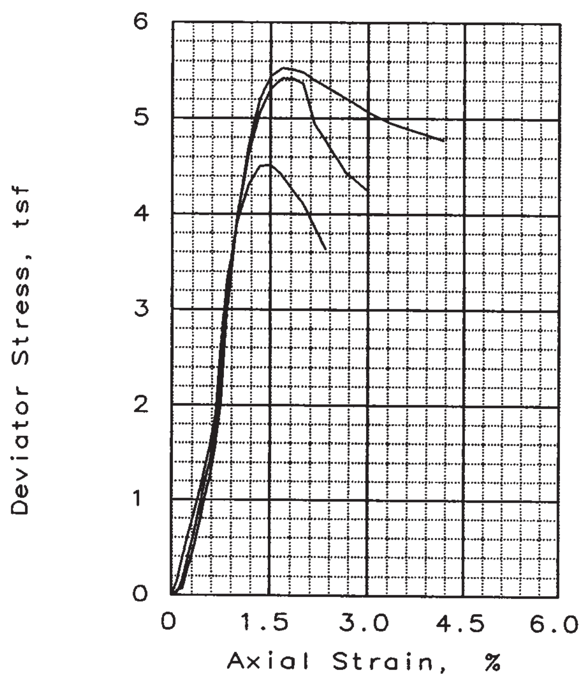
Combined sample

RESULTS OF MOISTURE-DENSITY TEST

REITZ & JENS, Inc.

Fig. No. B-4




| SAMPLE NO.: | | 1 | 2 | 3 |
|---|---|---|---|---|
| INITIAL | WATER CONTENT, % | 29.8 | 29.8 | 29.8 |
| | DRY DENSITY, pcf | 73.1 | 73.1 | 73.1 |
| | SATURATION, % | 66.8 | 66.8 | 66.8 |
| | VOID RATIO | 1.093 | 1.093 | 1.093 |
| | DIAMETER, in | 2.85 | 2.85 | 2.85 |
| | HEIGHT, in | 6.00 | 6.00 | 6.00 |
| AT TEST | WATER CONTENT, % | 0.0 | 44.6 | 44.6 |
| | DRY DENSITY, pcf | 73.1 | 73.1 | 73.1 |
| | SATURATION, % | 0.0 | 100.0 | 100.0 |
| | VOID RATIO | 1.093 | 1.093 | 1.093 |
| | DIAMETER, in | 2.85 | 2.85 | 2.85 |
| | HEIGHT, in | 6.00 | 6.00 | 6.00 |
| Strain rate, %/min | | 0.85 | 0.85 | 0.85 |
| BACK PRESSURE, tsf | | 0.00 | 0.00 | 0.00 |
| CELL PRESSURE, tsf | | 0.22 | 0.43 | 0.65 |
| FAIL. STRESS, tsf | | 4.51 | 5.42 | 5.52 |
| STRAIN, % | | 1.5 | 1.7 | 1.7 |
| ULT. STRESS, tsf | | | | |
| STRAIN, % | | | | |
| $\sigma_1$ FAILURE, tsf | | 4.73 | 5.85 | 6.17 |
| $\sigma_3$ FAILURE, tsf | | 0.22 | 0.43 | 0.65 |

TYPE OF TEST:
Unconsolidated Undrained

SAMPLE TYPE: Bulk

DESCRIPTION: Flyash

SPECIFIC GRAVITY= 2.45

REMARKS: Compacted to 100% of standard Proctor dry density, compacted dry of optimum

Fig. No.: B-5

CLIENT: Ameren Services

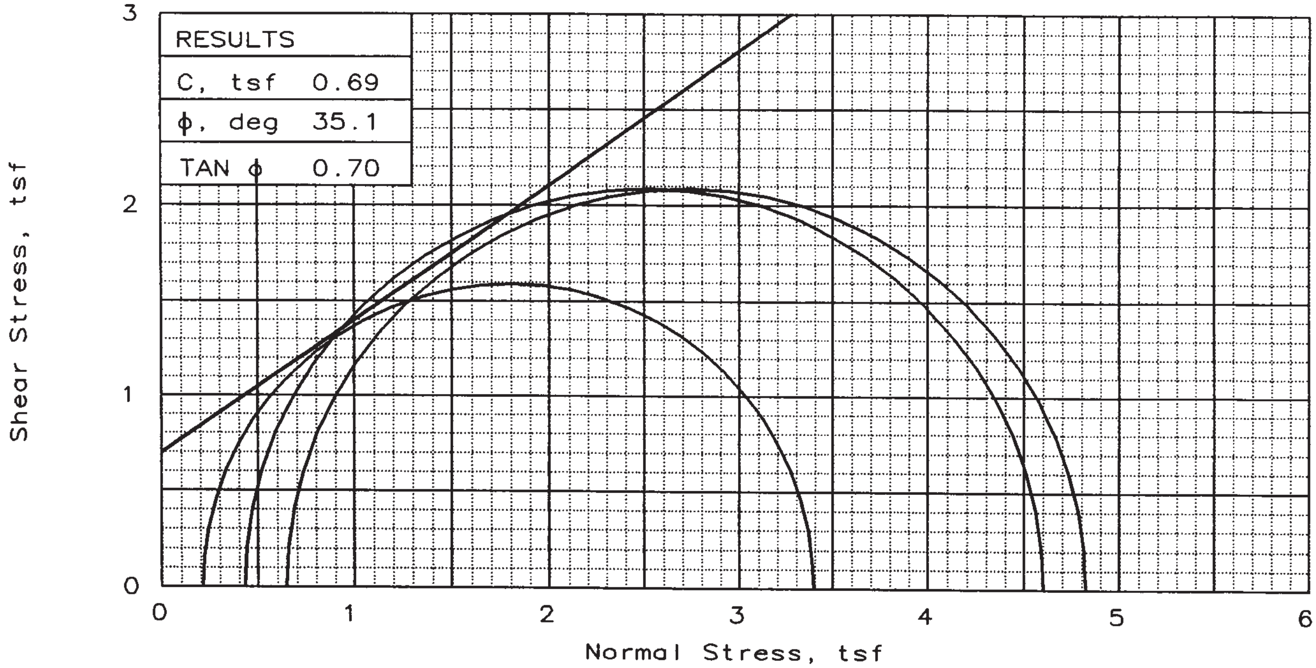
PROJECT: Sioux Plant Rail Loop Extension

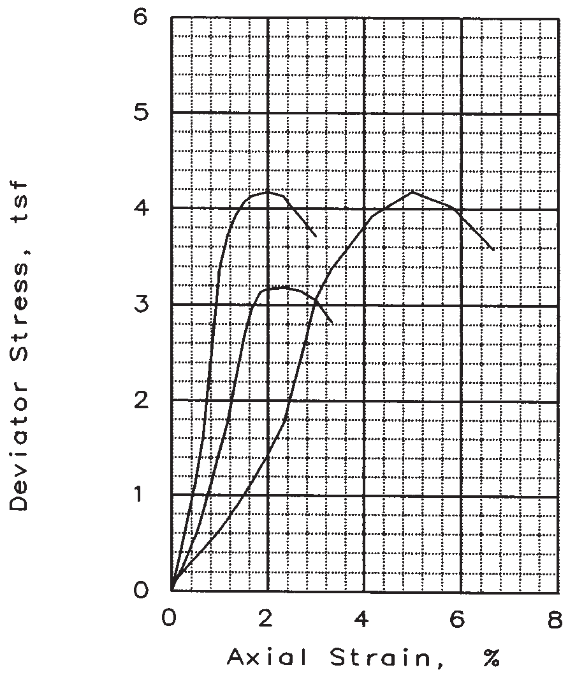
SAMPLE LOCATION: TP-4, -5, -6 (Bulk Mix)

PROJ. NO.: 2001012413 DATE: 12-12-01

TRIAXIAL SHEAR TEST REPORT

REITZ & JENS, Inc.




| SAMPLE NO.: | | 1 | 2 | 3 |
|---|---|---|---|---|
| INITIAL | WATER CONTENT, % | 40.0 | 40.0 | 40.0 |
| | DRY DENSITY, pcf | 76.6 | 76.6 | 76.6 |
| | SATURATION, % | 98.3 | 98.3 | 98.3 |
| | VOID RATIO | 0.996 | 0.996 | 0.996 |
| | DIAMETER, in | 2.85 | 2.85 | 2.85 |
| | HEIGHT, in | 6.00 | 6.00 | 6.00 |
| AT TEST | WATER CONTENT, % | 0.0 | 0.0 | 0.0 |
| | DRY DENSITY, pcf | 76.6 | 76.6 | 76.6 |
| | SATURATION, % | 0.0 | 0.0 | 0.0 |
| | VOID RATIO | 0.996 | 0.996 | 0.996 |
| | DIAMETER, in | 2.85 | 2.85 | 2.85 |
| | HEIGHT, in | 6.00 | 6.00 | 6.00 |
| Strain rate, %/min | | 0.85 | 0.85 | 0.85 |
| BACK PRESSURE, tsf | | 0.00 | 0.00 | 0.00 |
| CELL PRESSURE, tsf | | 0.22 | 0.43 | 0.65 |
| FAIL. STRESS, tsf | | 3.18 | 4.17 | 4.18 |
| STRAIN, % | | 2.3 | 2.0 | 5.0 |
| ULT. STRESS, tsf | | | | |
| STRAIN, % | | | | |
| $\sigma_1$ FAILURE, tsf | | 3.39 | 4.60 | 4.82 |
| $\sigma_3$ FAILURE, tsf | | 0.22 | 0.43 | 0.65 |

TYPE OF TEST:
Unconsolidated Undrained

SAMPLE TYPE: Bulk

DESCRIPTION: Flyash

SPECIFIC GRAVITY= 2.45

REMARKS: Compacted to 100% of standard Proctor dry density, compacted wet of optimum

Fig. No.: B-6

CLIENT: Ameren Services

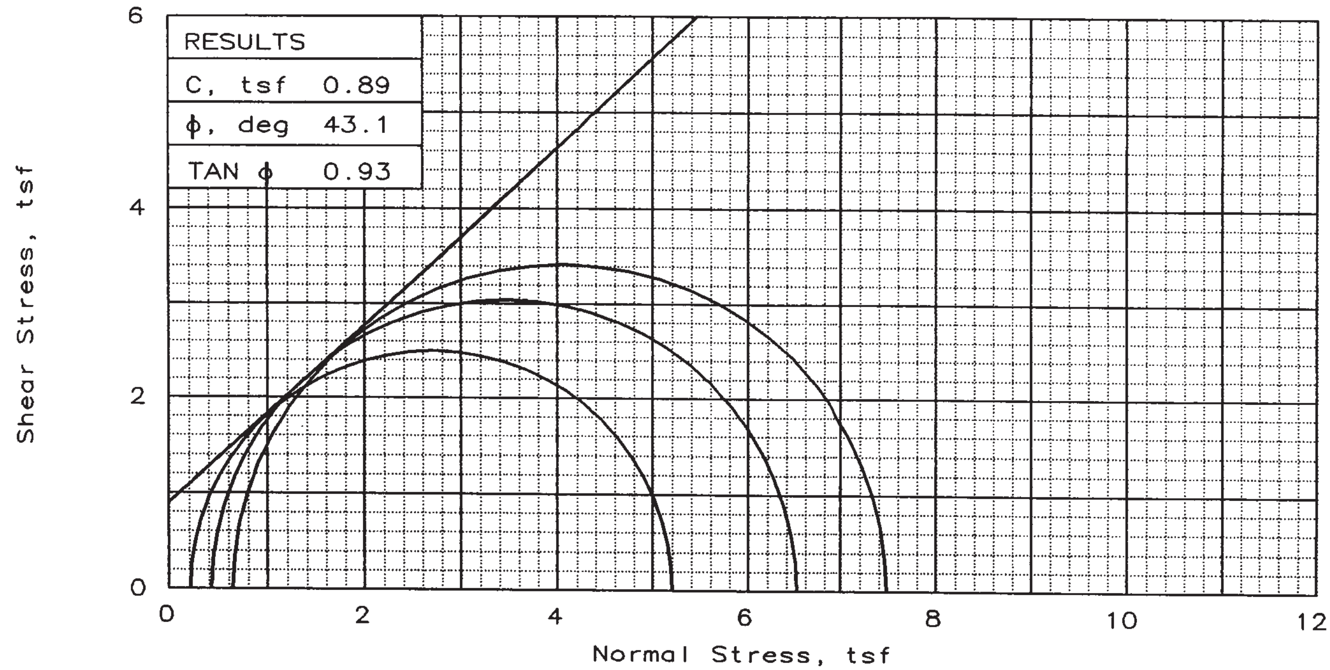
PROJECT: Sioux Plant Rail Loop Extension

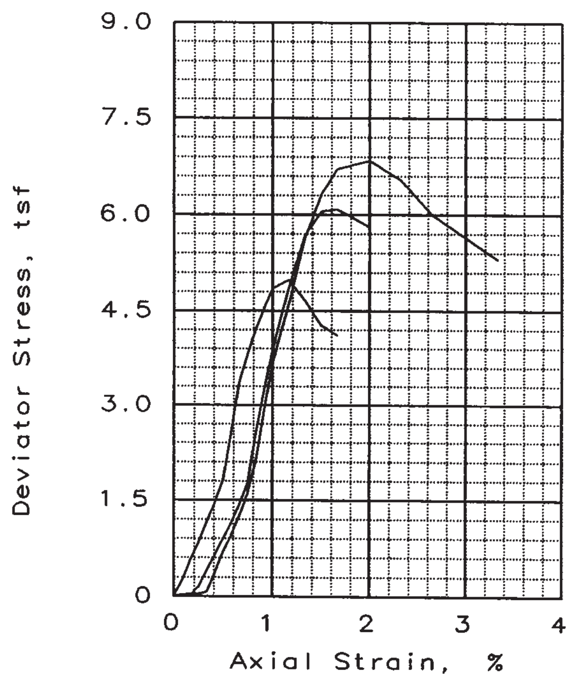
SAMPLE LOCATION: TP-10,-11,-12 (Bulk Mix)

PROJ. NO.: 2001012413 DATE: 12-12-01

TRIAXIAL SHEAR TEST REPORT

REITZ & JENS, Inc.




| SAMPLE NO.: | | 1 | 2 | 3 |
|---|---|---|---|---|
| INITIAL | WATER CONTENT, % | 22.7 | 22.7 | 22.7 |
| | DRY DENSITY, pcf | 76.6 | 76.6 | 76.6 |
| | SATURATION, % | 55.8 | 55.8 | 55.8 |
| | VOID RATIO | 0.997 | 0.997 | 0.997 |
| | DIAMETER, in | 2.85 | 2.85 | 2.85 |
| | HEIGHT, in | 6.00 | 6.00 | 6.00 |
| AT TEST | WATER CONTENT, % | 0.0 | 0.0 | 0.0 |
| | DRY DENSITY, pcf | 76.6 | 76.6 | 76.6 |
| | SATURATION, % | 0.0 | 0.0 | 0.0 |
| | VOID RATIO | 0.997 | 0.997 | 0.997 |
| | DIAMETER, in | 2.85 | 2.85 | 2.85 |
| | HEIGHT, in | 6.00 | 6.00 | 6.00 |
| Strain rate, %/min | | 0.85 | 0.85 | 0.85 |
| BACK PRESSURE, tsf | | 0.00 | 0.00 | 0.00 |
| CELL PRESSURE, tsf | | 0.22 | 0.43 | 0.65 |
| FAIL. STRESS, tsf | | 4.99 | 6.08 | 6.84 |
| STRAIN, % | | 1.2 | 1.7 | 2.0 |
| ULT. STRESS, tsf | | | | |
| STRAIN, % | | | | |
| $\sigma_1$ FAILURE, tsf | | 5.21 | 6.51 | 7.48 |
| $\sigma_3$ FAILURE, tsf | | 0.22 | 0.43 | 0.65 |

TYPE OF TEST:
Unconsolidated Undrained

SAMPLE TYPE: Bulk

DESCRIPTION: Flyash

SPECIFIC GRAVITY= 2.45

REMARKS: Compacted to 100% of standard Proctor dry density, compacted dry of optimum

Fig. No.: B-7

CLIENT: Ameren Services

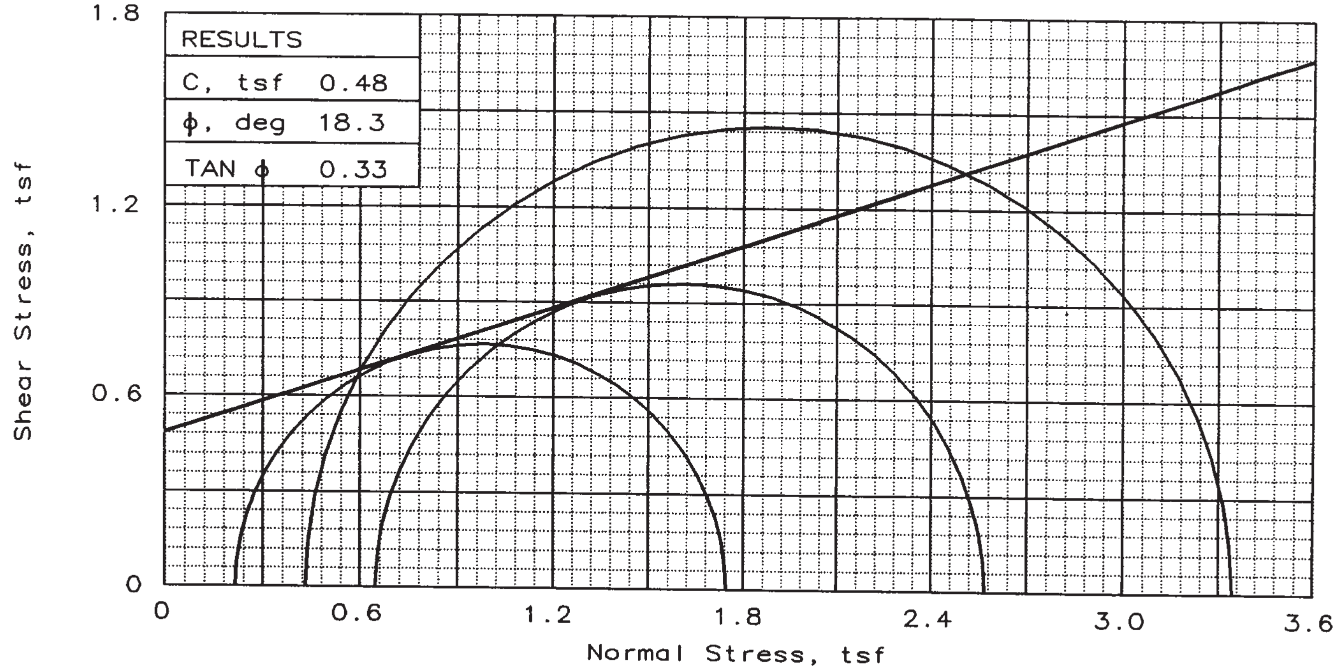
PROJECT: Sioux Plant Rail Loop Extension

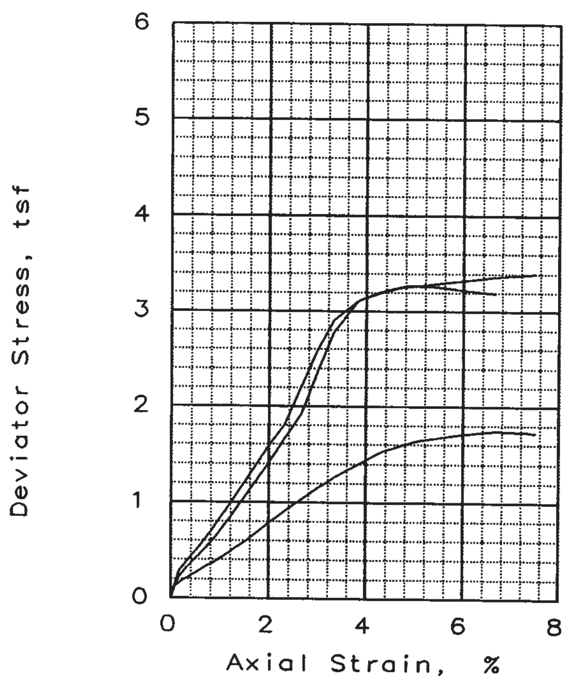
SAMPLE LOCATION: TP-10,-11,-12 (Bulk Mix)

PROJ. NO.: 2001012413 DATE: 12-12-01

TRIAXIAL SHEAR TEST REPORT

REITZ & JENS, Inc.




| SAMPLE NO.: | | 1 | 2 | 3 |
|---|---|---|---|---|
| INITIAL | WATER CONTENT, % | 45.0 | 45.0 | 45.0 |
| | DRY DENSITY, pcf | 73.1 | 73.1 | 73.1 |
| | SATURATION, % | 100.9 | 100.9 | 100.9 |
| | VOID RATIO | 1.093 | 1.093 | 1.093 |
| | DIAMETER, in | 2.85 | 2.85 | 2.85 |
| | HEIGHT, in | 6.00 | 6.00 | 6.00 |
| AT TEST | WATER CONTENT, % | 0.0 | 0.0 | 0.0 |
| | DRY DENSITY, pcf | 73.1 | 73.1 | 73.1 |
| | SATURATION, % | 0.0 | 0.0 | 0.0 |
| | VOID RATIO | 1.093 | 1.093 | 1.093 |
| | DIAMETER, in | 2.85 | 2.85 | 2.85 |
| | HEIGHT, in | 6.00 | 6.00 | 6.00 |
| Strain rate, %/min | | 0.85 | 0.85 | 0.85 |
| BACK PRESSURE, tsf | | 0.00 | 0.00 | 0.00 |
| CELL PRESSURE, tsf | | 0.22 | 0.43 | 0.65 |
| FAIL. STRESS, tsf | | 1.53 | 2.91 | 1.92 |
| STRAIN, % | | 4.3 | 3.3 | 2.7 |
| ULT. STRESS, tsf | | 1.75 | 3.40 | 3.27 |
| STRAIN, % | | | | |
| $\sigma_1$ FAILURE, tsf | | 1.75 | 3.34 | 2.57 |
| $\sigma_3$ FAILURE, tsf | | 0.22 | 0.43 | 0.65 |

TYPE OF TEST:
Unconsolidated Undrained

SAMPLE TYPE: Bulk

DESCRIPTION: Flyash

SPECIFIC GRAVITY= 2.45

REMARKS: Compacted to 100% of standard Proctor dry density, compacted wet of optimum

Fig. No.: B-8

CLIENT: Ameren Services

PROJECT: Sioux Plant Rail Loop Extension

SAMPLE LOCATION: TP-4, -5, -6 (Bulk Mix)

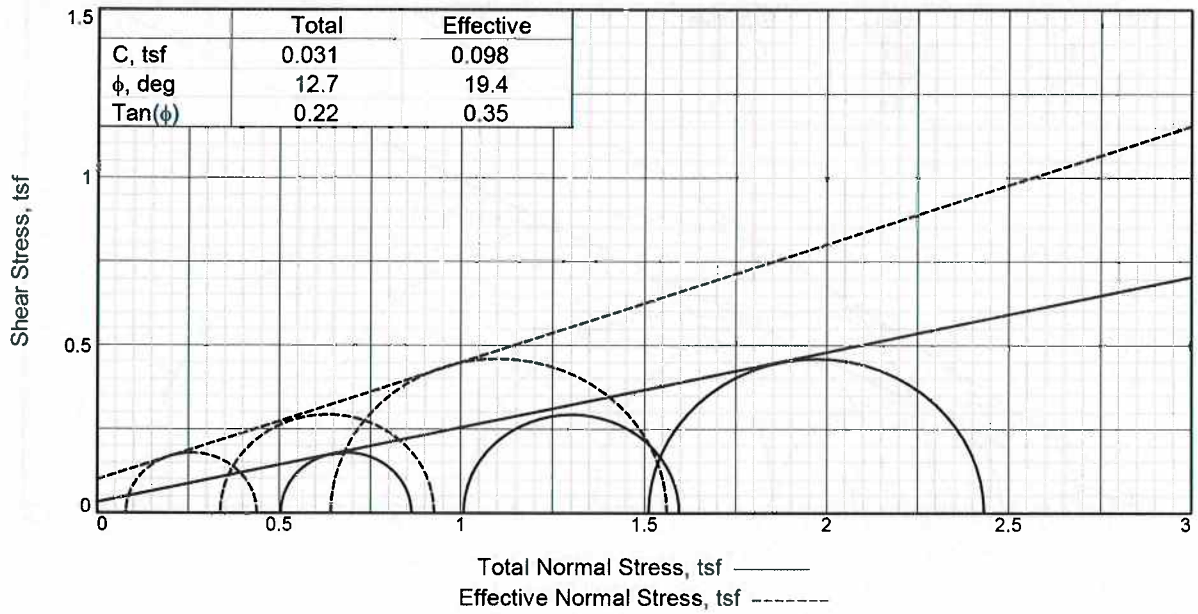
PROJ. NO.: 2001012413 DATE: 12-12-01

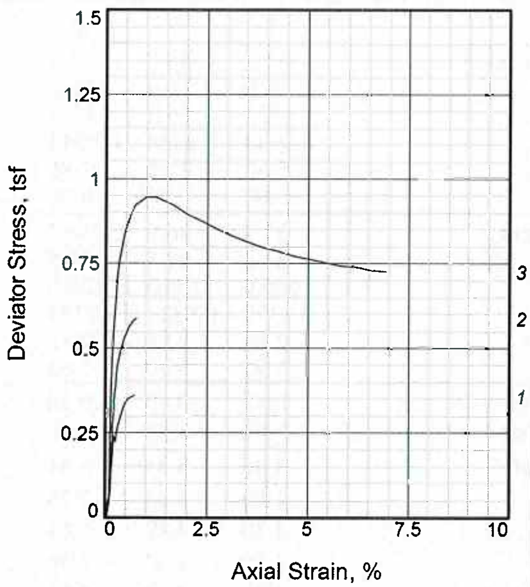
TRIAXIAL SHEAR TEST REPORT

REITZ & JENS, Inc.

## Appendix 2.1

# RESULTS OF LABORATORY TESTING ON FLY ASH FROM ADDENDUM




| Sample No. | | 1 | 2 | 3 |
|---|---|---|---|---|
| Initial | Water Content, | 34.5 | 34.5 | 34.5 |
| | Dry Density, pcf | 64.1 | 64.1 | 64.1 |
| | Saturation, | 59.7 | 59.7 | 59.7 |
| | Void Ratio | 1.4555 | 1.4555 | 1.4555 |
| | Diameter, in. | 2.86 | 2.86 | 2.86 |
| | Height, in. | 6.00 | 6.00 | 6.00 |
| At Test | Water Content, | 50.5 | 49.0 | 48.2 |
| | Dry Density, pcf | 69.2 | 70.4 | 71.1 |
| | Saturation, | 100.0 | 100.0 | 100.0 |
| | Void Ratio | 1.2721 | 1.2346 | 1.2135 |
| | Diameter, in. | 2.79 | 2.78 | 2.79 |
| | Height, in. | 5.85 | 5.78 | 5.72 |
| Strain rate, %/min. | | 0.30 | 0.30 | 0.10 |
| Back Pressure, tsf | | 4.68 | 5.11 | 5.83 |
| Cell Pressure, tsf | | 5.18 | 6.12 | 7.34 |
| Fail. Stress, tsf | | 0.36 | 0.59 | 0.92 |
| Total Pore Pr., tsf | | 5.10 | 5.78 | 6.70 |
| Ult. Stress, tsf | | 0.36 | 0.59 | 0.92 |
| Total Pore Pr., tsf | | 5.10 | 5.78 | 6.70 |
| $\bar{\sigma}_1$ Failure, tsf | | 0.44 | 0.93 | 1.56 |
| $\bar{\sigma}_3$ Failure, tsf | | 0.08 | 0.34 | 0.64 |

**Type of Test:**
CU with Pore Pressures

**Sample Type:** Compacted

**Description:** Fly Ash, at approximately 81% of standard proctor maximum dry density

**Assumed Specific Gravity=** 2.52

**Remarks:**

**Figure** 1

**Client:** Ameren UE

**Project:** UWL Dry Cell Design

**Source of Sample:** Sioux Fly Ash

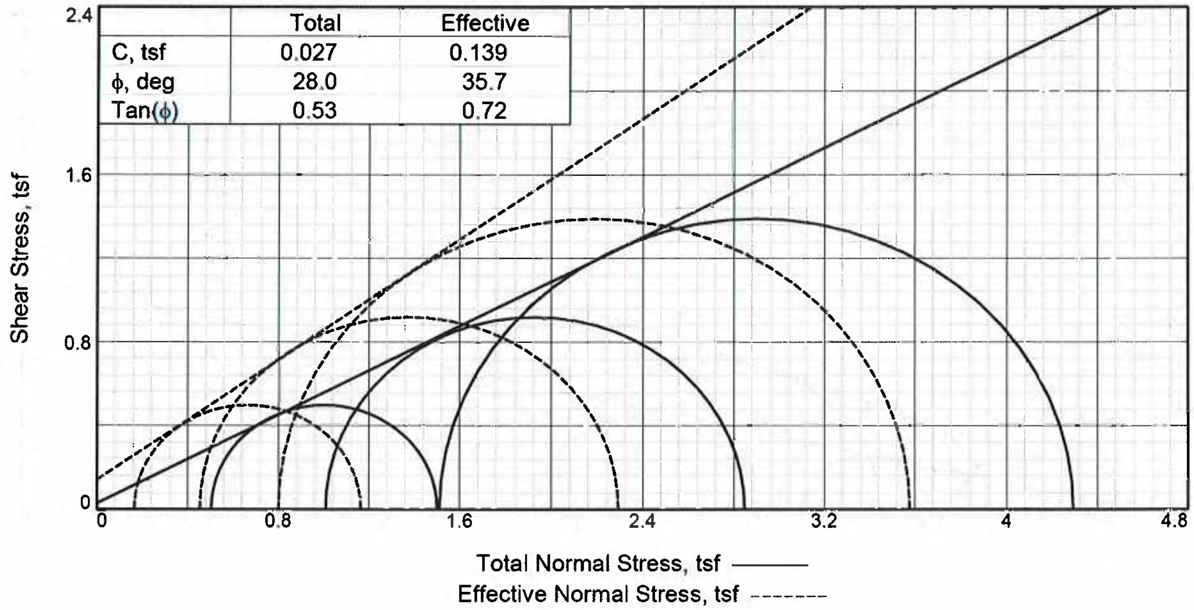
**Sample Number:** Grab-1

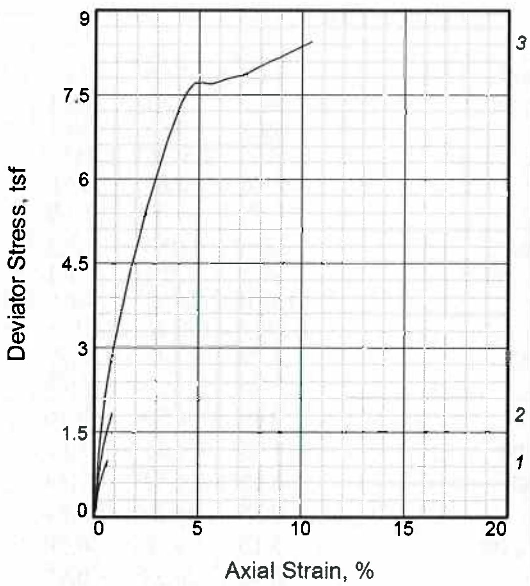
**Proj. No.:** 2009012470 **Date:**

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Tested By:** K. Kocher **Checked By:** J. Fouse

| | Total | Effective |
|---|---|---|
| C, tsf | 0.027 | 0.139 |
| ϕ, deg | 28.0 | 35.7 |
| Tan(ϕ) | 0.53 | 0.72 |




| | Sample No. | 1 | 2 | 3 |
|---|---|---|---|---|
| Initial | Water Content, | 35.2 | 35.2 | 35.2 |
| | Dry Density, pcf | 78.9 | 78.9 | 78.9 |
| | Saturation, | 89.3 | 89.3 | 89.3 |
| | Void Ratio | 0.9944 | 0.9944 | 0.9944 |
| | Diameter, in. | 2.86 | 2.86 | 2.86 |
| | Height, in. | 6.00 | 6.00 | 6.00 |
| At Test | Water Content, | 37.2 | 36.9 | 36.7 |
| | Dry Density, pcf | 81.2 | 81.5 | 81.8 |
| | Saturation, | 100.0 | 100.0 | 100.0 |
| | Void Ratio | 0.9370 | 0.9311 | 0.9242 |
| | Diameter, in. | 2.84 | 2.84 | 2.85 |
| | Height, in. | 5.95 | 5.90 | 5.84 |
| | Strain rate, %/min. | 0.30 | 0.30 | 0.30 |
| | Back Pressure, tsf | 3.96 | 4.32 | 4.90 |
| | Cell Pressure, tsf | 4.46 | 5.33 | 6.41 |
| | Fail. Stress, tsf | 1.00 | 1.84 | 2.78 |
| | Total Pore Pr., tsf | 4.30 | 4.87 | 5.61 |
| | Ult. Stress, tsf | 1.00 | 1.84 | 2.78 |
| | Total Pore Pr., tsf | 4.30 | 4.87 | 5.61 |
| | $\bar{\sigma}_1$ Failure, tsf | 1.16 | 2.29 | 3.58 |
| | $\bar{\sigma}_3$ Failure, tsf | 0.17 | 0.45 | 0.80 |

**Type of Test:**
CU with Pore Pressures

**Sample Type:** Compacted

**Description:** Fly Ash, at approximately 100% of standard proctor maximum dry density

**Assumed Specific Gravity=** 2.52

**Remarks:**

**Figure** 2

**Client:** Ameren UE

**Project:** UWL Dry Cell Design

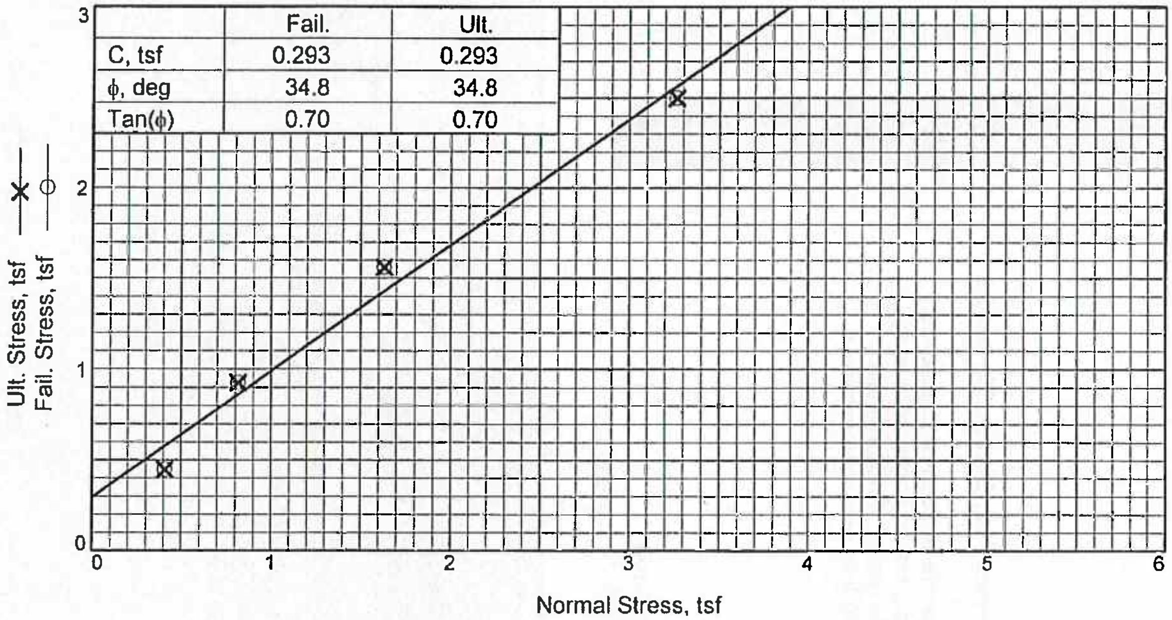
**Source of Sample:** Sioux Fly Ash

**Sample Number:** Grab-1

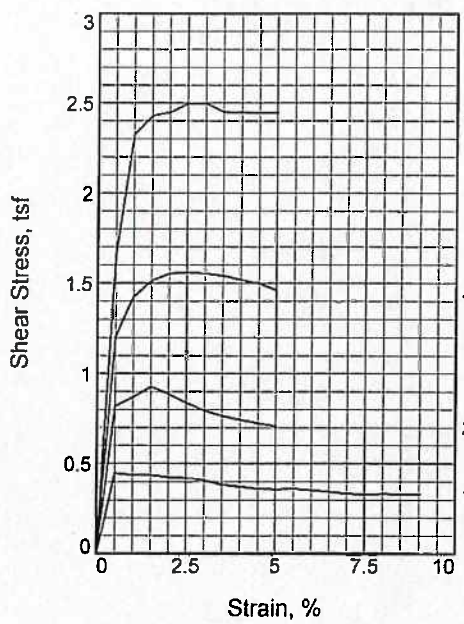
**Proj. No.:** 2009012470 **Date:**

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Tested By:** K. Kocher **Checked By:** J. Fouse




| | Fail. | Ult. |
|---|---|---|
| C, tsf | 0.293 | 0.293 |
| $\phi$, deg | 34.8 | 34.8 |
| Tan($\phi$) | 0.70 | 0.70 |




| Sample No. | | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Initial | Water Content, % | 30.0 | 30.0 | 30.0 | 30.0 |
| | Dry Density, pcf | 54.4 | 59.2 | 57.5 | 59.9 |
| | Saturation, % | 39.9 | 47.0 | 44.9 | 47.9 |
| | Void Ratio | 1.8943 | 1.5319 | 1.6053 | 1.5033 |
| | Diameter, in. | 1.99 | 1.99 | 1.99 | 1.99 |
| | Height, in. | 1.07 | 1.03 | 1.15 | 1.11 |
| At Test | Water Content, % | 30.0 | 30.0 | 30.0 | 30.0 |
| | Dry Density, pcf | 54.4 | 59.2 | 57.5 | 59.9 |
| | Saturation, % | 39.9 | 47.0 | 44.9 | 47.9 |
| | Void Ratio | 1.8943 | 1.5319 | 1.6053 | 1.5033 |
| | Diameter, in. | 1.99 | 1.99 | 1.99 | 1.99 |
| | Height, in. | 1.07 | 1.03 | 1.15 | 1.11 |
| Normal Stress, tsf | | 0.408 | 0.816 | 1.631 | 3.263 |
| Fail. Stress, tsf | | 0.446 | 0.927 | 1.560 | 2.498 |
| Strain, % | | 0.5 | 1.5 | 2.5 | 2.5 |
| Ult. Stress, tsf | | 0.446 | 0.927 | 1.560 | 2.498 |
| Strain, % | | 0.5 | 1.5 | 2.5 | 2.5 |
| Strain rate, %/min. | | N/A | N/A | N/A | N/A |

**Sample Type:** Compacted

**Description:** Fly Ash on textured liner, compacted to approximately 58 pcf dry unit weight

**Assumed Specific Gravity=** 2.52

**Remarks:**

**Figure** 14

**Client:** Ameren UE

**Project:** UWL Dry Cell Design

**Source of Sample:** Sioux Fly Ash

**Sample Number:** Grab-1

**Proj. No.:** 2009012470 **Date:** 6/15/10

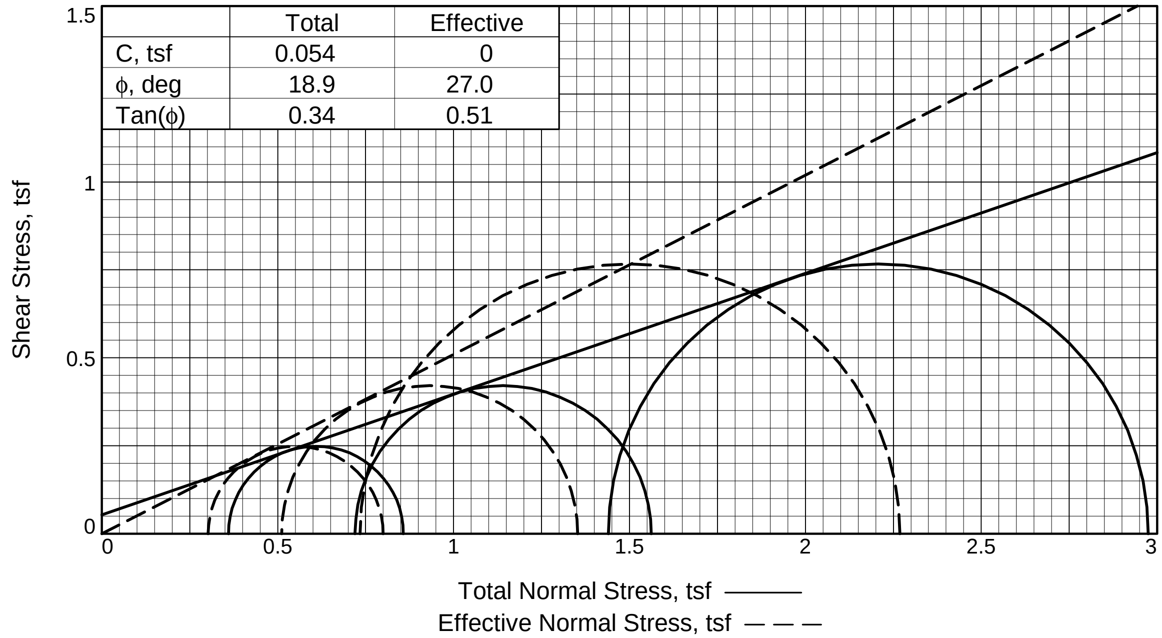
REITZ & JENS, INC.
CONSULTING ENGINEERS

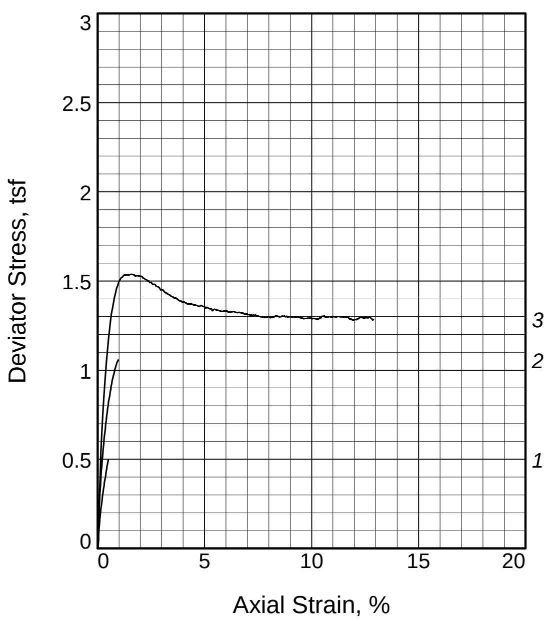
**Tested By:** J. Crose, J. Pruett **Checked By:** J. Fouse

**Appendix 2.2**

# RESULTS OF LABORATORY TESTING ON FLY ASH FROM CQA REPORT FOR CELL 4A PHASE 3 – INITIAL FILLING

|  | Total | Effective |
|---|---|---|
| C, tsf | 0.054 | 0 |
| φ, deg | 18.9 | 27.0 |
| Tan(φ) | 0.34 | 0.51 |




| Sample No. | | 1 | 2 | 3 |
|---|---|---|---|---|
| Initial | Water Content, % | 55.9 | 55.9 | 55.9 |
| | Dry Density, pcf | 57.5 | 57.5 | 57.5 |
| | Saturation, % | 79.7 | 79.7 | 79.7 |
| | Void Ratio | 1.8227 | 1.8227 | 1.8227 |
| | Diameter, in. | 2.87 | 2.87 | 2.87 |
| | Height, in. | 6.00 | 6.00 | 6.00 |
| At Test | Water Content, % | 69.6 | 69.5 | 69.1 |
| | Dry Density, pcf | 57.8 | 57.8 | 58.0 |
| | Saturation, % | 100.0 | 100.0 | 100.0 |
| | Void Ratio | 1.8100 | 1.8058 | 1.7973 |
| | Diameter, in. | 2.86 | 2.87 | 2.88 |
| | Height, in. | 5.99 | 5.96 | 5.90 |
| Strain rate, %/min. | | 0.10 | 0.10 | 0.10 |
| Back Pressure, tsf | | 3.24 | 3.31 | 3.60 |
| Cell Pressure, tsf | | 3.60 | 4.03 | 5.04 |
| Fail. Stress, tsf | | 0.50 | 0.84 | 1.53 |
| Total Pore Pr., tsf | | 3.30 | 3.52 | 4.31 |
| Ult. Stress, tsf | | | | |
| Total Pore Pr., tsf | | | | |
| $\bar{\sigma}_1$ Failure, tsf | | 0.80 | 1.35 | 2.27 |
| $\bar{\sigma}_3$ Failure, tsf | | 0.30 | 0.51 | 0.73 |

**Type of Test:**
CU with Pore Pressures

**Sample Type:** Laboratory Compacted

**Description:** Sioux Ash, dark grey to black, silt to fine sand sized grains

**Assumed Specific Gravity=** 2.6

**Remarks:**

**Figure** _______

**Client:** Ameren Missouri

**Project:** Sioux UWL-Cell 4 Construction CQA

**Source of Sample:** Offsite Borrow

**Sample Number:** Ballast Fill Grab

**Proj. No.:** 2013012477 **Date Sampled:** 2/4/14

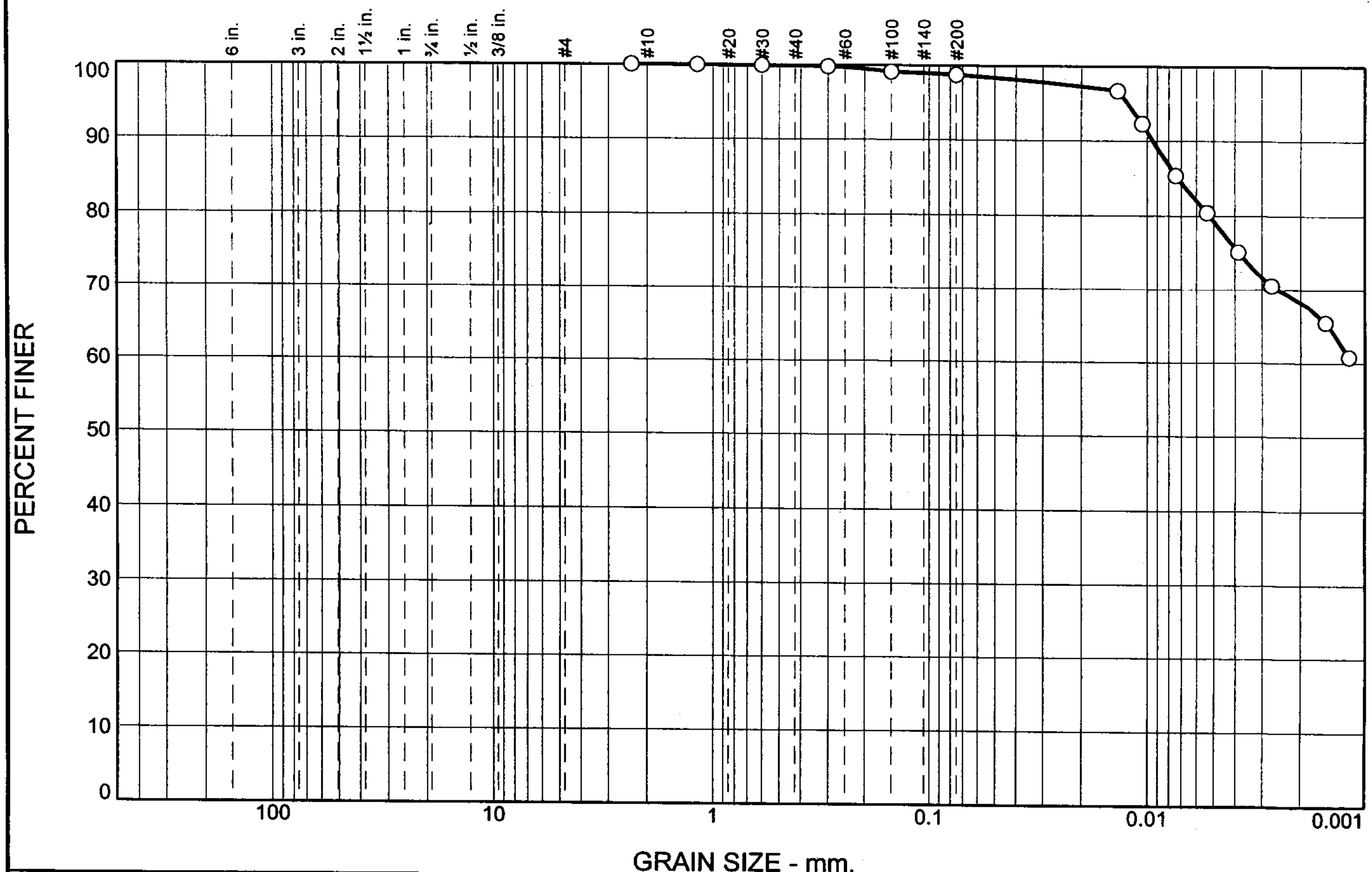
REITZ & JENS, INC.
CONSULTING ENGINEERS

**Tested By:** K. Kocher **Checked By:** J. Bertel

**Appendix 3**

# RESULTS OF GRAIN SIZE ANALYSES ON COMPOSITE SAMPLES

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 1.2 | 19.4 | 79.3 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 99.9 | | |
| .6mm | 99.9 | | |
| .3mm | 99.8 | | |
| .15mm | 99.1 | | |
| .075mm | 98.7 | | |

* (no specification provided)

**Material Description**

Clay (CH), brown to greyish brown, high plastic

**Atterberg Limits (ASTM D 4318)**

PL= 26 LL= 69 PI= 43

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0072 $D_{60}$= $D_{50}$=
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 12/01/06 **Tested By:** RTH

**Remarks**

**Sample No.:** "CH" **Source of Sample:** Section A **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

# GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section A
**Sample Number:** "CH"
**Material Description:** Clay (CH), brown to greyish brown, high plastic
**PL:** 26 **LL:** 69 **PI:** 43
**USCS Classification:** CH
**Tested By:** RTH **Test Date:** 12/01/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =37.88
**Tare Wt.** =37.18
**Minus #200 from wash** =98.6%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.03 | 99.9 |
| | | | .6mm | 0.06 | 99.9 |
| | | | .3mm | 0.12 | 99.8 |
| | | | .15mm | 0.46 | 99.1 |
| | | | .075mm | 0.65 | 98.7 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation:** L =16.294964 - 0.164 x Rm

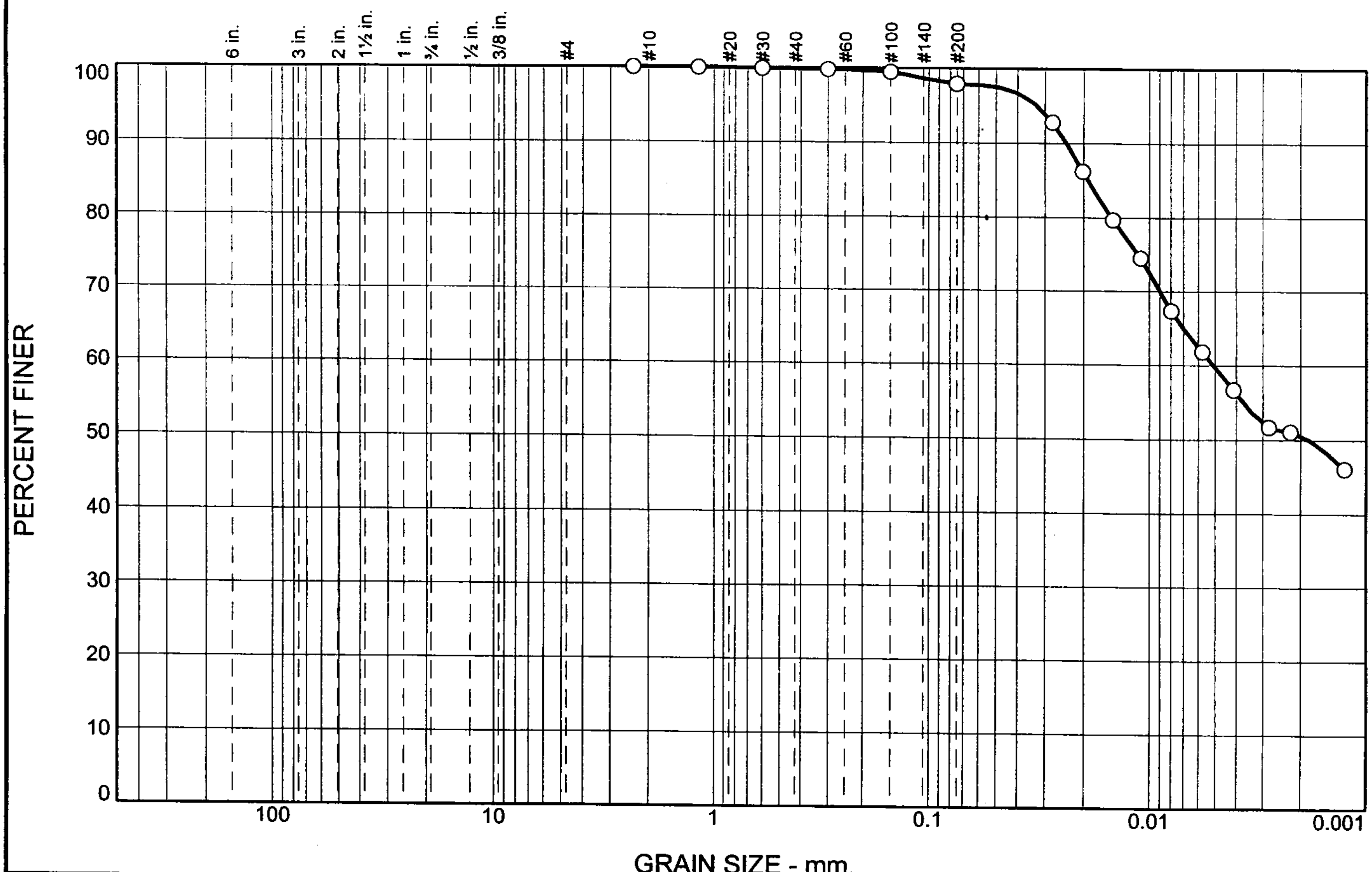
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 8.00 | 22.1 | 48.2 | 48.6 | 0.0132 | 47.2 | 8.6 | 0.0136 | 96.6 |
| 14.00 | 22.1 | 46.0 | 46.4 | 0.0132 | 45.0 | 8.9 | 0.0105 | 92.3 |
| 30.00 | 22.2 | 42.5 | 43.0 | 0.0132 | 41.5 | 9.5 | 0.0074 | 85.4 |
| 60.00 | 22.2 | 40.0 | 40.5 | 0.0132 | 39.0 | 9.9 | 0.0053 | 80.4 |
| 120.00 | 22.3 | 37.3 | 37.8 | 0.0131 | 36.3 | 10.3 | 0.0039 | 75.1 |
| 252.00 | 22.7 | 34.9 | 35.5 | 0.0131 | 33.9 | 10.7 | 0.0027 | 70.5 |
| 815.00 | 23.0 | 32.3 | 33.0 | 0.0130 | 31.3 | 11.2 | 0.0015 | 65.5 |
| 1468.00 | 20.6 | 30.5 | 30.6 | 0.0134 | 29.5 | 11.5 | 0.0012 | 60.8 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 1.2 | 1.3 | 19.4 | 79.3 | 98.7 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 0.0052 | 0.0072 | 0.0094 | 0.0122 |

| Fineness Modulus |
|---|
| 0.01 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 1.9 | 38.2 | 59.7 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 100.0 | | |
| .6mm | 99.9 | | |
| .3mm | 99.8 | | |
| .15mm | 99.4 | | |
| .075mm | 97.9 | | |

* (no specification provided)

**Material Description**

Clay (CH), brown to greyish brown, slightly silty, med-high plasticity

**Atterberg Limits (ASTM D 4318)**

PL= 21 LL= 52 PI= 31

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0191 $D_{60}$= 0.0051 $D_{50}$= 0.0018
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 12-01-06 **Tested By:** RTH

**Remarks**

**Sample No.:** "CL" **Source of Sample:** Section A **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section A
**Sample Number:** "CL"
**Material Description:** Clay (CH), brown to greyish brown, slightly silty, med-high plasticity
**PL:** 21 **LL:** 52 **PI:** 31
**USCS Classification:** CH
**Tested By:** RTH **Test Date:** 12-01-06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare =** 38.41
**Tare Wt. =** 37.31
**Minus #200 from wash =** 97.8%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.01 | 100.0 |
| | | | .6mm | 0.06 | 99.9 |
| | | | .3mm | 0.11 | 99.8 |
| | | | .15mm | 0.29 | 99.4 |
| | | | .075mm | 1.05 | 97.9 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample =**100.0
**Weight of hydrometer sample =**50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C =**01352
**Meniscus correction only =**-1.0
**Specific gravity of solids =**2.68
**Hydrometer type =**152H
**Hydrometer effective depth equation: L =**16.294964 - 0.164 **x Rm**

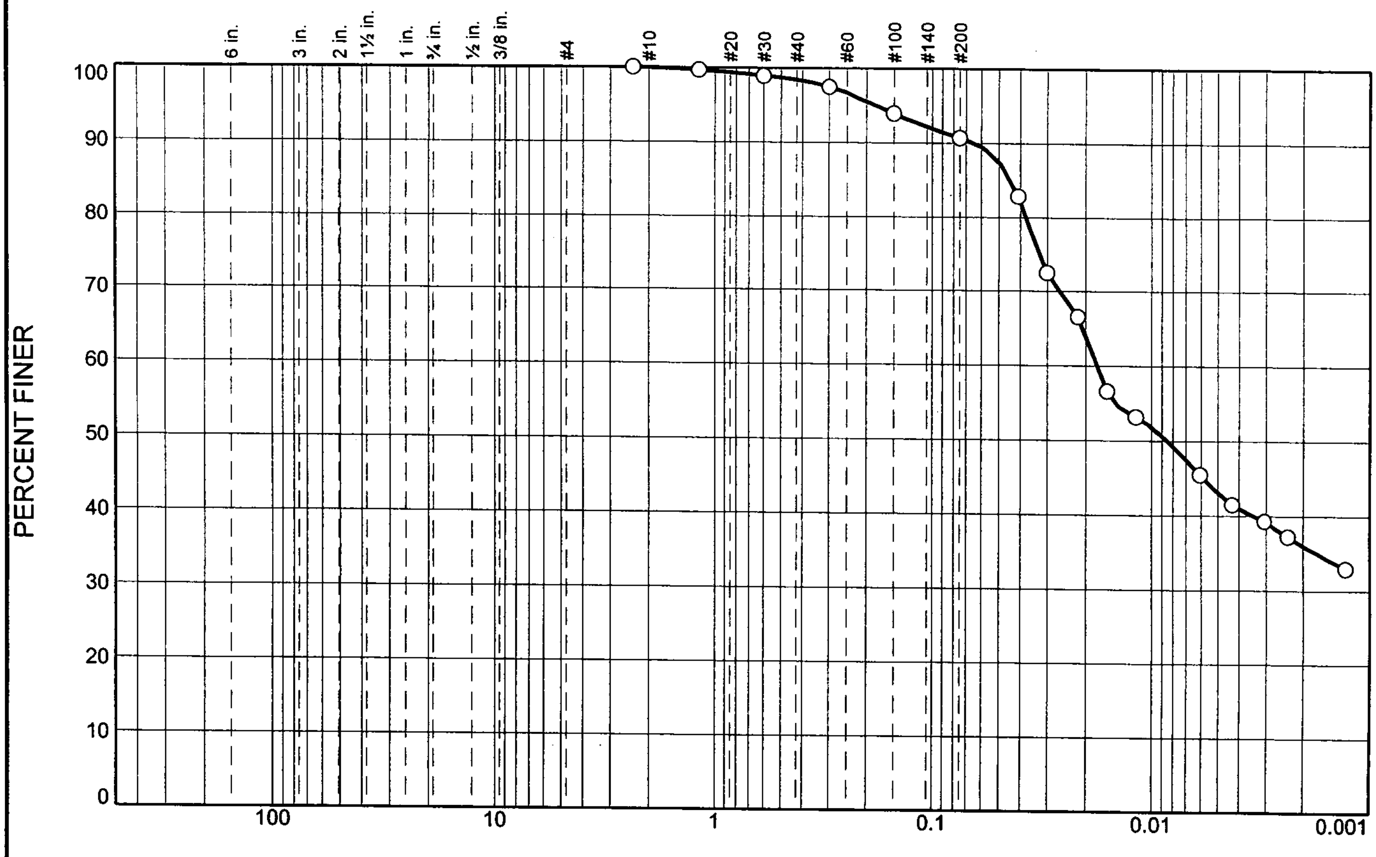
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 2.00 | 22.3 | 46.2 | 46.7 | 0.0131 | 45.2 | 8.9 | 0.0277 | 92.8 |
| 4.00 | 22.3 | 42.9 | 43.4 | 0.0131 | 41.9 | 9.4 | 0.0202 | 86.2 |
| 8.00 | 22.3 | 39.6 | 40.1 | 0.0131 | 38.6 | 10.0 | 0.0147 | 79.7 |
| 15.00 | 22.3 | 37.0 | 37.5 | 0.0131 | 36.0 | 10.4 | 0.0109 | 74.5 |
| 30.00 | 22.3 | 33.4 | 33.9 | 0.0131 | 32.4 | 11.0 | 0.0080 | 67.3 |
| 60.00 | 22.3 | 30.6 | 31.1 | 0.0131 | 29.6 | 11.4 | 0.0057 | 61.8 |
| 120.00 | 22.4 | 28.0 | 28.5 | 0.0131 | 27.0 | 11.9 | 0.0041 | 56.7 |
| 265.00 | 22.8 | 25.4 | 26.0 | 0.0131 | 24.4 | 12.3 | 0.0028 | 51.7 |
| 423.00 | 23.1 | 25.0 | 25.7 | 0.0130 | 24.0 | 12.4 | 0.0022 | 51.1 |
| 1440.00 | 20.6 | 23.1 | 23.2 | 0.0134 | 22.1 | 12.7 | 0.0013 | 46.1 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 1.9 | 2.1 | 38.2 | 59.7 | 97.9 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0018 | 0.0051 | 0.0150 | 0.0191 | 0.0240 | 0.0325 |

| Fineness Modulus |
|---|
| 0.01 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.1 | 1.5 | 7.7 | 47.7 | 43.0 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 99.6 | | |
| .6mm | 98.9 | | |
| .3mm | 97.4 | | |
| .15mm | 93.9 | | |
| .075mm | 90.7 | | |

* (no specification provided)

**Material Description**

CLAY (CL), brown, silty

**Atterberg Limits (ASTM D 4318)**

PL= 19 LL= 39 PI= 20

**Classification**

USCS= CL AASHTO=

**Coefficients**

$D_{85}$= 0.0441 $D_{60}$= 0.0178 $D_{50}$= 0.0085
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/30/06 **Tested By:** JLC

**Remarks**

**Sample No.:** "MCL" **Source of Sample:** Section A **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

# GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section A
**Sample Number:** "MCL"
**Material Description:** CLAY (CL), brown, silty
**PL:** 19 **LL:** 39 **PI:** 20
**USCS Classification:** CL
**Tested By:** JLC **Test Date:** 11/30/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =45.96
**Tare Wt.** =41.01
**Minus #200 from wash** =90.1%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.18 | 99.6 |
| | | | .6mm | 0.56 | 98.9 |
| | | | .3mm | 1.28 | 97.4 |
| | | | .15mm | 3.06 | 93.9 |
| | | | .075mm | 4.66 | 90.7 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** = 152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 **x Rm**

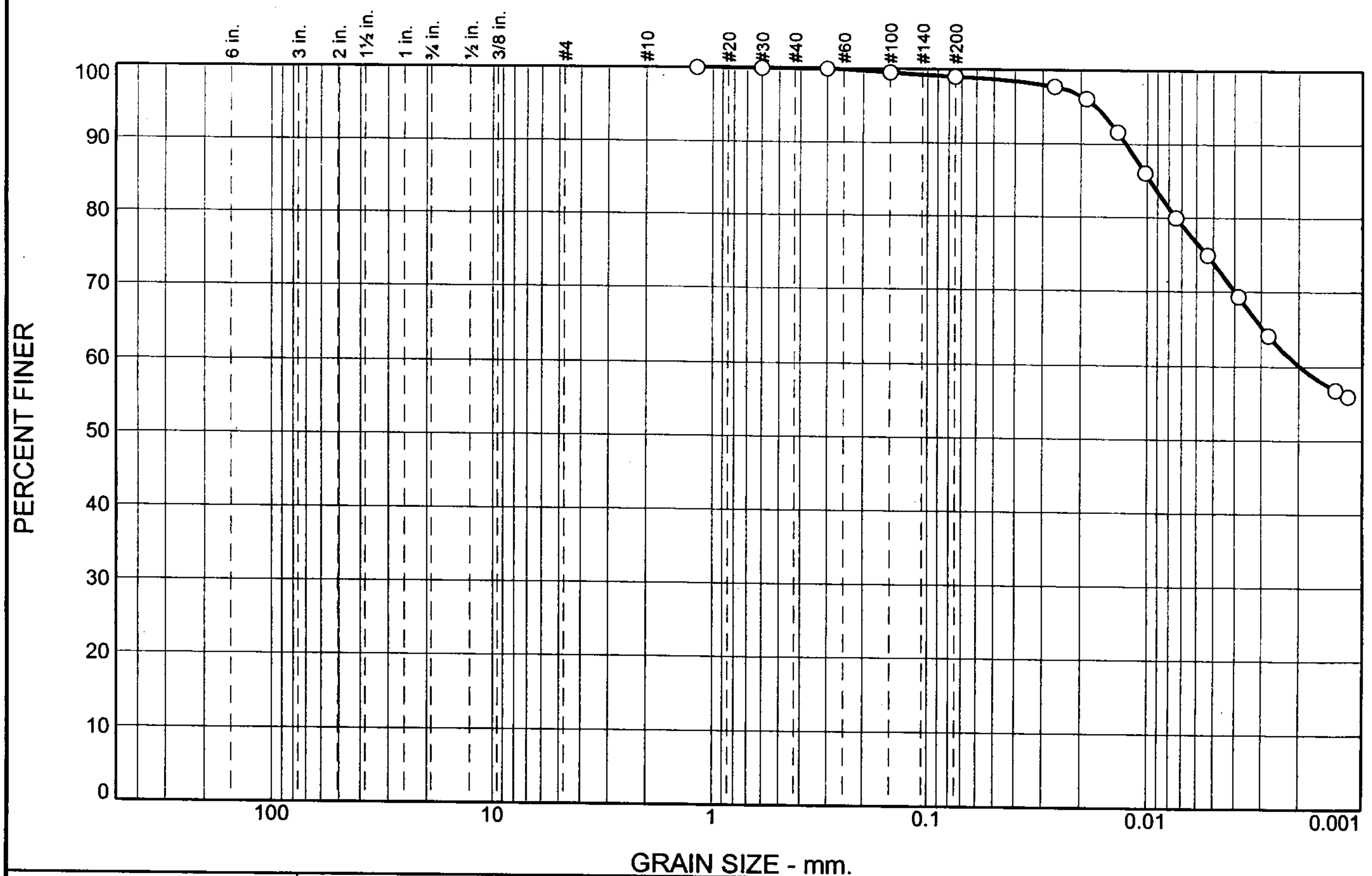
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 1.00 | 22.7 | 41.1 | 41.7 | 0.0131 | 40.1 | 9.7 | 0.0408 | 82.8 |
| 2.00 | 22.7 | 35.9 | 36.5 | 0.0131 | 34.9 | 10.6 | 0.0301 | 72.5 |
| 4.00 | 22.7 | 32.9 | 33.5 | 0.0131 | 31.9 | 11.1 | 0.0218 | 66.5 |
| 8.00 | 22.7 | 27.9 | 28.5 | 0.0131 | 26.9 | 11.9 | 0.0159 | 56.6 |
| 15.00 | 22.7 | 26.2 | 26.8 | 0.0131 | 25.2 | 12.2 | 0.0118 | 53.2 |
| 60.00 | 22.7 | 22.3 | 22.9 | 0.0131 | 21.3 | 12.8 | 0.0060 | 45.5 |
| 120.00 | 23.0 | 20.2 | 20.9 | 0.0130 | 19.2 | 13.1 | 0.0043 | 41.5 |
| 240.00 | 23.7 | 18.9 | 19.8 | 0.0129 | 17.9 | 13.4 | 0.0030 | 39.3 |
| 409.00 | 23.6 | 17.9 | 18.7 | 0.0129 | 16.9 | 13.5 | 0.0024 | 37.2 |
| 1440.00 | 22.3 | 16.1 | 16.6 | 0.0131 | 15.1 | 13.8 | 0.0013 | 33.0 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 1.5 | 7.7 | 9.3 | 47.7 | 43.0 | 90.7 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0085 | 0.0178 | 0.0375 | 0.0441 | 0.0643 | 0.1835 |

| Fineness Modulus |
|---|
| 0.10 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 25.1 | 73.9 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 1.18mm | 100.0 | | |
| .6mm | 100.0 | | |
| .3mm | 99.9 | | |
| .15mm | 99.5 | | |
| .075mm | 99.0 | | |

* (no specification provided)

**Material Description**

CLAY (CH), brown to greyish brown, high plastic

**Atterberg Limits (ASTM D 4318)**

PL= 27 LL= 71 PI= 44

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0097 $D_{60}$= 0.0020 $D_{50}$=
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/30/06 **Tested By:** RTH

**Remarks**

**Sample No.:** "CH" **Source of Sample:** Section B **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

# GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section B
**Sample Number:** "CH"
**Material Description:** CLAY (CH), brown to greyish brown, high plastic
**PL:** 27 **LL:** 71 **PI:** 44
**USCS Classification:** CH
**Tested By:** RTH **Test Date:** 11/30/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare =**41.32
**Tare Wt. =**40.76
**Minus #200 from wash =**98.9%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 1.18mm | 0.00 | 100.0 |
| | | | .6mm | 0.01 | 100.0 |
| | | | .3mm | 0.04 | 99.9 |
| | | | .15mm | 0.27 | 99.5 |
| | | | .075mm | 0.52 | 99.0 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample =**100.0
**Weight of hydrometer sample =**50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C =**01352
**Meniscus correction only =**-1.0
**Specific gravity of solids =**2.68
**Hydrometer type =**152H
**Hydrometer effective depth equation: L =**16.294964 - 0.164 **x Rm**

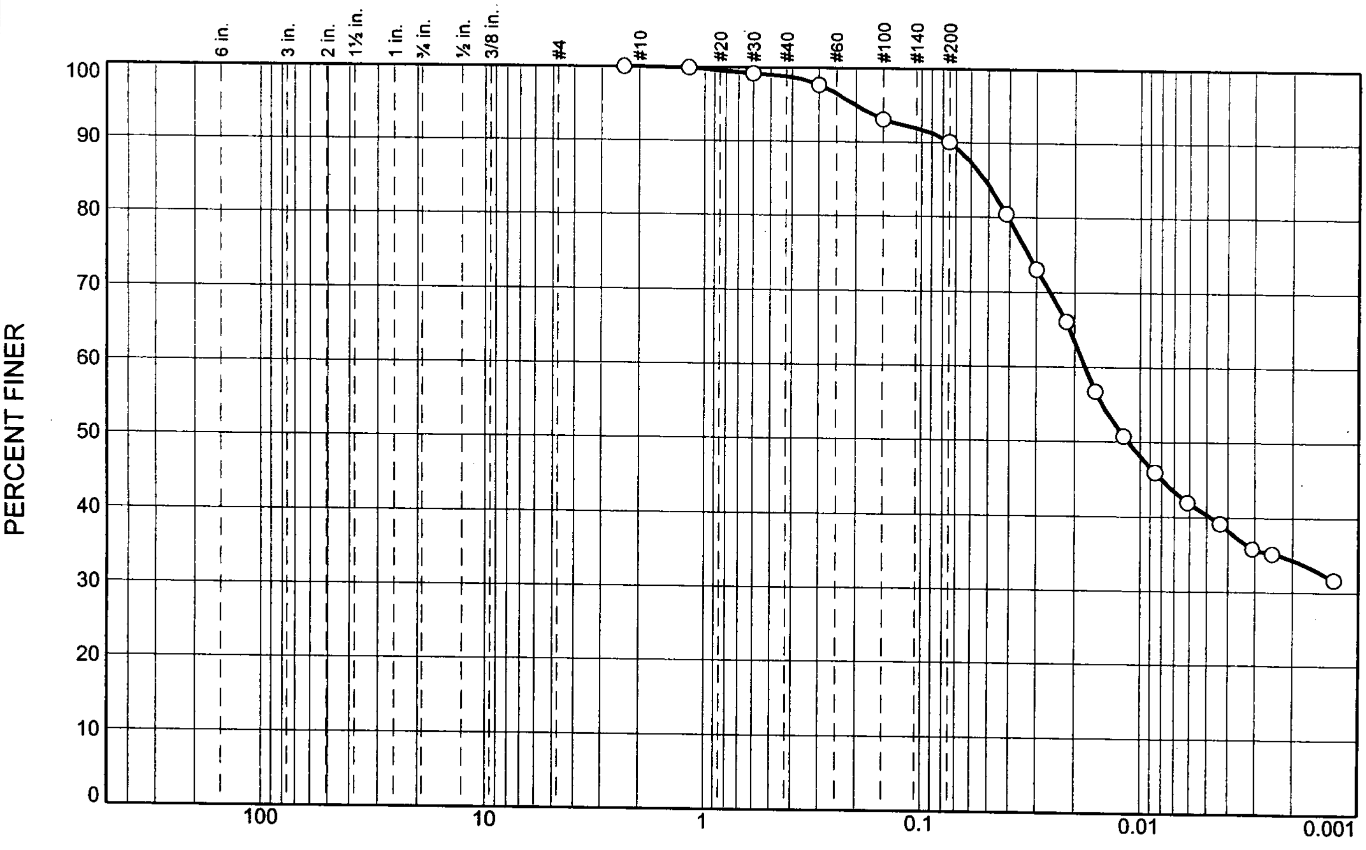
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 2.00 | 24.7 | 48.0 | 49.2 | 0.0128 | 47.0 | 8.6 | 0.0265 | 97.7 |
| 4.00 | 24.7 | 47.2 | 48.4 | 0.0128 | 46.2 | 8.7 | 0.0189 | 96.1 |
| 8.00 | 24.5 | 45.0 | 46.1 | 0.0128 | 44.0 | 9.1 | 0.0136 | 91.6 |
| 15.00 | 24.5 | 42.2 | 43.3 | 0.0128 | 41.2 | 9.5 | 0.0102 | 86.1 |
| 30.00 | 24.5 | 39.1 | 40.2 | 0.0128 | 38.1 | 10.0 | 0.0074 | 79.9 |
| 60.00 | 25.0 | 36.4 | 37.7 | 0.0127 | 35.4 | 10.5 | 0.0053 | 74.9 |
| 120.00 | 25.3 | 33.5 | 34.9 | 0.0127 | 32.5 | 11.0 | 0.0038 | 69.3 |
| 240.00 | 25.0 | 31.0 | 32.3 | 0.0127 | 30.0 | 11.4 | 0.0028 | 64.1 |
| 1132.00 | 23.1 | 27.9 | 28.6 | 0.0130 | 26.9 | 11.9 | 0.0013 | 56.8 |
| 1440.00 | 25.0 | 26.9 | 28.2 | 0.0127 | 25.9 | 12.0 | 0.0012 | 56.0 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 1.0 | 25.1 | 73.9 | 99.0 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 0.0020 | 0.0075 | 0.0097 | 0.0125 | 0.0170 |

| Fineness Modulus |
|---|
| 0.01 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 1.2 | 8.8 | 49.7 | 40.3 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 99.9 | | |
| .6mm | 99.2 | | |
| .3mm | 97.7 | | |
| .15mm | 93.1 | | |
| .075mm | 90.0 | | |

* (no specification provided)

**Material Description**

CLAY (CL), brown to greyish brown, slightly silty

**Atterberg Limits (ASTM D 4318)**

PL= 22 LL= 41 PI= 19

**Classification**

USCS= CL AASHTO=

**Coefficients**

$D_{85}$= 0.0517 $D_{60}$= 0.0179 $D_{50}$= 0.0113
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/30/06 **Tested By:** JLC

**Remarks**

**Sample No.:** "CL" **Source of Sample:** Section B **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

# GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section B
**Sample Number:** "CL"
**Material Description:** CLAY (CL), brown to greyish brown, slightly silty
**PL:** 22 **LL:** 41 **PI:** 19
**USCS Classification:** CL
**Tested By:** JLC **Test Date:** 11/30/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =45.73
**Tare Wt.** =40.67
**Minus #200 from wash** =89.9%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.06 | 99.9 |
| | | | .6mm | 0.42 | 99.2 |
| | | | .3mm | 1.15 | 97.7 |
| | | | .15mm | 3.46 | 93.1 |
| | | | .075mm | 4.98 | 90.0 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x Rm

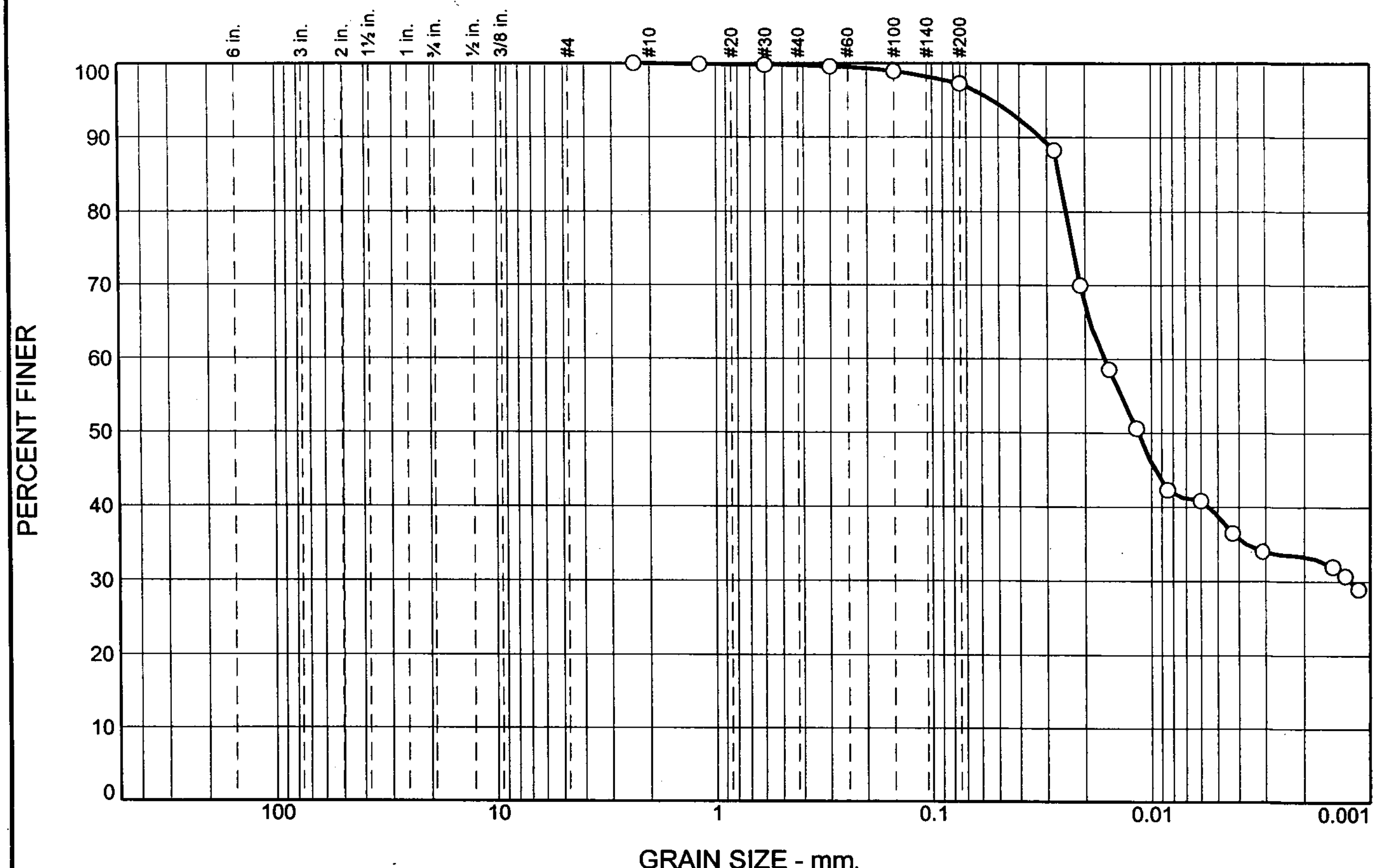
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 1.00 | 22.6 | 39.9 | 40.5 | 0.0131 | 38.9 | 9.9 | 0.0412 | 80.4 |
| 2.00 | 22.6 | 36.2 | 36.8 | 0.0131 | 35.2 | 10.5 | 0.0300 | 73.0 |
| 4.00 | 22.6 | 32.7 | 33.3 | 0.0131 | 31.7 | 11.1 | 0.0218 | 66.1 |
| 8.00 | 22.5 | 28.0 | 28.5 | 0.0131 | 27.0 | 11.9 | 0.0160 | 56.7 |
| 15.00 | 22.5 | 25.0 | 25.5 | 0.0131 | 24.0 | 12.4 | 0.0119 | 50.7 |
| 30.00 | 22.5 | 22.6 | 23.1 | 0.0131 | 21.6 | 12.8 | 0.0086 | 46.0 |
| 60.00 | 22.8 | 20.5 | 21.1 | 0.0131 | 19.5 | 13.1 | 0.0061 | 42.0 |
| 120.00 | 23.1 | 19.0 | 19.7 | 0.0130 | 18.0 | 13.3 | 0.0043 | 39.1 |
| 240.00 | 23.8 | 17.1 | 18.0 | 0.0129 | 16.1 | 13.7 | 0.0031 | 35.8 |
| 374.00 | 23.4 | 16.9 | 17.7 | 0.0130 | 15.9 | 13.7 | 0.0025 | 35.1 |
| 1440.00 | 22.4 | 15.4 | 15.9 | 0.0131 | 14.4 | 13.9 | 0.0013 | 31.6 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.2 | 8.8 | 10.0 | 49.7 | 40.3 | 90.0 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0113 | 0.0179 | 0.0405 | 0.0517 | 0.0747 | 0.2022 |

| Fineness Modulus |
|---|
| 0.10 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 2.5 | 58.5 | 38.7 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 99.9 | | |
| .6mm | 99.7 | | |
| .3mm | 99.5 | | |
| .15mm | 98.9 | | |
| .075mm | 97.2 | | |

* (no specification provided)

**Material Description**

CLAY (CL), brown, silty

**Atterberg Limits (ASTM D 4318)**

PL= 22 LL= 39 PI= 17

**Classification**

USCS= CL AASHTO=

**Coefficients**

$D_{85}$= 0.0263 $D_{60}$= 0.0164 $D_{50}$= 0.0114
$D_{30}$= 0.0012 $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/27/06 **Tested By:** JLC & RTH

**Remarks**

**Sample No.:** "MCL" **Source of Sample:** Section B **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section B
**Sample Number:** "MCL"
**Material Description:** CLAY (CL), brown, silty
**PL:** 22 **LL:** 39 **PI:** 17
**USCS Classification:** CL
**Tested By:** JLC & RTH **Test Date:** 11/27/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare =** 42.26
**Tare Wt. =** 40.84
**Minus #200 from wash =** 97.2%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.07 | 99.9 |
| | | | .6mm | 0.13 | 99.7 |
| | | | .3mm | 0.25 | 99.5 |
| | | | .15mm | 0.57 | 98.9 |
| | | | .075mm | 1.40 | 97.2 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample =**100.0
**Weight of hydrometer sample =**50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C =**01352
**Meniscus correction only =**-1.0
**Specific gravity of solids =**2.68
**Hydrometer type =**152H
**Hydrometer effective depth equation: L =**16.294964 - 0.164 **x Rm**

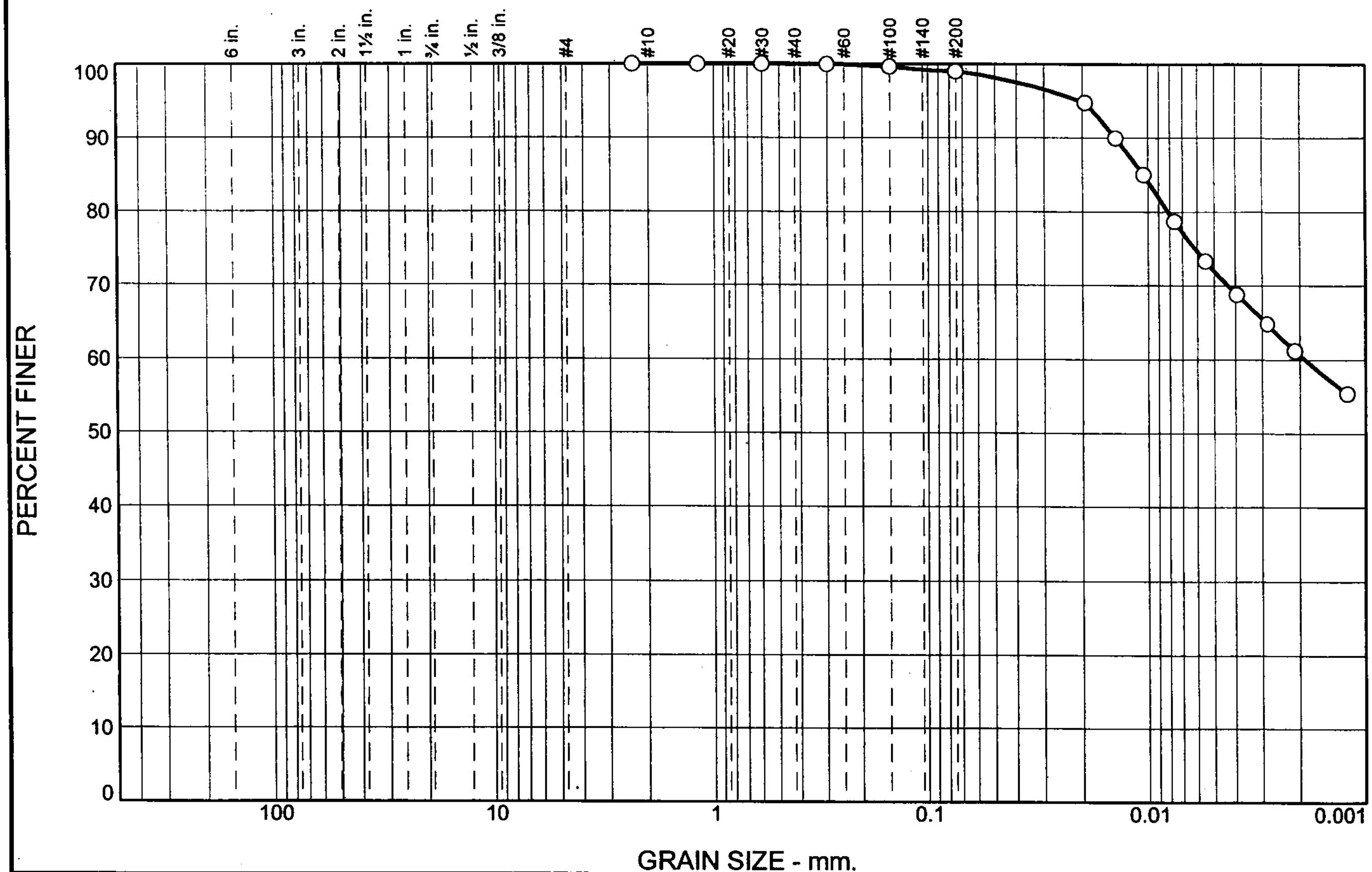
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 2.00 | 24.8 | 43.2 | 44.4 | 0.0128 | 42.2 | 9.4 | 0.0276 | 88.2 |
| 4.00 | 24.8 | 34.0 | 35.2 | 0.0128 | 33.0 | 10.9 | 0.0210 | 70.0 |
| 8.00 | 24.7 | 28.3 | 29.5 | 0.0128 | 27.3 | 11.8 | 0.0155 | 58.6 |
| 15.00 | 24.7 | 24.3 | 25.5 | 0.0128 | 23.3 | 12.5 | 0.0117 | 50.6 |
| 30.00 | 24.7 | 20.1 | 21.3 | 0.0128 | 19.1 | 13.2 | 0.0085 | 42.3 |
| 60.00 | 24.9 | 19.3 | 20.6 | 0.0127 | 18.3 | 13.3 | 0.0060 | 40.8 |
| 120.00 | 25.2 | 17.0 | 18.4 | 0.0127 | 16.0 | 13.7 | 0.0043 | 36.5 |
| 240.00 | 23.8 | 16.2 | 17.1 | 0.0129 | 15.2 | 13.8 | 0.0031 | 34.0 |
| 1165.00 | 19.6 | 16.2 | 16.1 | 0.0136 | 15.2 | 13.8 | 0.0015 | 32.0 |
| 1440.00 | 22.1 | 15.0 | 15.4 | 0.0132 | 14.0 | 14.0 | 0.0013 | 30.7 |
| 1917.00 | 22.1 | 14.1 | 14.5 | 0.0132 | 13.1 | 14.1 | 0.0011 | 28.9 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 2.5 | 2.8 | 58.5 | 38.7 | 97.2 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | 0.0012 | 0.0114 | 0.0164 | 0.0244 | 0.0263 | 0.0319 | 0.0532 |

| Fineness Modulus |
|---|
| 0.02 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 27.1 | 71.9 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 100.0 | | |
| .6mm | 100.0 | | |
| .3mm | 100.0 | | |
| .15mm | 99.6 | | |
| .075mm | 99.0 | | |

* (no specification provided)

**Material Description**

CLAY (CH), brown to greyish brown, high plastic

**Atterberg Limits (ASTM D 4318)**

PL= 20 LL= 62 PI= 42

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0105 $D_{60}$= 0.0019 $D_{50}$=
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 12/01/06 **Tested By:** RTH

**Remarks**

**Sample No.:** "CH" **Source of Sample:** Section C **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

# GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section C
**Sample Number:** "CH"
**Material Description:** CLAY (CH), brown to greyish brown, high plastic
**PL:** 20 **LL:** 62 **PI:** 42
**USCS Classification:** CH
**Tested By:** RTH **Test Date:** 12/01/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =41.33
**Tare Wt.** =40.78
**Minus #200 from wash** =98.9%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.00 | 100.0 |
| | | | .6mm | 0.01 | 100.0 |
| | | | .3mm | 0.02 | 100.0 |
| | | | .15mm | 0.21 | 99.6 |
| | | | .075mm | 0.52 | 99.0 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x **Rm**

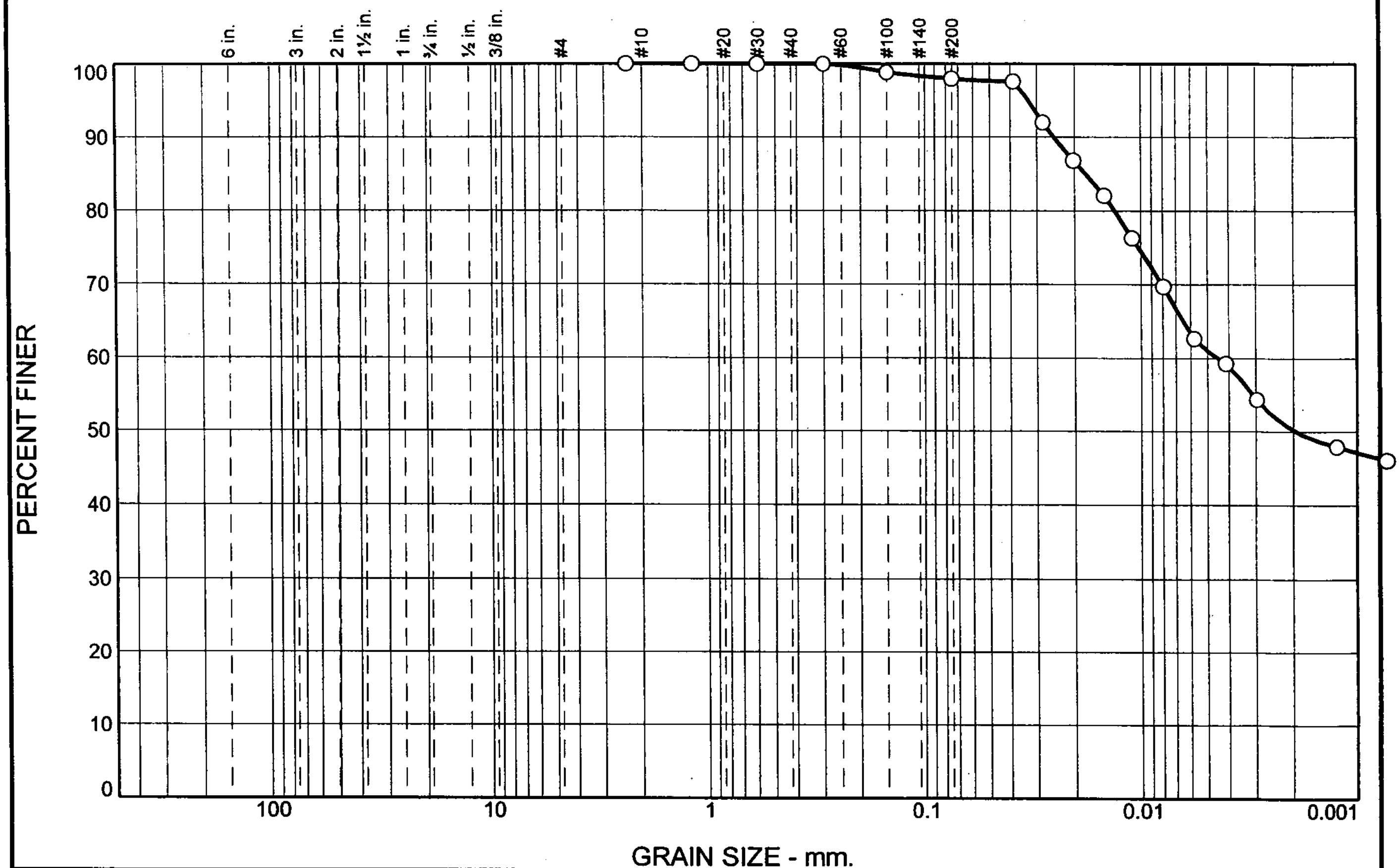
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 4.00 | 22.3 | 47.2 | 47.7 | 0.0131 | 46.2 | 8.7 | 0.0194 | 94.7 |
| 8.00 | 22.3 | 44.8 | 45.3 | 0.0131 | 43.8 | 9.1 | 0.0140 | 90.0 |
| 15.00 | 22.3 | 42.3 | 42.8 | 0.0131 | 41.3 | 9.5 | 0.0105 | 85.0 |
| 30.00 | 22.3 | 39.1 | 39.6 | 0.0131 | 38.1 | 10.0 | 0.0076 | 78.7 |
| 60.00 | 22.3 | 36.4 | 36.9 | 0.0131 | 35.4 | 10.5 | 0.0055 | 73.3 |
| 120.00 | 22.4 | 34.1 | 34.6 | 0.0131 | 33.1 | 10.9 | 0.0040 | 68.8 |
| 240.00 | 22.8 | 32.0 | 32.6 | 0.0131 | 31.0 | 11.2 | 0.0028 | 64.8 |
| 441.00 | 23.1 | 30.1 | 30.8 | 0.0130 | 29.1 | 11.5 | 0.0021 | 61.2 |
| 1454.00 | 20.6 | 27.8 | 27.9 | 0.0134 | 26.8 | 11.9 | 0.0012 | 55.4 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 1.0 | 27.1 | 71.9 | 99.0 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 0.0019 | 0.0082 | 0.0105 | 0.0140 | 0.0205 |

| Fineness Modulus |
|---|
| 0.00 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 2.0 | 36.9 | 61.0 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 100.0 | | |
| .6mm | 100.0 | | |
| .3mm | 99.9 | | |
| .15mm | 98.8 | | |
| .075mm | 97.9 | | |

* (no specification provided)

**Material Description**

CLAY (CH), brown to greyish brown, slightly silty, med-high plasticity

**Atterberg Limits (ASTM D 4318)**

PL= 19 LL= 52 PI= 33

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0178 $D_{60}$= 0.0045 $D_{50}$= 0.0019
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 12/04/06 **Tested By:** RTH & JRD

**Remarks**

**Sample No.:** "CL" **Source of Sample:** Section C **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

# GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section C
**Sample Number:** "CL"
**Material Description:** CLAY (CH), brown to greyish brown, slightly silty, med-high plasticity
**PL:** 19 **LL:** 52 **PI:** 33
**USCS Classification:** CH
**Tested By:** RTH & JRD **Test Date:** 12/04/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =41.69
**Tare Wt.** =40.58
**Minus #200 from wash** =97.8%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.01 | 100.0 |
| | | | .6mm | 0.02 | 100.0 |
| | | | .3mm | 0.04 | 99.9 |
| | | | .15mm | 0.60 | 98.8 |
| | | | .075mm | 1.04 | 97.9 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x **Rm**

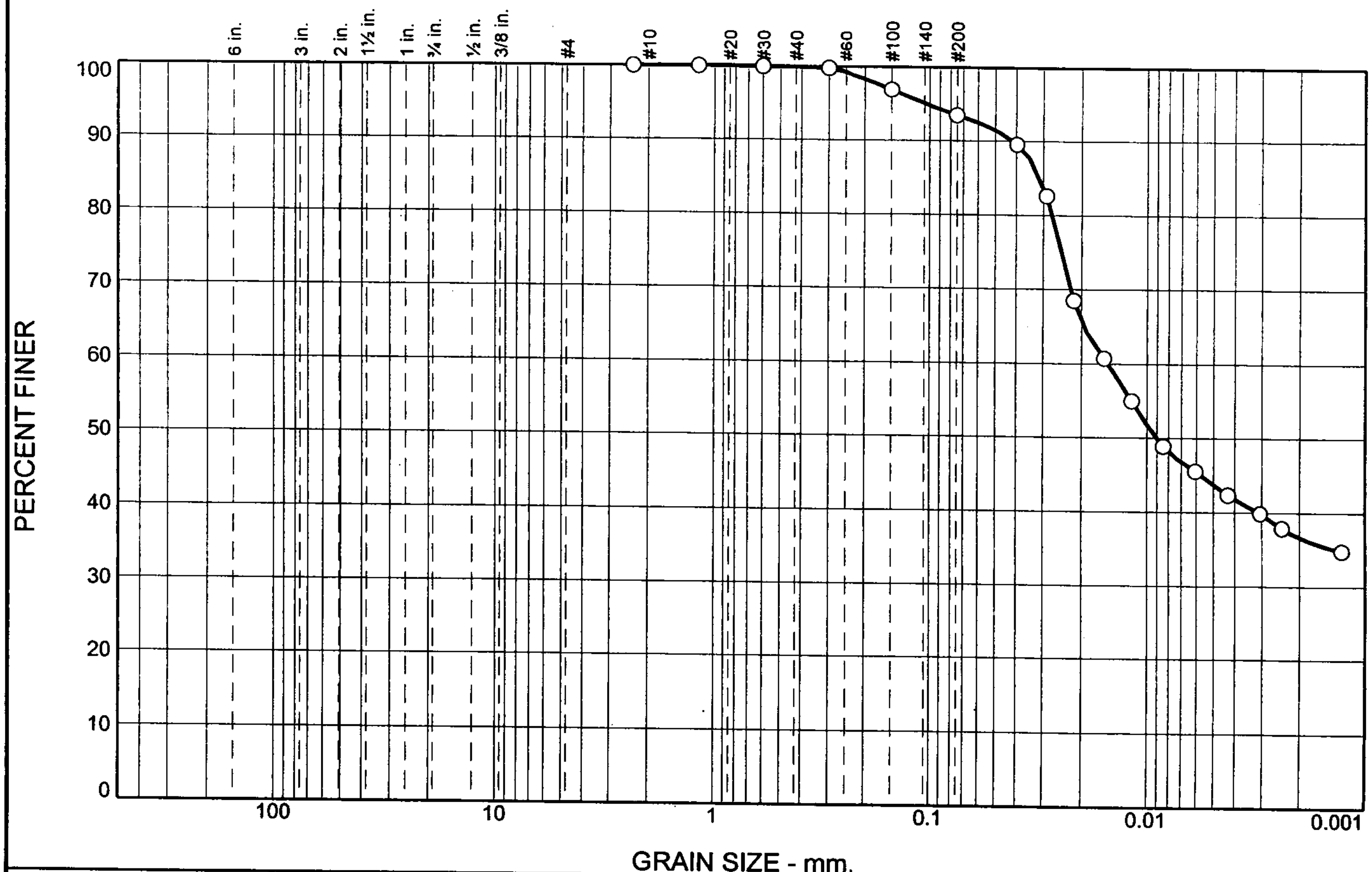
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 1.00 | 21.5 | 48.8 | 49.1 | 0.0133 | 47.8 | 8.5 | 0.0386 | 97.5 |
| 2.00 | 21.5 | 46.0 | 46.3 | 0.0133 | 45.0 | 8.9 | 0.0280 | 92.0 |
| 4.00 | 21.5 | 43.4 | 43.7 | 0.0133 | 42.4 | 9.3 | 0.0203 | 86.8 |
| 8.00 | 21.5 | 41.0 | 41.3 | 0.0133 | 40.0 | 9.7 | 0.0146 | 82.0 |
| 15.00 | 21.5 | 38.1 | 38.4 | 0.0133 | 37.1 | 10.2 | 0.0110 | 76.3 |
| 30.00 | 21.5 | 34.8 | 35.1 | 0.0133 | 33.8 | 10.8 | 0.0079 | 69.7 |
| 60.00 | 21.6 | 31.2 | 31.5 | 0.0133 | 30.2 | 11.3 | 0.0058 | 62.6 |
| 120.00 | 21.6 | 29.5 | 29.8 | 0.0133 | 28.5 | 11.6 | 0.0041 | 59.3 |
| 240.00 | 21.7 | 27.0 | 27.4 | 0.0132 | 26.0 | 12.0 | 0.0030 | 54.3 |
| 1439.00 | 20.7 | 24.0 | 24.1 | 0.0134 | 23.0 | 12.5 | 0.0013 | 47.9 |
| 4310.00 | 20.1 | 23.2 | 23.2 | 0.0135 | 22.2 | 12.7 | 0.0007 | 46.1 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 2.0 | 2.1 | 36.9 | 61.0 | 97.9 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0019 | 0.0045 | 0.0131 | 0.0178 | 0.0250 | 0.0328 |

| Fineness Modulus |
|---|
| 0.01 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 6.4 | 49.8 | 43.7 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 100.0 | | |
| .6mm | 99.9 | | |
| .3mm | 99.8 | | |
| .15mm | 96.9 | | |
| .075mm | 93.5 | | |

* (no specification provided)

**Material Description**

CLAY (CL), brown, silty

**Atterberg Limits (ASTM D 4318)**

PL= 20 LL= 40 PI= 20

**Classification**

USCS= CL AASHTO=

**Coefficients**

$D_{85}$= 0.0309 $D_{60}$= 0.0151 $D_{50}$= 0.0091
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/30/06 **Tested By:** JLC & JRD

**Remarks**

**Sample No.:** "MCL" **Source of Sample:** Section C **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

# GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section C
**Sample Number:** "MCL"
**Material Description:** CLAY (CL), brown, silty
**PL:** 20 **LL:** 40 **PI:** 20
**USCS Classification:** CL
**Tested By:** JLC & JRD **Test Date:** 11/30/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare =** 44.05
**Tare Wt. =** 40.63
**Minus #200 from wash =** 93.2%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.01 | 100.0 |
| | | | .6mm | 0.03 | 99.9 |
| | | | .3mm | 0.11 | 99.8 |
| | | | .15mm | 1.57 | 96.9 |
| | | | .075mm | 3.27 | 93.5 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample =** 100.0
**Weight of hydrometer sample =** 50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C =** 01352
**Meniscus correction only =** -1.0
**Specific gravity of solids =** 2.68
**Hydrometer type =** 152H
**Hydrometer effective depth equation: L =** 16.294964 - 0.164 **x Rm**

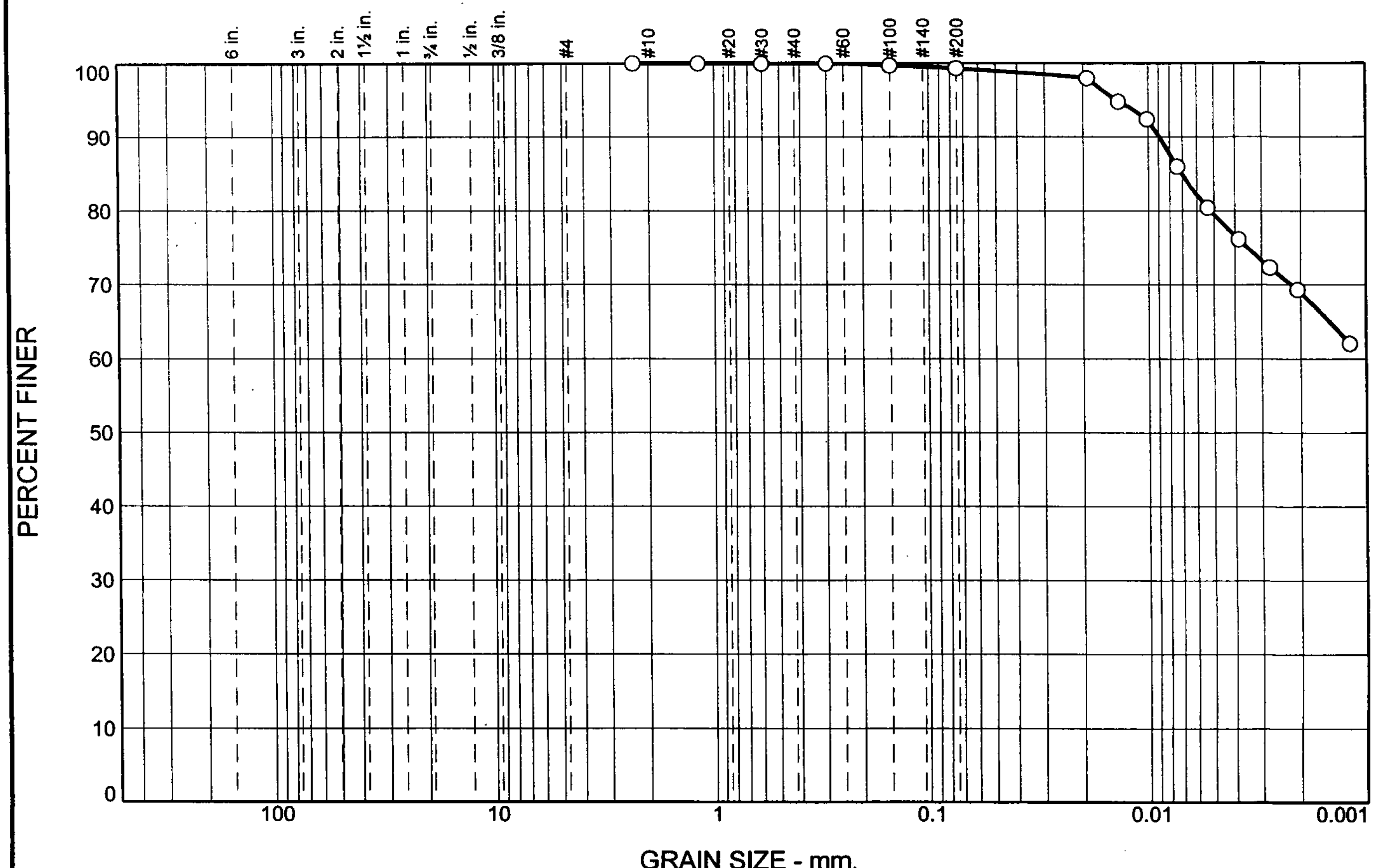
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 1.00 | 22.6 | 44.5 | 45.1 | 0.0131 | 43.5 | 9.2 | 0.0396 | 89.5 |
| 2.00 | 22.6 | 41.0 | 41.6 | 0.0131 | 40.0 | 9.7 | 0.0289 | 82.6 |
| 4.00 | 22.6 | 33.9 | 34.5 | 0.0131 | 32.9 | 10.9 | 0.0216 | 68.5 |
| 8.00 | 22.6 | 30.0 | 30.6 | 0.0131 | 29.0 | 11.5 | 0.0157 | 60.7 |
| 15.00 | 22.6 | 27.1 | 27.7 | 0.0131 | 26.1 | 12.0 | 0.0117 | 55.0 |
| 30.00 | 22.7 | 24.0 | 24.6 | 0.0131 | 23.0 | 12.5 | 0.0085 | 48.9 |
| 60.00 | 22.7 | 22.3 | 22.9 | 0.0131 | 21.3 | 12.8 | 0.0060 | 45.5 |
| 120.00 | 23.1 | 20.6 | 21.3 | 0.0130 | 19.6 | 13.1 | 0.0043 | 42.3 |
| 240.00 | 23.7 | 19.2 | 20.1 | 0.0129 | 18.2 | 13.3 | 0.0030 | 39.9 |
| 390.00 | 23.7 | 18.2 | 19.1 | 0.0129 | 17.2 | 13.5 | 0.0024 | 37.9 |
| 1440.00 | 22.4 | 17.0 | 17.5 | 0.0131 | 16.0 | 13.7 | 0.0013 | 34.8 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 6.4 | 6.5 | 49.8 | 43.7 | 93.5 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0091 | 0.0151 | 0.0273 | 0.0309 | 0.0415 | 0.1045 |

| Fineness Modulus |
|---|
| 0.03 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.7 | 19.7 | 79.5 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 100.0 | | |
| .6mm | 100.0 | | |
| .3mm | 99.9 | | |
| .15mm | 99.7 | | |
| .075mm | 99.2 | | |

* (no specification provided)

**Material Description**

CLAY (CH), brown to greyish brown, high plastic

**Atterberg Limits (ASTM D 4318)**

PL= 31 LL= 76 PI= 45

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0070 $D_{60}$= $D_{50}$=
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 12/01/06 **Tested By:** RTH

**Remarks**

**Sample No.:** "CH" **Source of Sample:** Section D **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill

**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section D
**Sample Number:** "CH"
**Material Description:** CLAY (CH), brown to greyish brown, high plastic
**PL:** 31 **LL:** 76 **PI:** 45
**USCS Classification:** CH
**Tested By:** RTH **Test Date:** 12/01/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =41.09
**Tare Wt.** =40.70
**Minus #200 from wash** =99.2%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.01 | 100.0 |
| | | | .6mm | 0.02 | 100.0 |
| | | | .3mm | 0.04 | 99.9 |
| | | | .15mm | 0.17 | 99.7 |
| | | | .075mm | 0.38 | 99.2 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation:** L =16.294964 - 0.164 x Rm

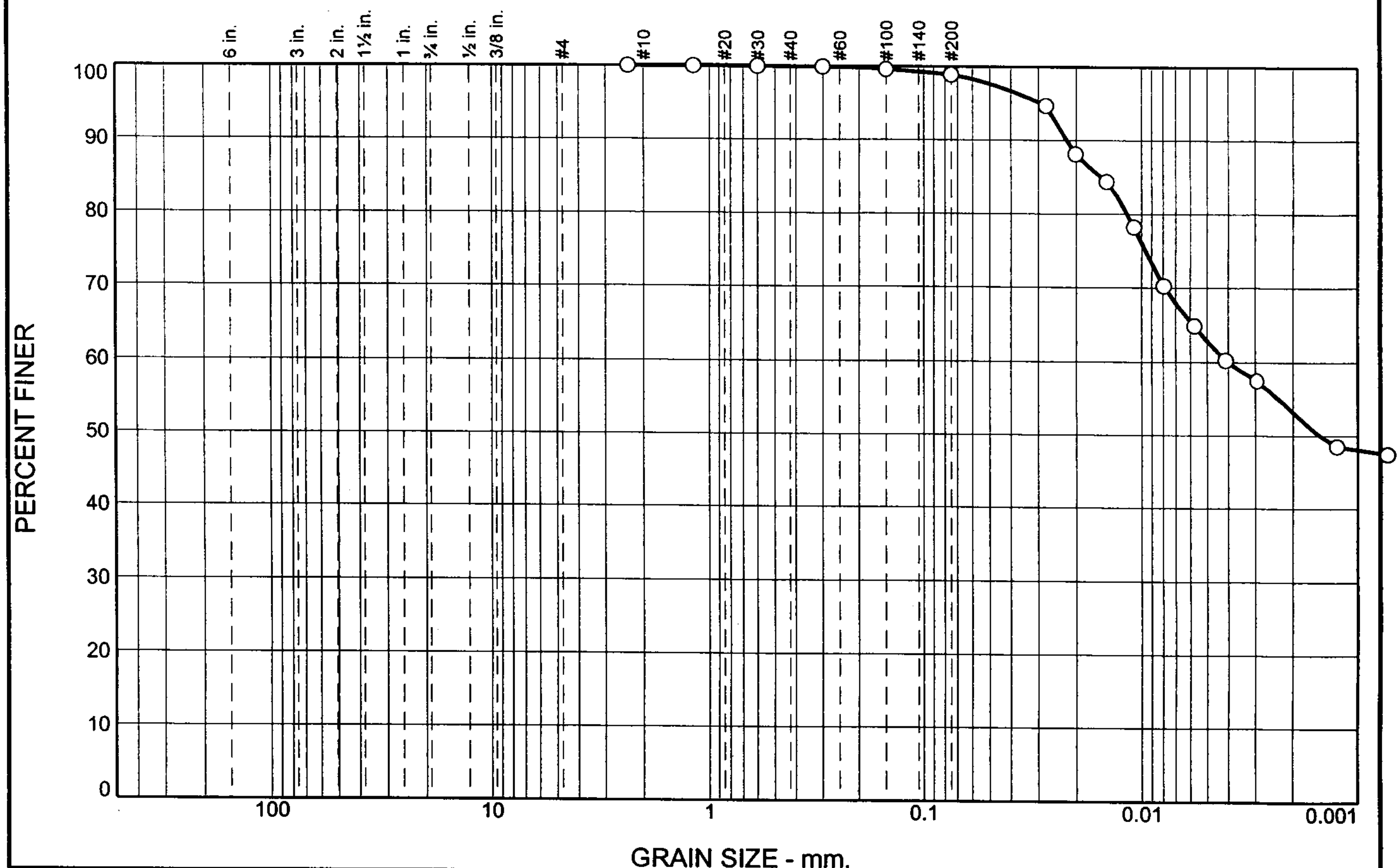
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 4.00 | 22.3 | 48.8 | 49.3 | 0.0131 | 47.8 | 8.5 | 0.0191 | 97.9 |
| 8.00 | 22.3 | 47.2 | 47.7 | 0.0131 | 46.2 | 8.7 | 0.0137 | 94.7 |
| 15.00 | 22.3 | 46.0 | 46.5 | 0.0131 | 45.0 | 8.9 | 0.0101 | 92.4 |
| 30.00 | 22.2 | 42.8 | 43.3 | 0.0132 | 41.8 | 9.4 | 0.0074 | 86.0 |
| 60.00 | 22.2 | 40.0 | 40.5 | 0.0132 | 39.0 | 9.9 | 0.0053 | 80.4 |
| 120.00 | 22.4 | 37.8 | 38.3 | 0.0131 | 36.8 | 10.3 | 0.0038 | 76.1 |
| 240.00 | 22.7 | 35.8 | 36.4 | 0.0131 | 34.8 | 10.6 | 0.0027 | 72.3 |
| 432.00 | 23.0 | 34.2 | 34.9 | 0.0130 | 33.2 | 10.9 | 0.0021 | 69.3 |
| 1445.00 | 20.6 | 31.1 | 31.2 | 0.0134 | 30.1 | 11.4 | 0.0012 | 62.0 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.7 | 0.8 | 19.7 | 79.5 | 99.2 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 0.0052 | 0.0070 | 0.0089 | 0.0142 |

| Fineness Modulus |
|---|
| 0.00 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 1.0 | 36.0 | 62.9 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 100.0 | | |
| .6mm | 99.9 | | |
| .3mm | 99.9 | | |
| .15mm | 99.5 | | |
| .075mm | 98.9 | | |

* (no specification provided)

**Material Description**

CLAY (CH), brown to greyish brown, slightly silty, med-high plasticity

**Atterberg Limits (ASTM D 4318)**

PL= 27 LL= 59 PI= 32

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0152 $D_{60}$= 0.0040 $D_{50}$= 0.0015
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 12/04/06 **Tested By:** RTH & JRD

**Remarks**

**Sample No.:** "CL" **Source of Sample:** Section D **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

# GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section D
**Sample Number:** "CL"
**Material Description:** CLAY (CH), brown to greyish brown, slightly silty, med-high plasticity
**PL:** 27 **LL:** 59 **PI:** 32
**USCS Classification:** CH
**Tested By:** RTH & JRD **Test Date:** 12/04/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =41.31
**Tare Wt.** =40.71
**Minus #200 from wash** =98.8%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.01 | 100.0 |
| | | | .6mm | 0.03 | 99.9 |
| | | | .3mm | 0.06 | 99.9 |
| | | | .15mm | 0.23 | 99.5 |
| | | | .075mm | 0.56 | 98.9 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x **Rm**

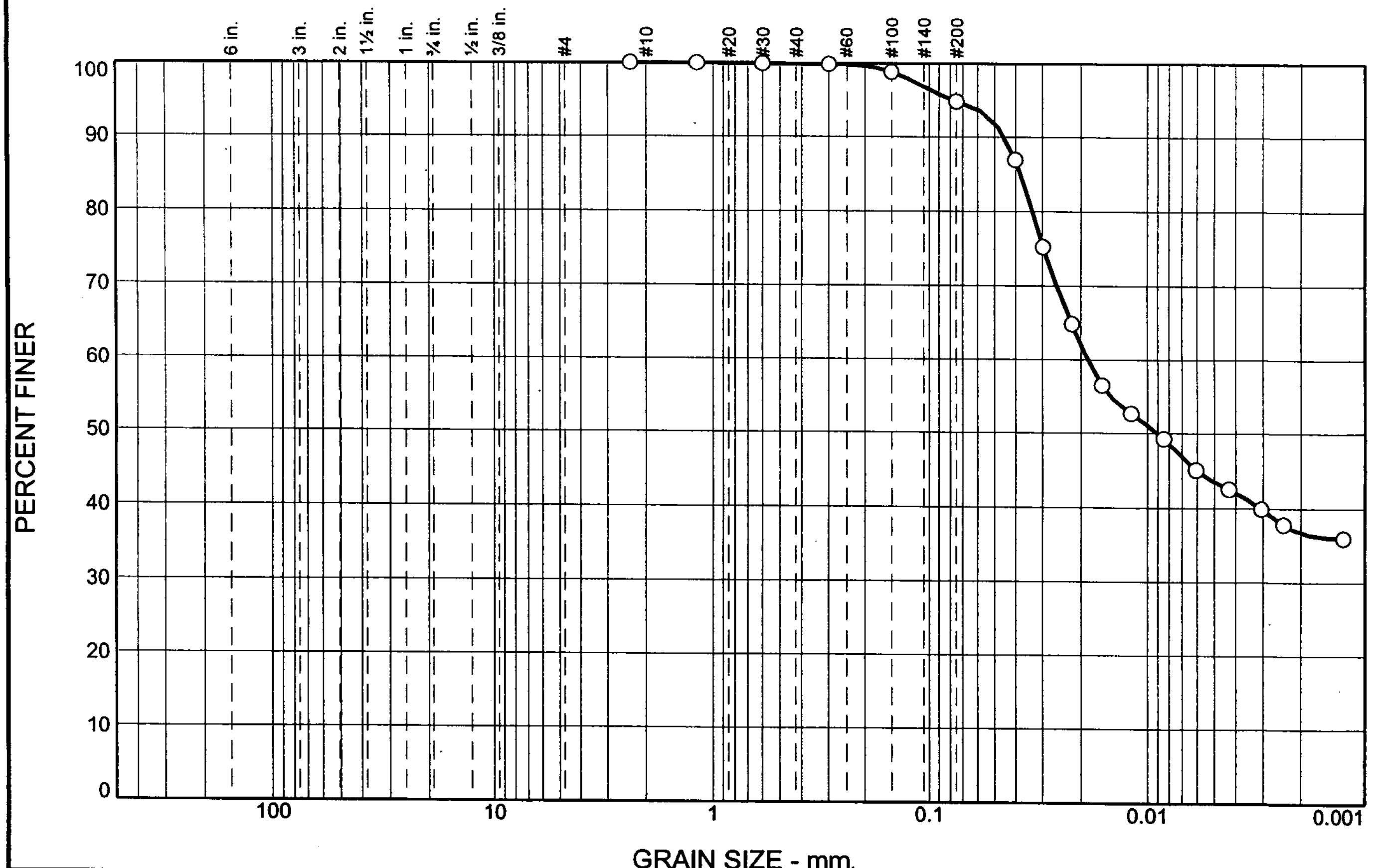
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 2.00 | 21.8 | 47.3 | 47.7 | 0.0132 | 46.3 | 8.7 | 0.0276 | 94.7 |
| 4.00 | 21.8 | 44.0 | 44.4 | 0.0132 | 43.0 | 9.2 | 0.0201 | 88.1 |
| 8.00 | 21.8 | 42.1 | 42.5 | 0.0132 | 41.1 | 9.6 | 0.0145 | 84.4 |
| 15.00 | 21.8 | 39.0 | 39.4 | 0.0132 | 38.0 | 10.1 | 0.0108 | 78.2 |
| 30.00 | 21.7 | 35.0 | 35.4 | 0.0132 | 34.0 | 10.7 | 0.0079 | 70.2 |
| 60.00 | 21.7 | 32.3 | 32.7 | 0.0132 | 31.3 | 11.2 | 0.0057 | 64.9 |
| 120.00 | 21.6 | 30.0 | 30.3 | 0.0133 | 29.0 | 11.5 | 0.0041 | 60.2 |
| 240.00 | 21.6 | 28.6 | 28.9 | 0.0133 | 27.6 | 11.8 | 0.0029 | 57.5 |
| 1431.00 | 20.7 | 24.3 | 24.4 | 0.0134 | 23.3 | 12.5 | 0.0013 | 48.5 |
| 4302.00 | 20.1 | 23.9 | 23.9 | 0.0135 | 22.9 | 12.5 | 0.0007 | 47.5 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 1.0 | 1.1 | 36.0 | 62.9 | 98.9 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0015 | 0.0040 | 0.0116 | 0.0152 | 0.0222 | 0.0290 |

| Fineness Modulus |
|---|
| 0.01 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 5.0 | 51.3 | 43.5 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 100.0 | | |
| .6mm | 99.9 | | |
| .3mm | 99.8 | | |
| .15mm | 98.8 | | |
| .075mm | 94.8 | | |

* (no specification provided)

**Material Description**

CLAY (CL), brown, silty

**Atterberg Limits (ASTM D 4318)**

PL= 23 LL= 40 PI= 17

**Classification**

USCS= CL AASHTO=

**Coefficients**

$D_{85}$= 0.0379 $D_{60}$= 0.0186 $D_{50}$= 0.0090
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/30/06 **Tested By:** JLC, JRD, RTH

**Remarks**

**Sample No.:** "MCL" **Source of Sample:** Section D **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC. CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section D
**Sample Number:** "MCL"
**Material Description:** CLAY (CL), brown, silty
**PL:** 23 **LL:** 40 **PI:** 17
**USCS Classification:** CL
**Tested By:** JLC, JRD, RTH **Test Date:** 11/30/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =44.07
**Tare Wt.** =40.88
**Minus #200 from wash** =93.6%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.01 | 100.0 |
| | | | .6mm | 0.05 | 99.9 |
| | | | .3mm | 0.10 | 99.8 |
| | | | .15mm | 0.61 | 98.8 |
| | | | .075mm | 2.61 | 94.8 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x **Rm**

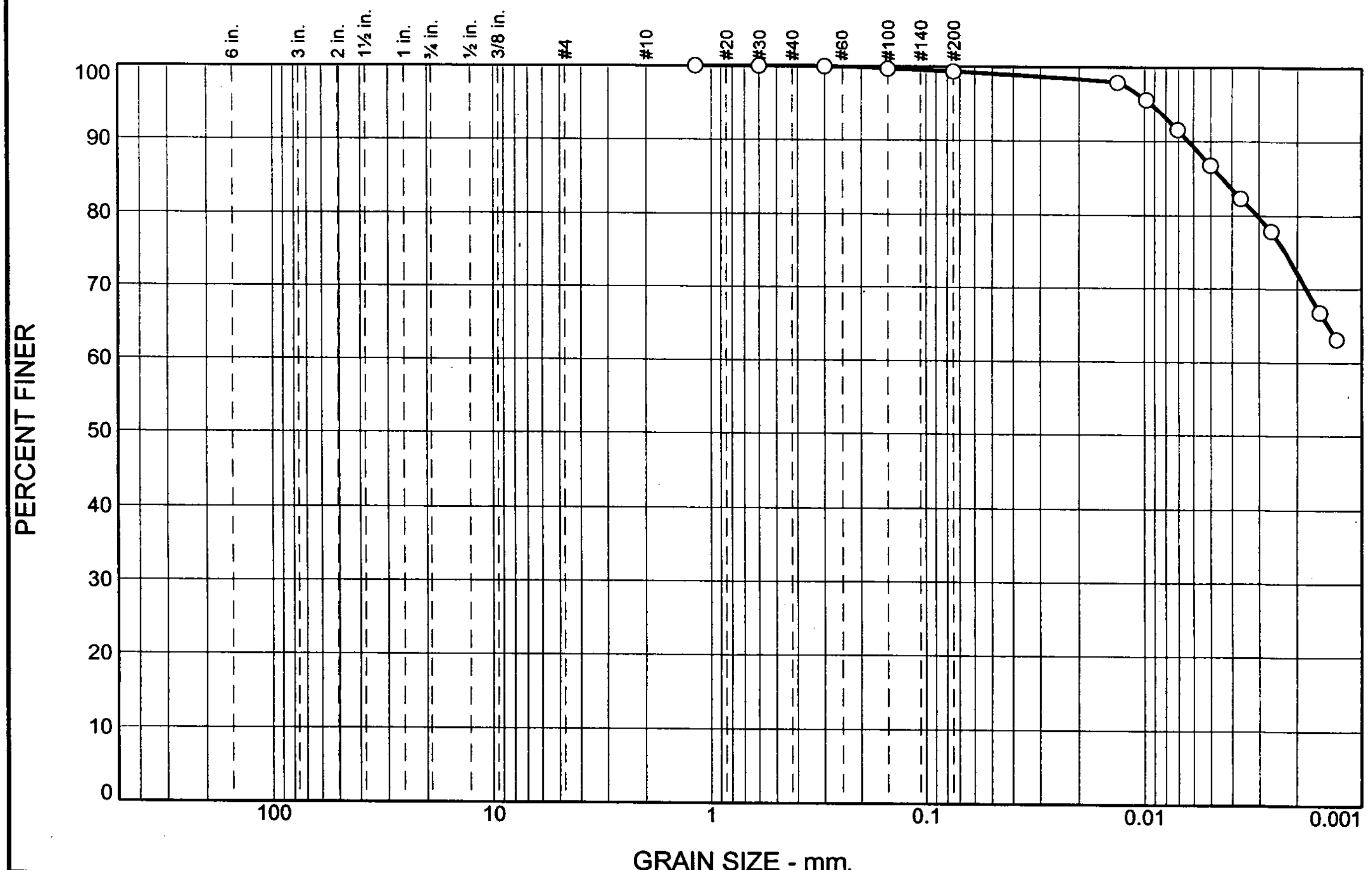
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 1.00 | 22.6 | 43.2 | 43.8 | 0.0131 | 42.2 | 9.4 | 0.0401 | 87.0 |
| 2.00 | 22.6 | 37.3 | 37.9 | 0.0131 | 36.3 | 10.3 | 0.0298 | 75.2 |
| 4.00 | 22.5 | 32.1 | 32.6 | 0.0131 | 31.1 | 11.2 | 0.0219 | 64.9 |
| 8.00 | 22.5 | 27.9 | 28.4 | 0.0131 | 26.9 | 11.9 | 0.0160 | 56.5 |
| 15.00 | 22.7 | 25.9 | 26.5 | 0.0131 | 24.9 | 12.2 | 0.0118 | 52.6 |
| 30.00 | 22.7 | 24.2 | 24.8 | 0.0131 | 23.2 | 12.5 | 0.0084 | 49.3 |
| 60.00 | 22.7 | 22.1 | 22.7 | 0.0131 | 21.1 | 12.8 | 0.0061 | 45.1 |
| 120.00 | 23.1 | 20.7 | 21.4 | 0.0130 | 19.7 | 13.1 | 0.0043 | 42.5 |
| 240.00 | 23.7 | 19.2 | 20.1 | 0.0129 | 18.2 | 13.3 | 0.0030 | 39.9 |
| 391.00 | 23.5 | 18.2 | 19.0 | 0.0130 | 17.2 | 13.5 | 0.0024 | 37.8 |
| 1440.00 | 23.4 | 17.3 | 18.1 | 0.0130 | 16.3 | 13.6 | 0.0013 | 35.9 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 5.0 | 5.2 | 51.3 | 43.5 | 94.8 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0090 | 0.0186 | 0.0334 | 0.0379 | 0.0449 | 0.0785 |

| Fineness Modulus |
|---|
| 0.02 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.7 | 12.5 | 86.8 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 1.18mm | 100.0 | | |
| .6mm | 100.0 | | |
| .3mm | 99.9 | | |
| .15mm | 99.7 | | |
| .075mm | 99.3 | | |

* (no specification provided)

**Material Description**

CLAY (CH), brown to greyish brown, high plastic

**Atterberg Limits (ASTM D 4318)**

PL= 28 LL= 82 PI= 54

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0044 $D_{60}$= $D_{50}$=
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/30/06 **Tested By:** RTH

**Remarks**

**Sample No.:** "CH" **Source of Sample:** Section E **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section E
**Sample Number:** "CH"
**Material Description:** CLAY (CH), brown to greyish brown, high plastic
**PL:** 28 **LL:** 82 **PI:** 54
**USCS Classification:** CH
**Tested By:** RTH **Test Date:** 11/30/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =41.71
**Tare Wt.** =41.32
**Minus #200 from wash** =99.2%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 1.18mm | 0.00 | 100.0 |
| | | | .6mm | 0.01 | 100.0 |
| | | | .3mm | 0.03 | 99.9 |
| | | | .15mm | 0.17 | 99.7 |
| | | | .075mm | 0.35 | 99.3 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x Rm

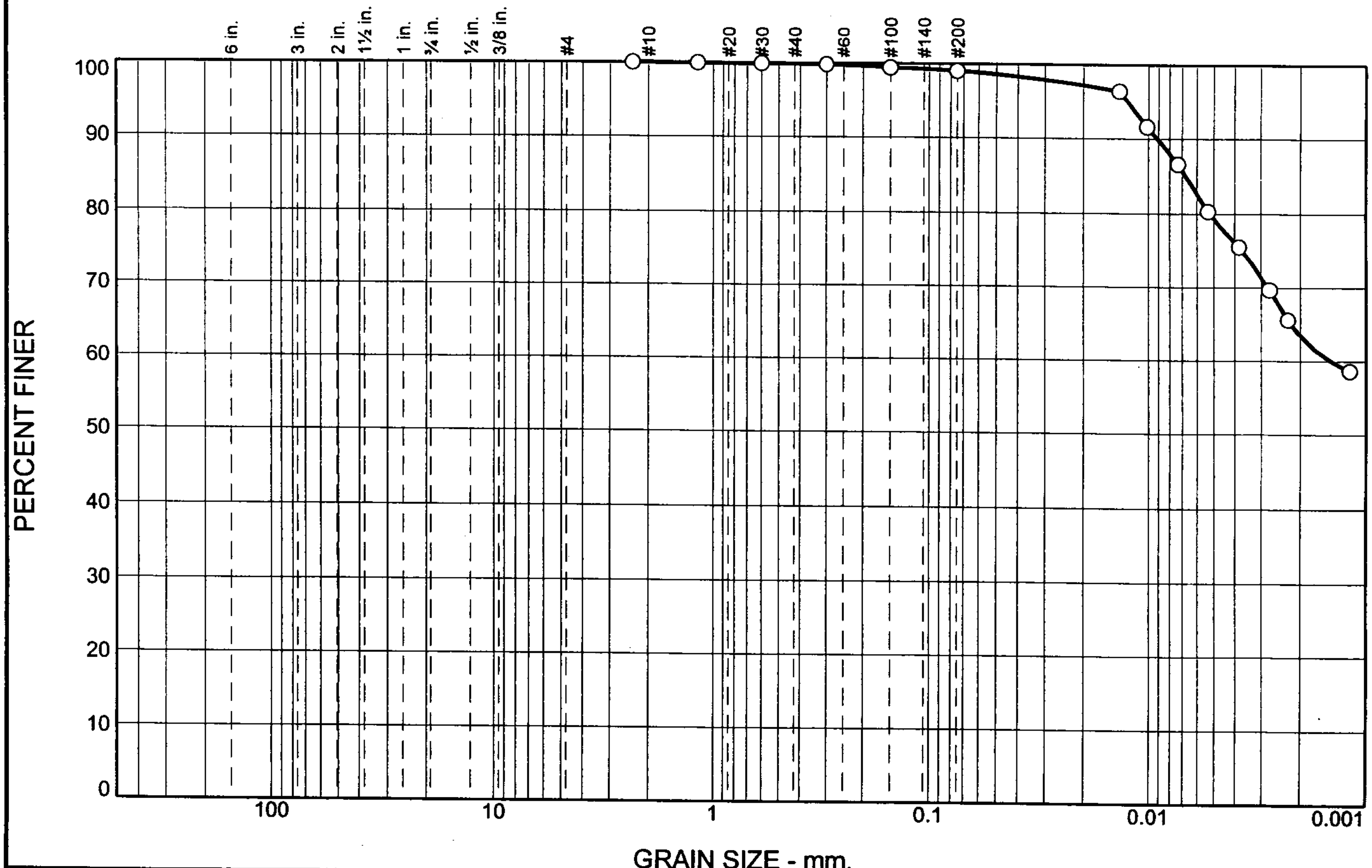
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 8.00 | 24.4 | 48.2 | 49.3 | 0.0128 | 47.2 | 8.6 | 0.0133 | 97.9 |
| 15.00 | 24.4 | 47.0 | 48.1 | 0.0128 | 46.0 | 8.8 | 0.0098 | 95.5 |
| 30.00 | 24.4 | 45.0 | 46.1 | 0.0128 | 44.0 | 9.1 | 0.0071 | 91.6 |
| 62.00 | 24.7 | 42.5 | 43.7 | 0.0128 | 41.5 | 9.5 | 0.0050 | 86.8 |
| 120.00 | 25.1 | 40.1 | 41.4 | 0.0127 | 39.1 | 9.9 | 0.0036 | 82.3 |
| 240.00 | 25.0 | 37.9 | 39.2 | 0.0127 | 36.9 | 10.2 | 0.0026 | 77.8 |
| 763.00 | 23.1 | 32.9 | 33.6 | 0.0130 | 31.9 | 11.1 | 0.0016 | 66.8 |
| 1080.00 | 25.0 | 30.5 | 31.8 | 0.0127 | 29.5 | 11.5 | 0.0013 | 63.1 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.7 | 0.7 | 12.5 | 86.8 | 99.3 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 0.0030 | 0.0044 | 0.0063 | 0.0093 |

| Fineness Modulus |
|---|
| 0.00 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.9 | 19.7 | 79.3 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 99.9 | | |
| .6mm | 99.9 | | |
| .3mm | 99.8 | | |
| .15mm | 99.4 | | |
| .075mm | 99.0 | | |

* (no specification provided)

**Material Description**

CLAY (CH), brown to greyish brown, slightly silty, med-high plasticity

**Atterberg Limits (ASTM D 4318)**

PL= 24 LL= 67 PI= 43

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0067 $D_{60}$= 0.0014 $D_{50}$=
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/27/06 **Tested By:** JRD, RTH, & JLC

**Remarks**

**Sample No.:** "CL" **Source of Sample:** Section E **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

# GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section E
**Sample Number:** "CL"
**Material Description:** CLAY (CH), brown to greyish brown, slightly silty, med-high plasticity
**PL:** 24 **LL:** 67 **PI:** 43
**USCS Classification:** CH
**Tested By:** JRD, RTH, & JLC **Test Date:** 11/27/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =41.34
**Tare Wt.** =40.83
**Minus #200 from wash** =99.0%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.04 | 99.9 |
| | | | .6mm | 0.05 | 99.9 |
| | | | .3mm | 0.11 | 99.8 |
| | | | .15mm | 0.31 | 99.4 |
| | | | .075mm | 0.50 | 99.0 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation:** L =16.294964 - 0.164 x Rm

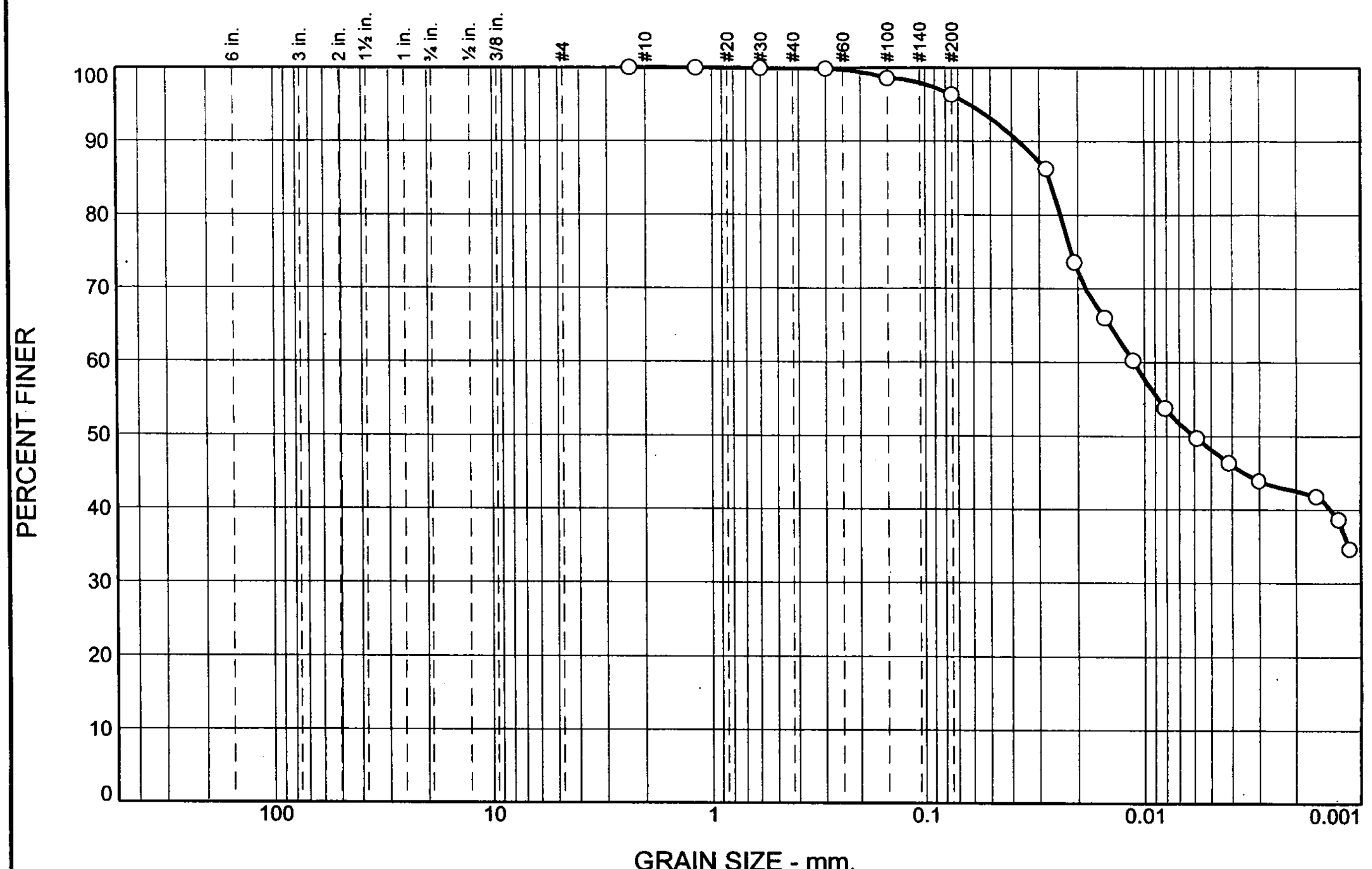
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 8.00 | 22.7 | 47.9 | 48.5 | 0.0131 | 46.9 | 8.6 | 0.0136 | 96.3 |
| 15.00 | 22.7 | 45.5 | 46.1 | 0.0131 | 44.5 | 9.0 | 0.0101 | 91.6 |
| 30.00 | 22.7 | 43.0 | 43.6 | 0.0131 | 42.0 | 9.4 | 0.0073 | 86.6 |
| 60.00 | 22.8 | 39.8 | 40.4 | 0.0131 | 38.8 | 9.9 | 0.0053 | 80.3 |
| 120.00 | 23.1 | 37.3 | 38.0 | 0.0130 | 36.3 | 10.3 | 0.0038 | 75.5 |
| 240.00 | 23.7 | 34.2 | 35.1 | 0.0129 | 33.2 | 10.9 | 0.0027 | 69.7 |
| 366.00 | 23.5 | 32.2 | 33.0 | 0.0130 | 31.2 | 11.2 | 0.0023 | 65.6 |
| 1440.00 | 22.4 | 29.0 | 29.5 | 0.0131 | 28.0 | 11.7 | 0.0012 | 58.6 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.9 | 1.0 | 19.7 | 79.3 | 99.0 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 0.0014 | 0.0052 | 0.0067 | 0.0091 | 0.0125 |

| Fineness Modulus |
|---|
| 0.01 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 3.5 | 48.1 | 48.2 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 99.9 | | |
| .6mm | 99.9 | | |
| .3mm | 99.8 | | |
| .15mm | 98.5 | | |
| .075mm | 96.3 | | |

* (no specification provided)

**Material Description**

CLAY (CL), brown, silty

**Atterberg Limits (ASTM D 4318)**

PL= 19 LL= 46 PI= 27

**Classification**

USCS= CL AASHTO=

**Coefficients**

$D_{85}$= 0.0270 $D_{60}$= 0.0111 $D_{50}$= 0.0060
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/27/06 **Tested By:** RTH, JRD, & JLC

**Remarks**

**Sample No.:** "MCL" **Source of Sample:** Section E **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section E
**Sample Number:** "MCL"
**Material Description:** CLAY (CL), brown, silty
**PL:** 19 **LL:** 46 **PI:** 27
**USCS Classification:** CL
**Tested By:** RTH, JRD, & JLC **Test Date:** 11/27/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =43.19
**Tare Wt.** =41.30
**Minus #200 from wash** =96.2%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.03 | 99.9 |
| | | | .6mm | 0.06 | 99.9 |
| | | | .3mm | 0.10 | 99.8 |
| | | | .15mm | 0.73 | 98.5 |
| | | | .075mm | 1.85 | 96.3 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x Rm

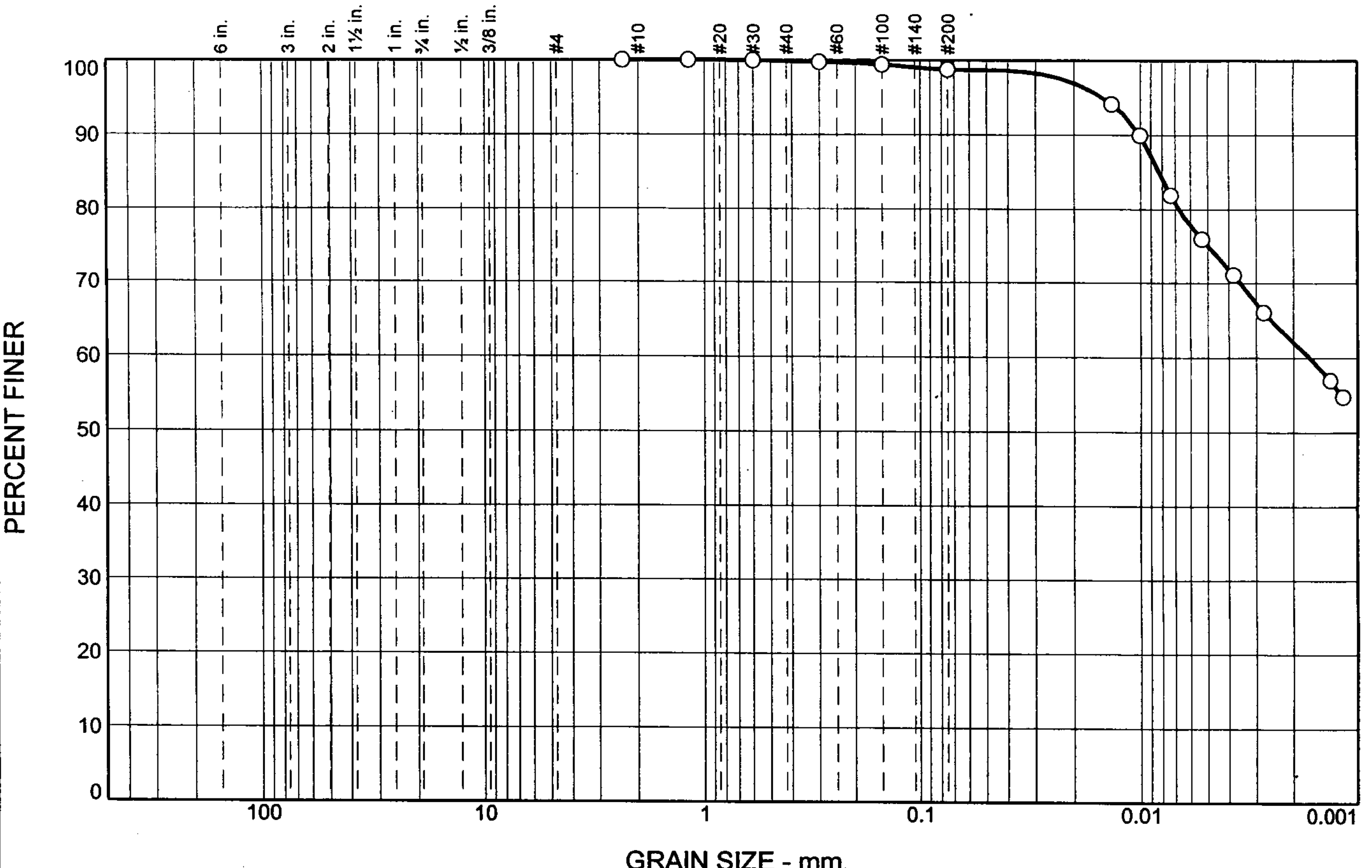
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 2.00 | 24.8 | 42.2 | 43.4 | 0.0128 | 41.2 | 9.5 | 0.0279 | 86.3 |
| 4.00 | 24.8 | 35.8 | 37.0 | 0.0128 | 34.8 | 10.6 | 0.0208 | 73.5 |
| 8.00 | 24.8 | 32.0 | 33.2 | 0.0128 | 31.0 | 11.2 | 0.0151 | 66.0 |
| 15.00 | 24.8 | 29.1 | 30.3 | 0.0128 | 28.1 | 11.7 | 0.0113 | 60.2 |
| 30.00 | 24.7 | 25.9 | 27.1 | 0.0128 | 24.9 | 12.2 | 0.0082 | 53.8 |
| 60.00 | 24.9 | 23.8 | 25.1 | 0.0127 | 22.8 | 12.6 | 0.0058 | 49.8 |
| 120.00 | 25.2 | 22.0 | 23.4 | 0.0127 | 21.0 | 12.9 | 0.0042 | 46.4 |
| 240.00 | 23.8 | 21.2 | 22.1 | 0.0129 | 20.2 | 13.0 | 0.0030 | 43.9 |
| 916.00 | 19.8 | 21.1 | 21.0 | 0.0136 | 20.1 | 13.0 | 0.0016 | 41.8 |
| 1440.00 | 22.1 | 19.0 | 19.4 | 0.0132 | 18.0 | 13.3 | 0.0013 | 38.6 |
| 1908.00 | 21.1 | 17.2 | 17.4 | 0.0133 | 16.2 | 13.6 | 0.0011 | 34.6 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 3.5 | 3.7 | 48.1 | 48.2 | 96.3 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0060 | 0.0111 | 0.0242 | 0.0270 | 0.0371 | 0.0620 |

| Fineness Modulus |
|---|
| 0.02 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 1.1 | 23.7 | 75.0 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 100.0 | | |
| .6mm | 99.9 | | |
| .3mm | 99.7 | | |
| .15mm | 99.4 | | |
| .075mm | 98.7 | | |

* (no specification provided)

**Material Description**

CLAY (CH), brown to greyish brown, high plastic

**Atterberg Limits (ASTM D 4318)**

PL= 28 LL= 72 PI= 44

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0083 $D_{60}$= 0.0017 $D_{50}$=
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/30/06 **Tested By:** RTH, JDB, & JRD

**Remarks**

**Sample No.:** "CH" **Source of Sample:** Section F **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section F
**Sample Number:** "CH"
**Material Description:** CLAY (CH), brown to greyish brown, high plastic
**PL:** 28 **LL:** 72 **PI:** 44
**USCS Classification:** CH
**Tested By:** RTH, JDB, & JRD **Test Date:** 11/30/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =38.83
**Tare Wt.** =38.09
**Minus #200 from wash** =98.5%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.00 | 100.0 |
| | | | .6mm | 0.04 | 99.9 |
| | | | .3mm | 0.14 | 99.7 |
| | | | .15mm | 0.30 | 99.4 |
| | | | .075mm | 0.63 | 98.7 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x Rm

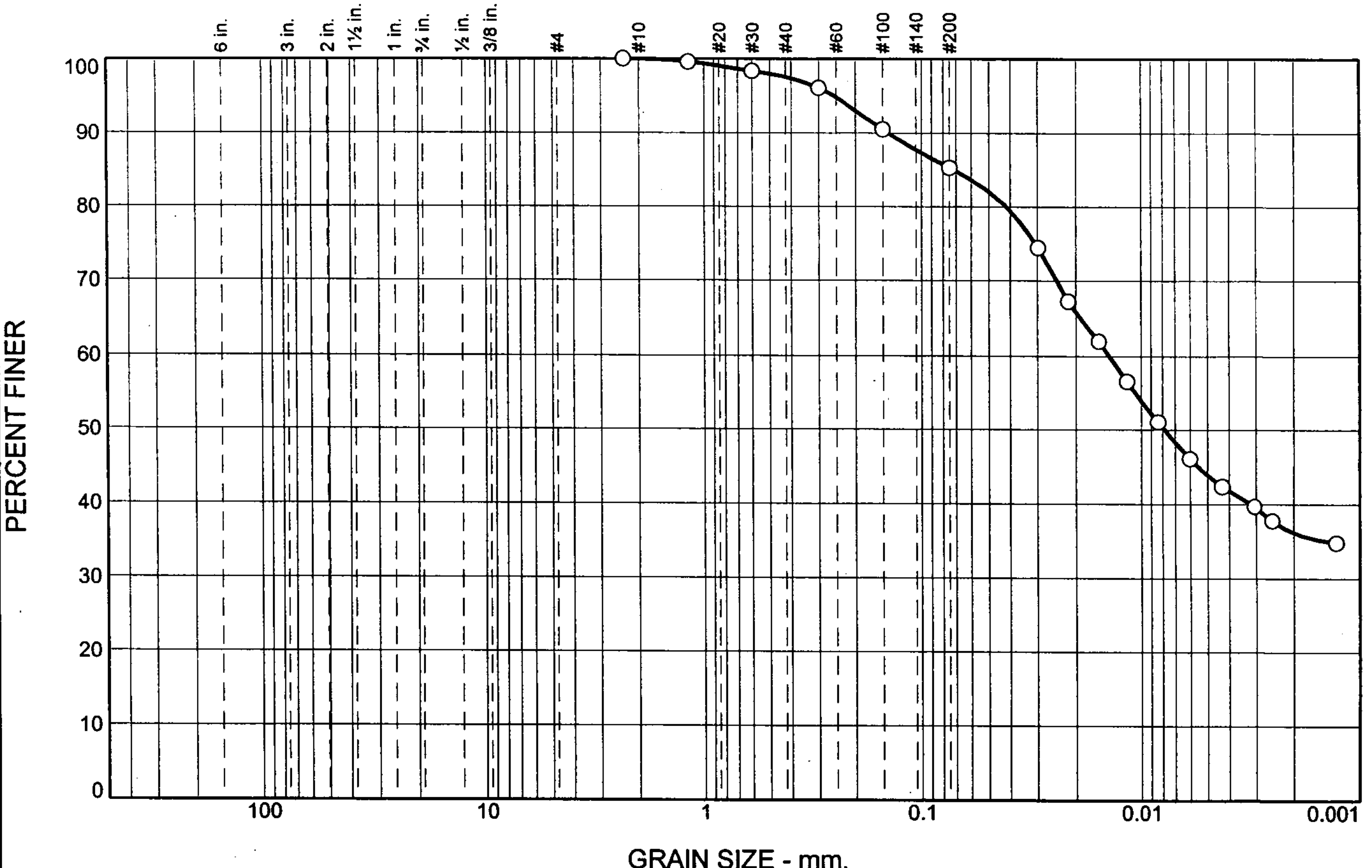
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 8.00 | 24.4 | 46.3 | 47.4 | 0.0128 | 45.3 | 8.9 | 0.0135 | 94.1 |
| 15.00 | 24.4 | 44.2 | 45.3 | 0.0128 | 43.2 | 9.2 | 0.0100 | 90.0 |
| 30.00 | 24.5 | 40.1 | 41.2 | 0.0128 | 39.1 | 9.9 | 0.0073 | 81.9 |
| 60.00 | 24.8 | 37.0 | 38.2 | 0.0128 | 36.0 | 10.4 | 0.0053 | 75.9 |
| 120.00 | 25.0 | 34.5 | 35.8 | 0.0127 | 33.5 | 10.8 | 0.0038 | 71.1 |
| 240.00 | 24.9 | 32.0 | 33.3 | 0.0127 | 31.0 | 11.2 | 0.0028 | 66.1 |
| 1115.00 | 23.1 | 28.0 | 28.7 | 0.0130 | 27.0 | 11.9 | 0.0013 | 57.0 |
| 1440.00 | 25.0 | 26.3 | 27.6 | 0.0127 | 25.3 | 12.1 | 0.0012 | 54.8 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 1.1 | 1.3 | 23.7 | 75.0 | 98.7 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 0.0017 | 0.0068 | 0.0083 | 0.0101 | 0.0149 |

| Fineness Modulus |
|---|
| 0.01 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.1 | 2.4 | 12.2 | 41.5 | 43.8 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 99.6 | | |
| .6mm | 98.3 | | |
| .3mm | 96.1 | | |
| .15mm | 90.5 | | |
| .075mm | 85.3 | | |

* (no specification provided)

**Material Description**

CLAY (CL), brown to greyish brown, slightly silty

**Atterberg Limits (ASTM D 4318)**

PL= 22 LL= 39 PI= 17

**Classification**

USCS= CL AASHTO=

**Coefficients**

$D_{85}$= 0.0720 $D_{60}$= 0.0140 $D_{50}$= 0.0078
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/30/06 **Tested By:** JLC & RTH

**Remarks**

**Sample No.:** "CL" **Source of Sample:** Section F **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section F
**Sample Number:** "CL"
**Material Description:** CLAY (CL), brown to greyish brown, slightly silty
**PL:** 22 **LL:** 39 **PI:** 17
**USCS Classification:** CL
**Tested By:** JLC & RTH **Test Date:** 11/30/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare =** 48.95
**Tare Wt. =** 41.13
**Minus #200 from wash =** 84.4%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.22 | 99.6 |
| | | | .6mm | 0.85 | 98.3 |
| | | | .3mm | 1.96 | 96.1 |
| | | | .15mm | 4.77 | 90.5 |
| | | | .075mm | 7.36 | 85.3 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample =** 100.0
**Weight of hydrometer sample =** 50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C =** 01352
**Meniscus correction only =** -1.0
**Specific gravity of solids =** 2.68
**Hydrometer type =** 152H
**Hydrometer effective depth equation: L =** 16.294964 - 0.164 **x Rm**

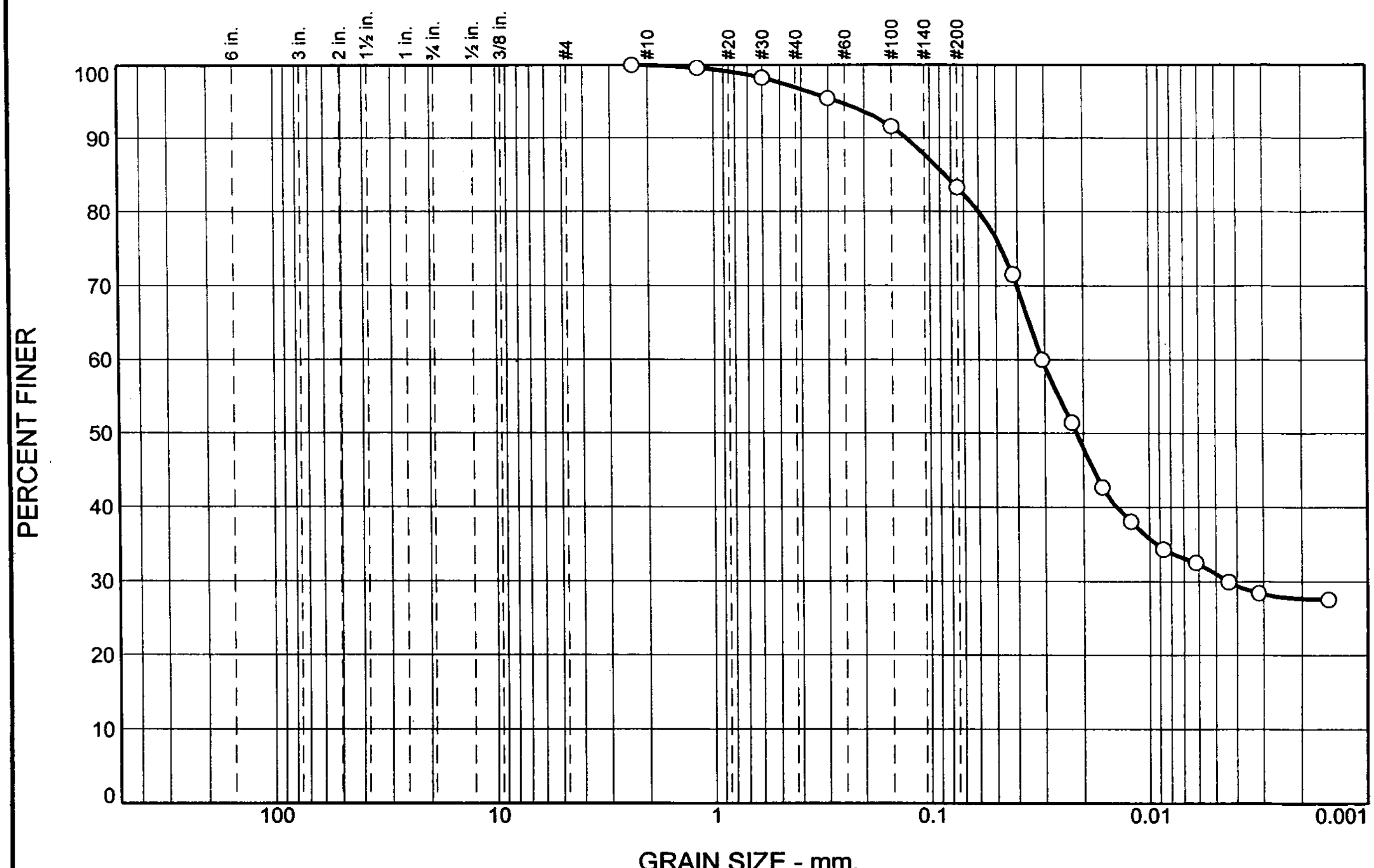
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 2.00 | 23.0 | 36.8 | 37.5 | 0.0130 | 35.8 | 10.4 | 0.0298 | 74.5 |
| 4.00 | 23.0 | 33.2 | 33.9 | 0.0130 | 32.2 | 11.0 | 0.0216 | 67.3 |
| 8.00 | 23.0 | 30.5 | 31.2 | 0.0130 | 29.5 | 11.5 | 0.0156 | 61.9 |
| 15.00 | 23.0 | 27.8 | 28.5 | 0.0130 | 26.8 | 11.9 | 0.0116 | 56.6 |
| 30.00 | 23.1 | 25.0 | 25.7 | 0.0130 | 24.0 | 12.4 | 0.0084 | 51.1 |
| 60.00 | 23.1 | 22.5 | 23.2 | 0.0130 | 21.5 | 12.8 | 0.0060 | 46.1 |
| 120.00 | 23.1 | 20.6 | 21.3 | 0.0130 | 19.6 | 13.1 | 0.0043 | 42.3 |
| 240.00 | 23.7 | 19.1 | 20.0 | 0.0129 | 18.1 | 13.3 | 0.0030 | 39.7 |
| 358.00 | 23.5 | 18.2 | 19.0 | 0.0130 | 17.2 | 13.5 | 0.0025 | 37.8 |
| 1440.00 | 22.4 | 17.0 | 17.5 | 0.0131 | 16.0 | 13.7 | 0.0013 | 34.8 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 2.4 | 12.2 | 14.7 | 41.5 | 43.8 | 85.3 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0078 | 0.0140 | 0.0414 | 0.0720 | 0.1420 | 0.2554 |

| Fineness Modulus |
|---|
| 0.16 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.1 | 3.0 | 13.7 | 52.3 | 30.9 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 99.6 | | |
| .6mm | 98.2 | | |
| .3mm | 95.4 | | |
| .15mm | 91.5 | | |
| .075mm | 83.2 | | |

* (no specification provided)

**Material Description**

CLAY (CL), brown, silty

**Atterberg Limits (ASTM D 4318)**

PL= 20 LL= 33 PI= 13

**Classification**

USCS= CL AASHTO=

**Coefficients**

$D_{85}$= 0.0857 $D_{60}$= 0.0309 $D_{50}$= 0.0214
$D_{30}$= 0.0044 $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/21/06 **Tested By:** RTH & JRD

**Remarks**

**Sample No.:** "MCL" **Source of Sample:** Section F **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

# GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section F
**Sample Number:** "MCL"
**Material Description:** CLAY (CL), brown, silty
**PL:** 20 **LL:** 33 **PI:** 13
**USCS Classification:** CL
**Tested By:** RTH & JRD **Test Date:** 11/21/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =43.10
**Tare Wt.** =34.48
**Minus #200 from wash** =82.8%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.21 | 99.6 |
| | | | .6mm | 0.88 | 98.2 |
| | | | .3mm | 2.28 | 95.4 |
| | | | .15mm | 4.23 | 91.5 |
| | | | .075mm | 8.39 | 83.2 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x Rm

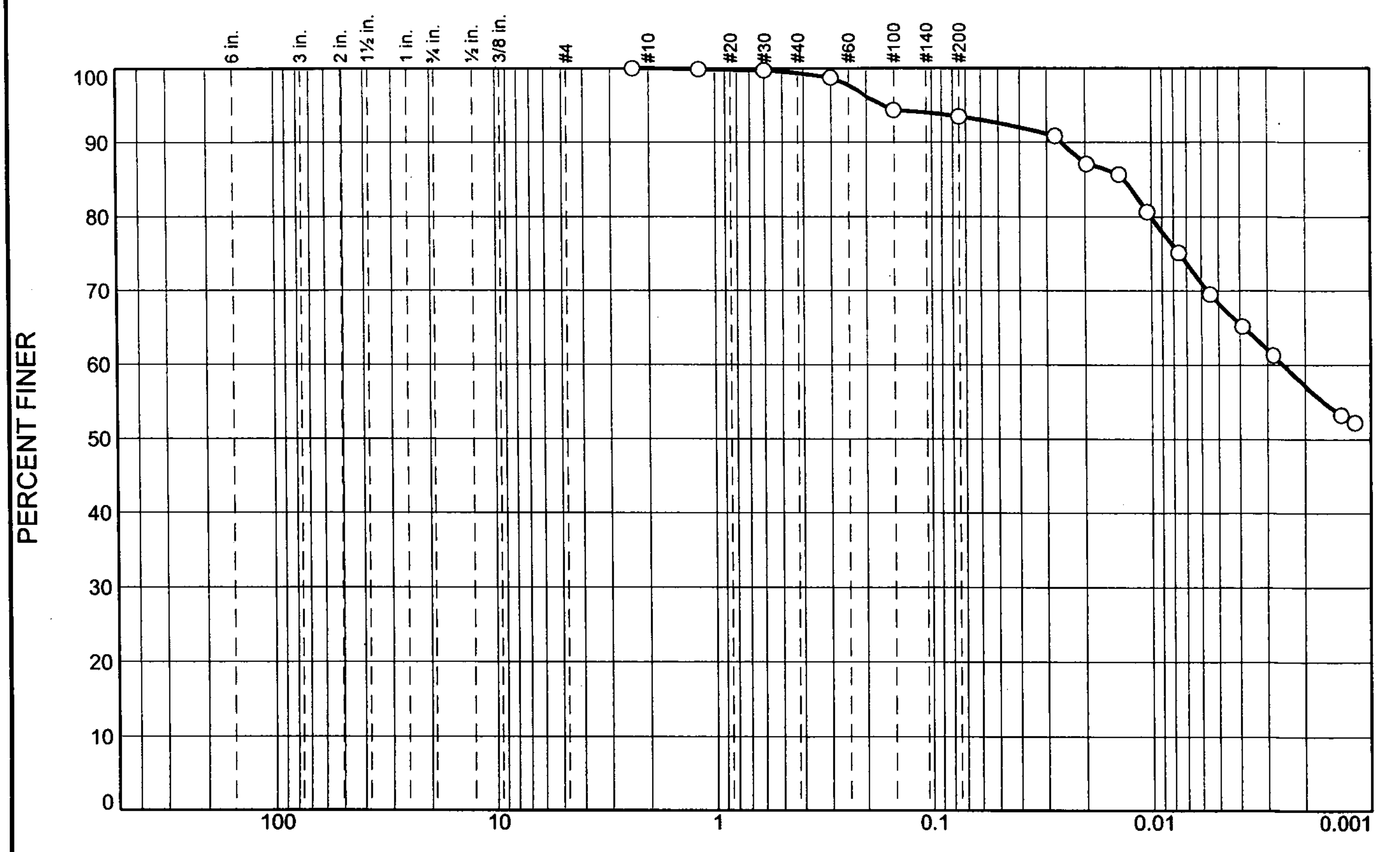
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 1.00 | 24.7 | 34.8 | 36.0 | 0.0128 | 33.8 | 10.8 | 0.0419 | 71.5 |
| 2.00 | 24.7 | 29.0 | 30.2 | 0.0128 | 28.0 | 11.7 | 0.0309 | 60.0 |
| 4.00 | 24.7 | 24.7 | 25.9 | 0.0128 | 23.7 | 12.4 | 0.0225 | 51.4 |
| 8.00 | 24.7 | 20.3 | 21.5 | 0.0128 | 19.3 | 13.1 | 0.0164 | 42.7 |
| 15.00 | 24.6 | 18.0 | 19.2 | 0.0128 | 17.0 | 13.5 | 0.0121 | 38.0 |
| 30.00 | 24.6 | 16.1 | 17.3 | 0.0128 | 15.1 | 13.8 | 0.0087 | 34.3 |
| 60.00 | 24.6 | 15.2 | 16.4 | 0.0128 | 14.2 | 14.0 | 0.0062 | 32.5 |
| 120.00 | 25.2 | 13.7 | 15.1 | 0.0127 | 12.7 | 14.2 | 0.0044 | 29.9 |
| 240.00 | 23.4 | 13.5 | 14.3 | 0.0130 | 12.5 | 14.2 | 0.0032 | 28.4 |
| 1147.00 | 19.5 | 14.0 | 13.9 | 0.0136 | 13.0 | 14.2 | 0.0015 | 27.5 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 3.0 | 13.7 | 16.8 | 52.3 | 30.9 | 83.2 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | 0.0044 | 0.0214 | 0.0309 | 0.0598 | 0.0857 | 0.1284 | 0.2703 |

| Fineness Modulus |
|---|
| 0.15 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.7 | 5.9 | 25.2 | 68.2 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 99.9 | | |
| .6mm | 99.7 | | |
| .3mm | 98.7 | | |
| .15mm | 94.3 | | |
| .075mm | 93.4 | | |

* (no specification provided)

**Material Description**

CLAY (CH), brown to greyish brown, high plastic

**Atterberg Limits (ASTM D 4318)**

PL= 21 LL= 69 PI= 48

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0133 $D_{60}$= 0.0025 $D_{50}$=
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/30/06 **Tested By:** RTH & JRD

**Remarks**

**Sample No.:** "CH" **Source of Sample:** Section G **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

# GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section G
**Sample Number:** "CH"
**Material Description:** CLAY (CH), brown to greyish brown, high plastic
**PL:** 21 **LL:** 69 **PI:** 48
**USCS Classification:** CH
**Tested By:** RTH & JRD **Test Date:** 11/30/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =36.79
**Tare Wt.** =33.44
**Minus #200 from wash** =93.3%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.07 | 99.9 |
| | | | .6mm | 0.16 | 99.7 |
| | | | .3mm | 0.64 | 98.7 |
| | | | .15mm | 2.86 | 94.3 |
| | | | .075mm | 3.30 | 93.4 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x Rm

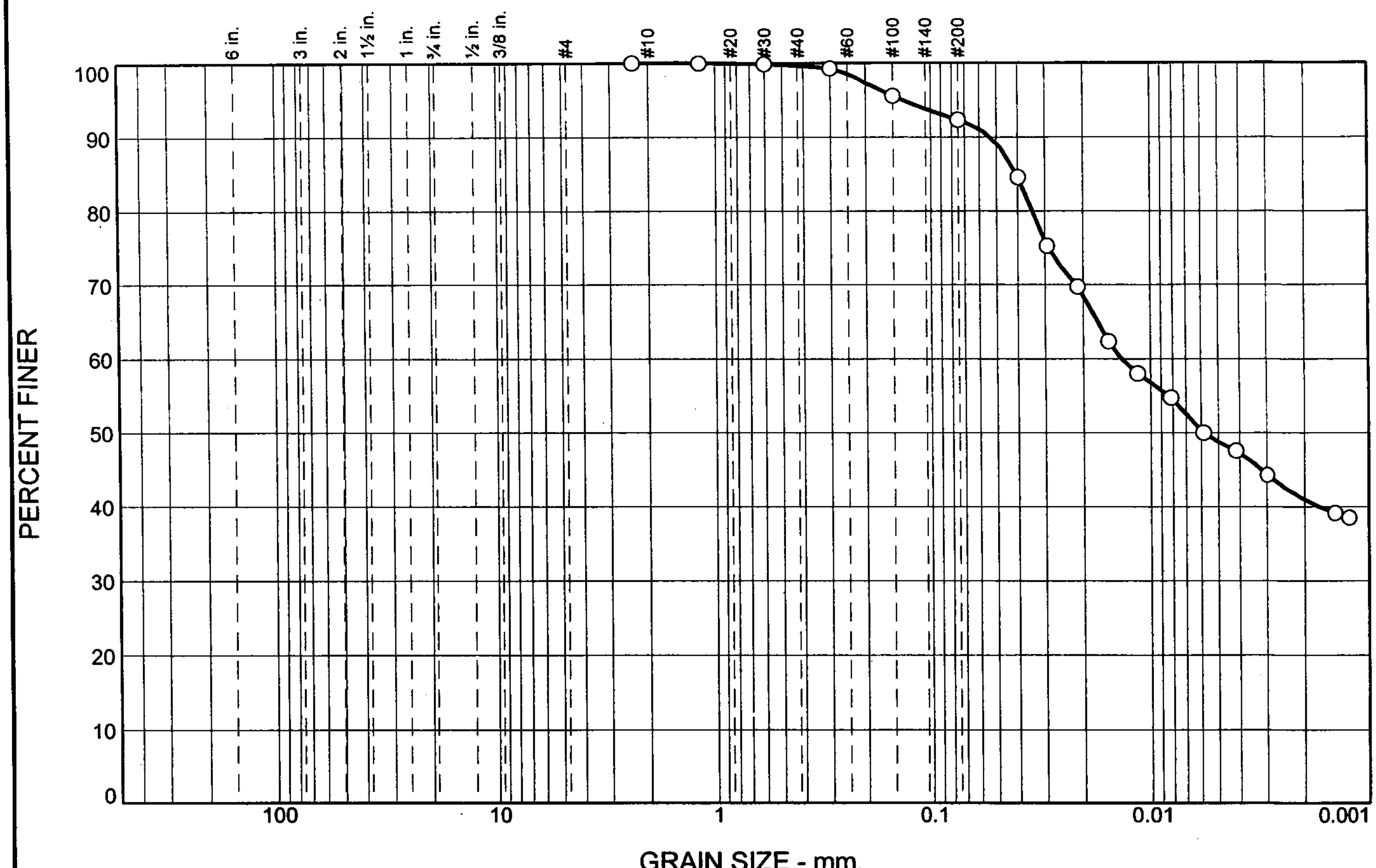
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 2.00 | 24.5 | 44.6 | 45.7 | 0.0128 | 43.6 | 9.1 | 0.0274 | 90.8 |
| 4.00 | 24.5 | 42.7 | 43.8 | 0.0128 | 41.7 | 9.5 | 0.0197 | 87.1 |
| 8.00 | 24.5 | 42.0 | 43.1 | 0.0128 | 41.0 | 9.6 | 0.0140 | 85.7 |
| 15.00 | 24.4 | 39.5 | 40.6 | 0.0128 | 38.5 | 10.0 | 0.0105 | 80.6 |
| 30.00 | 24.5 | 36.7 | 37.8 | 0.0128 | 35.7 | 10.4 | 0.0076 | 75.1 |
| 60.00 | 24.7 | 33.8 | 35.0 | 0.0128 | 32.8 | 10.9 | 0.0054 | 69.5 |
| 120.00 | 25.0 | 31.5 | 32.8 | 0.0127 | 30.5 | 11.3 | 0.0039 | 65.1 |
| 240.00 | 24.9 | 29.6 | 30.9 | 0.0127 | 28.6 | 11.6 | 0.0028 | 61.3 |
| 1107.00 | 23.1 | 26.1 | 26.8 | 0.0130 | 25.1 | 12.2 | 0.0014 | 53.2 |
| 1440.00 | 25.0 | 25.0 | 26.3 | 0.0127 | 24.0 | 12.4 | 0.0012 | 52.2 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.7 | 5.9 | 6.6 | 25.2 | 68.2 | 93.4 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 0.0025 | 0.0101 | 0.0133 | 0.0256 | 0.1704 |

| Fineness Modulus |
|---|
| 0.07 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 7.3 | 43.5 | 48.8 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 99.9 | | |
| .6mm | 99.8 | | |
| .3mm | 99.2 | | |
| .15mm | 95.5 | | |
| .075mm | 92.3 | | |

* (no specification provided)

**Material Description**

CLAY (CL), brown to greyish brown, slightly silty

**Atterberg Limits (ASTM D 4318)**

PL= 18 LL= 47 PI= 29

**Classification**

USCS= CL AASHTO=

**Coefficients**

$D_{85}$= 0.0404 $D_{60}$= 0.0135 $D_{50}$= 0.0058
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/30/06 **Tested By:** RTH & JRD

**Remarks**

**Sample No.:** "CL" **Source of Sample:** Section G **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section G
**Sample Number:** "CL"
**Material Description:** CLAY (CL), brown to greyish brown, slightly silty
**PL:** 18 **LL:** 47 **PI:** 29
**USCS Classification:** CL
**Tested By:** RTH & JRD **Test Date:** 11/30/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =43.43
**Tare Wt.** =39.44
**Minus #200 from wash** =92.0%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.03 | 99.9 |
| | | | .6mm | 0.09 | 99.8 |
| | | | .3mm | 0.39 | 99.2 |
| | | | .15mm | 2.24 | 95.5 |
| | | | .075mm | 3.87 | 92.3 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x Rm

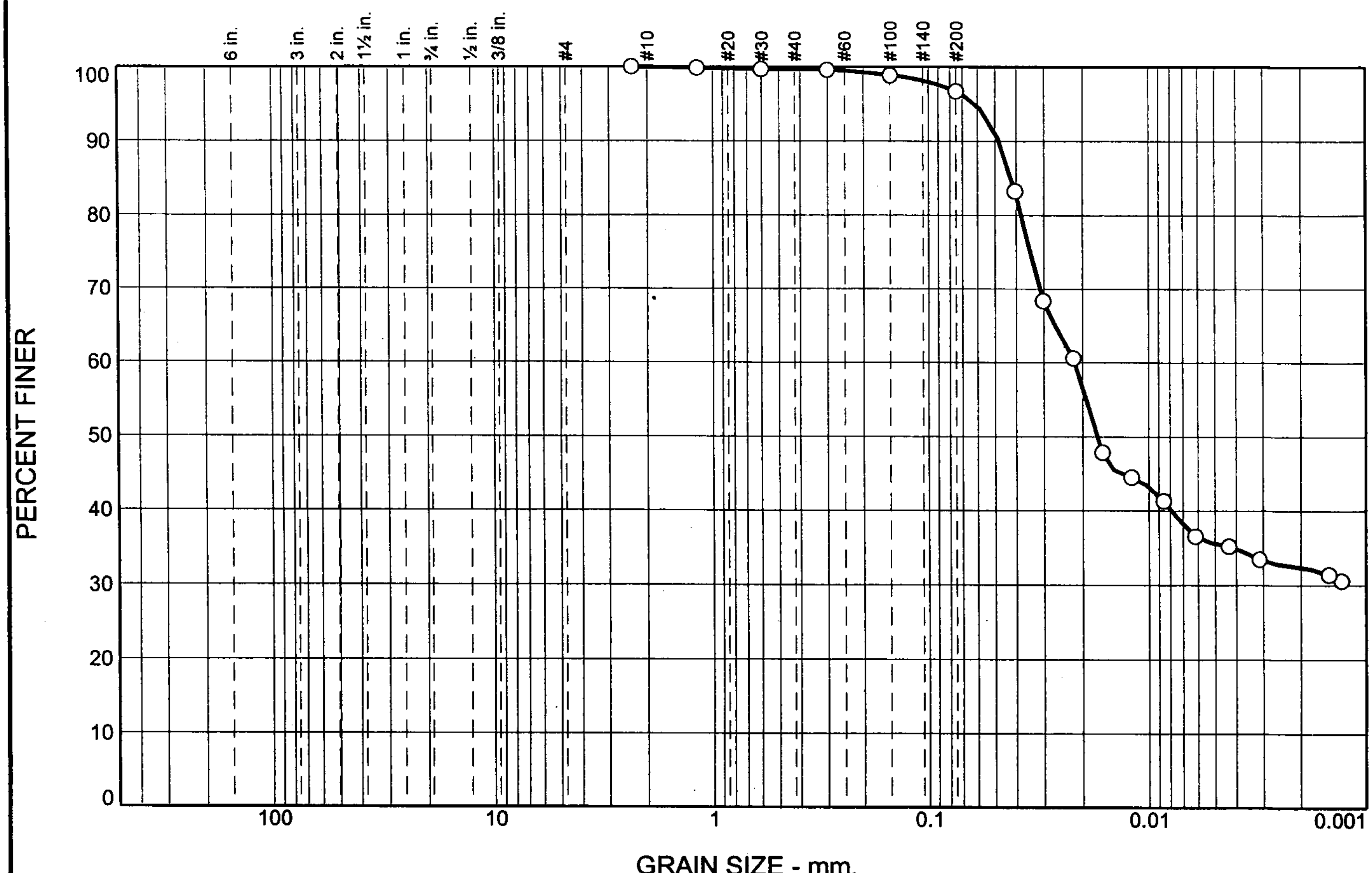
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 1.00 | 24.4 | 41.5 | 42.6 | 0.0128 | 40.5 | 9.7 | 0.0398 | 84.6 |
| 2.00 | 24.4 | 36.8 | 37.9 | 0.0128 | 35.8 | 10.4 | 0.0293 | 75.3 |
| 4.00 | 24.4 | 34.0 | 35.1 | 0.0128 | 33.0 | 10.9 | 0.0211 | 69.7 |
| 8.00 | 24.4 | 30.3 | 31.4 | 0.0128 | 29.3 | 11.5 | 0.0154 | 62.4 |
| 15.00 | 24.4 | 28.1 | 29.2 | 0.0128 | 27.1 | 11.9 | 0.0114 | 58.0 |
| 30.00 | 24.6 | 26.4 | 27.6 | 0.0128 | 25.4 | 12.1 | 0.0081 | 54.7 |
| 60.00 | 24.7 | 24.0 | 25.2 | 0.0128 | 23.0 | 12.5 | 0.0058 | 50.0 |
| 120.00 | 24.9 | 22.7 | 24.0 | 0.0127 | 21.7 | 12.7 | 0.0042 | 47.6 |
| 240.00 | 24.7 | 21.1 | 22.3 | 0.0128 | 20.1 | 13.0 | 0.0030 | 44.3 |
| 1099.00 | 23.1 | 19.0 | 19.7 | 0.0130 | 18.0 | 13.3 | 0.0014 | 39.1 |
| 1440.00 | 25.0 | 18.1 | 19.4 | 0.0127 | 17.1 | 13.5 | 0.0012 | 38.5 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 7.3 | 7.7 | 43.5 | 48.8 | 92.3 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0058 | 0.0135 | 0.0344 | 0.0404 | 0.0532 | 0.1364 |

| Fineness Modulus |
|---|
| 0.06 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 2.9 | 61.1 | 35.6 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 99.8 | | |
| .6mm | 99.7 | | |
| .3mm | 99.5 | | |
| .15mm | 98.8 | | |
| .075mm | 96.7 | | |

* (no specification provided)

**Material Description**

CLAY (CL), brown, silty

**Atterberg Limits (ASTM D 4318)**

PL= 21 LL= 37 PI= 16

**Classification**

USCS= CL AASHTO=

**Coefficients**

$D_{85}$= 0.0418 $D_{60}$= 0.0216 $D_{50}$= 0.0172
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/27/06 **Tested By:** RTH & JRD

**Remarks**

**Sample No.:** "MCL" **Source of Sample:** Section G **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section G
**Sample Number:** "MCL"
**Material Description:** CLAY (CL), brown, silty
**PL:** 21 **LL:** 37 **PI:** 16
**USCS Classification:** CL
**Tested By:** RTH & JRD **Test Date:** 11/27/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =39.04
**Tare Wt.** =37.31
**Minus #200 from wash** =96.5%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.10 | 99.8 |
| | | | .6mm | 0.17 | 99.7 |
| | | | .3mm | 0.23 | 99.5 |
| | | | .15mm | 0.58 | 98.8 |
| | | | .075mm | 1.65 | 96.7 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x **Rm**

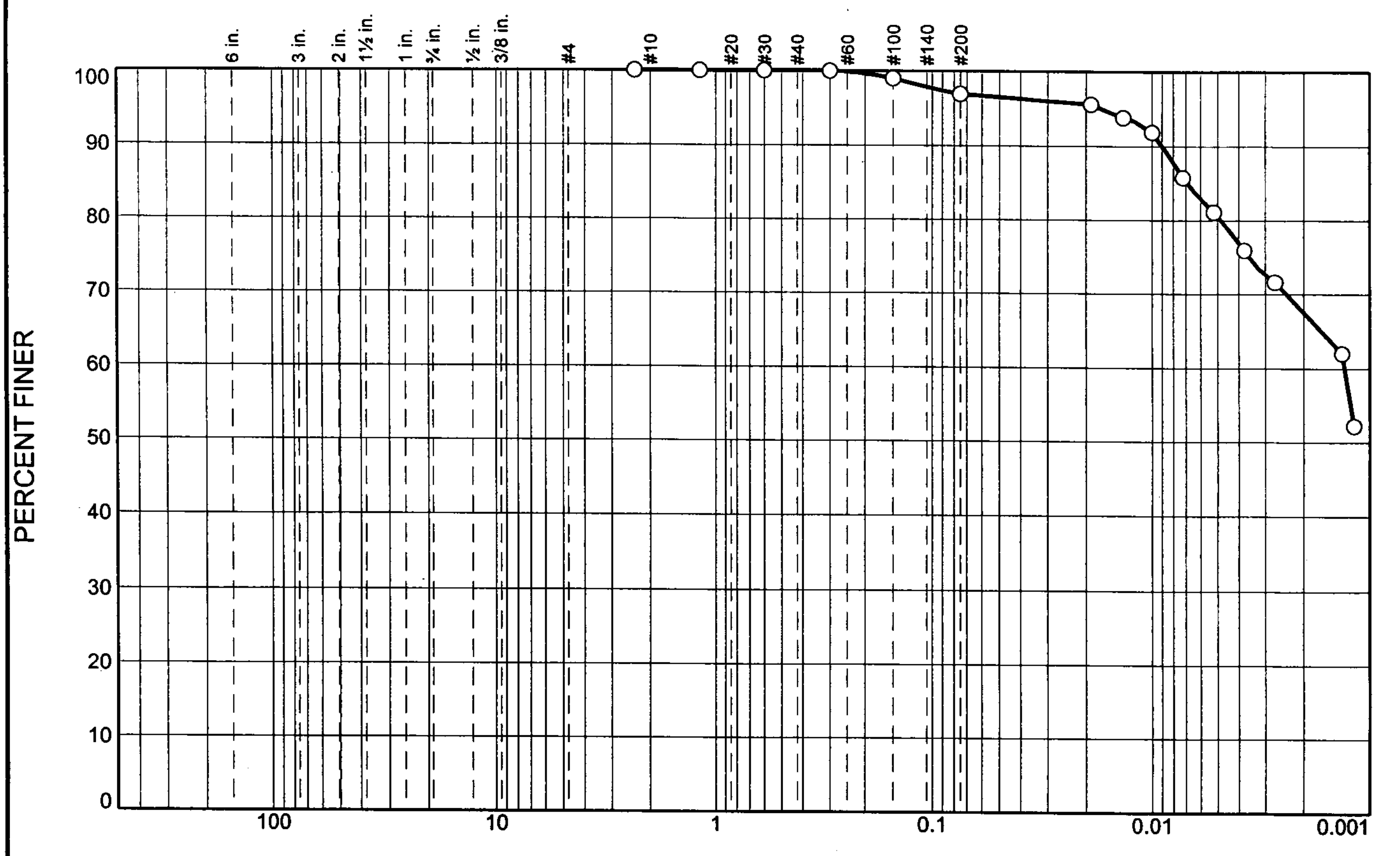
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 1.00 | 23.8 | 41.0 | 41.9 | 0.0129 | 40.0 | 9.7 | 0.0403 | 83.2 |
| 2.00 | 23.8 | 33.5 | 34.4 | 0.0129 | 32.5 | 11.0 | 0.0302 | 68.3 |
| 4.00 | 23.8 | 29.6 | 30.5 | 0.0129 | 28.6 | 11.6 | 0.0220 | 60.6 |
| 8.00 | 23.8 | 23.2 | 24.1 | 0.0129 | 22.2 | 12.7 | 0.0162 | 47.9 |
| 15.00 | 23.8 | 21.5 | 22.4 | 0.0129 | 20.5 | 12.9 | 0.0120 | 44.5 |
| 30.00 | 23.8 | 19.9 | 20.8 | 0.0129 | 18.9 | 13.2 | 0.0086 | 41.3 |
| 60.00 | 23.8 | 17.5 | 18.4 | 0.0129 | 16.5 | 13.6 | 0.0061 | 36.6 |
| 120.00 | 24.8 | 16.5 | 17.7 | 0.0128 | 15.5 | 13.8 | 0.0043 | 35.2 |
| 240.00 | 23.2 | 16.1 | 16.8 | 0.0130 | 15.1 | 13.8 | 0.0031 | 33.4 |
| 1163.00 | 19.7 | 15.9 | 15.8 | 0.0136 | 14.9 | 13.9 | 0.0015 | 31.4 |
| 1440.00 | 22.3 | 14.9 | 15.4 | 0.0131 | 13.9 | 14.0 | 0.0013 | 30.6 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 2.9 | 3.3 | 61.1 | 35.6 | 96.7 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0172 | 0.0216 | 0.0379 | 0.0418 | 0.0478 | 0.0611 |

| Fineness Modulus |
|---|
| 0.02 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.1 | 16.4 | 80.5 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 100.0 | | |
| .6mm | 100.0 | | |
| .3mm | 100.0 | | |
| .15mm | 98.9 | | |
| .075mm | 96.9 | | |

* (no specification provided)

**Material Description**

CLAY (CH), brown to greyish brown, high plastic

**Atterberg Limits (ASTM D 4318)**

PL= 21 LL= 80 PI= 59

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0069 $D_{60}$= 0.0013 $D_{50}$=
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/30/06 **Tested By:** RTH & JRD

**Remarks**

**Sample No.:** "CH" **Source of Sample:** Section H **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

# GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section H
**Sample Number:** "CH"
**Material Description:** CLAY (CH), brown to greyish brown, high plastic
**PL:** 21 **LL:** 80 **PI:** 59
**USCS Classification:** CH
**Tested By:** RTH & JRD **Test Date:** 11/30/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =42.35
**Tare Wt.** =40.71
**Minus #200 from wash** =96.7%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.00 | 100.0 |
| | | | .6mm | 0.01 | 100.0 |
| | | | .3mm | 0.02 | 100.0 |
| | | | .15mm | 0.53 | 98.9 |
| | | | .075mm | 1.54 | 96.9 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation:** L =16.294964 - 0.164 x Rm

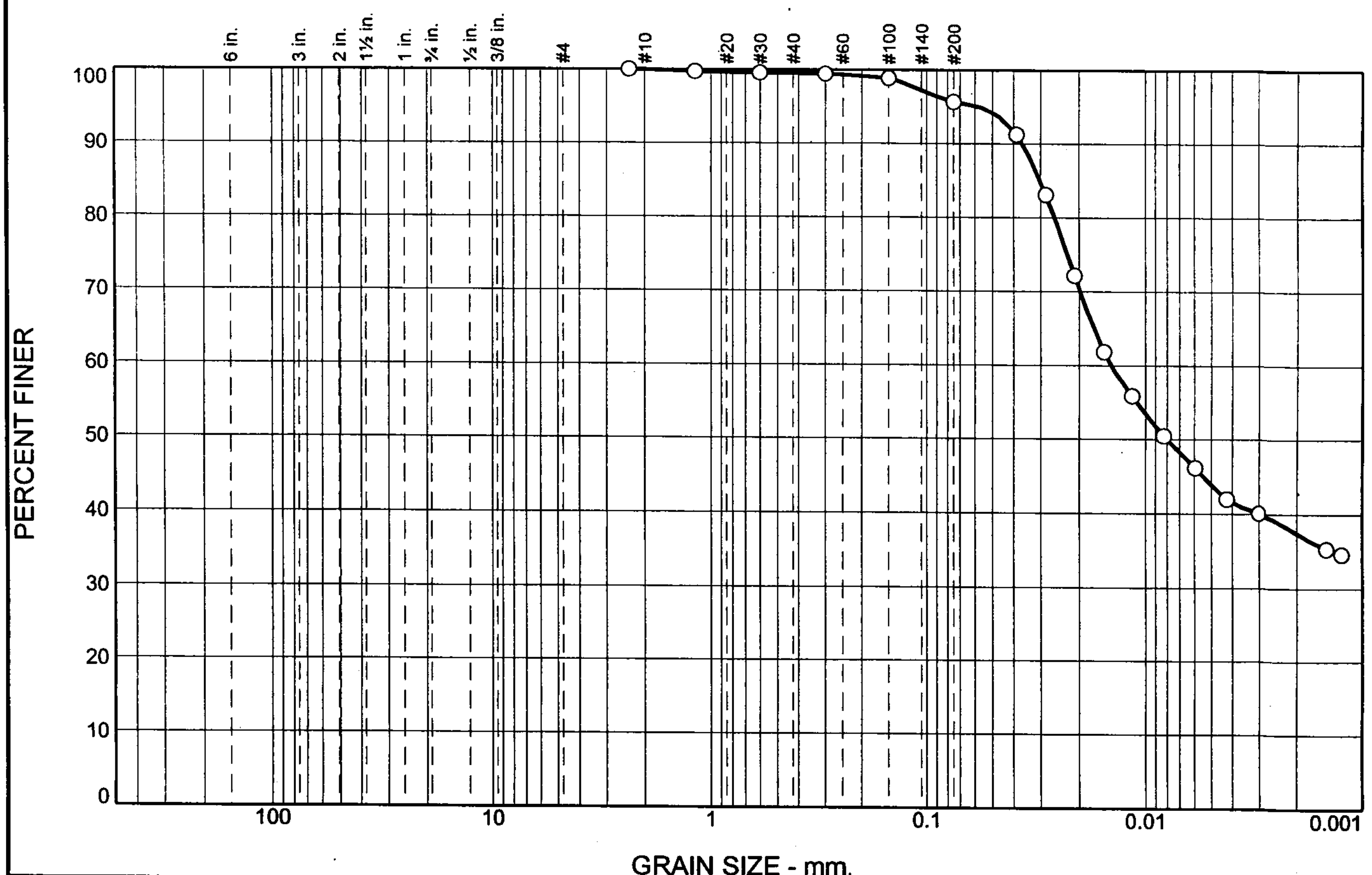
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 4.00 | 24.5 | 47.0 | 48.1 | 0.0128 | 46.0 | 8.8 | 0.0189 | 95.6 |
| 8.00 | 24.5 | 46.1 | 47.2 | 0.0128 | 45.1 | 8.9 | 0.0135 | 93.8 |
| 15.00 | 24.5 | 45.1 | 46.2 | 0.0128 | 44.1 | 9.1 | 0.0100 | 91.8 |
| 30.00 | 24.6 | 42.0 | 43.2 | 0.0128 | 41.0 | 9.6 | 0.0072 | 85.7 |
| 60.00 | 24.8 | 39.6 | 40.8 | 0.0128 | 38.6 | 10.0 | 0.0052 | 81.1 |
| 120.00 | 24.8 | 37.0 | 38.2 | 0.0128 | 36.0 | 10.4 | 0.0038 | 75.9 |
| 240.00 | 24.9 | 34.8 | 36.1 | 0.0127 | 33.8 | 10.8 | 0.0027 | 71.6 |
| 1083.00 | 23.1 | 30.5 | 31.2 | 0.0130 | 29.5 | 11.5 | 0.0013 | 62.0 |
| 1440.00 | 25.0 | 25.0 | 26.3 | 0.0127 | 24.0 | 12.4 | 0.0012 | 52.2 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.1 | 3.1 | 16.4 | 80.5 | 96.9 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 0.0013 | 0.0048 | 0.0069 | 0.0089 | 0.0169 |

| Fineness Modulus |
|---|
| 0.01 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.1 | 0.4 | 3.9 | 51.7 | 43.9 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 99.7 | | |
| .6mm | 99.5 | | |
| .3mm | 99.4 | | |
| .15mm | 98.8 | | |
| .075mm | 95.6 | | |

* (no specification provided)

**Material Description**

CLAY (CL), brown to greyish brown, slightly silty

**Atterberg Limits (ASTM D 4318)**

PL= 21 LL= 43 PI= 22

**Classification**

USCS= CL AASHTO=

**Coefficients**

$D_{85}$= 0.0301 $D_{60}$= 0.0143 $D_{50}$= 0.0080
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/30/06 **Tested By:** RTH & JRD

**Remarks**

**Sample No.:** "CL" **Source of Sample:** Section H **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section H
**Sample Number:** "CL"
**Material Description:** CLAY (CL), brown to greyish brown, slightly silty
**PL:** 21 **LL:** 43 **PI:** 22
**USCS Classification:** CL
**Tested By:** RTH & JRD **Test Date:** 11/30/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =39.90
**Tare Wt.** =37.58
**Minus #200 from wash** =95.4%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.15 | 99.7 |
| | | | .6mm | 0.24 | 99.5 |
| | | | .3mm | 0.30 | 99.4 |
| | | | .15mm | 0.59 | 98.8 |
| | | | .075mm | 2.18 | 95.6 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x Rm

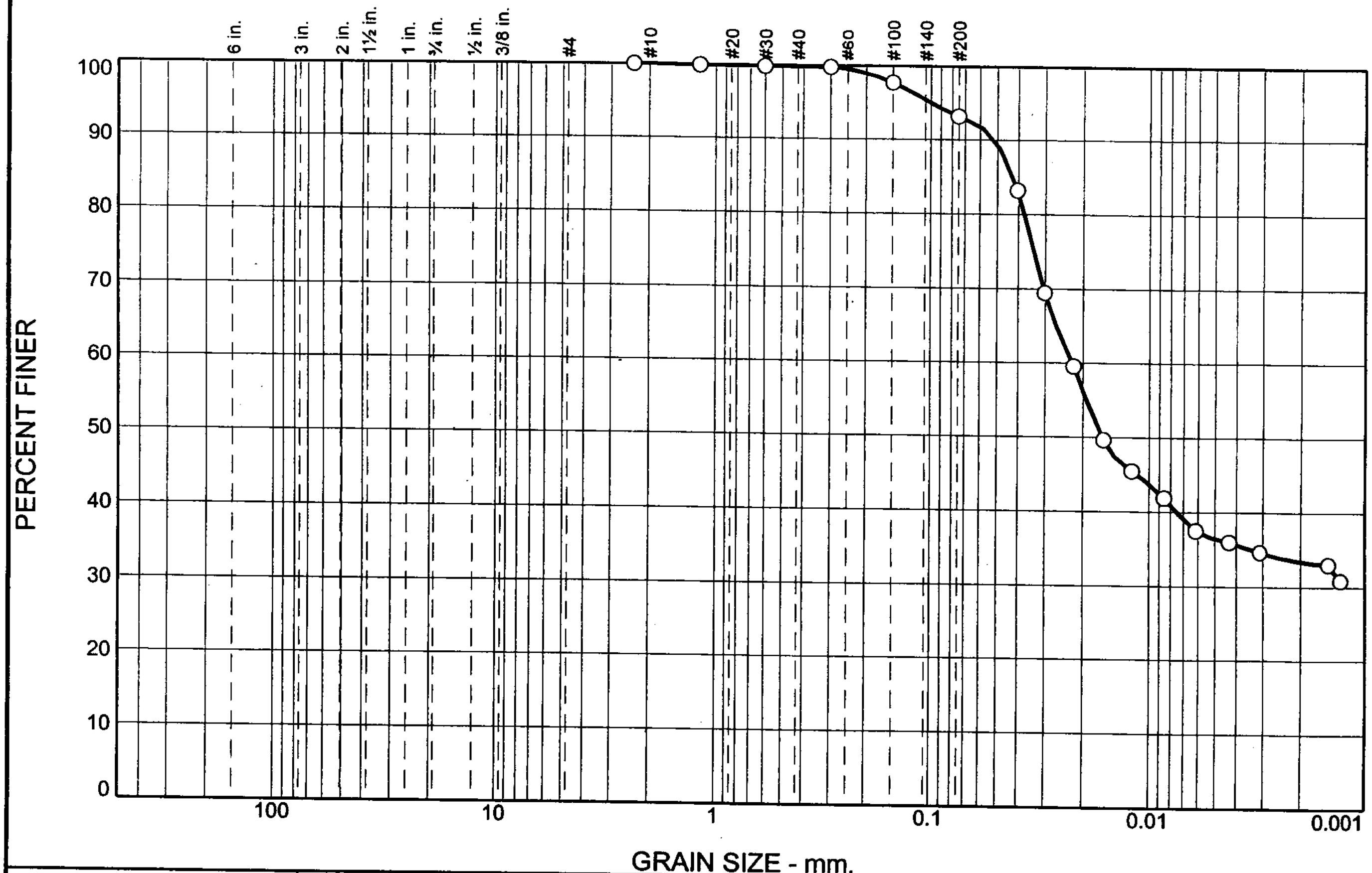
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 1.00 | 24.5 | 44.8 | 45.9 | 0.0128 | 43.8 | 9.1 | 0.0387 | 91.2 |
| 2.00 | 24.5 | 40.7 | 41.8 | 0.0128 | 39.7 | 9.8 | 0.0283 | 83.1 |
| 4.00 | 24.5 | 35.2 | 36.3 | 0.0128 | 34.2 | 10.7 | 0.0209 | 72.2 |
| 8.00 | 24.5 | 30.0 | 31.1 | 0.0128 | 29.0 | 11.5 | 0.0154 | 61.8 |
| 15.00 | 24.5 | 27.0 | 28.1 | 0.0128 | 26.0 | 12.0 | 0.0115 | 55.9 |
| 30.00 | 24.7 | 24.2 | 25.4 | 0.0128 | 23.2 | 12.5 | 0.0082 | 50.4 |
| 60.00 | 24.8 | 22.0 | 23.2 | 0.0128 | 21.0 | 12.9 | 0.0059 | 46.1 |
| 120.00 | 24.5 | 20.0 | 21.1 | 0.0128 | 19.0 | 13.2 | 0.0042 | 42.0 |
| 240.00 | 25.0 | 18.9 | 20.2 | 0.0127 | 17.9 | 13.4 | 0.0030 | 40.1 |
| 1075.00 | 23.1 | 17.1 | 17.8 | 0.0130 | 16.1 | 13.7 | 0.0015 | 35.4 |
| 1440.00 | 25.1 | 16.1 | 17.4 | 0.0127 | 15.1 | 13.8 | 0.0012 | 34.6 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.4 | 3.9 | 4.4 | 51.7 | 43.9 | 95.6 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0080 | 0.0143 | 0.0259 | 0.0301 | 0.0364 | 0.0582 |

| Fineness Modulus |
|---|
| 0.03 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 6.6 | 56.8 | 36.4 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 99.9 | | |
| .6mm | 99.8 | | |
| .3mm | 99.8 | | |
| .15mm | 97.7 | | |
| .075mm | 93.2 | | |

* (no specification provided)

**Material Description**

CLAY (CL), brown, silty

**Atterberg Limits (ASTM D 4318)**

PL= 22 LL= 36 PI= 14

**Classification**

USCS= CL AASHTO=

**Coefficients**

$D_{85}$= 0.0423 $D_{60}$= 0.0224 $D_{50}$= 0.0164
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/27/06 **Tested By:** RTH & JRD

**Remarks**

**Sample No.:** "MCL" **Source of Sample:** Section H **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

# GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section H
**Sample Number:** "MCL"
**Material Description:** CLAY (CL), brown, silty
**PL:** 22 **LL:** 36 **PI:** 14
**USCS Classification:** CL
**Tested By:** RTH & JRD **Test Date:** 11/27/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare =** 41.21
**Tare Wt. =** 37.73
**Minus #200 from wash =** 93.0%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.06 | 99.9 |
| | | | .6mm | 0.09 | 99.8 |
| | | | .3mm | 0.12 | 99.8 |
| | | | .15mm | 1.14 | 97.7 |
| | | | .075mm | 3.42 | 93.2 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample =** 100.0
**Weight of hydrometer sample =** 50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C =** 01352
**Meniscus correction only =** -1.0
**Specific gravity of solids =** 2.68
**Hydrometer type =** 152H
**Hydrometer effective depth equation: L =** 16.294964 - 0.164 x Rm

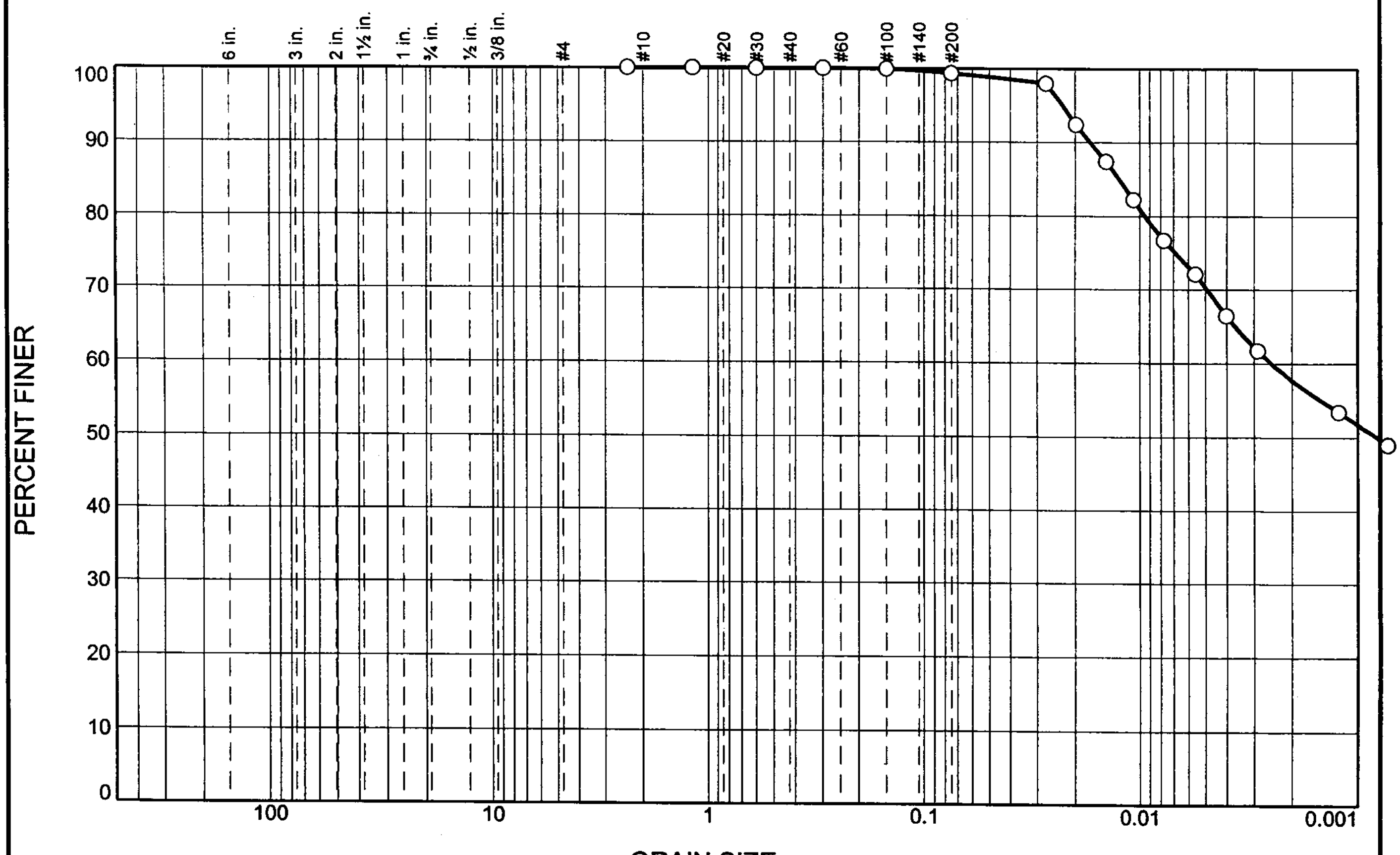
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 1.00 | 23.7 | 41.0 | 41.9 | 0.0129 | 40.0 | 9.7 | 0.0403 | 83.2 |
| 2.00 | 23.7 | 34.1 | 35.0 | 0.0129 | 33.1 | 10.9 | 0.0301 | 69.5 |
| 4.00 | 23.7 | 29.1 | 30.0 | 0.0129 | 28.1 | 11.7 | 0.0221 | 59.5 |
| 8.00 | 23.7 | 24.1 | 25.0 | 0.0129 | 23.1 | 12.5 | 0.0162 | 49.6 |
| 15.00 | 23.7 | 22.0 | 22.9 | 0.0129 | 21.0 | 12.9 | 0.0120 | 45.4 |
| 30.00 | 23.7 | 20.2 | 21.1 | 0.0129 | 19.2 | 13.1 | 0.0086 | 41.9 |
| 60.00 | 23.7 | 18.0 | 18.9 | 0.0129 | 17.0 | 13.5 | 0.0061 | 37.5 |
| 120.00 | 24.8 | 16.9 | 18.1 | 0.0128 | 15.9 | 13.7 | 0.0043 | 36.0 |
| 240.00 | 23.2 | 16.7 | 17.4 | 0.0130 | 15.7 | 13.7 | 0.0031 | 34.6 |
| 1154.00 | 19.7 | 16.7 | 16.6 | 0.0136 | 15.7 | 13.7 | 0.0015 | 33.0 |
| 1440.00 | 22.4 | 15.0 | 15.5 | 0.0131 | 14.0 | 14.0 | 0.0013 | 30.8 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 6.6 | 6.8 | 56.8 | 36.4 | 93.2 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0164 | 0.0224 | 0.0375 | 0.0423 | 0.0516 | 0.1000 |

| Fineness Modulus |
|---|
| 0.03 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.6 | 29.0 | 70.3 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 100.0 | | |
| .6mm | 100.0 | | |
| .3mm | 99.9 | | |
| .15mm | 99.9 | | |
| .075mm | 99.3 | | |

* (no specification provided)

**Material Description**

CLAY (CH), brown to greyish brown, high plastic

**Atterberg Limits (ASTM D 4318)**

PL= 24 LL= 61 PI= 37

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0124 $D_{60}$= 0.0025 $D_{50}$= 0.0008
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 12/4/06 **Tested By:** RTH & JRD

**Remarks**

**Sample No.:** "CH" **Source of Sample:** Section I **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

# GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section I
**Sample Number:** "CH"
**Material Description:** CLAY (CH), brown to greyish brown, high plastic
**PL:** 24 **LL:** 61 **PI:** 37
**USCS Classification:** CH
**Tested By:** RTH & JRD **Test Date:** 12/4/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =41.72
**Tare Wt.** =41.32
**Minus #200 from wash** =99.2%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.01 | 100.0 |
| | | | .6mm | 0.02 | 100.0 |
| | | | .3mm | 0.03 | 99.9 |
| | | | .15mm | 0.07 | 99.9 |
| | | | .075mm | 0.36 | 99.3 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 **x Rm**

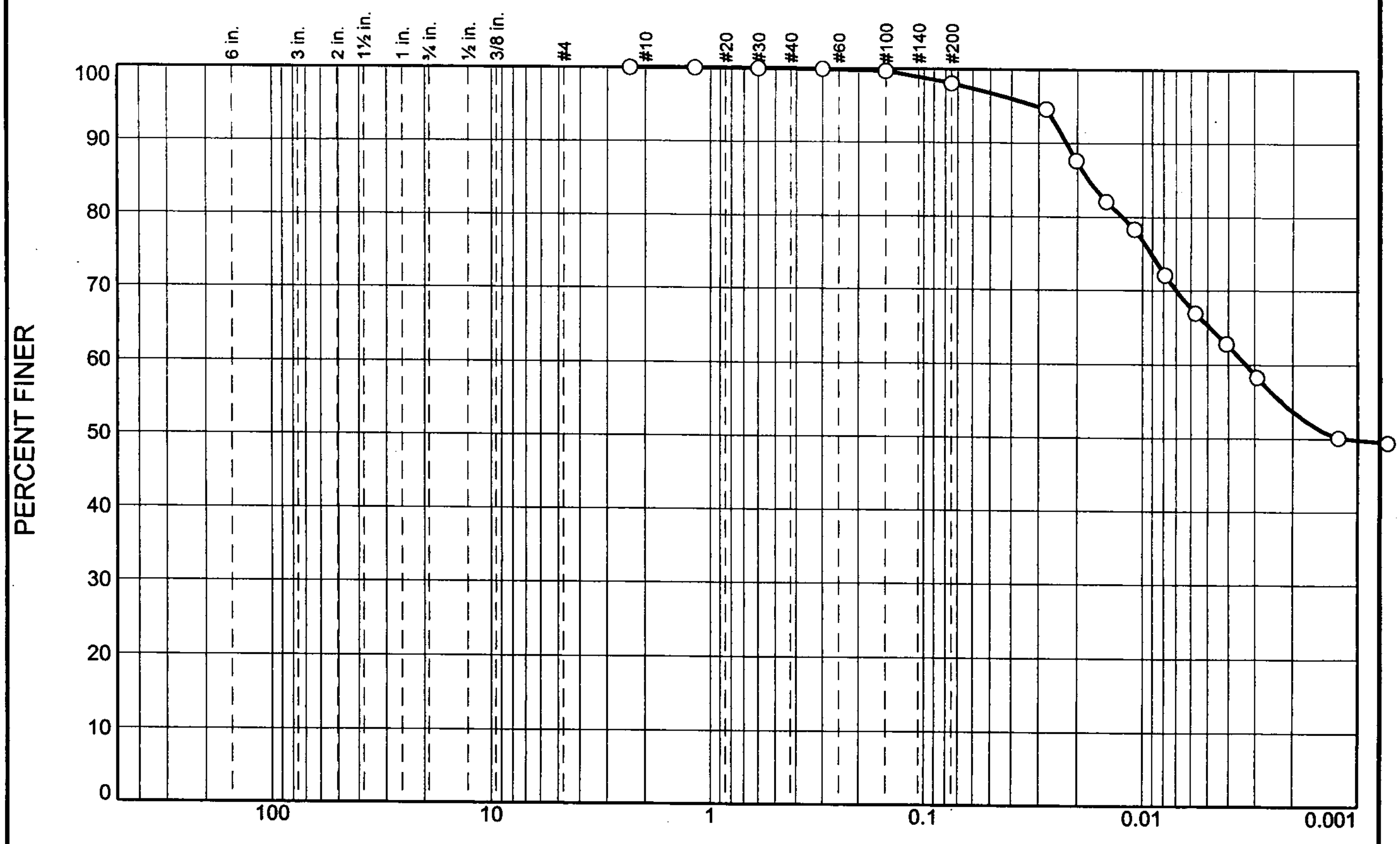
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 2.00 | 21.5 | 49.0 | 49.3 | 0.0133 | 48.0 | 8.4 | 0.0272 | 97.9 |
| 4.00 | 21.5 | 46.2 | 46.5 | 0.0133 | 45.2 | 8.9 | 0.0198 | 92.4 |
| 8.00 | 21.5 | 43.7 | 44.0 | 0.0133 | 42.7 | 9.3 | 0.0143 | 87.4 |
| 15.00 | 21.5 | 41.1 | 41.4 | 0.0133 | 40.1 | 9.7 | 0.0107 | 82.2 |
| 30.00 | 21.5 | 38.3 | 38.6 | 0.0133 | 37.3 | 10.2 | 0.0077 | 76.7 |
| 60.00 | 21.5 | 36.0 | 36.3 | 0.0133 | 35.0 | 10.6 | 0.0056 | 72.1 |
| 120.00 | 21.7 | 33.1 | 33.5 | 0.0132 | 32.1 | 11.0 | 0.0040 | 66.4 |
| 240.00 | 21.7 | 30.7 | 31.1 | 0.0132 | 29.7 | 11.4 | 0.0029 | 61.7 |
| 1448.00 | 20.7 | 26.8 | 26.9 | 0.0134 | 25.8 | 12.1 | 0.0012 | 53.5 |
| 4320.00 | 20.1 | 24.7 | 24.7 | 0.0135 | 23.7 | 12.4 | 0.0007 | 49.1 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.6 | 0.7 | 29.0 | 70.3 | 99.3 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0008 | 0.0025 | 0.0094 | 0.0124 | 0.0170 | 0.0229 |

| Fineness Modulus |
|---|
| 0.00 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 1.9 | 32.7 | 65.3 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 100.0 | | |
| .6mm | 100.0 | | |
| .3mm | 99.9 | | |
| .15mm | 99.6 | | |
| .075mm | 98.0 | | |

* (no specification provided)

**Material Description**

CLAY (CL), brown to greyish brown, slightly silty, med-high plasticity

**Atterberg Limits (ASTM D 4318)**

PL= 20 LL= 55 PI= 35

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0177 $D_{60}$= 0.0033 $D_{50}$= 0.0011
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 12/4/06 **Tested By:** RTH & JRD

**Remarks**

**Sample No.:** "CL" **Source of Sample:** Section I **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

# GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section I
**Sample Number:** "CL"
**Material Description:** CLAY (CL), brown to greyish brown, slightly silty, med-high plasticity
**PL:** 20 **LL:** 55 **PI:** 35
**USCS Classification:** CH
**Tested By:** RTH & JRD **Test Date:** 12/4/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

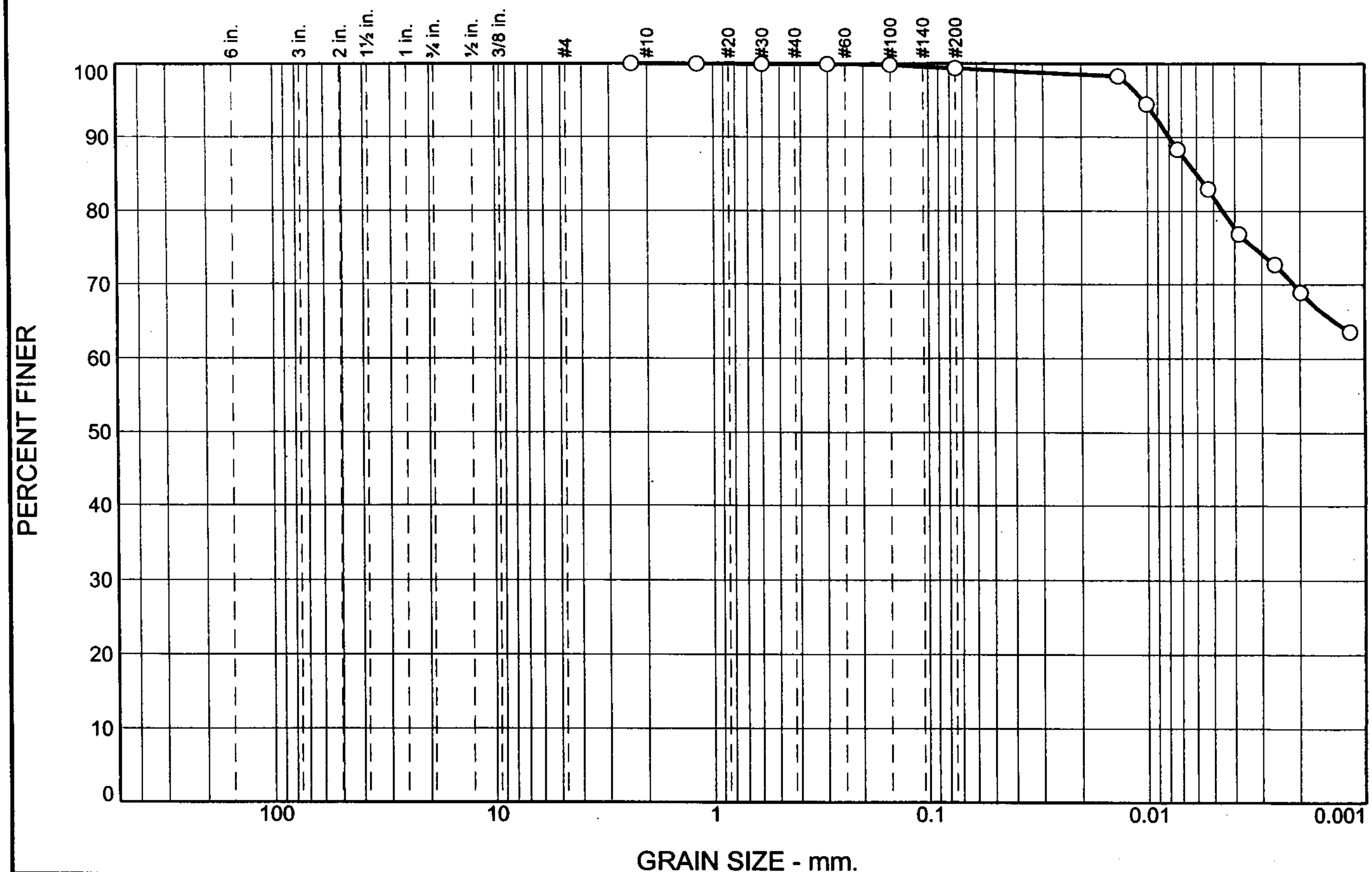
**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =42.15
**Tare Wt.** =41.13
**Minus #200 from wash** =98.0%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.01 | 100.0 |
| | | | .6mm | 0.02 | 100.0 |
| | | | .3mm | 0.06 | 99.9 |
| | | | .15mm | 0.19 | 99.6 |
| | | | .075mm | 1.00 | 98.0 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x Rm

| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 2.00 | 21.5 | 47.3 | 47.6 | 0.0133 | 46.3 | 8.7 | 0.0277 | 94.6 |
| 4.00 | 21.5 | 43.8 | 44.1 | 0.0133 | 42.8 | 9.3 | 0.0202 | 87.6 |
| 8.00 | 21.5 | 41.0 | 41.3 | 0.0133 | 40.0 | 9.7 | 0.0146 | 82.0 |
| 15.00 | 21.5 | 39.1 | 39.4 | 0.0133 | 38.1 | 10.0 | 0.0109 | 78.3 |
| 30.00 | 21.5 | 36.0 | 36.3 | 0.0133 | 35.0 | 10.6 | 0.0079 | 72.1 |
| 60.00 | 21.5 | 33.4 | 33.7 | 0.0133 | 32.4 | 11.0 | 0.0057 | 67.0 |
| 120.00 | 21.6 | 31.3 | 31.6 | 0.0133 | 30.3 | 11.3 | 0.0041 | 62.8 |
| 240.00 | 21.7 | 29.0 | 29.4 | 0.0132 | 28.0 | 11.7 | 0.0029 | 58.3 |
| 1457.00 | 20.7 | 25.1 | 25.2 | 0.0134 | 24.1 | 12.3 | 0.0012 | 50.1 |
| 4320.00 | 20.1 | 24.9 | 24.9 | 0.0135 | 23.9 | 12.4 | 0.0007 | 49.5 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.6 | 17.5 | 81.8 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 99.9 | | |
| .6mm | 99.9 | | |
| .3mm | 99.9 | | |
| .15mm | 99.8 | | |
| .075mm | 99.3 | | |

* (no specification provided)

**Material Description**

CLAY (CH), brown to greyish brown, high plastic

**Atterberg Limits (ASTM D 4318)**

PL= 29 LL= 75 PI= 46

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0060 $D_{60}$= $D_{50}$=
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 12/1/06 **Tested By:** RTH

**Remarks**

**Sample No.:** "CH" **Source of Sample:** Section K **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

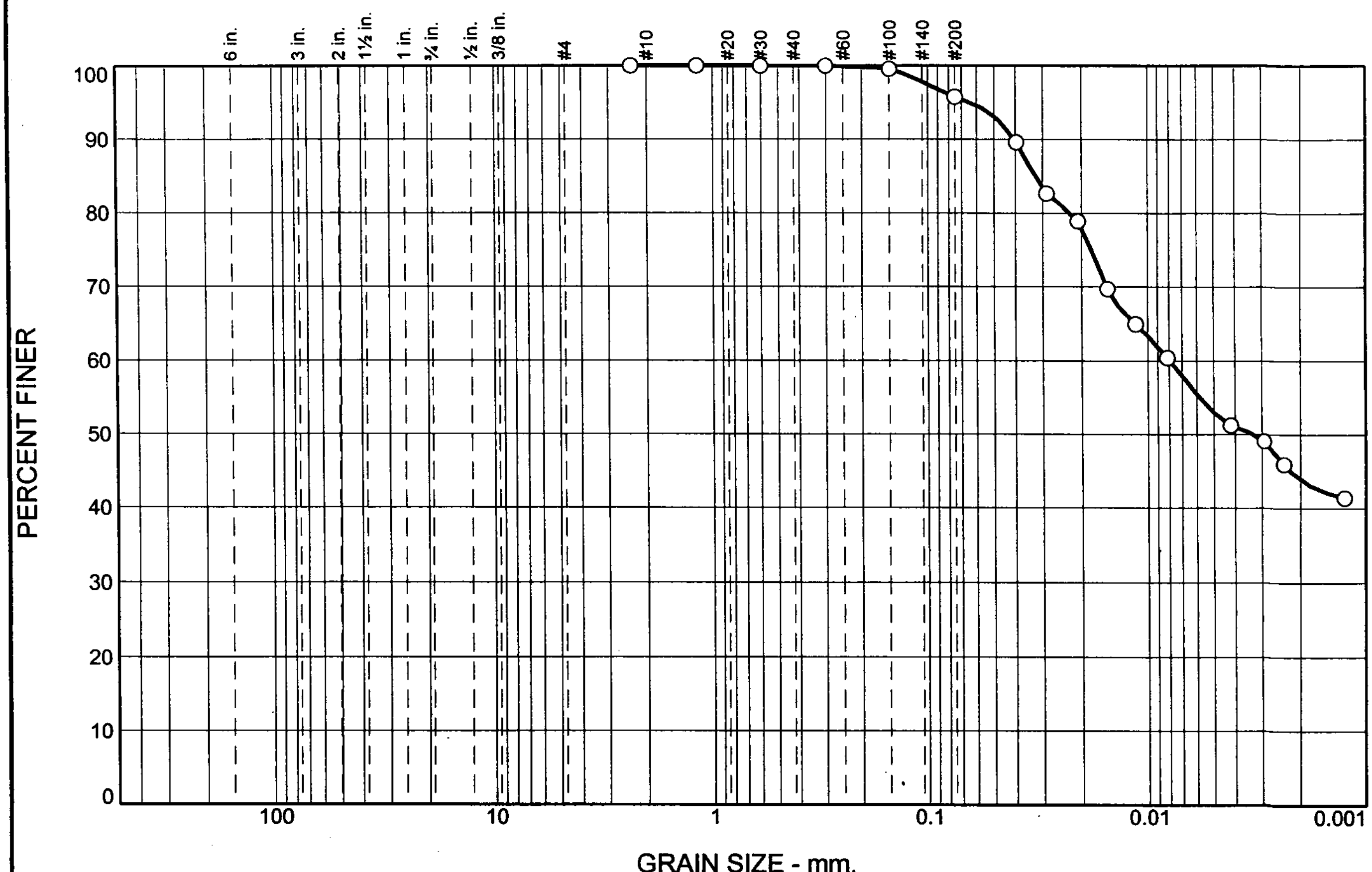
**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 1.9 | 2.0 | 32.7 | 65.3 | 98.0 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0011 | 0.0033 | 0.0123 | 0.0177 | 0.0224 | 0.0308 |

| Fineness Modulus |
|---|
| 0.01 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 4.2 | 42.7 | 53.0 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 100.0 | | |
| .6mm | 99.9 | | |
| .3mm | 99.9 | | |
| .15mm | 99.5 | | |
| .075mm | 95.7 | | |

* (no specification provided)

**Material Description**

CLAY (CL) brown, silty

**Atterberg Limits (ASTM D 4318)**

PL= 19 LL= 44 PI= 25

**Classification**

USCS= CL AASHTO=

**Coefficients**

$D_{85}$= 0.0326 $D_{60}$= 0.0079 $D_{50}$= 0.0032
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/30/06 **Tested By:** JLC & RTH

**Remarks**

**Sample No.:** "MCL" **Source of Sample:** Section I **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section I
**Sample Number:** "MCL"
**Material Description:** CLAY (CL) brown, silty
**PL:** 19 **LL:** 44 **PI:** 25
**USCS Classification:** CL
**Tested By:** JLC & RTH **Test Date:** 11/30/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =43.94
**Tare Wt.** =41.35
**Minus #200 from wash** =94.8%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.00 | 100.0 |
| | | | .6mm | 0.03 | 99.9 |
| | | | .3mm | 0.04 | 99.9 |
| | | | .15mm | 0.24 | 99.5 |
| | | | .075mm | 2.15 | 95.7 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x **Rm**

| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 1.00 | 22.7 | 44.5 | 45.1 | 0.0131 | 43.5 | 9.2 | 0.0396 | 89.6 |
| 2.00 | 22.7 | 41.0 | 41.6 | 0.0131 | 40.0 | 9.7 | 0.0289 | 82.6 |
| 4.00 | 22.7 | 39.1 | 39.7 | 0.0131 | 38.1 | 10.0 | 0.0207 | 78.9 |
| 8.00 | 22.7 | 34.5 | 35.1 | 0.0131 | 33.5 | 10.8 | 0.0152 | 69.7 |
| 15.00 | 22.7 | 32.1 | 32.7 | 0.0131 | 31.1 | 11.2 | 0.0113 | 65.0 |
| 30.00 | 22.7 | 29.8 | 30.4 | 0.0131 | 28.8 | 11.6 | 0.0081 | 60.4 |
| 120.00 | 23.1 | 25.1 | 25.8 | 0.0130 | 24.1 | 12.3 | 0.0042 | 51.3 |
| 245.00 | 23.8 | 23.8 | 24.7 | 0.0129 | 22.8 | 12.6 | 0.0029 | 49.1 |
| 383.00 | 23.5 | 22.3 | 23.1 | 0.0130 | 21.3 | 12.8 | 0.0024 | 45.9 |
| 1440.00 | 22.4 | 20.3 | 20.8 | 0.0131 | 19.3 | 13.1 | 0.0013 | 41.4 |

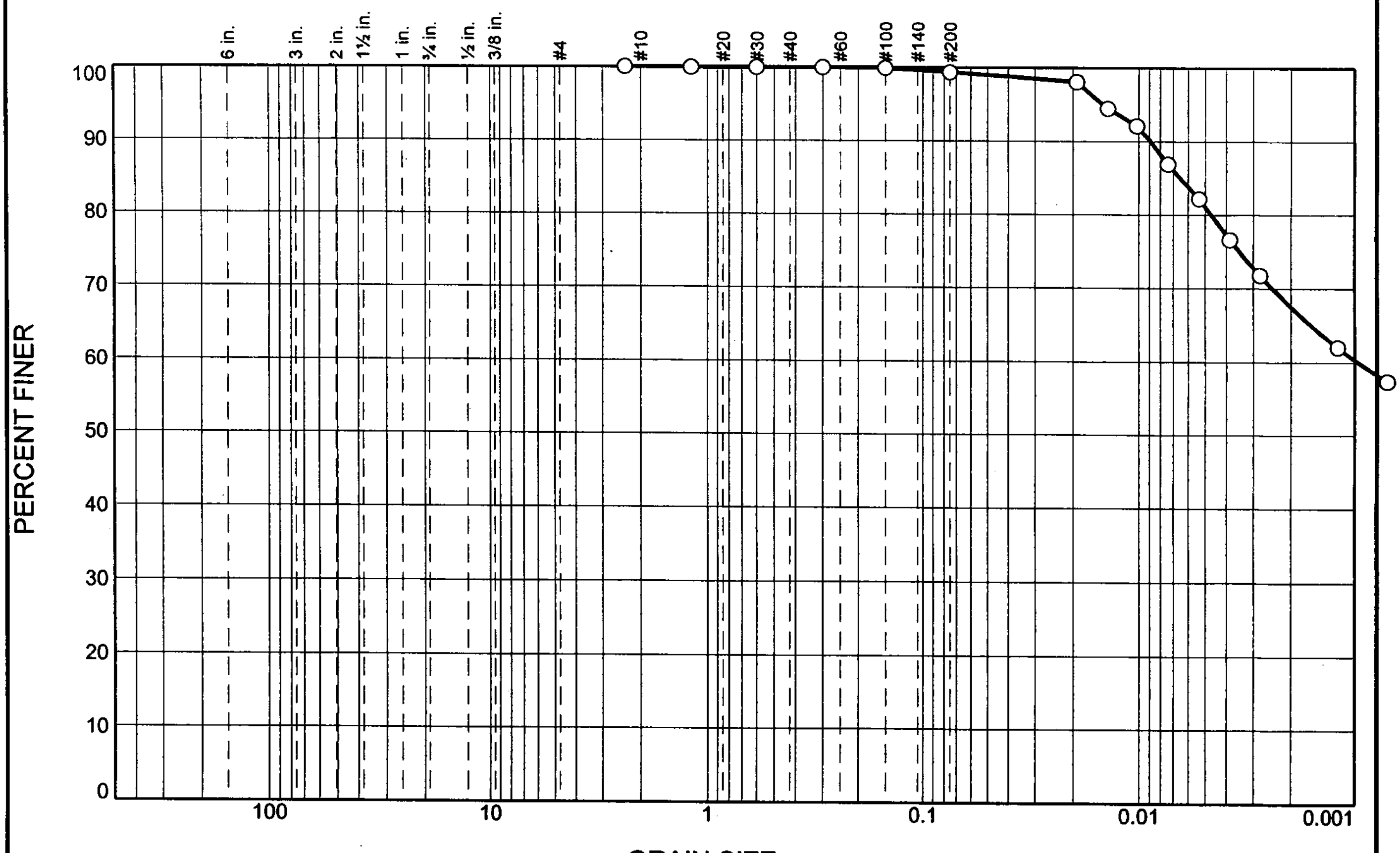
[redacted]

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 4.2 | 4.3 | 42.7 | 53.0 | 95.7 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0032 | 0.0079 | 0.0222 | 0.0326 | 0.0404 | 0.0650 |

| Fineness Modulus |
|---|
| 0.01 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.6 | 18.2 | 81.1 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 100.0 | | |
| .6mm | 99.9 | | |
| .3mm | 99.9 | | |
| .15mm | 99.8 | | |
| .075mm | 99.3 | | |

* (no specification provided)

**Material Description**

CLAY (CH), brown to greyish brown, high plastic

**Atterberg Limits (ASTM D 4318)**

PL= 22 LL= 70 PI= 48

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0065 $D_{60}$= 0.0010 $D_{50}$=
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 12/4/06 **Tested By:** RTH & JRD

**Remarks**

**Sample No.:** "CH" **Source of Sample:** Section J **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section J
**Sample Number:** "CH"
**Material Description:** CLAY (CH), brown to greyish brown, high plastic
**PL:** 22 **LL:** 70 **PI:** 48
**USCS Classification:** CH
**Tested By:** RTH & JRD **Test Date:** 12/4/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare =** 40.09
**Tare Wt. =** 39.73
**Minus #200 from wash =** 99.3%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.02 | 100.0 |
| | | | .6mm | 0.03 | 99.9 |
| | | | .3mm | 0.03 | 99.9 |
| | | | .15mm | 0.08 | 99.8 |
| | | | .075mm | 0.34 | 99.3 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample =** 100.0
**Weight of hydrometer sample =** 50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C =** 01352
**Meniscus correction only =** -1.0
**Specific gravity of solids =** 2.68
**Hydrometer type =** 152H
**Hydrometer effective depth equation: L =** 16.294964 - 0.164 x **Rm**

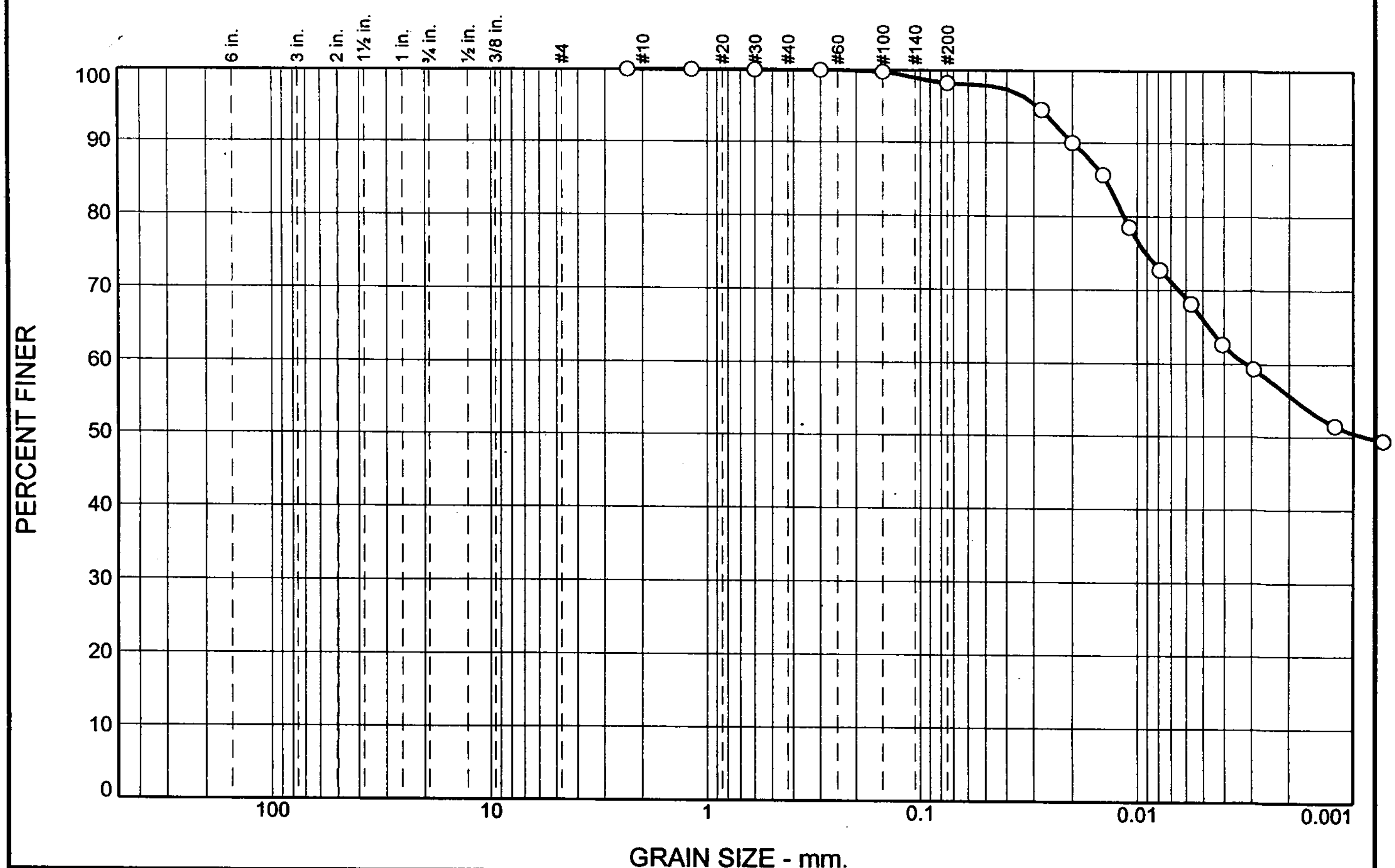
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 4.00 | 21.7 | 49.0 | 49.4 | 0.0132 | 48.0 | 8.4 | 0.0192 | 98.0 |
| 8.00 | 21.7 | 47.2 | 47.6 | 0.0132 | 46.2 | 8.7 | 0.0138 | 94.5 |
| 15.00 | 21.7 | 46.0 | 46.4 | 0.0132 | 45.0 | 8.9 | 0.0102 | 92.1 |
| 30.00 | 21.7 | 43.4 | 43.8 | 0.0132 | 42.4 | 9.3 | 0.0074 | 86.9 |
| 60.00 | 21.7 | 41.0 | 41.4 | 0.0132 | 40.0 | 9.7 | 0.0053 | 82.1 |
| 120.00 | 21.7 | 38.2 | 38.6 | 0.0132 | 37.2 | 10.2 | 0.0039 | 76.6 |
| 240.00 | 21.6 | 35.8 | 36.1 | 0.0133 | 34.8 | 10.6 | 0.0028 | 71.8 |
| 1422.00 | 20.7 | 31.1 | 31.2 | 0.0134 | 30.1 | 11.4 | 0.0012 | 62.0 |
| 4293.00 | 20.1 | 28.9 | 28.9 | 0.0135 | 27.9 | 11.7 | 0.0007 | 57.4 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.6 | 0.7 | 18.2 | 81.1 | 99.3 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 0.0010 | 0.0047 | 0.0065 | 0.0089 | 0.0146 |

| Fineness Modulus |
|---|
| 0.00 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.8 | 32.2 | 66.0 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 100.0 | | |
| .6mm | 100.0 | | |
| .3mm | 100.0 | | |
| .15mm | 99.7 | | |
| .075mm | 98.2 | | |

* (no specification provided)

**Material Description**

CLAY (CH), brown to greyish brown, slightly silty, med-high plasticity

**Atterberg Limits (ASTM D 4318)**

PL= 20 LL= 53 PI= 33

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0140 $D_{60}$= 0.0032 $D_{50}$= 0.0009
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 12/4/06 **Tested By:** RTH & JRD

**Remarks**

**Sample No.:** "CL" **Source of Sample:** Section J **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section J
**Sample Number:** "CL"
**Material Description:** CLAY (CH), brown to greyish brown, slightly silty, med-high plasticity
**PL:** 20 **LL:** 53 **PI:** 33
**USCS Classification:** CH
**Tested By:** RTH & JRD **Test Date:** 12/4/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =42.31
**Tare Wt.** =41.35
**Minus #200 from wash** =98.1%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.01 | 100.0 |
| | | | .6mm | 0.02 | 100.0 |
| | | | .3mm | 0.02 | 100.0 |
| | | | .15mm | 0.14 | 99.7 |
| | | | .075mm | 0.91 | 98.2 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 **x Rm**

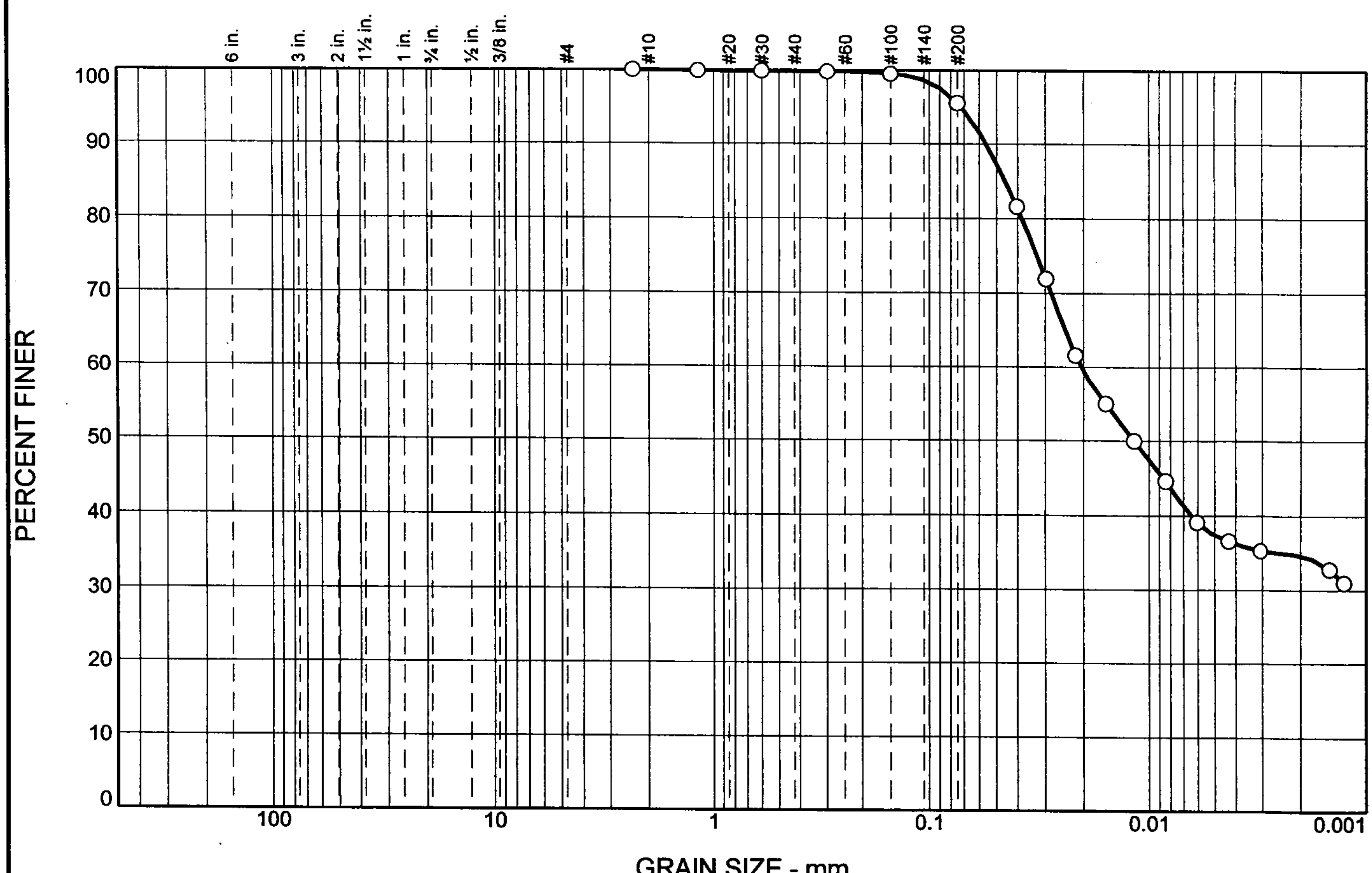
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 2.00 | 21.5 | 47.3 | 47.6 | 0.0133 | 46.3 | 8.7 | 0.0277 | 94.6 |
| 4.00 | 21.5 | 45.0 | 45.3 | 0.0133 | 44.0 | 9.1 | 0.0200 | 90.0 |
| 8.00 | 21.5 | 42.8 | 43.1 | 0.0133 | 41.8 | 9.4 | 0.0144 | 85.6 |
| 15.00 | 21.5 | 39.2 | 39.5 | 0.0133 | 38.2 | 10.0 | 0.0109 | 78.5 |
| 30.00 | 21.5 | 36.3 | 36.6 | 0.0133 | 35.3 | 10.5 | 0.0079 | 72.7 |
| 60.00 | 21.5 | 34.0 | 34.3 | 0.0133 | 33.0 | 10.9 | 0.0057 | 68.1 |
| 120.00 | 21.6 | 31.2 | 31.5 | 0.0133 | 30.2 | 11.3 | 0.0041 | 62.6 |
| 240.00 | 21.7 | 29.5 | 29.9 | 0.0132 | 28.5 | 11.6 | 0.0029 | 59.3 |
| 1465.00 | 20.7 | 25.8 | 25.9 | 0.0134 | 24.8 | 12.2 | 0.0012 | 51.5 |
| 4320.00 | 20.1 | 24.9 | 24.9 | 0.0135 | 23.9 | 12.4 | 0.0007 | 49.5 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.8 | 1.8 | 32.2 | 66.0 | 98.2 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0009 | 0.0032 | 0.0115 | 0.0140 | 0.0200 | 0.0287 |

| Fineness Modulus |
|---|
| 0.00 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 4.3 | 58.1 | 37.4 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 99.9 | | |
| .6mm | 99.8 | | |
| .3mm | 99.8 | | |
| .15mm | 99.5 | | |
| .075mm | 95.5 | | |

* (no specification provided)

**Material Description**

CLAY (CL), brown, silty

**Atterberg Limits (ASTM D 4318)**

PL= 21 LL= 34 PI= 13

**Classification**

USCS= CL AASHTO=

**Coefficients**

$D_{85}$= 0.0455 $D_{60}$= 0.0205 $D_{50}$= 0.0117
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/30/06 **Tested By:** RTH & JRD

**Remarks**

**Sample No.:** "MCL" **Source of Sample:** Section J **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section J
**Sample Number:** "MCL"
**Material Description:** CLAY (CL), brown, silty
**PL:** 21 **LL:** 34 **PI:** 13
**USCS Classification:** CL
**Tested By:** RTH & JRD **Test Date:** 11/30/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =43.07
**Tare Wt.** =40.68
**Minus #200 from wash** =95.2%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.05 | 99.9 |
| | | | .6mm | 0.08 | 99.8 |
| | | | .3mm | 0.11 | 99.8 |
| | | | .15mm | 0.27 | 99.5 |
| | | | .075mm | 2.24 | 95.5 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation:** L =16.294964 - 0.164 x Rm

| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 1.00 | 24.4 | 40.0 | 41.1 | 0.0128 | 39.0 | 9.9 | 0.0403 | 81.6 |
| 2.00 | 24.4 | 35.1 | 36.2 | 0.0128 | 34.1 | 10.7 | 0.0297 | 71.9 |
| 4.00 | 24.4 | 29.9 | 31.0 | 0.0128 | 28.9 | 11.6 | 0.0218 | 61.6 |
| 8.00 | 24.4 | 26.6 | 27.7 | 0.0128 | 25.6 | 12.1 | 0.0158 | 55.0 |
| 15.00 | 24.6 | 24.0 | 25.2 | 0.0128 | 23.0 | 12.5 | 0.0117 | 50.0 |
| 30.00 | 24.6 | 21.3 | 22.5 | 0.0128 | 20.3 | 13.0 | 0.0084 | 44.6 |
| 60.00 | 24.7 | 18.5 | 19.7 | 0.0128 | 17.5 | 13.4 | 0.0060 | 39.1 |
| 120.00 | 24.8 | 17.2 | 18.4 | 0.0128 | 16.2 | 13.6 | 0.0043 | 36.6 |
| 240.00 | 24.9 | 16.5 | 17.8 | 0.0127 | 15.5 | 13.8 | 0.0031 | 35.3 |
| 1091.00 | 23.1 | 15.8 | 16.5 | 0.0130 | 14.8 | 13.9 | 0.0015 | 32.8 |
| 1440.00 | 25.0 | 14.3 | 15.6 | 0.0127 | 13.3 | 14.1 | 0.0013 | 31.0 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 4.3 | 4.5 | 58.1 | 37.4 | 95.5 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0117 | 0.0205 | 0.0382 | 0.0455 | 0.0556 | 0.0724 |

| Fineness Modulus |
|---|
| 0.01 |

# GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section K
**Sample Number:** "CH"
**Material Description:** CLAY (CH), brown to greyish brown, high plastic
**PL:** 29 **LL:** 75 **PI:** 46
**USCS Classification:** CH
**Tested By:** RTH **Test Date:** 12/1/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =34.95
**Tare Wt.** =34.57
**Minus #200 from wash** =99.2%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.03 | 99.9 |
| | | | .6mm | 0.05 | 99.9 |
| | | | .3mm | 0.06 | 99.9 |
| | | | .15mm | 0.12 | 99.8 |
| | | | .075mm | 0.36 | 99.3 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x **Rm**

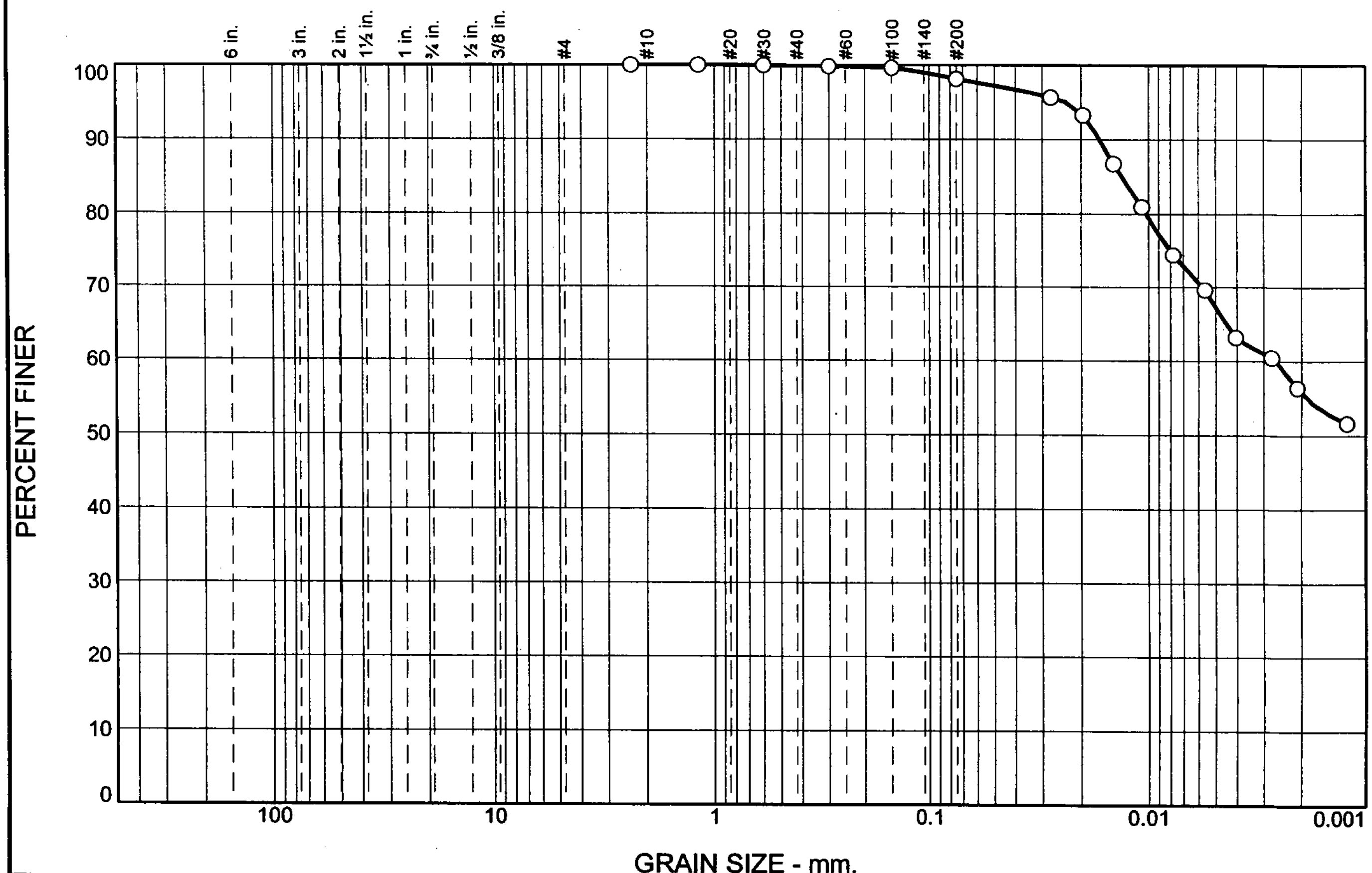
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 8.00 | 22.1 | 49.0 | 49.4 | 0.0132 | 48.0 | 8.4 | 0.0135 | 98.2 |
| 15.00 | 22.1 | 47.1 | 47.5 | 0.0132 | 46.1 | 8.7 | 0.0101 | 94.5 |
| 30.00 | 22.1 | 44.0 | 44.4 | 0.0132 | 43.0 | 9.2 | 0.0073 | 88.3 |
| 60.00 | 22.1 | 41.3 | 41.7 | 0.0132 | 40.3 | 9.7 | 0.0053 | 82.9 |
| 120.00 | 22.2 | 38.2 | 38.7 | 0.0132 | 37.2 | 10.2 | 0.0038 | 76.8 |
| 270.00 | 22.7 | 36.0 | 36.6 | 0.0131 | 35.0 | 10.6 | 0.0026 | 72.7 |
| 473.00 | 23.0 | 34.0 | 34.7 | 0.0130 | 33.0 | 10.9 | 0.0020 | 68.9 |
| 1485.00 | 20.6 | 31.9 | 32.0 | 0.0134 | 30.9 | 11.2 | 0.0012 | 63.6 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.6 | 0.7 | 17.5 | 81.8 | 99.3 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 0.0046 | 0.0060 | 0.0080 | 0.0104 |

| Fineness Modulus |
|---|
| 0.01 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 1.8 | 30.8 | 67.3 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 100.0 | | |
| .6mm | 99.9 | | |
| .3mm | 99.8 | | |
| .15mm | 99.6 | | |
| .075mm | 98.1 | | |

* (no specification provided)

**Material Description**

CLAY (CH), brown to greyish brown, slightly silty, med-high plasticity

**Atterberg Limits (ASTM D 4318)**

PL= 22 LL= 60 PI= 38

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0131 $D_{60}$= 0.0026 $D_{50}$=
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 12/01/06 **Tested By:** RTH & JRD

**Remarks**

**Sample No.:** "CL" **Source of Sample:** Section K **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill

**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section K
**Sample Number:** "CL"
**Material Description:** CLAY (CH), brown to greyish brown, slightly silty, med-high plasticity
**PL:** 22 **LL:** 60 **PI:** 38
**USCS Classification:** CH
**Tested By:** RTH & JRD **Test Date:** 12/01/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =41.82
**Tare Wt.** =40.84
**Minus #200 from wash** =98.0%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.01 | 100.0 |
| | | | .6mm | 0.04 | 99.9 |
| | | | .3mm | 0.09 | 99.8 |
| | | | .15mm | 0.21 | 99.6 |
| | | | .075mm | 0.94 | 98.1 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation:** L =16.294964 - 0.164 x Rm

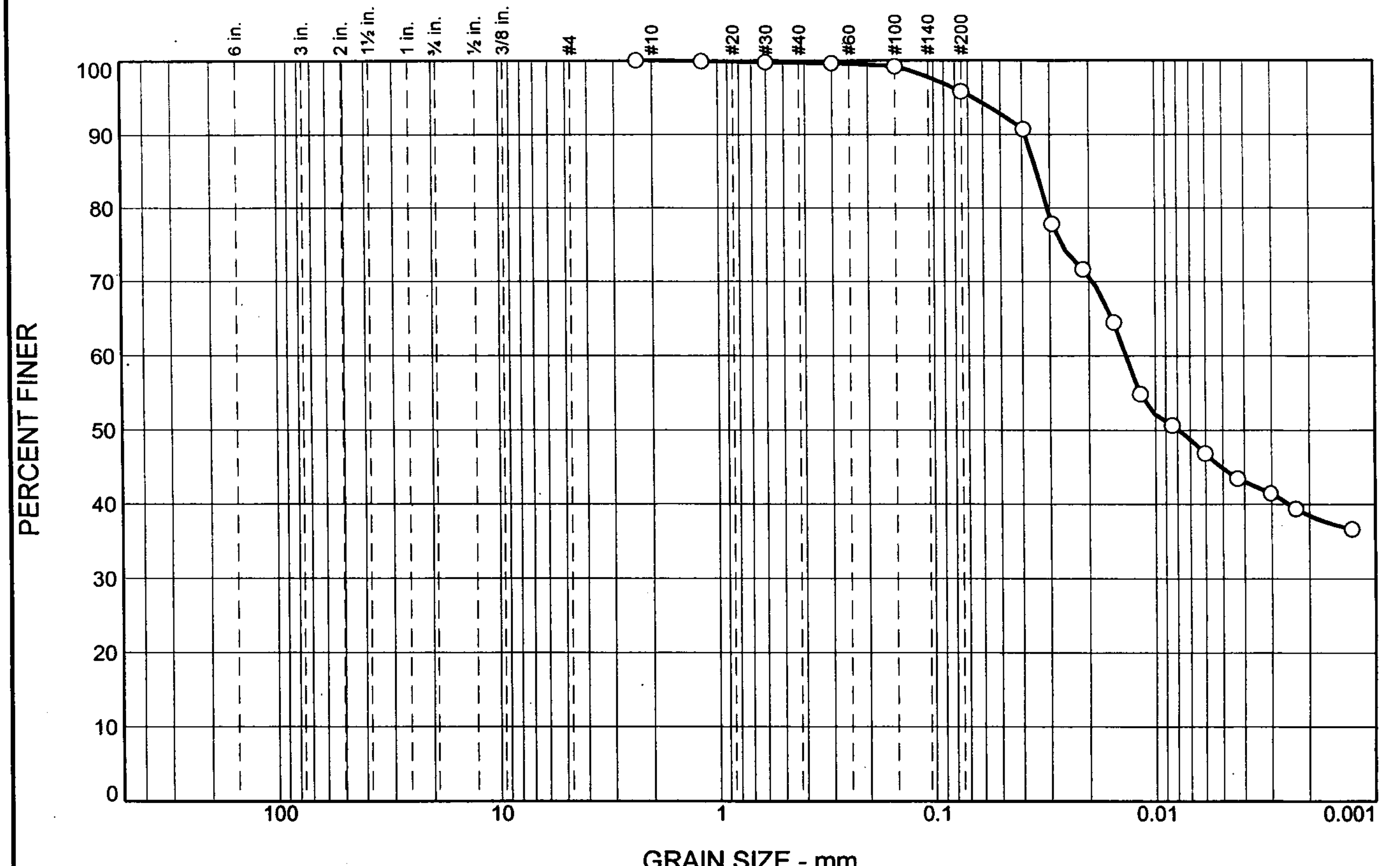
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 2.00 | 22.1 | 47.7 | 48.1 | 0.0132 | 46.7 | 8.6 | 0.0274 | 95.6 |
| 4.00 | 22.1 | 46.5 | 46.9 | 0.0132 | 45.5 | 8.8 | 0.0196 | 93.3 |
| 8.00 | 22.1 | 43.2 | 43.6 | 0.0132 | 42.2 | 9.4 | 0.0143 | 86.7 |
| 15.00 | 22.1 | 40.3 | 40.7 | 0.0132 | 39.3 | 9.9 | 0.0107 | 80.9 |
| 30.00 | 22.1 | 37.0 | 37.4 | 0.0132 | 36.0 | 10.4 | 0.0078 | 74.4 |
| 60.00 | 22.1 | 34.6 | 35.0 | 0.0132 | 33.6 | 10.8 | 0.0056 | 69.6 |
| 120.00 | 22.3 | 31.3 | 31.8 | 0.0131 | 30.3 | 11.3 | 0.0040 | 63.2 |
| 261.00 | 22.8 | 29.8 | 30.4 | 0.0131 | 28.8 | 11.6 | 0.0028 | 60.4 |
| 464.00 | 23.0 | 27.7 | 28.4 | 0.0130 | 26.7 | 11.9 | 0.0021 | 56.4 |
| 1477.00 | 20.6 | 25.9 | 26.0 | 0.0134 | 24.9 | 12.2 | 0.0012 | 51.7 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 1.8 | 1.9 | 30.8 | 67.3 | 98.1 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 0.0026 | 0.0102 | 0.0131 | 0.0165 | 0.0234 |

| Fineness Modulus |
|---|
| 0.01 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 3.8 | 51.0 | 44.8 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 99.9 | | |
| .6mm | 99.7 | | |
| .3mm | 99.6 | | |
| .15mm | 99.2 | | |
| .075mm | 95.8 | | |

* (no specification provided)

**Material Description**

CLAY (CL) brown, silty

**Atterberg Limits (ASTM D 4318)**

PL= 22 LL= 37 PI= 15

**Classification**

USCS= CL AASHTO=

**Coefficients**

$D_{85}$= 0.0345 $D_{60}$= 0.0136 $D_{50}$= 0.0078
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/30/06 **Tested By:** JLC & RTH

**Remarks**

**Sample No.:** "MCL" **Source of Sample:** Section K **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section K
**Sample Number:** "MCL"
**Material Description:** CLAY (CL) brown, silty
**PL:** 22 **LL:** 37 **PI:** 15
**USCS Classification:** CL
**Tested By:** JLC & RTH **Test Date:** 11/30/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =42.72
**Tare Wt.** =40.50
**Minus #200 from wash** =95.6%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.07 | 99.9 |
| | | | .6mm | 0.14 | 99.7 |
| | | | .3mm | 0.21 | 99.6 |
| | | | .15mm | 0.42 | 99.2 |
| | | | .075mm | 2.09 | 95.8 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x Rm

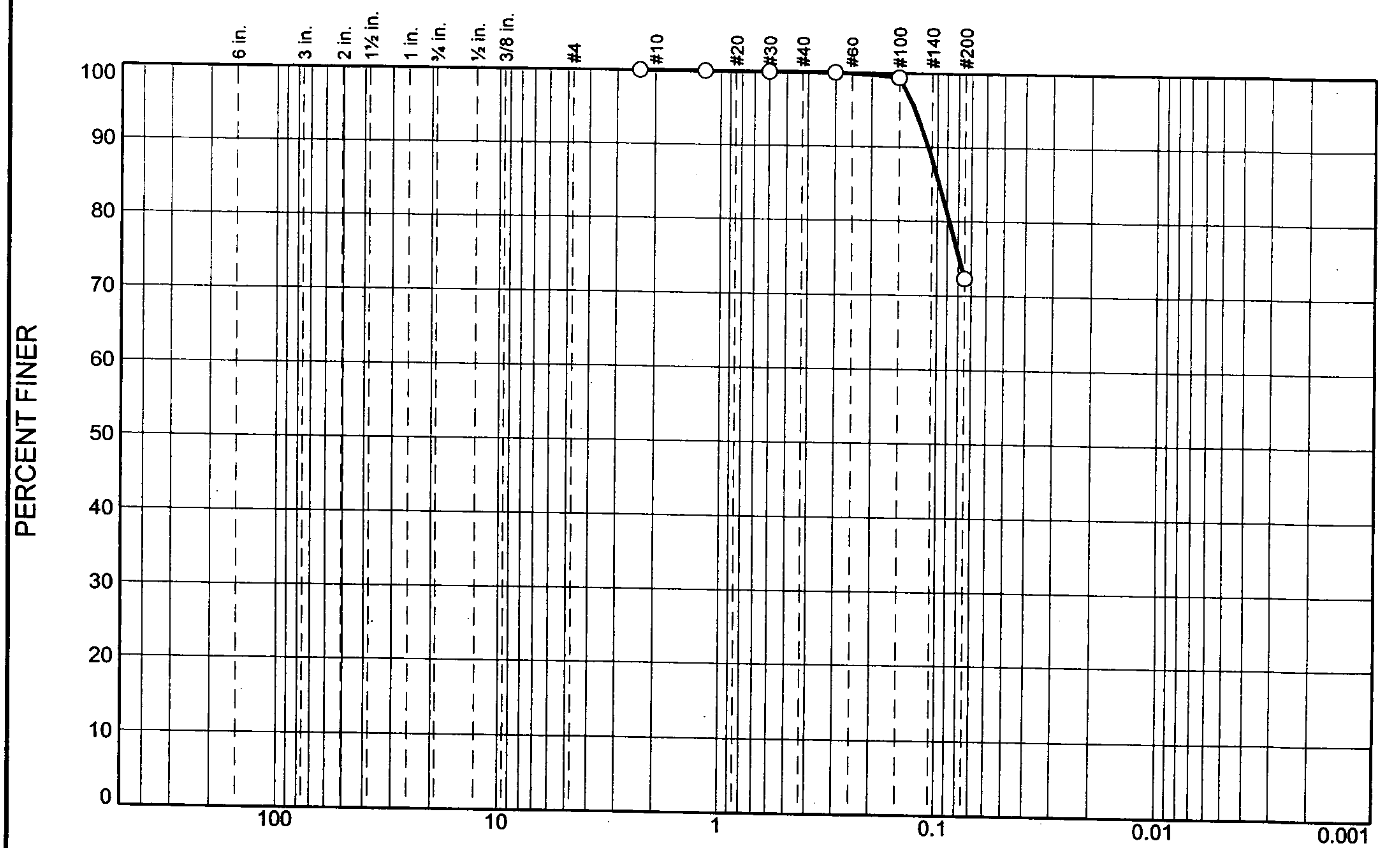
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 1.00 | 23.0 | 45.0 | 45.7 | 0.0130 | 44.0 | 9.1 | 0.0393 | 90.7 |
| 2.00 | 23.0 | 38.5 | 39.2 | 0.0130 | 37.5 | 10.1 | 0.0294 | 77.8 |
| 4.00 | 23.3 | 35.3 | 36.1 | 0.0130 | 34.3 | 10.7 | 0.0212 | 71.6 |
| 8.00 | 23.3 | 31.7 | 32.5 | 0.0130 | 30.7 | 11.3 | 0.0154 | 64.5 |
| 15.00 | 22.8 | 27.0 | 27.6 | 0.0131 | 26.0 | 12.0 | 0.0117 | 54.9 |
| 30.00 | 22.7 | 24.9 | 25.5 | 0.0131 | 23.9 | 12.4 | 0.0084 | 50.7 |
| 60.00 | 22.7 | 23.0 | 23.6 | 0.0131 | 22.0 | 12.7 | 0.0060 | 46.9 |
| 120.00 | 23.0 | 21.2 | 21.9 | 0.0130 | 20.2 | 13.0 | 0.0043 | 43.5 |
| 240.00 | 23.7 | 20.0 | 20.9 | 0.0129 | 19.0 | 13.2 | 0.0030 | 41.5 |
| 418.00 | 23.5 | 19.0 | 19.8 | 0.0130 | 18.0 | 13.3 | 0.0023 | 39.4 |
| 1440.00 | 22.1 | 18.0 | 18.4 | 0.0132 | 17.0 | 13.5 | 0.0013 | 36.6 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 3.8 | 4.2 | 51.0 | 44.8 | 95.8 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0078 | 0.0136 | 0.0310 | 0.0345 | 0.0385 | 0.0663 |

| Fineness Modulus |
|---|
| 0.02 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 27.7 | 72.3 | |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #8 | 100.0 | | |
| #16 | 100.0 | | |
| #30 | 100.0 | | |
| #50 | 100.0 | | |
| #100 | 99.4 | | |
| #200 | 72.3 | | |

* (no specification provided)

**Material Description**

Sandy Silt/Silty Sand Tan Very Fine Grained Silty Sand

**Atterberg Limits (ASTM D 4318)**

PL= LL= PI=

**Classification**

USCS= AASHTO=

**Coefficients**

$D_{85}$= 0.0978 $D_{60}$= $D_{50}$=
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 12/06/06 **Tested By:** RTH

**Remarks**

**Sample No.:** Silty Sand **Source of Sample:** Silty Sand **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** **Title:**

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

# GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Silty Sand
**Sample Number:** Silty Sand
**Material Description:** Sandy Silt/Silty Sand Tan Very Fine Grained Silty Sand
**Tested By:** RTH **Test Date:** 12/06/06
**Sieve opening list:** (Default opening sizes)

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 1138.25 | 0.00 | 0.00 | #8 | 0.00 | 100.0 |
| | | | #16 | 0.00 | 100.0 |
| | | | #30 | 0.10 | 100.0 |
| | | | #50 | 0.22 | 100.0 |
| | | | #100 | 6.95 | 99.4 |
| | | | #200 | 315.12 | 72.3 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 27.7 | 27.7 | | | 72.3 |

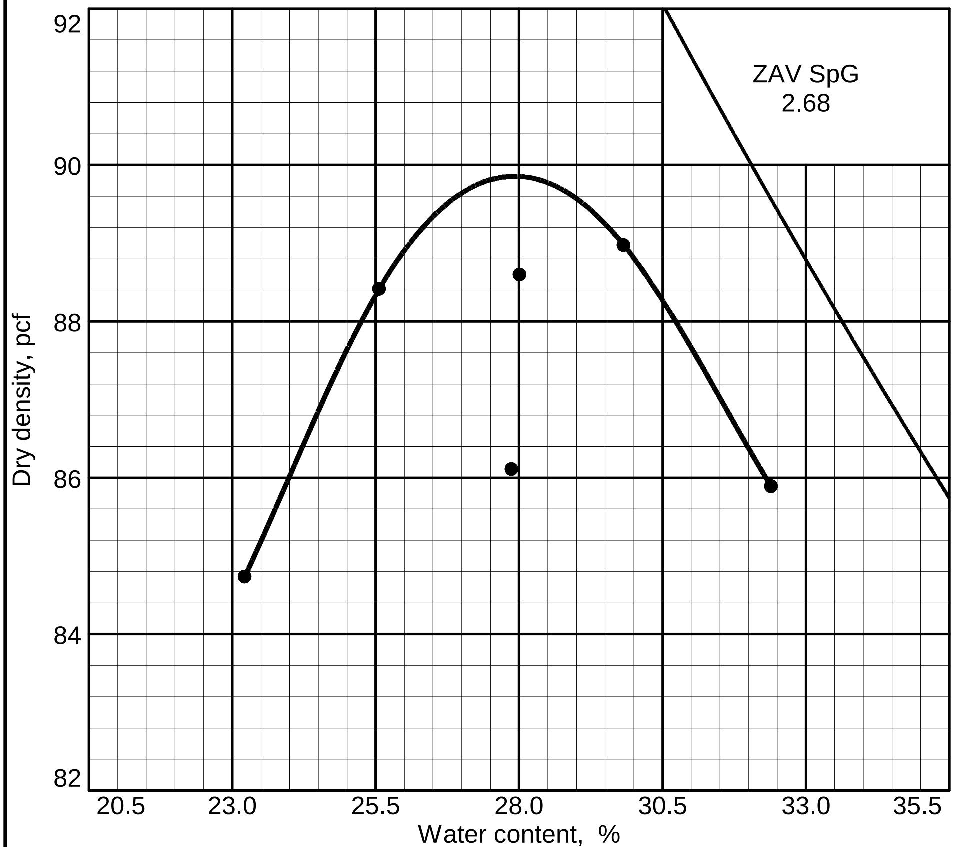
| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 0.0878 | 0.0978 | 0.1100 | 0.1264 |

| Fineness Modulus |
|---|
| 0.01 |

## Appendix 4

# RESULTS OF STANDARD PROCTOR MOISTURE-DENSITY COMPACTION TESTS ON COMPOSITE SAMPLES

# MOISTURE-DENSITY TEST REPORT




## Curve No.
## Composite #1

**Test Specification:**
ASTM D 698-00a Method A Standard

**Preparation Method**
**Hammer Wt.** 5.5 lb.
**Hammer Drop** 12 in.
**Number of Layers** three
**Blows per Layer** 25
**Mold Size** .03333 cu.ft.
**Test Performed on Material Passing** No.4 **Sieve**

**NM** **LL** 85 **PI** 62
**Sp.G. (ASTM D 854)** 2.68
**%>No.4** **%<No.200**
**USCS** CH **AASHTO**
**Date Sampled**
**Date Tested** 11/26/2006
**Tested By** RTH

### TESTING DATA

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **WM + WS** | 8.37 | 8.43 | 8.36 | 8.28 | 8.06 | 8.25 |
| **WM** | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 |
| **WW + T #1** | 320.40 | 272.42 | 288.81 | 294.20 | 248.41 | 216.88 |
| **WD + T #1** | 251.19 | 219.13 | 235.11 | 242.47 | 207.87 | 179.16 |
| **TARE #1** | 40.80 | 40.68 | 40.80 | 38.58 | 32.72 | 43.78 |
| **WW + T #2** | 293.91 | 291.54 | 273.49 | 302.63 | 245.38 | 230.96 |
| **WD + T #2** | 232.59 | 233.92 | 221.34 | 248.74 | 206.19 | 190.11 |
| **TARE #2** | 40.28 | 40.47 | 37.58 | 39.44 | 37.93 | 43.60 |
| **MOISTURE** | 32.4 | 29.8 | 28.0 | 25.6 | 23.2 | 27.9 |
| **DRY DENSITY** | 85.9 | 89.0 | 88.6 | 88.4 | 84.7 | 86.1 |

**TEST RESULTS**

Maximum dry density = 89.9 pcf

Optimum moisture = 27.9 %

**Material Description**

CLAY (CH), dark brownish grey, high plastic

**Remarks:**

**Project No.** 2005012477 **Client:** Ameren Services

**Project:** Sioux Plant UWLF

● **Source:** Composite #1 **Sample No.:** 1

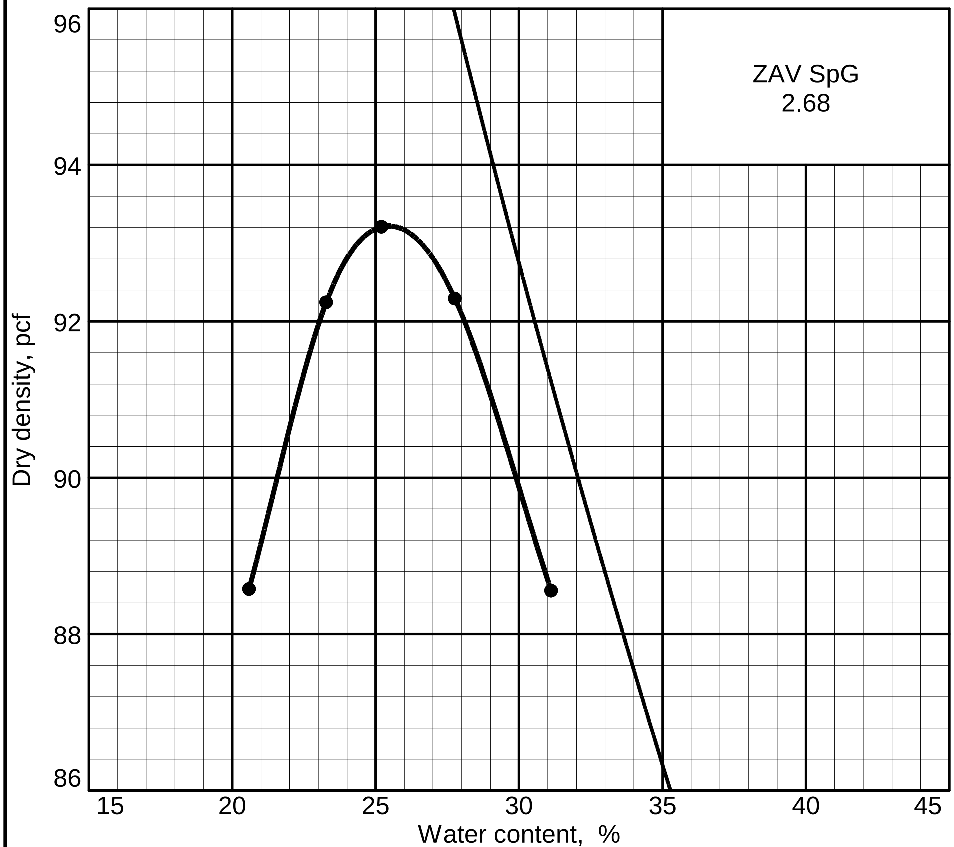
REITZ & JENS, INC.
CONSULTING ENGINEERS

**Checked by:** KEK

**Title:** P.E.

**Figure**

# MOISTURE-DENSITY TEST REPORT




## Curve No.
## Composite #2

**Test Specification:**
ASTM D 698-00a Method A Standard

**Preparation Method** 
**Hammer Wt.** 5.5 lb.
**Hammer Drop** 12 in.
**Number of Layers** three
**Blows per Layer** 25
**Mold Size** .03333 cu.ft.
**Test Performed on Material Passing** No.4 **Sieve**

**NM** **LL** 77 **PI** 53
**Sp.G. (ASTM D 854)** 2.68
**%>No.4** **%<No.200** 
**USCS** CH **AASHTO** 
**Date Sampled** 
**Date Tested** 11/30/2006
**Tested By** RTH

**TESTING DATA**

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **WM + WS** | 8.14 | 8.37 | 8.47 | 8.51 | 8.45 | |
| **WM** | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 | |
| **WW + T #1** | 263.15 | 283.93 | 292.87 | 345.45 | 276.48 | |
| **WD + T #1** | 225.29 | 238.00 | 242.29 | 279.31 | 220.62 | |
| **TARE #1** | 41.32 | 41.01 | 40.67 | 41.13 | 39.44 | |
| **WW + T #2** | 303.06 | 263.55 | 289.01 | 277.83 | 310.28 | |
| **WD + T #2** | 257.81 | 221.50 | 238.80 | 224.74 | 245.88 | |
| **TARE #2** | 38.09 | 40.50 | 40.68 | 33.44 | 40.83 | |
| **MOISTURE** | 20.6 | 23.3 | 25.2 | 27.8 | 31.1 | |
| **DRY DENSITY** | 88.6 | 92.2 | 93.2 | 92.3 | 88.6 | |

**TEST RESULTS**

Maximum dry density = 93.2 pcf

Optimum moisture = 25.5 %

**Material Description**

CLAY (CH), brownish grey, high plastic

**Remarks:**

**Project No.** 2005012477 **Client:** Ameren Services
**Project:** Sioux Plant UWLF

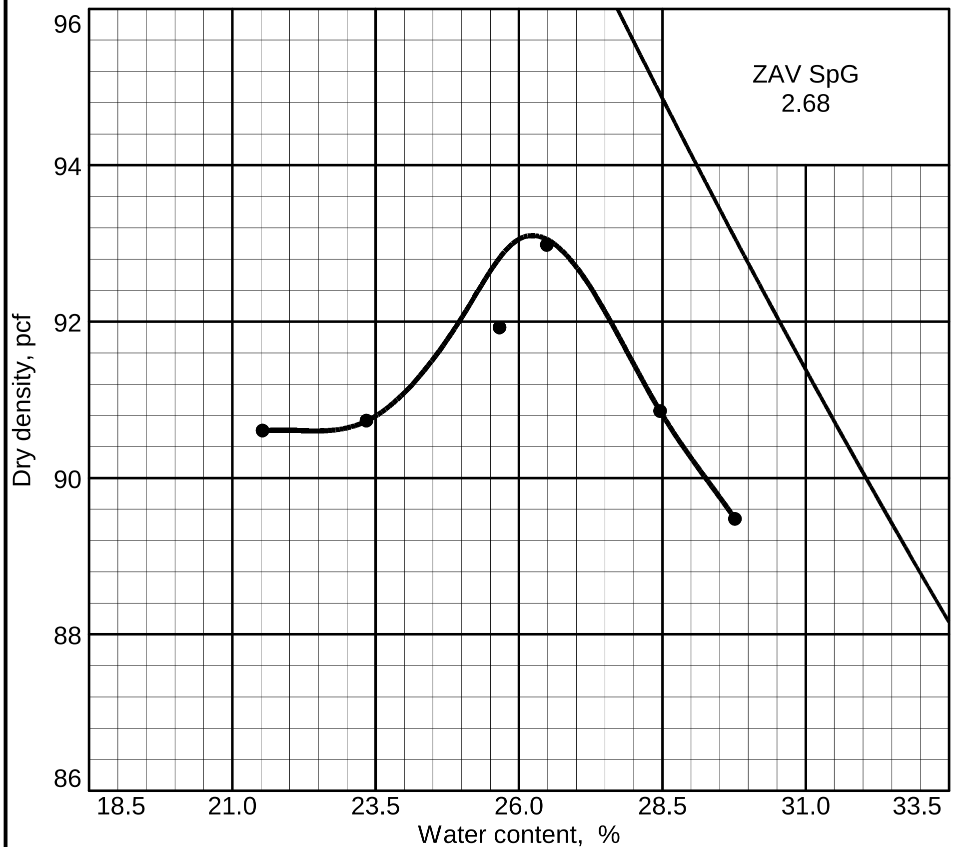
● **Source:** Composite #2 **Sample No.:** 1

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Checked by:** KEK
**Title:** P.E.

**Figure**

# MOISTURE-DENSITY TEST REPORT




## Curve No.
## Composite #3

**Test Specification:**
ASTM D 698-00a Method A Standard

**Preparation Method** ____
**Hammer Wt.** 5.5 lb.
**Hammer Drop** 12 in.
**Number of Layers** three
**Blows per Layer** 25
**Mold Size** .03333 cu.ft.
**Test Performed on Material Passing** No.4 **Sieve**

**NM** ____ **LL** 74 **PI** 52
**Sp.G. (ASTM D 854)** 2.68
**%>No.4** ____ **%<No.200** ____
**USCS** CH **AASHTO** ____
**Date Sampled** ____
**Date Tested** 01/04/2007
**Tested By** RTH & JJP

### TESTING DATA

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **WM + WS** | 8.45 | 8.47 | 8.50 | 8.31 | 8.25 | 8.43 |
| **WM** | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 |
| **WW + T #1** | 194.00 | 316.52 | 260.48 | 264.54 | 243.20 | 203.25 |
| **WD + T #1** | 157.16 | 255.84 | 213.62 | 222.02 | 206.94 | 170.45 |
| **TARE #1** | 33.44 | 40.79 | 36.76 | 41.32 | 39.49 | 43.56 |
| **WW + T #2** | 188.67 | 327.15 | 256.33 | 236.54 | 284.92 | 225.18 |
| **WD + T #2** | 154.79 | 263.05 | 211.19 | 198.89 | 241.90 | 188.29 |
| **TARE #2** | 40.94 | 39.77 | 40.76 | 36.31 | 40.90 | 43.48 |
| **MOISTURE** | 29.8 | 28.5 | 26.5 | 23.3 | 21.5 | 25.7 |
| **DRY DENSITY** | 89.5 | 90.9 | 93.0 | 90.7 | 90.6 | 91.9 |

### TEST RESULTS

Maximum dry density = 93.1 pcf

Optimum moisture = 26.2 %

### Material Description

CLAY (CH), brown to greyish brown, high plastic

**Remarks:**

**Project No.** 2005012477 **Client:** Ameren Services
**Project:** Sioux Plant UWLF

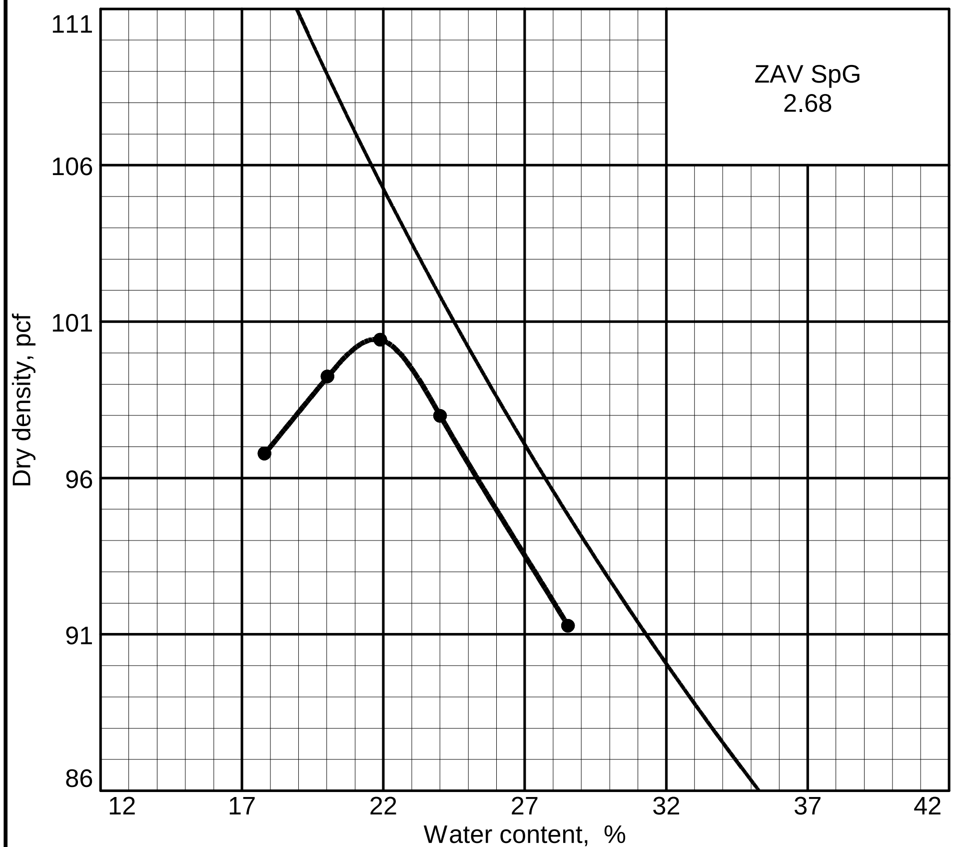
● **Source:** Composite #3 **Sample No.:** 1

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Checked by:** KEK
**Title:** P.E.

**Figure**

# MOISTURE-DENSITY TEST REPORT




**Curve No.**
**Composite #4**

**Test Specification:**
ASTM D 698-00a Method A Standard

**Preparation Method** ______
**Hammer Wt.** 5.5 lb.
**Hammer Drop** 12 in.
**Number of Layers** three
**Blows per Layer** 25
**Mold Size** .03333 cu.ft.

**Test Performed on Material Passing** No.4 **Sieve**

**NM** ______ **LL** 54 **PI** 34
**Sp.G. (ASTM D 854)** 2.68
**%>No.4** ______ **%<No.200** ______
**USCS** CH **AASHTO** ______
**Date Sampled** ______
**Date Tested** 11/26/2006
**Tested By** RTH

**TESTING DATA**

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **WM + WS** | 8.49 | 8.63 | 8.66 | 8.55 | 8.38 | |
| **WM** | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 | |
| **WW + T #1** | 328.58 | 243.66 | 204.74 | 240.86 | 219.73 | |
| **WD + T #1** | 264.13 | 204.35 | 174.65 | 207.13 | 192.82 | |
| **TARE #1** | 38.09 | 40.84 | 37.37 | 40.24 | 40.70 | |
| **WW + T #2** | 289.27 | 238.68 | 211.86 | 246.80 | 213.52 | |
| **WD + T #2** | 234.21 | 200.20 | 181.11 | 212.73 | 187.26 | |
| **TARE #2** | 41.32 | 39.73 | 40.58 | 41.04 | 40.71 | |
| **MOISTURE** | 28.5 | 24.0 | 21.9 | 20.0 | 17.8 | |
| **DRY DENSITY** | 91.3 | 98.0 | 100.4 | 99.2 | 96.8 | |

**TEST RESULTS**

Maximum dry density = 100.4 pcf

Optimum moisture = 21.7 %

**Material Description**

CLAY (CH) brown, with trace silt, med-high plastic

**Remarks:**

**Project No.** 2005012477 **Client:** Ameren Services
**Project:** Sioux Plant UWLF

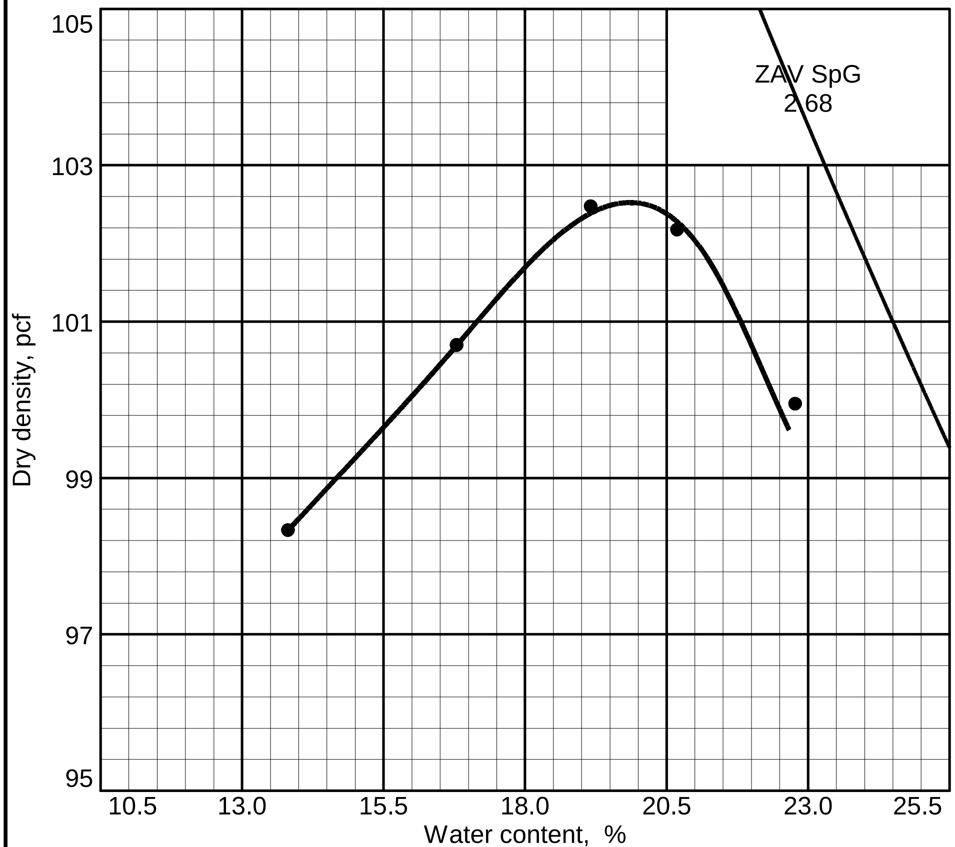
● **Source:** Composite #4 **Sample No.:** 1

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Checked by:** KEK
**Title:** P.E.

**Figure**

# MOISTURE-DENSITY TEST REPORT




**Curve No.**
**Composite #5**

**Test Specification:**
ASTM D 698-00a Method A Standard

**Preparation Method** ______
**Hammer Wt.** 5.5 lb.
**Hammer Drop** 12 in.
**Number of Layers** three
**Blows per Layer** 25
**Mold Size** .03333 cu.ft.
**Test Performed on Material Passing** No.4 **Sieve**

**NM** ______ **LL** 42 **PI** 22
**Sp.G. (ASTM D 854)** 2.68
**%>No.4** ______ **%<No.200** ______
**USCS** CL **AASHTO** ______
**Date Sampled** ______
**Date Tested** 11/29/2006
**Tested By** RTH

**TESTING DATA**

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **WM + WS** | 8.67 | 8.69 | 8.65 | 8.50 | 8.31 | |
| **WM** | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 | |
| **WW + T #1** | 256.14 | 282.53 | 321.53 | 218.32 | 259.39 | |
| **WD + T #1** | 216.18 | 241.82 | 275.55 | 191.99 | 233.30 | |
| **TARE #1** | 40.78 | 43.58 | 34.57 | 34.86 | 44.21 | |
| **WW + T #2** | 248.79 | 270.95 | 206.35 | 263.79 | 264.75 | |
| **WD + T #2** | 209.55 | 231.74 | 178.70 | 232.06 | 237.91 | |
| **TARE #2** | 37.18 | 43.60 | 35.06 | 43.56 | 43.78 | |
| **MOISTURE** | 22.8 | 20.7 | 19.2 | 16.8 | 13.8 | |
| **DRY DENSITY** | 100.0 | 102.2 | 102.5 | 100.7 | 98.3 | |

**TEST RESULTS**

Maximum dry density = 102.5 pcf

Optimum moisture = 19.9 %

**Material Description**

CLAY (CL), brown, silty

**Remarks:**

**Project No.** 2005012477 **Client:** Ameren Services
**Project:** Sioux Plant UWLF

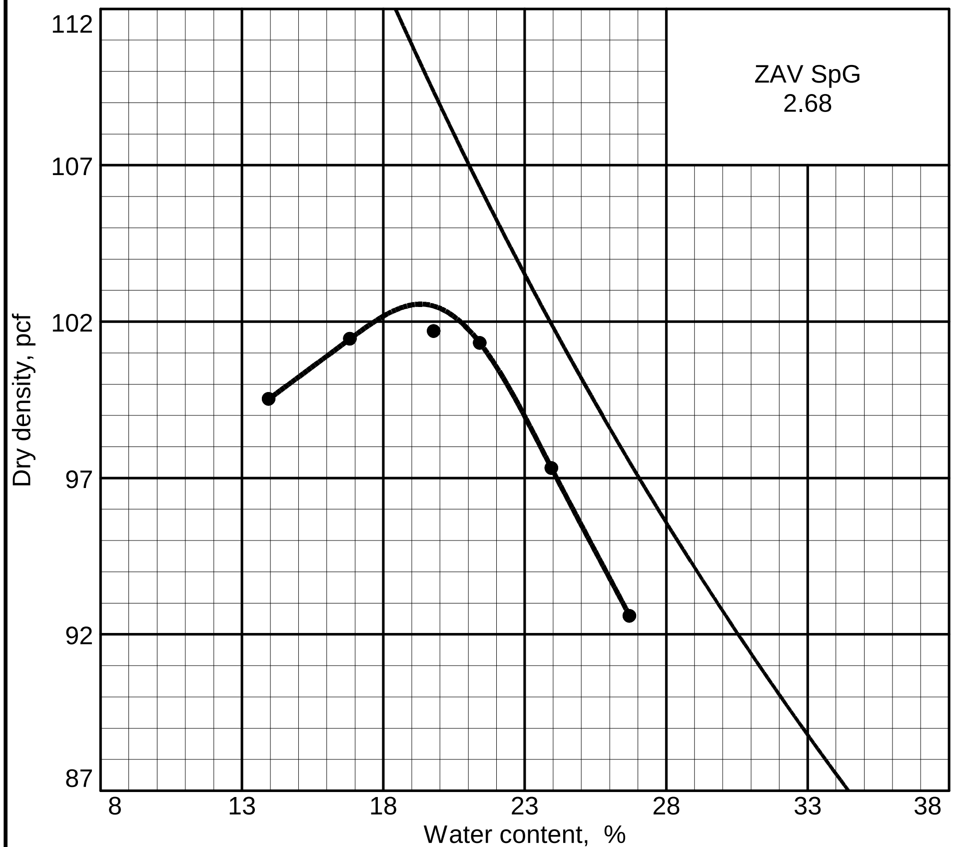
● **Source:** Composite #5 **Sample No.:** 1

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Checked by:** KEK
**Title:** P.E.

**Figure**

# MOISTURE-DENSITY TEST REPORT




## Curve No. Composite #6

**Test Specification:**
ASTM D 698-00a Method A Standard

**Preparation Method** ______
**Hammer Wt.** 5.5 lb.
**Hammer Drop** 12 in.
**Number of Layers** three
**Blows per Layer** 25
**Mold Size** .03333 cu.ft.
**Test Performed on Material Passing** No.4 **Sieve**

**NM** ______ **LL** 40 **PI** 18
**Sp.G. (ASTM D 854)** 2.68
**%>No.4** ______ **%<No.200** ______
**USCS** CL **AASHTO** ______
**Date Sampled** ______
**Date Tested** 12/26/2006
**Tested By** JJP & RTH

### TESTING DATA

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **WM + WS** | 8.36 | 8.64 | 8.68 | 8.60 | 8.49 | 8.53 |
| **WM** | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 |
| **WW + T #1** | 159.09 | 249.57 | 401.17 | 373.73 | 311.04 | 174.18 |
| **WD + T #1** | 144.84 | 215.57 | 337.96 | 308.58 | 253.44 | 155.20 |
| **TARE #1** | 43.58 | 43.66 | 40.84 | 36.76 | 37.73 | 43.48 |
| **WW + T #2** | 169.78 | 345.50 | 382.75 | 375.78 | 290.25 | 149.27 |
| **WD + T #2** | 154.45 | 295.15 | 322.01 | 311.16 | 236.93 | 134.18 |
| **TARE #2** | 43.60 | 40.70 | 40.24 | 40.94 | 37.31 | 43.56 |
| **MOISTURE** | 14.0 | 19.8 | 21.4 | 23.9 | 26.7 | 16.8 |
| **DRY DENSITY** | 99.5 | 101.7 | 101.3 | 97.3 | 92.6 | 101.4 |

### TEST RESULTS

Maximum dry density = 102.6 pcf

Optimum moisture = 19.3 %

### Material Description

CLAY (CL), brown, silty

**Remarks:**

**Project No.** 2005012477 **Client:** Ameren Services
**Project:** Sioux Plant UWLF

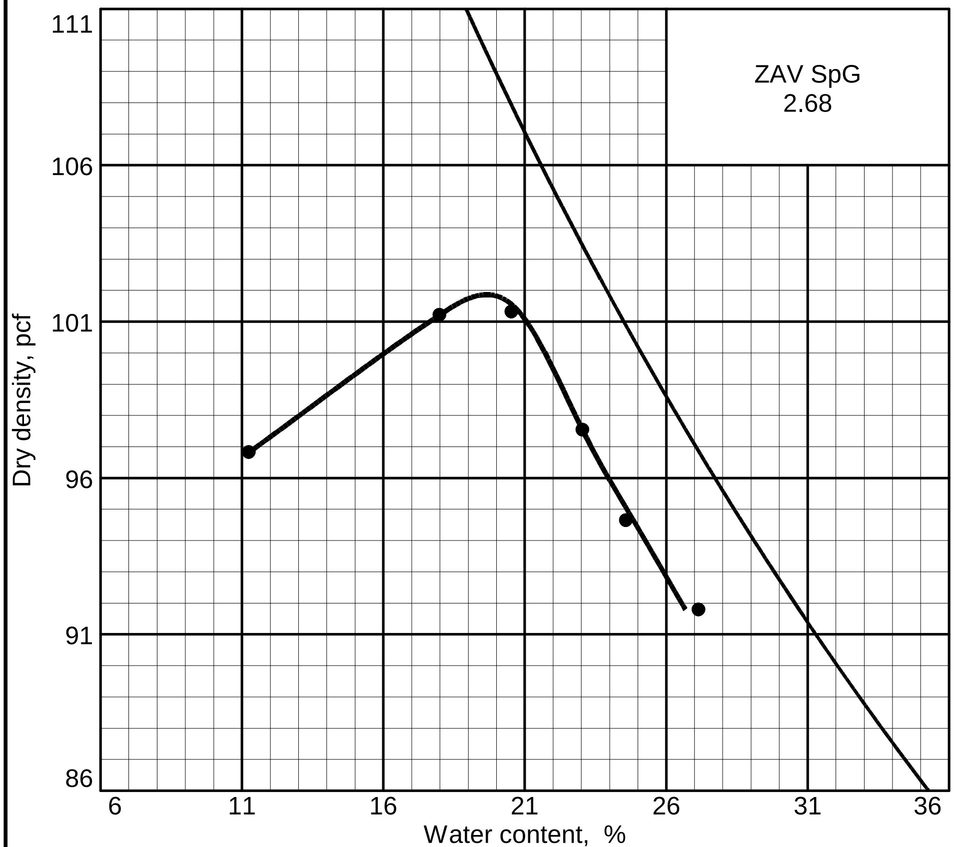
● **Source:** Composite #6 **Sample No.:** 1

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Checked by:** KEK
**Title:** P.E.

**Figure**

# MOISTURE-DENSITY TEST REPORT




**Curve No.**
**Composite #7**

**Test Specification:**
ASTM D 698-00a Method A Standard

**Preparation Method** 
**Hammer Wt.** 5.5 lb.
**Hammer Drop** 12 in.
**Number of Layers** three
**Blows per Layer** 25
**Mold Size** .03333 cu.ft.
**Test Performed on Material Passing** No.4 **Sieve**

**NM** **LL** 36 **PI** 14
**Sp.G. (ASTM D 854)** 2.68
**%>No.4** **%<No.200**
**USCS** CL **AASHTO**
**Date Sampled**
**Date Tested** 11-30-2006
**Tested By** RTH

**TESTING DATA**

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **WM + WS** | 8.65 | 8.47 | 8.58 | 8.51 | 8.56 | 8.17 |
| **WM** | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 |
| **WW + T #1** | 344.04 | 327.90 | 314.93 | 388.66 | 307.05 | 142.97 |
| **WD + T #1** | 292.51 | 266.10 | 263.40 | 319.36 | 266.39 | 131.56 |
| **TARE #1** | 40.58 | 37.93 | 40.63 | 37.58 | 40.88 | 35.05 |
| **WW + T #2** | 292.23 | 284.49 | 289.12 | 362.27 | 322.88 | 149.80 |
| **WD + T #2** | 249.29 | 232.13 | 242.77 | 298.96 | 279.97 | 138.70 |
| **TARE #2** | 40.84 | 39.73 | 40.76 | 41.35 | 40.71 | 34.64 |
| **MOISTURE** | 20.5 | 27.1 | 23.0 | 24.6 | 18.0 | 11.2 |
| **DRY DENSITY** | 101.3 | 91.8 | 97.5 | 94.6 | 101.2 | 96.8 |

**TEST RESULTS**

Maximum dry density = 101.9 pcf

Optimum moisture = 19.7 %

**Material Description**

CLAY (CL), brown, silty

**Remarks:**

**Project No.** 2005012477 **Client:** Ameren Services
**Project:** Sioux Plant UWLF

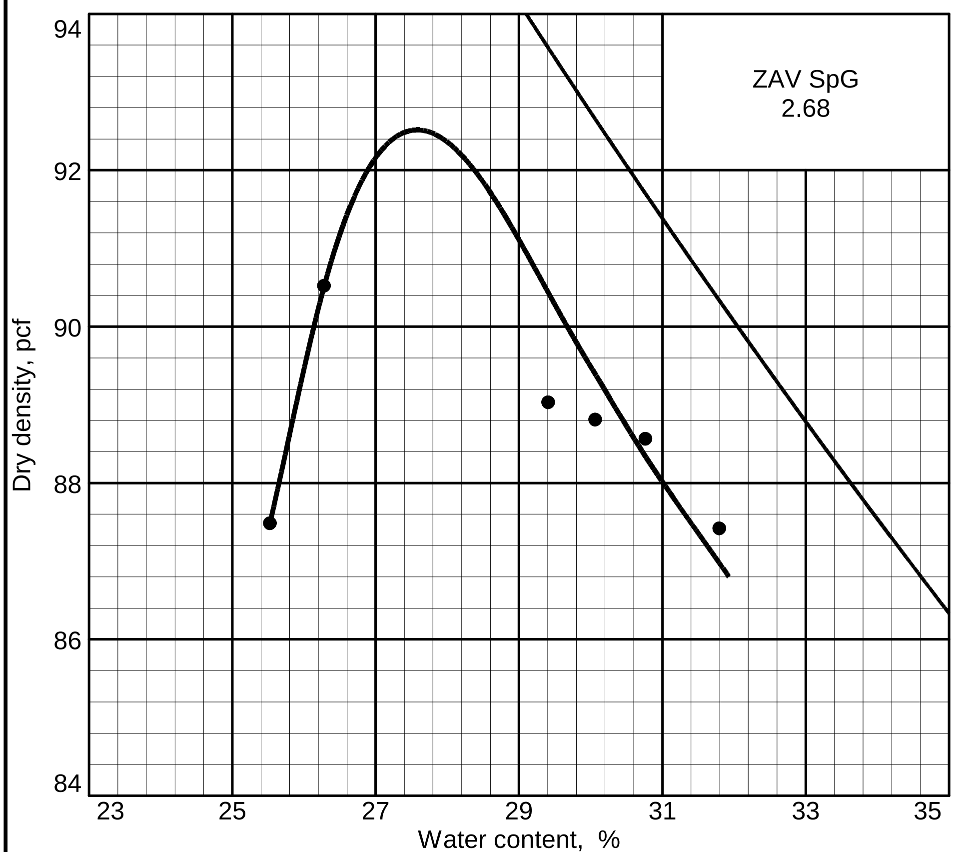
● **Source:** Composite #7 **Sample No.:** 1

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Checked by:** KEK
**Title:** P.E.

**Figure**

# MOISTURE-DENSITY TEST REPORT




## Curve No.
## Composite #8

**Test Specification:**
ASTM D 698-00a Method A Standard

**Preparation Method** ______
**Hammer Wt.** 5.5 lb.
**Hammer Drop** 12 in.
**Number of Layers** three
**Blows per Layer** 25
**Mold Size** .03333 cu.ft.
**Test Performed on Material Passing** No.4 **Sieve**

**NM** ______ **LL** 80 **PI** 58
**Sp.G. (ASTM D 854)** 2.68
**%>No.4** ______ **%<No.200** ______
**USCS** CH **AASHTO** ______
**Date Sampled** ______
**Date Tested** 01/04/2007
**Tested By** RTH & JJP

### TESTING DATA

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **WM + WS** | 8.42 | 8.39 | 8.43 | 8.44 | 8.42 | 8.24 |
| **WM** | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 |
| **WW + T #1** | 201.74 | 319.72 | 208.06 | 320.62 | 322.96 | 167.85 |
| **WD + T #1** | 161.42 | 261.94 | 168.22 | 254.40 | 259.09 | 140.82 |
| **TARE #1** | 35.08 | 40.47 | 35.05 | 37.40 | 40.70 | 34.64 |
| **WW + T #2** | 183.57 | 322.42 | 204.58 | 318.65 | 301.78 | 179.22 |
| **WD + T #2** | 147.80 | 263.47 | 165.21 | 252.84 | 242.23 | 149.81 |
| **TARE #2** | 34.88 | 40.80 | 34.91 | 40.63 | 40.83 | 34.89 |
| **MOISTURE** | 31.8 | 26.3 | 30.1 | 30.8 | 29.4 | 25.5 |
| **DRY DENSITY** | 87.4 | 90.5 | 88.8 | 88.6 | 89.0 | 87.5 |

### TEST RESULTS

Maximum dry density = 92.5 pcf

Optimum moisture = 27.6 %

### Material Description

CLAY (CH), brown to greyish brown, high plastic

**Remarks:**

**Project No.** 2005012477 **Client:** Ameren Services
**Project:** Sioux Plant UWLF

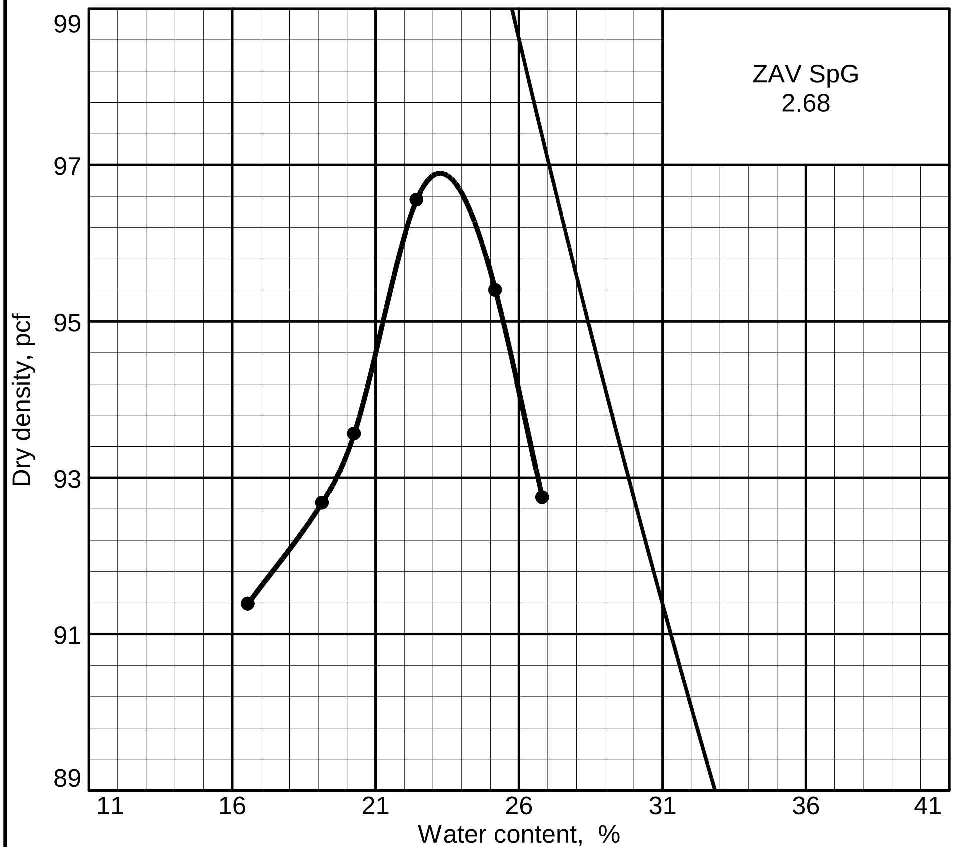
● **Source:** Composite #8 **Sample No.:** 1

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Checked by:** KEK
**Title:** P.E.

**Figure**

# MOISTURE-DENSITY TEST REPORT




**Curve No.**
**Composite #9**

**Test Specification:**
ASTM D 698-00a Method A Standard

**Preparation Method** ______
**Hammer Wt.** 5.5 lb.
**Hammer Drop** 12 in.
**Number of Layers** three
**Blows per Layer** 25
**Mold Size** .03333 cu.ft.
**Test Performed on Material Passing** No.4 **Sieve**

**NM** ______ **LL** 61 **PI** 41
**Sp.G. (ASTM D 854)** 2.68
**%>No.4** ______ **%<No.200** ______
**USCS** CH **AASHTO** ______
**Date Sampled** ______
**Date Tested** 12/04/2006
**Tested By** RTH

## TESTING DATA

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **WM + WS** | 8.52 | 8.33 | 8.26 | 8.13 | 8.50 | 8.56 |
| **WM** | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 |
| **WW + T #1** | 294.07 | 325.99 | 308.32 | 334.93 | 300.99 | 344.94 |
| **WD + T #1** | 247.63 | 277.78 | 264.93 | 293.18 | 246.27 | 283.51 |
| **TARE #1** | 40.84 | 40.80 | 36.76 | 40.28 | 40.84 | 40.79 |
| **WW + T #2** | 326.88 | 311.62 | 298.86 | 336.40 | 298.69 | 341.95 |
| **WD + T #2** | 274.00 | 266.16 | 257.22 | 294.42 | 243.80 | 281.67 |
| **TARE #2** | 37.93 | 40.68 | 40.88 | 41.32 | 40.30 | 40.84 |
| **MOISTURE** | 22.4 | 20.3 | 19.1 | 16.5 | 26.8 | 25.2 |
| **DRY DENSITY** | 96.6 | 93.6 | 92.7 | 91.4 | 92.8 | 95.4 |

## TEST RESULTS

Maximum dry density = 96.9 pcf

Optimum moisture = 23.2 %

## Material Description

CLAY (CH), brownish grey, moderately high plastic, trace silt

**Remarks:**

**Project No.** 2005012477 **Client:** Ameren Services
**Project:** Sioux Plant UWLF

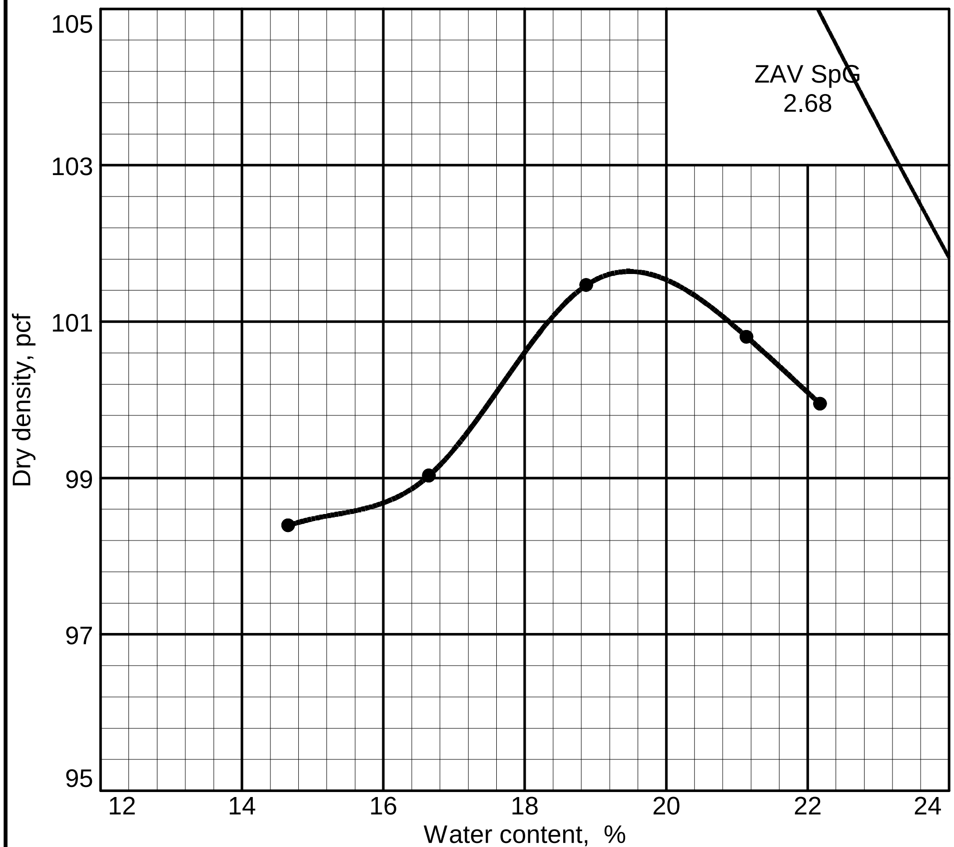
● **Source:** Composite #9 **Sample No.:** 1

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Checked by:** KEK
**Title:** P.E.

**Figure**

# MOISTURE-DENSITY TEST REPORT




**Curve No.**
**Composite #10**

**Test Specification:**
ASTM D 698-00a Method A Standard

**Preparation Method** ______
**Hammer Wt.** 5.5 lb.
**Hammer Drop** 12 in.
**Number of Layers** three
**Blows per Layer** 25
**Mold Size** .03333 cu.ft.
**Test Performed on Material Passing** No.4 **Sieve**
**NM** ______ **LL** 42 **PI** 25
**Sp.G. (ASTM D 854)** 2.68
**%>No.4** ______ **%<No.200** ______
**USCS** CL **AASHTO** ______
**Date Sampled** ______
**Date Tested** 12/26/2006
**Tested By** RTH & JJP

**TESTING DATA**

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **WM + WS** | 8.65 | 8.65 | 8.60 | 8.43 | 8.34 | |
| **WM** | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 | |
| **WW + T #1** | 127.16 | 309.62 | 313.73 | 329.25 | 331.10 | |
| **WD + T #1** | 109.88 | 262.10 | 270.22 | 288.02 | 293.95 | |
| **TARE #1** | 30.58 | 37.58 | 39.77 | 40.78 | 40.24 | |
| **WW + T #2** | 125.33 | 294.21 | 324.38 | 333.49 | 263.89 | |
| **WD + T #2** | 108.68 | 250.01 | 278.40 | 291.30 | 234.78 | |
| **TARE #2** | 34.88 | 40.67 | 34.57 | 37.31 | 36.31 | |
| **MOISTURE** | 22.2 | 21.1 | 18.9 | 16.6 | 14.7 | |
| **DRY DENSITY** | 99.9 | 100.8 | 101.5 | 99.0 | 98.4 | |

**TEST RESULTS**

Maximum dry density = 101.6 pcf

Optimum moisture = 19.5 %

**Material Description**

CLAY (CL), brown, silty

**Remarks:**

**Project No.** 2005012477 **Client:** Ameren Services
**Project:** Sioux Plant UWLF

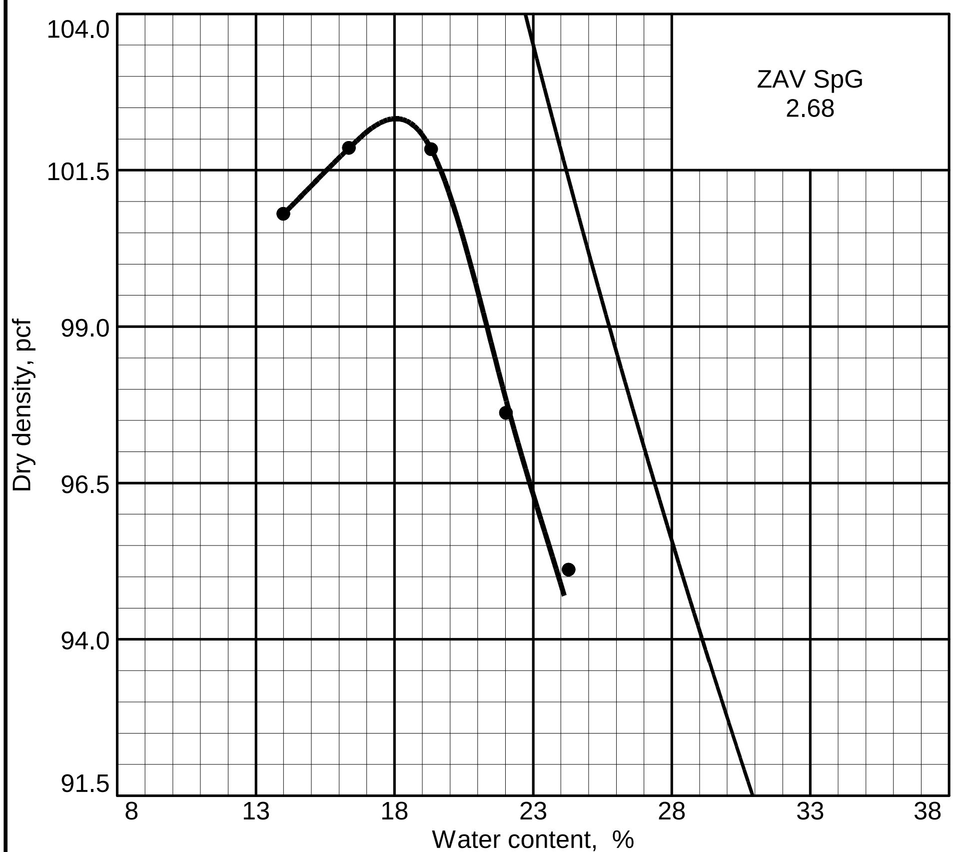
● **Source:** Composite #10 **Sample No.:** 1

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Checked by:** KEK
**Title:** P.E.

**Figure**

# MOISTURE-DENSITY TEST REPORT




## Curve No.
## Composite #7.a

**Test Specification:**
ASTM D 698-00a Method A Standard

**Preparation Method** ______

**Hammer Wt.** 5.5 lb.

**Hammer Drop** 12 in.

**Number of Layers** three

**Blows per Layer** 25

**Mold Size** .03333 cu.ft.

**Test Performed on Material Passing** No.4 **Sieve**

**NM** ______ **LL** 30 **PI** 7

**Sp.G. (ASTM D 854)** 2.68

**%>No.4** ______ **%<No.200** ______

**USCS** ML **AASHTO** ______

**Date Sampled** ______

**Date Tested** 01/02/2007

**Tested By** JJP

### TESTING DATA

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **WM + WS** | 8.52 | 8.55 | 8.63 | 8.53 | 8.41 | |
| **WM** | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 | |
| **WW + T #1** | 152.29 | 134.87 | 134.02 | 133.39 | 129.53 | |
| **WD + T #1** | 126.76 | 114.53 | 116.46 | 118.27 | 116.13 | |
| **TARE #1** | 21.80 | 22.25 | 22.26 | 22.44 | 22.07 | |
| **WW + T #2** | 165.77 | 151.01 | 152.42 | 144.56 | 133.37 | |
| **WD + T #2** | 137.77 | 127.80 | 130.73 | 126.82 | 119.88 | |
| **TARE #2** | 22.30 | 22.29 | 22.30 | 22.04 | 21.79 | |
| **MOISTURE** | 24.3 | 22.0 | 19.3 | 16.4 | 14.0 | |
| **DRY DENSITY** | 95.1 | 97.6 | 101.8 | 101.9 | 100.8 | |

### TEST RESULTS

Maximum dry density = 102.3 pcf

Optimum moisture = 18.0 %

### Material Description

SILT, (ML) brown, slightly clayey with very fine sand
70% Composite #7 with 30% silty fine sand

**Remarks:**
70% Composite #7 with 30% silty fine sand

**Project No.** 2005012477 **Client:** Ameren Services

**Project:** Sioux Plant UWLF

● **Source:** Composite#7(70%) & silty fine **Sample No.:** 1

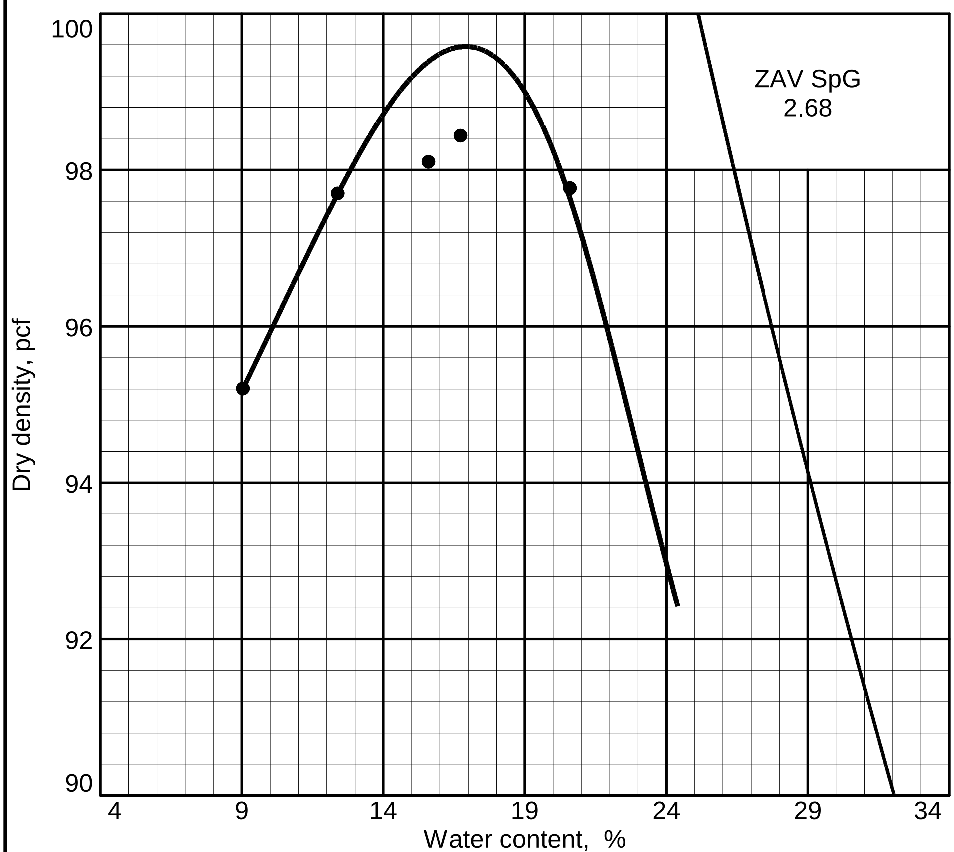
REITZ & JENS, INC.
CONSULTING ENGINEERS

**Checked by:** KEK

**Title:** P.E.

**Figure**

# MOISTURE-DENSITY TEST REPORT




## Curve No.
## Silty Fine Sand

**Test Specification:**
ASTM D 698-00a Method A Standard

**Preparation Method** ____________
**Hammer Wt.** 5.5 lb.
**Hammer Drop** 12 in.
**Number of Layers** three
**Blows per Layer** 25
**Mold Size** .03333 cu.ft.
**Test Performed on Material Passing** No.4 **Sieve**

**NM** ______ **LL** ______ **PI** ______
**Sp.G. (ASTM D 854)** 2.68
**%>No.4** ______ **%<No.200** ______
**USCS** ______ **AASHTO** ______
**Date Sampled** ______
**Date Tested** 01/02/2007
**Tested By** JJP

### TESTING DATA

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **WM + WS** | 8.04 | 8.51 | 8.41 | 8.36 | 8.24 | |
| **WM** | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 | |
| **WW + T #1** | 131.20 | 177.62 | 171.70 | 226.85 | 210.00 | |
| **WD + T #1** | 122.87 | 153.38 | 151.99 | 202.17 | 191.64 | |
| **TARE #1** | 35.16 | 35.03 | 34.96 | 43.60 | 43.78 | |
| **WW + T #2** | 155.40 | 182.58 | 165.78 | 218.14 | 201.57 | |
| **WD + T #2** | 145.88 | 157.25 | 147.12 | 194.61 | 184.18 | |
| **TARE #2** | 34.96 | 35.06 | 34.86 | 44.21 | 43.66 | |
| **MOISTURE** | 9.0 | 20.6 | 16.7 | 15.6 | 12.4 | |
| **DRY DENSITY** | 95.2 | 97.8 | 98.4 | 98.1 | 97.7 | |

### TEST RESULTS

Maximum dry density = 99.6 pcf

Optimum moisture = 16.9 %

### Material Description

SAND (SM) light brown, silty, fine grained

**Remarks:**

**Project No.** 2005012477 **Client:** Ameren Services
**Project:** Sioux Plant UWLF

● **Source:** Silty Fine Sand **Sample No.:** 1

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Checked by:** KEK
**Title:** P.E.

**Figure**

**Appendix 5**

# RESULTS OF FLEXIBLE-WALL HYDRAULIC CONDUCTIVITY TESTS ON COMPACTED COMPOSITE SAMPLES

Ameren - S  Power Plant
Utility Waste Disposal Area

**Test Pit Summary Table**

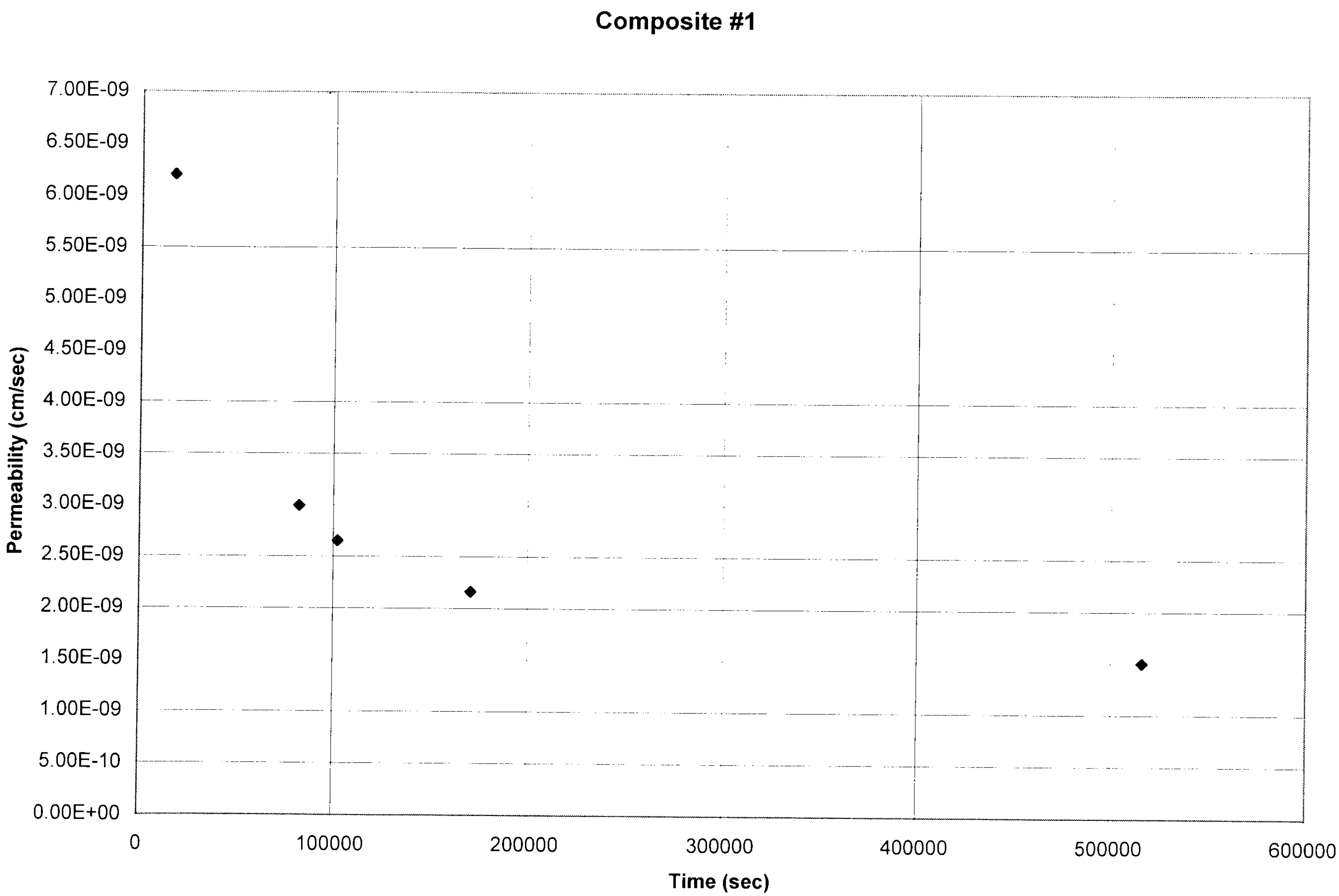
| Composite # | USCS Class | Liquid Limit | Plastic Index | Standard Proctor | | Permeability Sample | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Maximum Dry Density (ASTM D-698) pcf | Optimum Moisture (ASTM D-698) | Dry Density (pcf) | Moisture Content | k (cm/sec) |
| 1 | CH | 85 | 62 | 89.9 | 27.9% | 90.7 | 29.3% | 1.5E-09 |
| 2 | CH | 77 | 53 | 93.2 | 25.5% | 93.7 | 27.1% | 2.2E-09 |
| 3 | CH | 74 | 52 | 93.0 | 26.3% | 92.7 | 28.2% | 1.9E-09 |
| 4 | CH | 54 | 34 | 100.4 | 21.7% | 100.5 | 23.8% | 3.0E-09 |
| 5 | CL | 42 | 22 | 102.5 | 19.6% | 103.7 | 20.6% | 2.7E-08 |
| 6 | CL | 40 | 18 | 101.7 | 20.2% | 94.2 | 26.5% | 1.7E-08 |
| 7 | CL | 36 | 14 | 101.7 | 19.5% | 96.1 | 25.0% | 2.3E-07 |
| 8 | CH | 80 | 58 | 90.6 | 26.5% | 91.3 | 27.8% | 3.6E-09 |
| 9 | CH | 61 | 41 | 96.9 | 23.2% | 95.2 | 26.5% | 2.8E-09 |
| 10 | CL | 42 | 25 | 101.6 | 19.4% | 99.2 | 22.3% | 1.6E-08 |
| 70% Composite #7 plus 30% fine sand | CL | 30 | 23 | 102.3 | 18.0% | 98.1 | 23.6% | 4.5E-07 |
| Silty Fine Sand | ML | | | 99.6 | 16.9% | 99.7 | 19.1% | 2.5E-05 |

## Ameren, Soiux UWLF
**Project # 2005012477**
**Compostite #1**
**Hydraulic Conductivity**

| Soil Conditions | |
|---|---|
| **Pre-test conditions** | **Post-test Conditions** |
| Wet Density = 117.3 (lbs/ft^3) | Wet Density = 116.8 (lbs/ft^3) |
| % Moisture = 29.3% | % Moisture = 35.0% |
| Dry Density = 90.7 (lbs/ft^3) | Dry Density = 86.5 (lbs/ft^3) |

| Test Information | |
|---|---|
| a (cm^2)= | 0.19685 |
| L (cm)= | 8.359563 |
| A (cm^2)= | 20.662032 |

| | | | | Base Burette | | Top Burette | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Time | Elapsed Time (seconds) | Cell Burette Reading (ml) | Reading (ml) | Distance from Datum (cm) | Reading (ml) | Distance from Datum (cm) | Total Head Across Sample (cm of water) | Temperature (°C) | Weighted Average Temp. (°C) | Uncorrected Hydraulic Conductivity (cm/sec) | Correction Factor | Corrected Hydraulic Conductivity (cm/sec) |
| 12/27/2006 | 9:05 | 0 | 10.7 | 10.00 | 27.200 | 0.00 | 78.000 | 240.770 | 20.9 | | | | |
| | 13:50 | 17100 | 10.8 | 9.93 | 27.556 | 0.06 | 77.695 | 240.110 | 21.7 | 21.30 | 6.40E-09 | 0.9693013 | 6.20E-09 |
| 12/28/2006 | 8:00 | 82500 | 11.0 | 9.81 | 28.165 | 0.11 | 77.441 | 239.246 | 20.1 | 20.98 | 3.06E-09 | 0.9766988 | 2.99E-09 |
| | 13:30 | 102300 | 10.9 | 9.81 | 28.165 | 0.14 | 77.289 | 239.094 | 22.7 | 21.06 | 2.72E-09 | 0.9748066 | 2.65E-09 |
| 12/29/2006 | 8:30 | 170700 | 11.2 | 9.73 | 28.572 | 0.18 | 77.086 | 238.484 | 20.2 | 21.22 | 2.23E-09 | 0.9711948 | 2.16E-09 |
| 1/2/2007 | 8:30 | 516300 | 11.7 | 9.56 | 29.435 | 0.48 | 75.562 | 236.096 | 19.7 | 20.37 | 1.51E-09 | 0.9912832 | 1.50E-09 |



Composite #1
Permeability (cm/sec)
7.00E-09
6.50E-09
6.00E-09
5.50E-09
5.00E-09
4.50E-09
4.00E-09
3.50E-09
3.00E-09
2.50E-09
2.00E-09
1.50E-09
1.00E-09
5.00E-10
0.00E+00
0
100000
200000
300000
400000
500000
600000
Time (sec)

# Hydraulic Conductivity (ASTM-D 5084)
## Flow Rate Calculation

Job------- Ameron Sioux UWLF
Location-
Sample--- Composite #1
Depth-----

a=
A=
L=

Cell No. 3

| Cell Pressure (p.s.i.) | Base Pressure (p.s.i.) | Top Pressure (p.s.i.) |
|---|---|---|
| 92.7 | 85.0 | 87.7 |

| Date | Time | Elapsed Time Minutes | Cell Reading ML | Base Reading ML | Top Reading ML | Top Head CM | Base Head CM | h CM | Temp. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| 12-27-06 | 9:05 | 0 | 10.7 | 10.00 | 0.00 | | | | 20.9 | |
| | 13:50 | 285 | 10.75 | 9.93 | 0.06 | | | | 21.7 | |
| 12-28-06 | 8:00 | 1375 | 11.00 | 9.81 | 0.11 | | | | 20.1 | |
| | 13:30 | 1705 | 10.85 | 9.81 | 0.14 | | | | 22.7 | |
| 12-29-06 | 8:30 | 2845 | 11.20 | 9.73 | 0.18 | | | | 20.2 | |
| 1-2-07 | 8:30 | 8605 | 11.65 | 9.56 | 0.48 | | | | 19.7 | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

| a x L | t (sec) | 2 x A x t | aL/2At | h1 | h2 | ln(h1/h2) | K | Temp. Cor. | K -Cor. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

# TRIAXIAL CELL SETUP & TAKEDOWN

Project Ameren Sioux UWLF — Date 11-28-06

Sample Composite #1 — Depth Standard Proctor +12% Moisture

Description CLAY (CH), Brown & Grey, High Plastic

Type of Test Hyd. Cond. — Confining Pressure Differential

Cell Number 3 — Saturate (before) after Consolidation

Number of Membranes 2 — Filter Strips Yes (No)

| LENGTH CHANGE | |
|---|---|
| STRAIN GAUGE at setup | — |
| at saturation start | — |
| at consolidation start | |
| at axial load start | |

| MOISTURE CONTENT | INITIAL | | FINAL |
|---|---|---|---|
| Tare No. | M34 | 43 | |
| Wet Wt. + Tare | 93.48 | 103.14 | |
| Dry Wt. + Tare | 77.42 | 84.66 | |
| Wt. Water | | | |
| Tare Wt. | 22.37 | 21.93 | |
| Dry Soil Wt. | | | |
| Moisture % | 29.173 | 29.480 | |
| Avg. w % | 29.3265 | | |

| MASS PROPERTIES | | |
|---|---|---|
| Wt. Tube + Soil | | gm. |
| Wt. Tube | | gm. |
| Wt. Soil | 389.61 | gm. |
| Tube Diameter | | in. |
| Sample Length | | in |
| tube length | | in. |
| top trim | | in. |
| bottom trim | | in. |
| total trim | | in. |
| sample length | | in. |
| Density constant | | |
| 4.85/(D^2 * L) | | |
| Wet Density | | pcf. |
| Dry Density | | pcf. |

| SPECIMEN DIMENSIONS in. / mm. | HEIGHT | | DIAMETER | |
|---|---|---|---|---|
| | Initial | Final | Initial | Final |
| 1 | 3.2235 | 3.2880 | T 2.0000 | 2.0175 |
| 2 | 3.2210 | 3.2925 | M 1.9890 | 2.0165 |
| 3 | 3.2170 | 3.2930 | B 1.9910 | 2.0240 |
| Avg. | 3.2205 / 8.18007 | 3.29117 / 8.359563 | 1.99333 / 5.0631 | 2.019333 / 5.129107 |

A = 20.1345
V = 164.6

Description After Test — Final wt = 323.09 — $V_t$ = 164.69

$m_s$ = 239.402 — $m_w$ = 70.208

e = 0.8436397

Remarks

Initial: $\gamma_{moist}$ = 117.3; $\gamma_{dry}$ = 90.7; %m = 29.3

Final: $\gamma_{moist}$ = 116.76; $\gamma_{dry}$ 86.5; %m 35.0

Failure Sketch

Trimmed By KDL
Trimmed Date 11-28-06

Setup By KDL
Setup Date 11-28-06

Taken Down By
Take Down Date

trxSTUP.dwg revl. /12/98

REITZ & JENS, INC. Consulting Engineers — Sheet ______ of ______

# TRIAXIAL CELL SATURATION & BETA FACTOR

PROJECT: Ameron Sioux UWLF

SAMPLE: Composite #1 DEPTH: 

INITIAL CELL PRESSURE: 71.0 START DATE: 11-28-06

INITIAL PORE PRESSURE: 70.0 CELL NUMBER: 3

INITIAL TRANSDUCER READING: 71.1 TRANSDUCER NUMBER: 3

| TRIAL DATE | TRIAL TIME | BASE BURETTE READING | CELL PRESSURE | TRANS-DUCER READING | CHANGE IN PRESSURE (Transducer Constant ___): CELL DELTA (1) | TRANSDUCER: READING CHANGE | TRANSDUCER: PRESSURE CHANGE (2) | BETA FACTOR (2/1) |
|---|---|---|---|---|---|---|---|---|
| 12-5-06 | 0 | 2.04 | 71.0 | 70.7 | | | | |
| | 1 | | 76.0 | 75.3 | 5.0 | | 4.6 | 0.92 |
| | 2 | | 76.0 | 75.3 | 5.0 | | 4.6 | 0.92 |
| | 4 | | 76.0 | 75.3 | 5.0 | | 4.6 | 0.92 |
| | 8 | | 76.0 | 75.3 | 5.0 | | 4.6 | 0.92 |
| | | | Continue to | Saturate | | | | |
| | | | | | | | | |
| | | | | | | | | |
| 12-8-06 | 0 | 4.07 | 76.0 | 76.1 | | | | |
| | 1 | | 81.0 | 80.6 | 5.0 | | 4.5 | 0.90 |
| | 2 | | 81.0 | 80.7 | 5.0 | | 4.6 | 0.92 |
| | 4 | | 81.0 | 80.7 | 5.0 | | 4.6 | 0.92 |
| | 8 | | 81.0 | 80.7 | 5.0 | | 4.6 | 0.92 |
| | | | | | | | | |
| | | | Continue to | Sat. | | | | |
| | | | | | | | | |
| 12-~~8~~6-06 | 0 | 2.33 | 81.0 | 81.5 | | | | |
| | 1 | | 86.0 | 86.2 | 5.0 | | 4.7 | 0.94 |
| | 2 | | ↓ | 86.2 | 5.0 | | 4.7 | 0.94 |
| | 4 | | ↓ | 86.2 | 5.0 | | 4.7 | 0.94 |
| | 8 | | ↓ | 86.2 | 5.0 | | 4.7 | 0.94 |
| | | | | | | | | |
| 12-26-06 | 0 | 8.90 | 90.0 | 84.7 | | | | |
| | 1 | | 95.0 | 89.2 | 5.0 | | 4.5 | 0.90 |
| | 2 | | 95.0 | 89.3 | 5.0 | | 4.6 | 0.92 |
| | 4 | | 95.0 | 89.3 | 5.0 | | 4.6 | 0.92 |
| | 8 | | 95.0 | 89.3 | 5.0 | | 4.6 | 0.92 |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

# TRIAXIAL CELL CONSOLIDATION TEST

PROJECT American Sioux UWLF

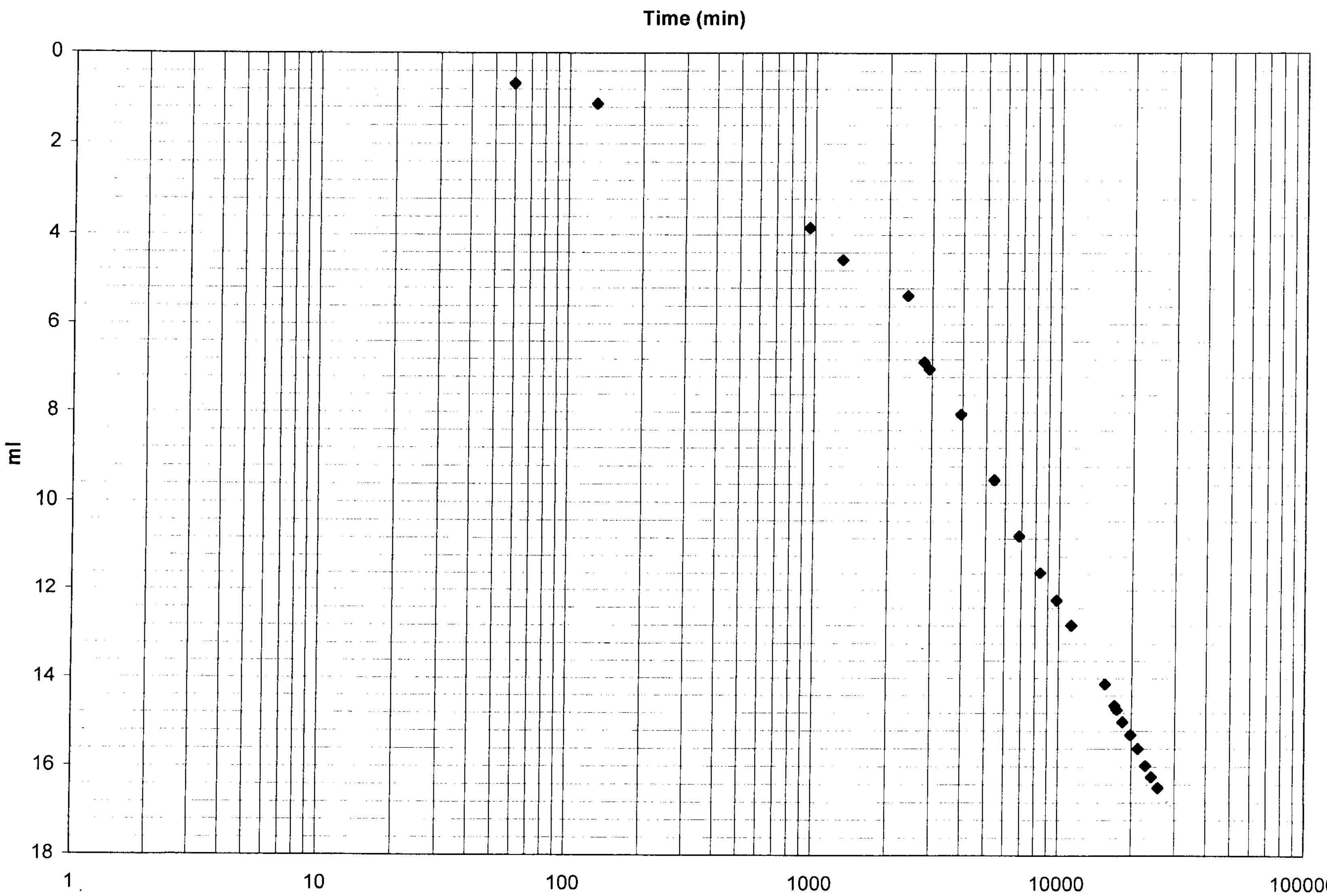
SAMPLE Composite #1 DEPTH

CONSOLIDATION CELL PRESSURE 90.0 CELL NUMBER 3

CONSOLIDATION PORE PRESSURE 85.0

| DATE | TIME | BURETTE READING | DELTA VOLUME | SUM DELTA VOLUME | DELTA TIME | TEMP | REMARKS |
|---|---|---|---|---|---|---|---|
| 12-19-06 | 10:40 | 10.00 | | | 0 | | Cell 8.00 |
| | | 9.86 | 0.14 | 0.14 | .1 | | |
| | | 9.86 | 0.00 | 0.14 | .25 | | |
| | | 9.85 | 0.01 | 0.15 | .5 | | |
| | 10:41 | 9.85 | 0.00 | 0.15 | 1 | | |
| | 10:42 | 9.84 | 0.01 | 0.16 | 2 | | Cell 8.70 |
| | 10:44 | 9.83 | 0.01 | 0.17 | 4 | | |
| | 10:48 | 9.82 | 0.01 | 0.18 | 8 | | |
| | 10:55 | 9.80 | 0.02 | 0.20 | 15 | | Cell 8.75 |
| | 11:10 | 9.78 | 0.02 | 0.22 | 30 | | |
| | 12:10 | 9.72 | 0.06 | 0.28 | 90 | | |
| | 13:40 | 9.68 | 0.04 | 0.32 | 180 | | |
| | 16:25 | 9.58 | 0.10 | 0.42 | 345 | | |
| 12-20-06 | 7:53 | 9.32 | 0.26 | 0.68 | 1273 | | Cell 9.10 |
| | 13:15 | 9.26 | 0.06 | 0.74 | 1595 | | |
| | 16:30 | 9.24 | 0.02 | 0.76 | 1790 | | |
| 12-21-06 | 8:20 | 9.11 | 0.13 | 0.89 | 2740 | | |
| 12-22-06 | 7:30 | 9.00 | 0.11 | 1.00 | 4130 | | Cell 9.7 |
| | 1508 | 8.95 | 0.05 | 1.05 | 4588 | | cell 9.5 |
| | 2240 | 8.94 | 0.01 | 1.06 | 5040 | | |
| 12/23 | 1339 | 8.96 | -0.02 | 1.04 | 5939 | | cell 10.0 |
| 12/24 | 14:22 | 8.88 | 0.08 | 1.12 | 7422 | | cell 10.0 |
| 12/26 | 7:40 | 8.99 | -0.11 | 1.01 | 9900 | | cell 10.4 |
| 12/27 | 9:00 | 8.98 | 0.01 | 0.02 | | | |

Composite #1

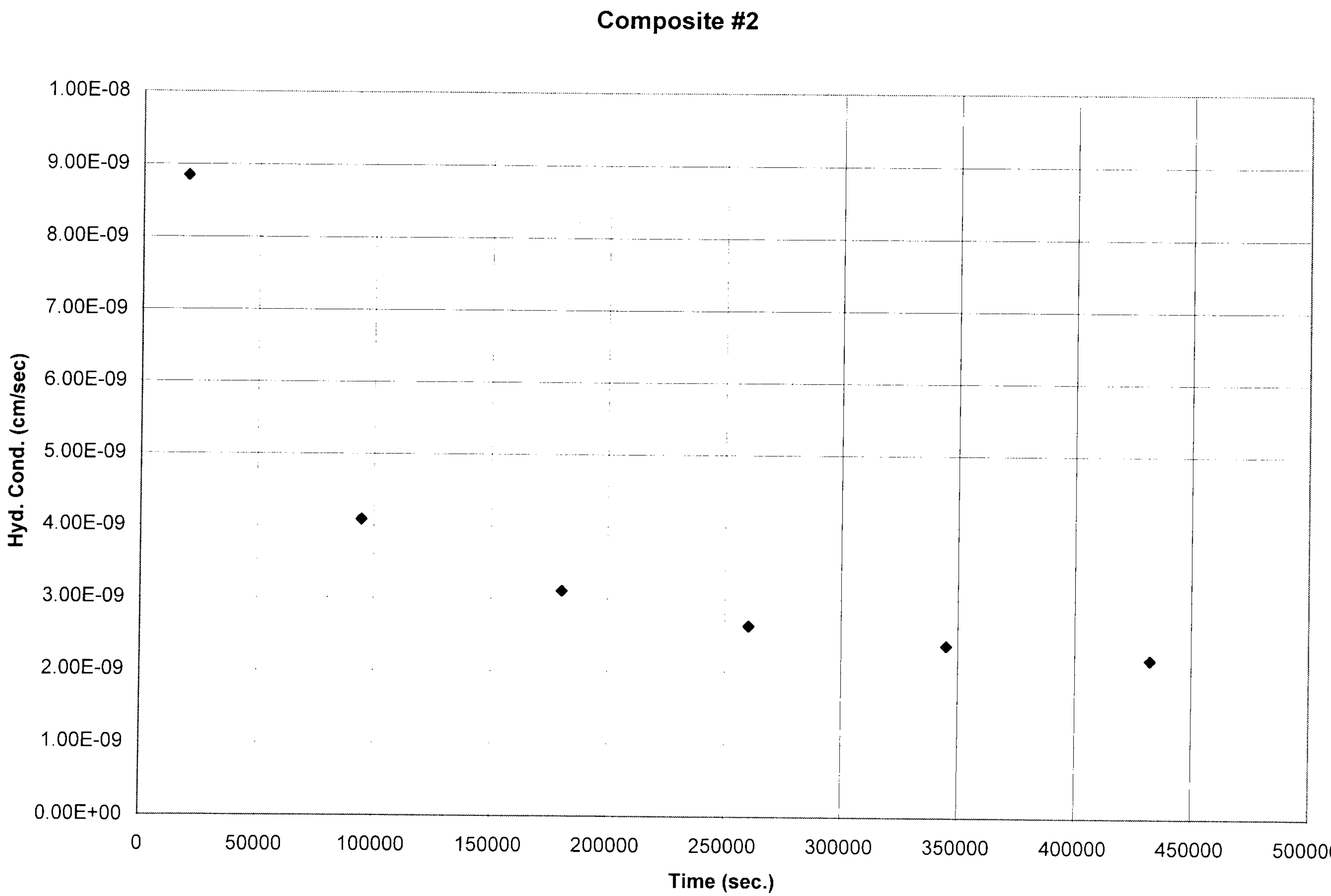


## Ameren, Soiux UWLF
**Project # 2005012477**
**Compostite #2**
**Hydraulic Conductivity**

| Soil Conditions | |
|---|---|
| **Pre-test conditions** | **Post-test Conditions** |
| Wet Density = 119.0 (lbs/ft^3) | Wet Density = 119.1 (lbs/ft^3) |
| % Moisture = 27.1% | % Moisture = 31.7% |
| Dry Density = 93.7 (lbs/ft^3) | Dry Density = 90.4 (lbs/ft^3) |

| Test Information | |
|---|---|
| a (cm^2)= | 0.19685 |
| L (cm)= | 9.7176167 |
| A (cm^2)= | 20.468077 |

| Date | Time | Elapsed Time (seconds) | Cell Burette Reading (ml) | Base Burette Reading (ml) | Base Burette Distance from Datum (cm) | Top Burette Reading (ml) | Top Burette Distance from Datum (cm) | Total Head Across Sample (cm of water) | Temperature (°C) | Weighted Average Temp. (°C) | Uncorrected Hydraulic Conductivity (cm/sec) | Correction Factor | Corrected Hydraulic Conductivity (cm/sec) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/5/2007 | 7:40 | 0 | 1.4 | 10.00 | 27.200 | 0.00 | 78.000 | 290.017 | 21.3 | | | | |
| | 13:05 | 19500 | 1.5 | 9.84 | 28.013 | 0.06 | 77.695 | 288.900 | 22.4 | 21.85 | 9.25E-09 | 0.9566877 | 8.85E-09 |
| 1/6/2007 | 10:00 | 94800 | 1.8 | 9.63 | 29.080 | 0.12 | 77.390 | 287.528 | 20.7 | 21.61 | 4.25E-09 | 0.9621193 | 4.09E-09 |
| 1/7/2007 | 9:50 | 180600 | 1.9 | 9.50 | 29.740 | 0.20 | 76.984 | 286.461 | 20.4 | 21.11 | 3.19E-09 | 0.9737855 | 3.11E-09 |
| 1/8/2007 | 8:00 | 260400 | 2.0 | 9.43 | 30.096 | 0.28 | 76.578 | 285.699 | 20.5 | 20.91 | 2.69E-09 | 0.9785101 | 2.63E-09 |
| 1/9/2007 | 7:30 | 345000 | 2.1 | 9.35 | 30.502 | 0.36 | 76.171 | 284.886 | 20.8 | 20.84 | 2.42E-09 | 0.9799897 | 2.37E-09 |
| 1/10/2007 | 7:45 | 432300 | 2.2 | 9.29 | 30.807 | 0.45 | 75.714 | 284.124 | 20 | 20.75 | 2.22E-09 | 0.9821063 | 2.18E-09 |


Composite #2
1.00E-08
9.00E-09
8.00E-09
7.00E-09
6.00E-09
5.00E-09
4.00E-09
3.00E-09
2.00E-09
1.00E-09
0.00E+00
Hyd. Cond. (cm/sec)
0
50000
100000
150000
200000
250000
300000
350000
400000
450000
500000
Time (sec.)

# Hydraulic Conductivity (ASTM-D 5084)
## Flow Rate Calculation

Job------- Ammon UWLF
Location-
Sample--- Composites #2
Depth-----

a=
A=
L=

**Cell No.** 1

| Cell Pressure (p.s.i.) | Base Pressure (p.s.i.) | Top Pressure (p.s.i.) |
|---|---|---|
| 83.4 | 75.0 | 78.4 |

| Date | Time | Elapsed Time Minutes | Cell Reading ML | Base Reading ML | Top Reading ML | Top Head CM | Base Head CM | h CM | Temp. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| 1-5-07 | 7:40 | 0 | 1.35 | 10.00 | 0.00 | | | | 21.3 | |
| | 13:05 | 325 | 1.50 | 9.84 | 0.06 | | | | 22.4 | |
| 1-6-09 | 10:00 | 1580 | 1.80 | 9.63 | 0.12 | | | | 20.7 | |
| 1-7-07 | 9:50 | 3010 | 1.90 | 9.50 | 0.20 | | | | 20.4 | |
| 1-8-07 | 8:00 | 4340 | 2.00 | 9.43 | 0.28 | | | | 20.5 | |
| 1-9-07 | 7:30 | 5750 | 2.10 | 9.35 | 0.36 | | | | 20.3 | |
| 1-10-07 | 7:45 | 7205 | 2.15 | 9.29 | 0.45 | | | | 20.0 | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

| a x L | t (sec) | 2 x A x t | aL/2At | h1 | h2 | ln(h1/h2) | K | Temp. Cor. | K -Cor. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

# TRIAXIAL CELL SETUP & TAKEDOWN

Project Amercan Sioux Date 12-26-06
Sample Composite #2 Depth @+ 12% Moisture Stand. Proct
Description CLAY(CH), Brown

Type of Test Hydr. Cond. Confining Pressure Differential 5psi
Cell Number 1 Saturate (before) after Consolidation
Number of Membranes 2 Filter Strips Yes (No)

## LENGTH CHANGE

| | |
|---|---|
| STRAIN GAUGE at setup | 500 |
| at saturation start | 500 |
| at consolidation start | 445 |
| at axial load start | 458 |

## MOISTURE CONTENT

| | INITIAL | | FINAL |
|---|---|---|---|
| Tare No. | Y10 | Y8 | R-100 |
| Wet Wt. + Tare | 119.76 | 148.08 | |
| Dry Wt. + Tare | 101.72 | 123.94 | |
| Wt. Water | | | |
| Tare Wt. | 34.92 | 34.92 | 33.44 |
| Dry Soil Wt. | | | |
| Moisture % | 27.01 | 27.12 | |
| Avg. w % | 27.06 | | |

## MASS PROPERTIES

| | | |
|---|---|---|
| Wt. Tube + Soil | | gm. |
| Wt. Tube | | gm. |
| Wt. Soil | | gm. |
| Tube Diameter | | in. |
| Sample Length | | in |
| tube length | | in. |
| top trim | | in. |
| bottom trim | | in. |
| total trim | | in. |
| sample length | | in. |
| Density constant 4.85/(D^2 * L) | | |
| Wet Density | | pcf. |
| Dry Density | | pcf. |

## SPECIMEN DIMENSIONS in. / mm.

| | HEIGHT | | DIAMETER | |
|---|---|---|---|---|
| | Initial | Final | Initial | Final |
| 1 | 3.8065 | 3.8285 | T 1.9855 | 2.025 |
| 2 | 3.8055 | 3.8270 | M 1.9785 | 1.9995 |
| 3 | 3.8060 | 3.8220 | B 1.9740 | 2.0175 |
| Avg. | 3.8060 in 9.66724 | 3.825833 9.7176166 | 1.979333 in 5.0275067 cm | 2.0098333 5.1049766 |

Description After Test Final Wt. = 379.35
Dry = 287.97

Remarks Initial $\gamma_m$ = 119.0 Final $\gamma_m$ = 119.1
$\gamma_{Dy}$ = 93.7 $\gamma_{Dy}$ = 90.4
%M = 27.1 %M = 31.72

Failure Sketch

| | |
|---|---|
| Trimmed By | JDB |
| Trimmed Date | 12-26-06 |
| Setup By | JDB |
| Setup Date | 12-26-06 |
| Taken Down By | |
| Take Down Date | |

(618) 659 9100 101

trxSTUP.dwg revised -/12/98

# TRIAXIAL CELL SATURATION & BETA FACTOR

PROJECT Anaram Sierra AWLF

SAMPLE Composite #2 DEPTH

INITIAL CELL PRESSURE 71.0 START DATE 12-28-06

INITIAL PORE PRESSURE 70.0 CELL NUMBER 1

INITIAL TRANSDUCER READING 70.5 TRANSDUCER NUMBER 1

| TRIAL DATE | TRIAL TIME | BASE BURETTE READING | CELL PRESSURE | TRANS-DUCER READING | CHANGE IN PRESSURE Transducer Constant | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | CELL DELTA (1) | TRANSDUCER READING CHANGE | TRANSDUCER PRESSURE CHANGE (2) | BETA FACTOR (2/1) |
| 1-2-07 | 0 | 436 | 71.0 | 70.5 | | | | |
| | 1 | | 76.0 | 75.4 | 5.0 | | 4.9 | 0.98 |
| | 2 | | 76.0 | 75.4 | 5.0 | | 4.9 | 0.98 |
| | 4 | | 76.0 | 75.4 | 5.0 | | 4.9 | 0.98 |
| | 8 | | 76.0 | 75.4 | 5.0 | | 4.9 | 0.98 |

# TRIAXIAL CELL CONSOLIDATION TEST

PROJECT American Sioux UWLF

SAMPLE Composite #2 DEPTH

CONSOLIDATION CELL PRESSURE 80.0 CELL NUMBER 1

CONSOLIDATION PORE PRESSURE 75.0

| DATE | TIME | BURETTE READING | DELTA VOLUME | SUM DELTA VOLUME | DELTA TIME | TEMP | REMARKS |
|---|---|---|---|---|---|---|---|
| 1-2-07 | 13:35 | 10.00 | | | 0 | | |
| | | 9.84 | | 0.16 | .1 | | |
| | | 9.82 | | 0.18 | .25 | | |
| | | 9.81 | | 0.19 | .5 | | |
| | 13:36 | 9.80 | | 0.20 | 1 | | |
| | 13:37 | 9.78 | | 0.22 | 2 | | |
| | 13:39 | 9.76 | | 0.24 | 4 | | |
| | 13:43 | 9.73 | | 0.27 | 8 | | |
| | 13:50 | 9.69 | | 0.31 | 15 | | |
| | 14:05 | 9.64 | | 0.36 | 30 | | |
| | 14:35 | 9.56 | | 0.44 | 60 | | |
| | 15:40 | 9.46 | | 0.54 | 125 | | |
| 1-3-09 | 8:30 | 9.00 | | 1.00 | 1135 | | |
| | 14:30 | 8.95 | | 1.05 | 1495 | | |
| 1-4-09 | 8:30 | 8.85 | | 1.15 | 2575 | | |
| 1-5-07 | 7:30 | 8.82 | | 1.18 | 3955 | | |

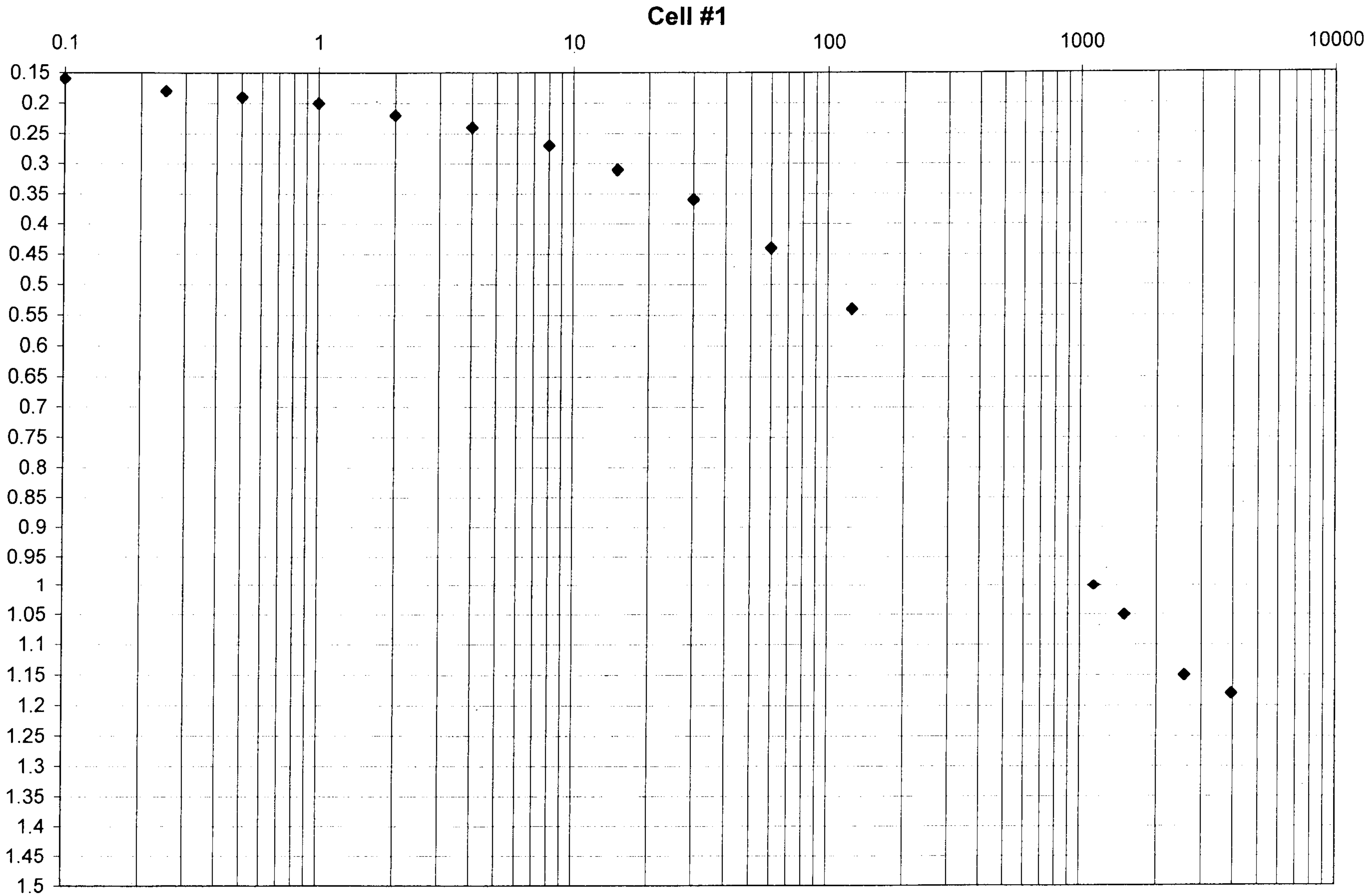
1135
1440
2575

2575
1380
3955

DONE

REITZ & JENS, INC. Consulting Engineers Sheet ______ of ______

Composite #2


Cell #1
0.1
1
10
100
1000
10000
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
0.55
0.6
0.65
0.7
0.75
0.8
0.85
0.9
0.95
1
1.05
1.1
1.15
1.2
1.25
1.3
1.35
1.4
1.45
1.5

## Ameren, Soiux UWLF

**Project # 2005012477**

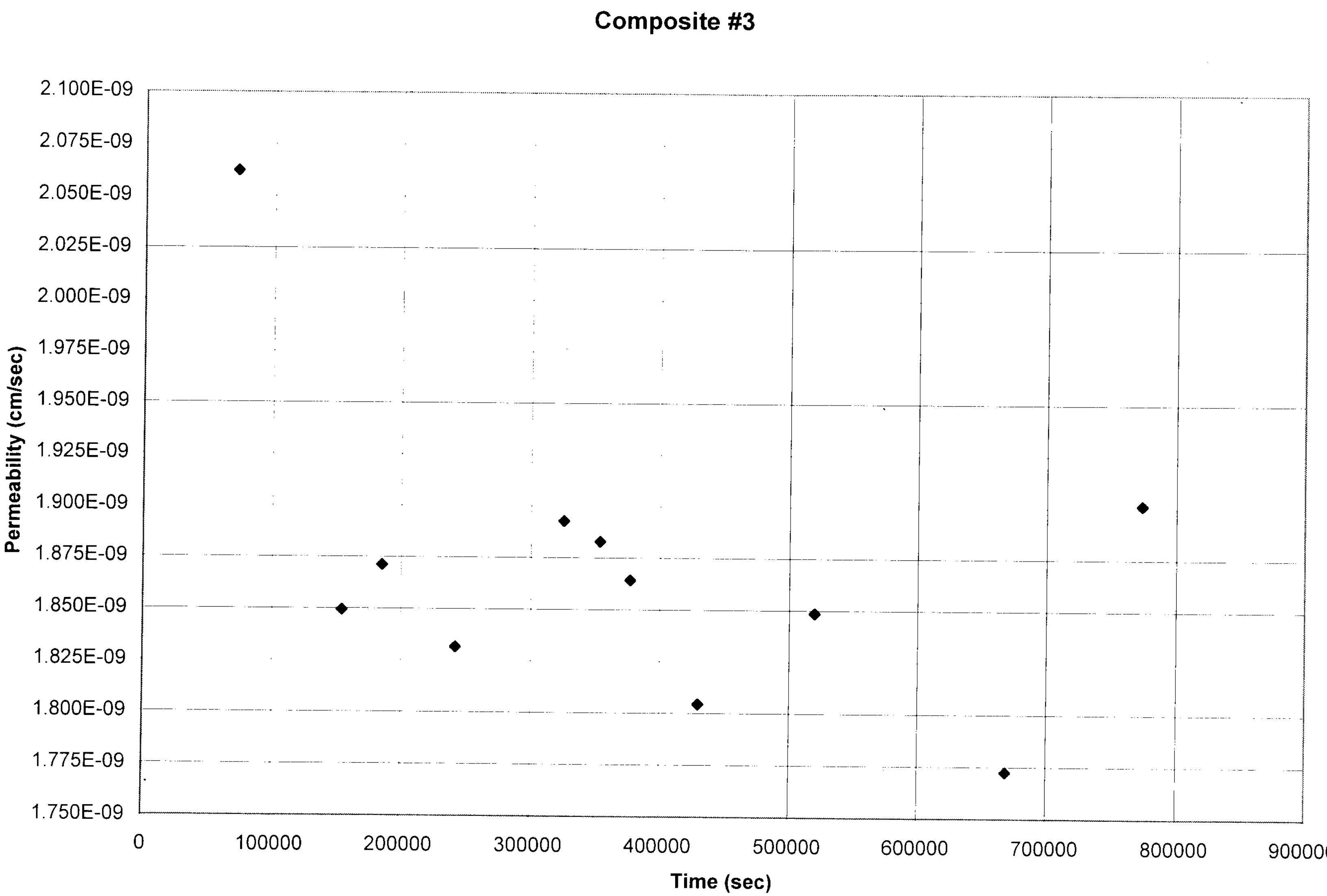
**Compostite #3**

**Hydraulic Conductivity**

| Soil Conditions | |
|---|---|
| **Pre-test conditions** | **Post-test Conditions** |
| Wet Density = 118.8 (lbs/ft^3) | Wet Density = 118.4(lbs/ft^3) |
| % Moisture = 28.2% | % Moisture = 32.8% |
| Dry Density = 92.7 (lbs/ft^3) | Dry Density = 89.2 (lbs/ft^3) |

| Test Information | |
|---|---|
| a (cm^2)= | 0.19685 |
| L (cm)= | 8.541597 |
| A (cm^2)= | 22.395469 |

| Date | Time | Elapsed Time (seconds) | Cell Burette Reading (ml) | Base Burette Reading (ml) | Base Burette Distance from Datum (cm) | Top Burette Reading (ml) | Top Burette Distance from Datum (cm) | Total Head Across Sample (cm of water) | Temperature (°C) | Weighted Average Temp. (°C) | Uncorrected Hydraulic Conductivity (cm/sec) | Correction Factor | Corrected Hydraulic Conductivity (cm/sec) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12/18/2006 | 13:00 | 0 | 3.1 | 10.00 | 27.200 | 0.00 | 78.000 | 156.337 | 21.8 | | | | |
| 12/19/2006 | 8:50 | 71400 | 3.0 | 9.95 | 27.454 | 0.07 | 77.644 | 155.727 | 17.9 | 19.85 | 2.05E-09 | 1.0039204 | 2.06E-09 |
| 12/20/2006 | 7:55 | 154500 | 3.1 | 9.94 | 27.505 | 0.17 | 77.136 | 155.169 | 20.2 | 19.42 | 1.82E-09 | 1.0146012 | 1.85E-09 |
| | 16:30 | 185400 | 3.2 | 9.93 | 27.556 | 0.21 | 76.933 | 154.915 | 20.3 | 19.56 | 1.85E-09 | 1.0111449 | 1.87E-09 |
| 12/21/2006 | 8:20 | 242400 | 3.3 | 9.90 | 27.708 | 0.26 | 76.679 | 154.508 | 20.9 | 19.80 | 1.82E-09 | 1.0050753 | 1.83E-09 |
| 12/22/2006 | 7:20 | 325200 | 3.3 | 9.84 | 28.013 | 0.34 | 76.273 | 153.797 | 20 | 19.97 | 1.89E-09 | 1.0010300 | 1.89E-09 |
| 12/22/2006 | 15:08 | 353280 | 3.5 | 9.86 | 27.911 | 0.40 | 75.968 | 153.594 | 20 | 19.97 | 1.88E-09 | 1.0009674 | 1.88E-09 |
| 12/22/2006 | 22:40 | 376800 | 3.4 | 9.83 | 28.064 | 0.40 | 75.968 | 153.441 | 20 | 19.97 | 1.86E-09 | 1.0009221 | 1.86E-09 |
| 12/23/2006 | 13:30 | 430200 | 3.5 | 9.83 | 28.064 | 0.46 | 75.663 | 153.137 | 20.7 | 20.02 | 1.80E-09 | 0.9997757 | 1.80E-09 |
| 12/24/2006 | 14:22 | 519720 | 3.5 | 9.80 | 28.216 | 0.58 | 75.054 | 152.375 | 20.7 | 20.14 | 1.85E-09 | 0.9969184 | 1.85E-09 |
| 12/26/2006 | 7:20 | 668400 | 3.4 | 9.76 | 28.419 | 0.72 | 74.342 | 151.460 | 20 | 20.18 | 1.78E-09 | 0.9957647 | 1.77E-09 |
| 12/27/2006 | 12:50 | 773400 | 3.6 | 9.72 | 28.622 | 0.83 | 73.784 | 150.698 | 21.2 | 17.44 | 1.78E-09 | 1.0663389 | 1.90E-09 |



Composite #3
Permeability (cm/sec)
2.100E-09
2.075E-09
2.050E-09
2.025E-09
2.000E-09
1.975E-09
1.950E-09
1.925E-09
1.900E-09
1.875E-09
1.850E-09
1.825E-09
1.800E-09
1.775E-09
1.750E-09
0
100000
200000
300000
400000
500000
600000
700000
800000
900000
Time (sec)

# Hydraulic Conductivity (ASTM-D 5084)
# Flow Rate Calculation

Job------- American Sioux WWLF
Location-
Sample--- Composite #3
Depth-----

a=
A=
L=

Cell No. 2

| | Cell Pressure (p.s.i.) | Base Pressure (p.s.i.) | Top Pressure (p.s.i.) |
|---|---|---|---|
| | 80.0 | 75.0 | 75.5 |
| Set New Pressures 12-15-06 | 81.5 | 75.0 | 76.5 |

| Date | Time | Elapsed Time Minutes | Cell Reading ML | Base Reading ML | Top Reading ML | Top Head CM | Base Head CM | h CM | Temp. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| 12-18-06 | 13:00 | 0 | 3.05 | 10.00 | 0.00 | | | | 21.8 | |
| 12-19-06 | 8:50 | 1190 | 3.00 | 9.95 | 0.07 | | | | 19.9 | |
| 12-20-06 | 7:55 | 2575 | 3.10 | 9.94 | 0.17 | | | | 20.2 | |
| | 16:30 | 3090 | 3.20 | 9.93 | 0.21 | | | | 21.3 | |
| 12-21-06 | 8:20 | 4040 | 3.30 | 9.90 | 0.26 | | | | 20.8 | |
| 12-22-06 | 7:20 | 5420 | 3.30 | 9.84 | 0.34 | | | | 20.0 | |
| | 1508 | 5888 | 3.45 | 9.86 | 0.40 | | | | | |
| | 2240 | 6280 | 3.40 | 9.83 | 0.40 | | | | | |
| 12/23 | 1330 | 7170 | 3.50 | 9.83 | 0.46 | | | | 20.7 | |
| 12/24 | 1422 | 8662 | 3.50 | 9.80 | 0.58 | | | | | |
| 12/26 | 740 | 11140 | 3.40 | 9.76 | 0.72 | | | | 20.0 | |
| 12-27-06 | 12:50 | 12890 | 3.55 | 9.72 | 0.83 | | | | 21.2 | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

| a x L | t (sec) | 2 x A x t | aL/2At | h1 | h2 | ln(h1/h2) | K | Temp. Cor. | K -Cor. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

# TRIAXIAL CELL SETUP & TAKEDOWN

Project: Ameren Sioux UWLF — Date: 11-28-06

Sample: Composite #3 — Depth: Standard Proctor +1.2% moisture

Description: CLAY (CH), Brown

Type of Test: Hyd. Cond — Confining Pressure Differential: ______

Cell Number: 2 — Saturate (before) after Consolidation ______

Number of Membranes: 2 — Filter Strips Yes (No)

| LENGTH CHANGE | |
|---|---|
| STRAIN GAUGE at setup | 500 |
| at saturation start | 500 |
| at consolidation start | 461 |
| at axial load start | 472 |

**MOISTURE CONTENT**

| | INITIAL | | FINAL |
|---|---|---|---|
| Tare No. | 83 | 84 | |
| Wet Wt. + Tare | 121.31 | 108.83 | |
| Dry Wt. + Tare | 99.33 | 89.73 | |
| Wt. Water | | | |
| Tare Wt. | 21.71 | 21.57 | |
| Dry Soil Wt. | | | |
| Moisture % | 28.3174 | 28.0223 | |
| Avg. w % | 28.170 | | |

**MASS PROPERTIES**

| | | |
|---|---|---|
| Wt. Tube + Soil | | gm. |
| Wt. Tube | | gm. |
| Wt. Soil | 350.28 | gm. |
| Tube Diameter | | in. |
| Sample Length | | in |
| tube length | | in. |
| top trim | | in. |
| bottom trim | | in. |
| total trim | | in. |
| sample length | | in. |
| Density constant | | |
| 4.85/(D^2 * L) | | |
| Wet Density | | pcf. |
| Dry Density | | pcf. |

**SPECIMEN DIMENSIONS in. / mm.**

| | HEIGHT | | DIAMETER | |
|---|---|---|---|---|
| | Initial | Final | Initial | Final |
| 1 | 3.3195 | 3.3695 | T 2.0770 | 2.1085 |
| 2 | 3.3155 | 3.3590 | M 2.0795 | 2.0985 |
| 3 | 3.3000 | 3.3600 | B 2.07165 | 2.1000 |
| Avg. | 3.31166 in<br>8.4116 cm | 3.362833 in<br>8.541597 cm | 2.0776 in<br>5.2773 cm | 2.102333<br>5.339927 |

Final moist wt = 362.89

Description After Test ______

Remarks: initial $\gamma_m$ = 118.8 — Final $\gamma_m$ = 118.4

$\gamma_{Dry}$ = 92.7 — $\gamma_{Dry}$ = 89.2

%m = 28.2 — %m = 32.8

Failure Sketch

Trimmed By: KEK
Trimmed Date: 11-28-06
Setup By: KEK
Setup Date: 11-28-06
Taken Down By: KCK
Take Down Date: 12-27-06

# TRIAXIAL CELL SATURATION & BETA FACTOR

PROJECT Ameron UWLF

SAMPLE Composite #3 DEPTH

INITIAL CELL PRESSURE 71.0 START DATE

INITIAL PORE PRESSURE 70.0 CELL NUMBER 2

INITIAL TRANSDUCER READING 71.2 TRANSDUCER NUMBER 2

| TRIAL DATE | TRIAL TIME | BASE BURETTE READING | CELL PRESSURE | TRANS-- DUCER READING | CHANGE IN PRESSURE Transducer Constant ____ | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | CELL DELTA (1) | TRANSDUCER READING CHANGE | TRANSDUCER PRESSURE CHANGE (2) | BETA FACTOR (2/1) |
| 12-5-06 | 0 | 2.05 | 71.0 | 70.3 | | | | |
| | 1 | | 76.0 | 75.2 | 5.0 | | 4.9 | 0.98 |
| | 2 | | 76.0 | 75.2 | 5.0 | | 4.9 | 0.98 |
| | 4 | | 76.0 | 75.2 | 5.0 | | 4.9 | 0.98 |
| | 8 | | 76.0 | 75.2 | 5.0 | | 4.9 | 0.98 |

OK

REITZ & JENS, INC. Consulting Engineers Sheet ____ of ____

# TRIAXIAL CELL CONSOLIDATION TEST

PROJECT Amerian Sorello UWLF

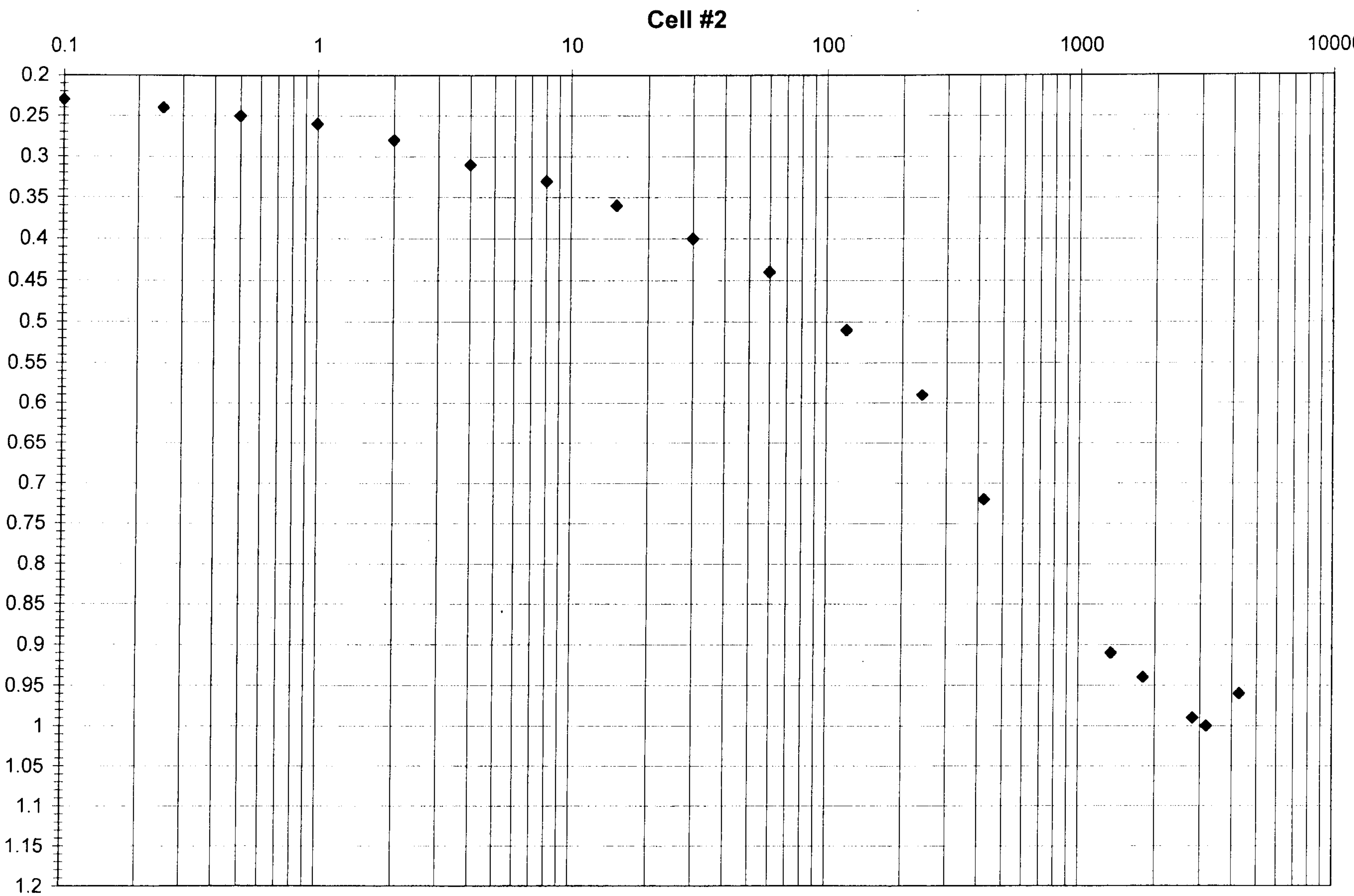
SAMPLE Composite #3 DEPTH

CONSOLIDATION CELL PRESSURE 80.0 CELL NUMBER 2

CONSOLIDATION PORE PRESSURE 75.0

| DATE | TIME | BURETTE READING | DELTA VOLUME | SUM DELTA VOLUME | DELTA TIME | TEMP | REMARKS |
|---|---|---|---|---|---|---|---|
| 12-5-06 | 9:57 | 10.00 | — | — | 0 | | |
| | | 9.77 | 0.23 | 0.23 | .1 | | |
| | | 9.76 | 0.01 | 0.24 | .25 | | |
| | | 9.75 | 0.01 | 0.25 | .5 | | |
| | 9:58 | 9.74 | 0.01 | 0.26 | 1 | | |
| | 9:59 | 9.72 | 0.02 | 0.28 | 2 | | |
| | 10:01 | 9.69 | 0.03 | 0.31 | 4 | | |
| | 10:05 | 9.67 | 0.02 | 0.33 | 8 | | |
| | 10:12 | 9.64 | 0.03 | 0.36 | 15 | | |
| | 10:27 | 9.60 | 0.04 | 0.40 | 30 | | |
| | 10:57 | 9.56 | 0.04 | 0.44 | 60 | | |
| | 11:57 | *9.49 | 0.07 | 0.51 | 120 | | |
| | 13:57 | 9.41 | 0.08 | 0.59 | 240 | | |
| | 16:59 | 9.28 | 0.13 | 0.72 | 422 | | |
| 12-6-06 | 8:22 | 9.09 | 0.19 | 0.91 | 1345 | | |
| | 15:57 | 9.06 | 0.03 | 0.94 | 1800 | | |
| 12/7 | 0848 | 9.01 | 0.05 | 0.99 | 2811 | | |
| | 15:00 | 9.00 | 0.01 | 1.00 | 3183 | | |
| 12-8-06 | 9:22 | 9.04 | -0.04 | 0.96 | 4285 | | |

Composite #3



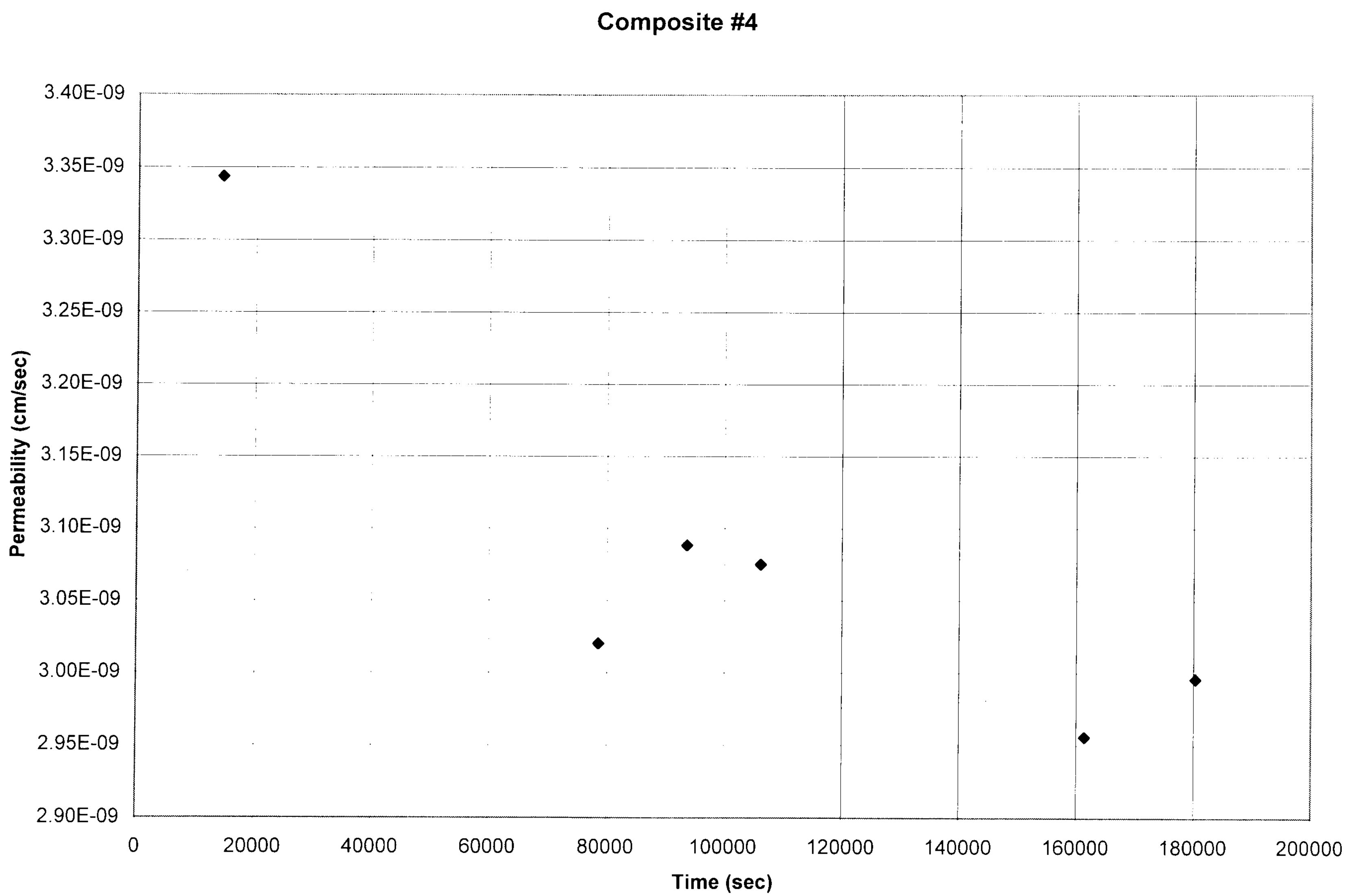
Cell #2
0.1
1
10
100
1000
10000
0.2
0.25
0.3
0.35
0.4
0.45
0.5
0.55
0.6
0.65
0.7
0.75
0.8
0.85
0.9
0.95
1
1.05
1.1
1.15
1.2

## Ameren, Soiux UWLF
**Project # 2005012477**
**Compostite #4**
**Hydraulic Conductivity**

| Soil Conditions | |
|---|---|
| **Pre-test conditions** | **Post-test Conditions** |
| Wet Density = 124.4 (lbs/ft^3) | Wet Density = 123.8 (lbs/ft^3) |
| % Moisture = 23.8% | % Moisture = 25.8% |
| Dry Density = 100.5 (lbs/ft^3) | Dry Density = 98.4 (lbs/ft^3) |

| Test Information | |
|---|---|
| a (cm^2)= | 0.19685 |
| L (cm)= | 10.620587 |
| A (cm^2)= | 21.996012 |

| Date | Time | Elapsed Time (seconds) | Cell Burette Reading (ml) | Base Burette Reading (ml) | Base Burette Distance from Datum (cm) | Top Burette Reading (ml) | Top Burette Distance from Datum (cm) | Total Head Across Sample (cm of water) | Temperature (°C) | Weighted Average Temp. (°C) | Uncorrected Hydraulic Conductivity (cm/sec) | Correction Factor | Corrected Hydraulic Conductivity (cm/sec) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12/18/2006 | 11:00 | 0 | 19.5 | 10.00 | 27.200 | 0.00 | 78.000 | 191.516 | 21.5 | | | | |
| | 15:00 | 14400 | 19.6 | 9.99 | 27.251 | 0.03 | 77.848 | 191.313 | 22.4 | 21.95 | 3.50E-09 | 0.9544233 | 3.34E-09 |
| 12/19/2006 | 8:50 | 78600 | 19.6 | 9.93 | 27.556 | 0.12 | 77.390 | 190.551 | 17.9 | 20.48 | 3.05E-09 | 0.9886321 | 3.02E-09 |
| | 13:00 | 93600 | 19.7 | 9.92 | 27.606 | 0.15 | 77.238 | 190.348 | 20.3 | 20.26 | 3.11E-09 | 0.9939545 | 3.09E-09 |
| | 16:30 | 106200 | 19.7 | 9.91 | 27.657 | 0.17 | 77.136 | 190.195 | 20.9 | 20.30 | 3.10E-09 | 0.9929760 | 3.08E-09 |
| 12/20/2006 | 7:50 | 161400 | 19.7 | 9.86 | 27.911 | 0.24 | 76.781 | 189.586 | 20.2 | 20.38 | 2.98E-09 | 0.9909087 | 2.96E-09 |
| | 13:05 | 180300 | 19.7 | 9.84 | 28.013 | 0.27 | 76.628 | 189.332 | 20.7 | 20.39 | 3.02E-09 | 0.9907446 | 3.00E-09 |


Composite #4
3.40E-09
3.35E-09
3.30E-09
3.25E-09
3.20E-09
3.15E-09
3.10E-09
3.05E-09
3.00E-09
2.95E-09
2.90E-09
Permeability (cm/sec)
0
20000
40000
60000
80000
100000
120000
140000
160000
180000
200000
Time (sec)

# Hydraulic Conductivity (ASTM-D 5084)
# Flow Rate Calculation

Job------- Amerian Sperx LWLF
Location-
Sample--- Composite #4
Depth-----

a=
A=
L=

Cell No. 1

| | Cell Pressure (p.s.i.) | Base Pressure (p.s.i.) | Top Pressure (p.s.i.) |
|---|---|---|---|
| | 80.0 | 75.0 | 75.5 |
| Reset To 12-15-06 | 82.0 | 75.0 | 77.0 |

| Date | Time | Elapsed Time Minutes | Cell Reading ML | Base Reading ML | Top Reading ML | Top Head CM | Base Head CM | h CM | Temp. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| 12-11-06 | 8:15 | 0 | 17.7 | 10.00 | 0.00 | | | | 20.0 | |
| | 14:30 | | 17.7 | 10.00 | 0.04 | | | | 21.8 | |
| | 16:45 | | 17.7 | 10.00 | 0.04 | | | | 22.1 | |
| 12-12-06 | 9:15 | | 17.95 | 10.00 | 0.12 | | | | 21.5 | |
| | 15:55 | | 17.90 | 9.98 | 0.13 | | | | 23.5 | |
| 12-13-06 | 8:15 | | 18.10 | 9.96 | 0.19 | | | | 20.8 | |
| 12-14-06 | 8:05 | | 18.20 | 9.93 | 0.24 | | | | 21.4 | |
| 12-15-06 | 8:05 | | 18.30 | 9.93 | 0.34 | | | | 20.8 | |
| | | | AFTER PRESSURES WERE RESET | | | | | | | |
| | | | | | | | | | | |
| 12-18-06 | 11:00 | 0 | 19.45 | 10.00 | 0.00 | | | | 21.5 | |
| | 15:00 | 240 | 19.60 | 9.99 | 0.03 | | | | 22.4 | |
| 12-19-06 | 8:50 | 1310 | 19.55 | 9.93 | 0.12 | | | | 17.9 | |
| | 13:00 | 1560 | 19.70 | 9.92 | 0.15 | | | | 20.3 | |
| | 16:30 | 1770 | 19.70 | 9.91 | 0.17 | | | | 20.9 | |
| 12-20-06 | 7:50 | 2690 | 19.70 | 9.86 | 0.24 | | | | 20.2 | |
| | 13:05 | 3005 | 19.70 | 9.84 | 0.27 | | | | 20.7 | |

| a x L | t (sec) | 2 x A x t | aL/2At | h1 | h2 | ln(h1/h2) | K | Temp. Cor. | K -Cor. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

# TRIAXIAL CELL SETUP & TAKEDOWN

Project: Ameren Sioux UWLF  Date: 11-28-06

Sample: Composite FF4  Depth: +10% M on Plate

Description: CLAY(CL), Brown, with Trace Silt

Type of Test: Hydr. Cond.  Confining Pressure Differential: 5 PSI

Cell Number: 1  Saturate (before) after Consolidation

Number of Membranes: 2  Filter Strips Yes (No)

| LENGTH CHANGE | |
|---|---|
| STRAIN GAUGE at setup | 500 |
| at saturation start | 500 |
| at consolidation start | 499 |
| at axial load start | 512 |

| MOISTURE CONTENT | INITIAL | | FINAL |
|---|---|---|---|
| Tare No. | M 36 | M 15 | |
| Wet Wt. + Tare | 99.32 | 89.52 | |
| Dry Wt. + Tare | 84.39 | 76.66 | |
| Wt. Water | | | |
| Tare Wt. | 22.14 | 22.38 | |
| Dry Soil Wt. | | | |
| Moisture % | 23.9839 | 23.6920 | |
| Avg. w % | 23.84 | | |

| MASS PROPERTIES | | |
|---|---|---|
| Wt. Tube + Soil | | gm. |
| Wt. Tube | | gm. |
| Wt. Soil | 455.87 | gm. |
| Tube Diameter | | in. |
| Sample Length | | in |
| tube length | | in. |
| top trim | | in. |
| bottom trim | | in. |
| total trim | | in. |
| sample length | | in. |
| Density constant 4.85/(D^2 * L) | | |
| Wet Density | | pcf. |
| Dry Density | | pcf. |

SPECIMEN DIMENSIONS in. / mm.

| | HEIGHT | | DIAMETER | |
|---|---|---|---|---|
| | Initial | Final | Initial | Final |
| 1 | 4.1570 | 4.1775 | T 2.0710 | 2.0875 |
| 2 | 4.1610 | 4.1810 | M 2.0535 | 2.0780 |
| 3 | 4.1760 | 4.1855 | B 2.0720 | 2.0850 |
| Avg. | 4.1647 in / 10.5783 cm | 4.181333 in / 10.620587 cm | 2.0655 in / 5.24637 cm | 2.0835 in / 5.29209 cm |

Description After Test: Dry Soil wt = 368.11  Post wt 463.36

Remarks: Initial $\gamma_m$ = 124.4, $\gamma_D$ = 100.5, %M = 23.8; Final $\gamma_m$ = 123.8, $\gamma_D$ = 98.4, %M = 25.8

Failure Sketch

Trimmed By: KEK
Trimmed Date: 11-28-06
Setup By: KEK
Setup Date: 11-28-06
Taken Down By: KEK
Take Down Date: 12-20-06

# TRIAXIAL CELL SATURATION & BETA FACTOR

PROJECT Ameren Sioux UWLF

SAMPLE Composite #4 DEPTH

INITIAL CELL PRESSURE 71.0 START DATE 11-28-06

INITIAL PORE PRESSURE 70.0 CELL NUMBER 1

INITIAL TRANSDUCER READING 71.4 TRANSDUCER NUMBER 1

| TRIAL DATE | TRIAL TIME | BASE BURETTE READING | CELL PRESSURE | TRANS-DUCER READING | CHANGE IN PRESSURE — Transducer Constant: CELL DELTA (1) | TRANSDUCER: READING CHANGE | TRANSDUCER: PRESSURE CHANGE (2) | BETA FACTOR (2/1) |
|---|---|---|---|---|---|---|---|---|
| 12-5-06 | 0 | 1.08 | 71.0 | 70.6 | | | | |
| | 1 | " | 76.0 | 75.5 | 5.0 | | 4.9 | 0.98 |
| | 2 | " | 76.0 | 75.5 | 5.0 | | 4.9 | 0.98 |
| | 4 | " | 76.0 | 75.5 | 5.0 | | 4.9 | 0.98 |
| | 8 | " | 76.0 | 75.5 | 5.0 | | 4.9 | 0.98 |

OK

REITZ & JENS, INC. Consulting Engineers Sheet ____ of ____

# TRIAXIAL CELL CONSOLIDATION TEST

PROJECT American Sioux UWF

SAMPLE Composite #4 DEPTH

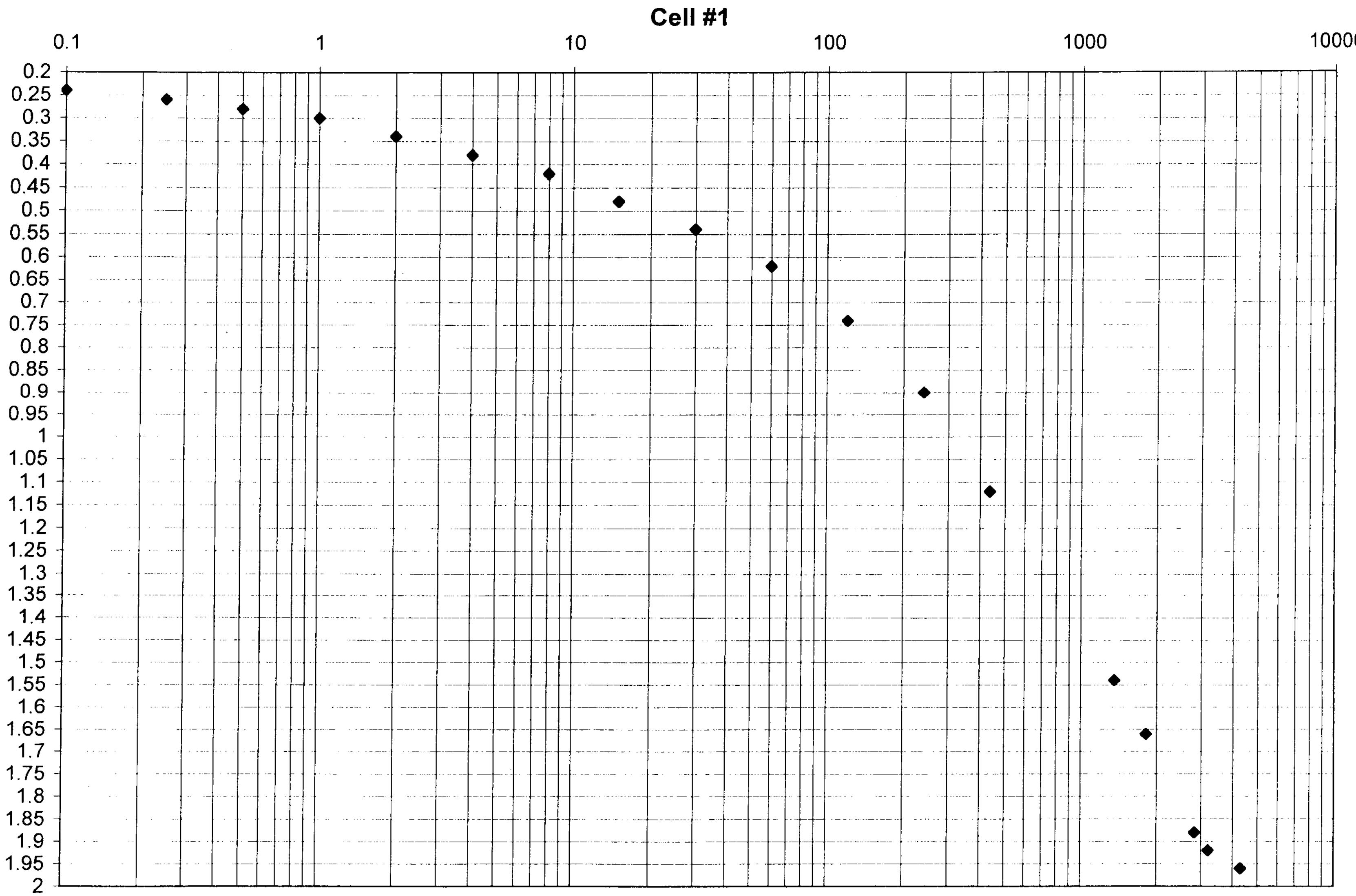
CONSOLIDATION CELL PRESSURE 80.0 CELL NUMBER 1

CONSOLIDATION PORE PRESSURE 75.0

| DATE | TIME | BURETTE READING | DELTA VOLUME | SUM DELTA VOLUME | DELTA TIME | TEMP | REMARKS |
|---|---|---|---|---|---|---|---|
| 12-5-06 | 9:40 | 10.00 | | | 0 | | |
| | | 9.76 | 0.24 | 0.24 | .1 | | |
| | | 9.74 | 0.02 | 0.26 | .25 | | |
| | | 9.72 | 0.02 | 0.28 | .5 | | |
| | 9:41 | 9.70 | 0.02 | 0.30 | 1 | | |
| | 9:42 | 9.66 | 0.04 | 0.34 | 2 | | |
| | 9:44 | 9.62 | 0.04 | 0.38 | 4 | | |
| | 9:48 | 9.58 | 0.04 | 0.42 | 8 | | |
| | 9:55 | 9.52 | 0.06 | 0.48 | 15 | | |
| | 10:10 | 9.46 | 0.06 | 0.54 | 30 | | |
| | 10:40 | 9.38 | 0.08 | 0.62 | 60 | | |
| | 11:40 | * 9.26 | 0.12 | 0.74 | 120 | | |
| | 13:40 | 9.10 | 0.16 | 0.90 | 240 | | |
| | 16:57 | 8.88 | 0.22 | 1.12 | 437 | | |
| 12-6-05 | 8:20 | 8.46 | 0.42 | 1.54 | 1360 | | |
| | 15:58 | 8.34 | 0.12 | 1.66 | 1818 | | |
| 12/7 | 0852 | 8.20 | 0.14 | 1.88 | 2832 | | |
| | 15:00 | 8.16 | 0.04 | 1.92 | 3200 | | |
| 12/8 | 9:20 | 8.12 | 0.04 | 1.96 | 4300 | | |

REITZ & JENS, INC. Consulting Engineers Sheet ____ of ____

Composite #4



Cell #1
0.1
1
10
100
1000
10000
0.2
0.25
0.3
0.35
0.4
0.45
0.5
0.55
0.6
0.65
0.7
0.75
0.8
0.85
0.9
0.95
1
1.05
1.1
1.15
1.2
1.25
1.3
1.35
1.4
1.45
1.5
1.55
1.6
1.65
1.7
1.75
1.8
1.85
1.9
1.95
2

## Ameren, Soiux UWLF

**Project # 2005012477**

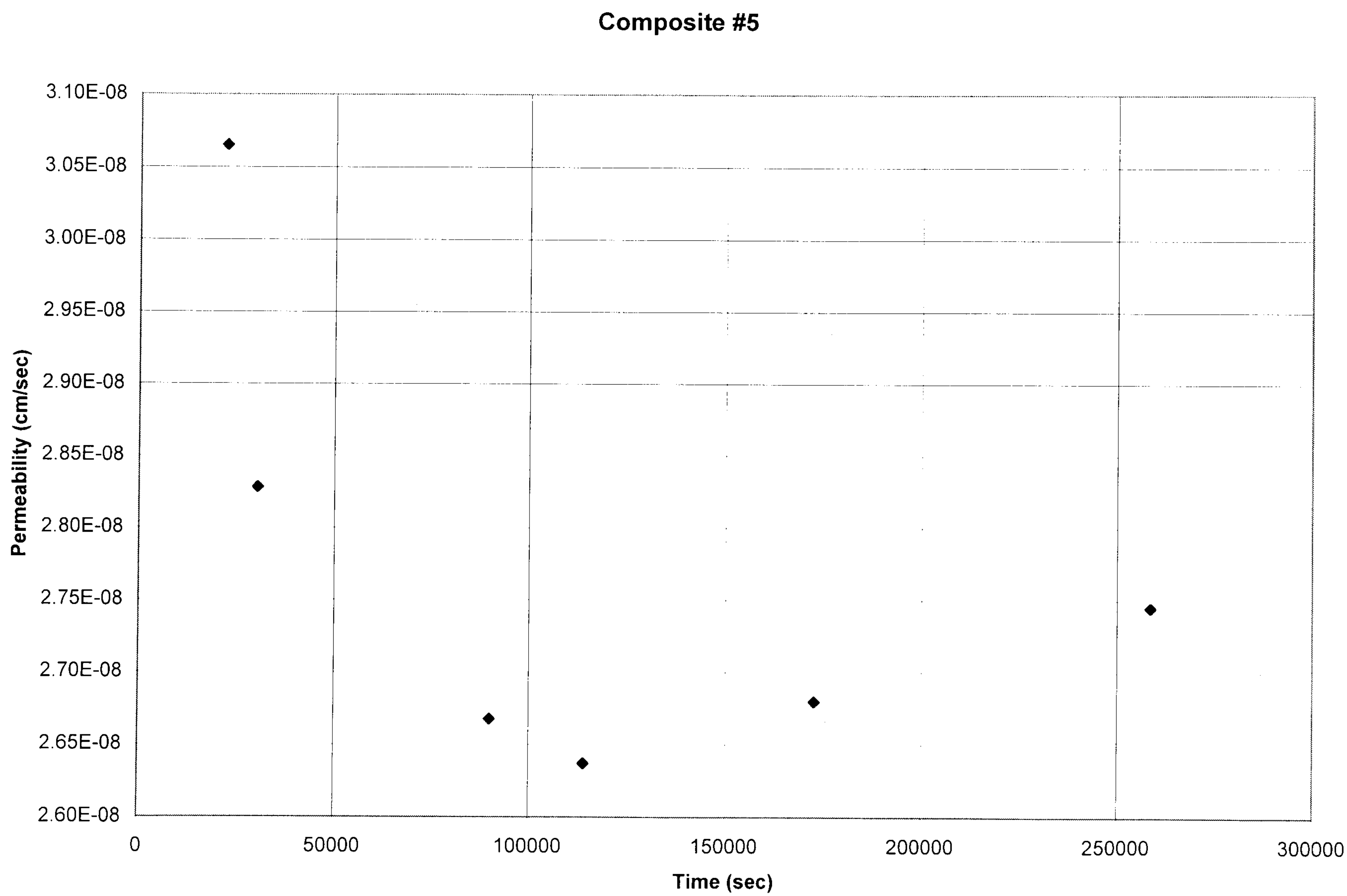
**Compostite #5**

**Hydraulic Conductivity**

| Soil Conditions | |
|---|---|
| **Pre-test conditions** | **Post-test Conditions** |
| Wet Density = 125.1 (lbs/ft^3) | Wet Density = 127.3 (lbs/ft^3) |
| % Moisture = 20.6% | % Moisture = 23.0% |
| Dry Density = 103.7 (lbs/ft^3) | Dry Density = 103.5 (lbs/ft^3) |

| Test Information | |
|---|---|
| a (cm^2)= | 0.19685 |
| L (cm)= | 10.6172 |
| A (cm^2)= | 20.288555 |

| Date | Time | Elapsed Time (seconds) | Cell Burette Reading (ml) | Base Burette Reading (ml) | Base Burette Distance from Datum (cm) | Top Burette Reading (ml) | Top Burette Distance from Datum (cm) | Total Head Across Sample (cm of water) | Temperature (°C) | Weighted Average Temp. (°C) | Uncorrected Hydraulic Conductivity (cm/sec) | Correction Factor | Corrected Hydraulic Conductivity (cm/sec) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12/11/2006 | 8:15 | 0 | 9.9 | 10.00 | 27.200 | 0.00 | 78.000 | 85.979 | 20 | | | | |
| | 14:30 | 22500 | 9.8 | 9.89 | 27.759 | 0.12 | 77.390 | 84.811 | 21.8 | 20.90 | 3.13E-08 | 0.9786485 | 3.07E-08 |
| | 16:45 | 30600 | 9.7 | 9.85 | 27.962 | 0.14 | 77.289 | 84.506 | 22.1 | 21.18 | 2.91E-08 | 0.9721378 | 2.83E-08 |
| 12/12/2006 | 9:15 | 90000 | 10.1 | 9.63 | 29.080 | 0.43 | 75.816 | 81.915 | 21.5 | 21.59 | 2.77E-08 | 0.9626510 | 2.67E-08 |
| | 15:55 | 114000 | 9.7 | 9.52 | 29.638 | 0.52 | 75.358 | 80.899 | 23.5 | 21.78 | 2.75E-08 | 0.9582691 | 2.64E-08 |
| 12/13/2006 | 8:15 | 172800 | 10.2 | 9.30 | 30.756 | 0.82 | 73.834 | 78.257 | 20.8 | 21.91 | 2.80E-08 | 0.9554149 | 2.68E-08 |
| 12/14/2006 | 8:05 | 258600 | 10.2 | 8.95 | 32.534 | 1.21 | 71.853 | 74.498 | 21.4 | 21.64 | 2.85E-08 | 0.9615018 | 2.74E-08 |



Composite #5
3.10E-08
3.05E-08
3.00E-08
2.95E-08
2.90E-08
2.85E-08
2.80E-08
2.75E-08
2.70E-08
2.65E-08
2.60E-08
Permeability (cm/sec)
0
50000
100000
150000
200000
250000
300000
Time (sec)

# Hydraulic Conductivity (ASTM-D 5084)
## Flow Rate Calculation

Job------- American Sioux UWLF
Location-
Sample--- Composite #5
Depth-----

a=
A=
L=

Cell No. 4

| Cell Pressure (p.s.i.) | Base Pressure (p.s.i.) | Top Pressure (p.s.i.) |
|---|---|---|
| 80.0 | 75.0 | 75.5 |

Dr. Cell Suite 710

| Date | Time | Elapsed Time Minutes | Cell Reading ML | Base Reading ML | Top Reading ML | Top Head CM | Base Head CM | h CM | Temp. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| 12-11-06 | 8:15 | 0 | 9.85 | 10.00 | 0.00 | | | | 20.0 | |
| | 14:30 | | 9.80 | 9.89 | 0.12 | | | | 21.8 | |
| | 16:45 | | 9.70 | 9.85 | 0.14 | | | | 22.1 | |
| 12-12-06 | 9:15 | | 10.05 | 9.63 | 0.43 | | | | 21.5 | |
| | 15:55 | | 9.70 | 9.52 | 0.52 | | | | 23.5 | |
| 12-13-06 | 8:15 | | 10.20 | 9.30 | 0.82 | | | | 20.8 | |
| 12-14-06 | 8:05 | | 10.20 | 8.95 | 1.21 | | | | 21.4 | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

| a x L | t (sec) | 2 x A x t | aL/2At | h1 | h2 | ln(h1/h2) | K | Temp. Cor. | K -Cor. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

# TRIAXIAL CELL SETUP & TAKEDOWN

Project *Ameren Sioux UWLF* Date *11-29-06*

Sample *Composite #5* Depth *Standard Proctor Point +8% Moisture*

Description *CLAY (CL), Brown, Silty*

Type of Test *Hyd. Cond.* Confining Pressure Differential ______

Cell Number *4* Saturate (before) after Consolidation ______

Number of Membranes *2* Filter Strips Yes (No)

| MOISTURE CONTENT | INITIAL | | FINAL |
|---|---|---|---|
| Tare No. | *M14* | *M10* | |
| Wet Wt. + Tare | *118.52* | *121.26* | |
| Dry Wt. + Tare | *101.99* | *104.34* | |
| Wt. Water | | | |
| Tare Wt. | *22.10* | *21.72* | |
| Dry Soil Wt. | | | |
| Moisture % | *20.69* | *20.48* | |
| Avg. w % | *20.59* | | |

| LENGTH CHANGE | |
|---|---|
| STRAIN GAUGE at setup | [illegible] |
| at saturation start | [illegible] |
| at consolidation start | |
| at axial load start | |

SPECIMEN DIMENSIONS in. / mm.

| | HEIGHT Initial | HEIGHT Final | DIAMETER Initial | DIAMETER Final |
|---|---|---|---|---|
| 1 | *4.1825* | *4.1820* | T *1.9900* | *1.9930* |
| 2 | *4.1880* | *4.1705* | M *1.9955* | *1.9910* |
| 3 | *4.1925* | *4.1875* | B *2.0050* | *2.0190* |
| Avg. | *4.18767 in* *10.63668 cm* | *4.1800* *10.6172* | *1.99683 in* *5.07195 cm* | *2.0010* *5.08254* |

| MASS PROPERTIES | | |
|---|---|---|
| Wt. Tube + Soil | | gm. |
| Wt. Tube | | gm. |
| Wt. Soil | *430.80* | gm. |
| Tube Diameter | | in. |
| Sample Length | | in |
| tube length | | in. |
| top trim | | in. |
| bottom trim | | in. |
| total trim | | in. |
| sample length | | in. |
| Density constant 4.85/(D^2 * L) | | |
| Wet Density | *125.13* | pcf. |
| Dry Density | *103.7* | pcf. |

Description After Test *Initial* $\gamma_m = 125.1$ $\gamma_D = 103.7$ $\%M = 20.6$ *Final* $\gamma_m = 127.3$ $\gamma_{Dry} = 103.5$ $\%M = 23.0$

Remarks *Final wet Wt 439.24*

Failure Sketch

Trimmed By *KEK*
Trimmed Date *11-29-06*

Setup By *KEK*
Setup Date *11-29-06*

Taken Down By *KEK*
Take Down Date *12-14-06*

trxSTUP.dwg rev. -/12/98

# TRIAXIAL CELL SATURATION & BETA FACTOR

PROJECT American Sioux UWLF

SAMPLE Composite #5 DEPTH

INITIAL CELL PRESSURE 71.0 START DATE 11-29-06

INITIAL PORE PRESSURE 70.0 CELL NUMBER 4

INITIAL TRANSDUCER READING 71.0 TRANSDUCER NUMBER 4

| TRIAL DATE | TRIAL TIME | BASE BURETTE READING | CELL PRESSURE | TRANS-DUCER READING | CHANGE IN PRESSURE Transducer Constant | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | CELL DELTA (1) | TRANSDUCER READING CHANGE | TRANSDUCER PRESSURE CHANGE (2) | BETA FACTOR (2/1) |
| 12-5-06 | 0 | 1.38 | 71.0 | 71.2 | | | | |
| | 1 | | 76.0 | 76.2 | 5.0 | | 5.0 | 1.0 |
| | 2 | | 76.0 | 76.2 | 5.0 | | 5.0 | 1.0 |
| | 4 | | 76.0 | 76.2 | 5.0 | | 5.0 | 1.0 |
| | 8 | | 76.0 | 76.2 | 5.0 | | 5.0 | 1.0 |

OK

# TRIAXIAL CELL CONSOLIDATION TEST

PROJECT American Sioux MWLF

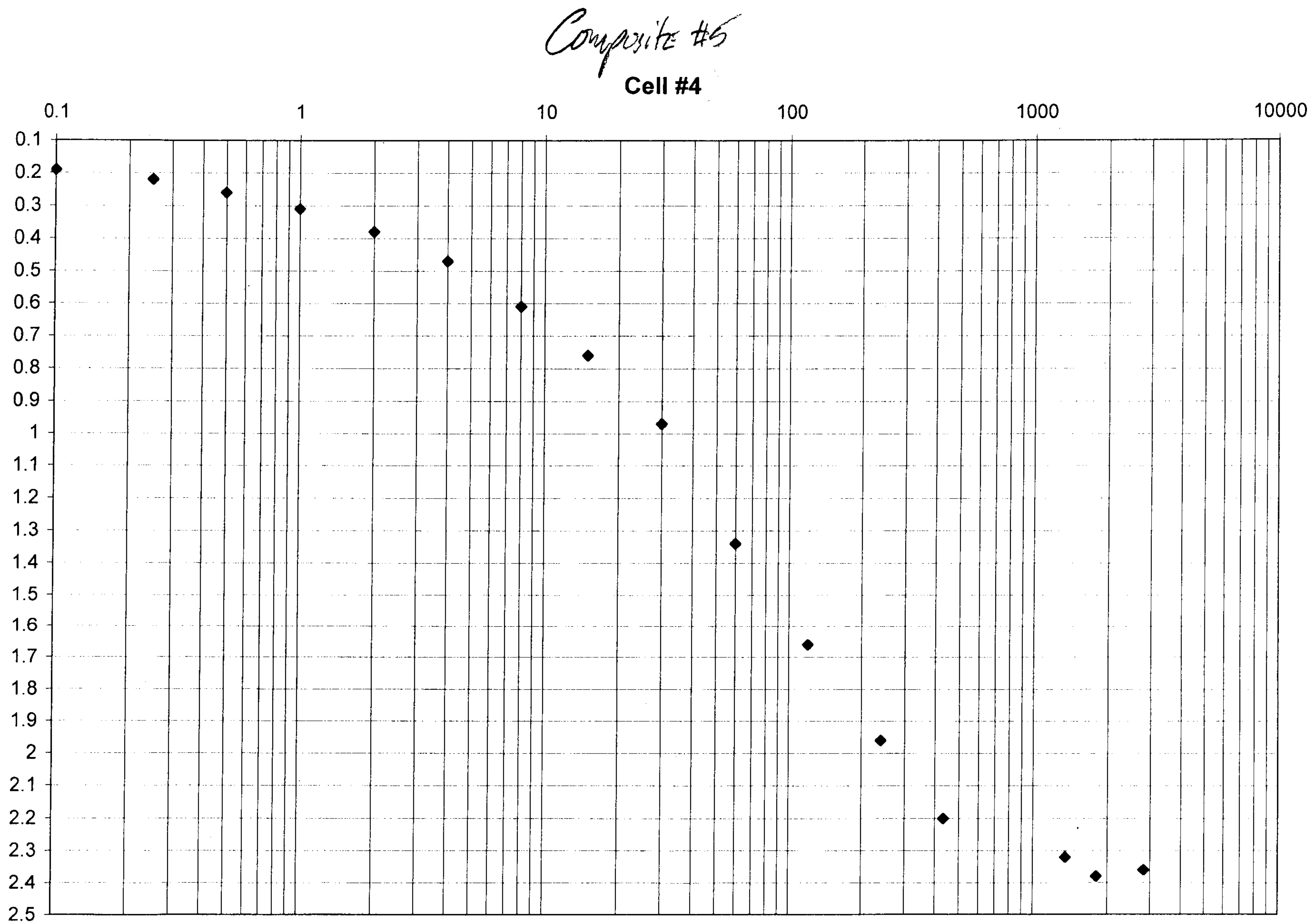
SAMPLE Composite #5 DEPTH

CONSOLIDATION CELL PRESSURE 80.0 CELL NUMBER 4

CONSOLIDATION PORE PRESSURE 75.0

| DATE | TIME | BURETTE READING | DELTA VOLUME | SUM DELTA VOLUME | DELTA TIME | TEMP | REMARKS |
|---|---|---|---|---|---|---|---|
| 12-5-06 | 9:46 | 10.00 | — | — | 0 | | |
| | | 9.81 | 0.19 | 0.19 | .1 | | |
| | | 9.78 | 0.03 | 0.22 | .25 | | |
| | | 9.74 | 0.04 | 0.26 | .5 | | |
| | 9:47 | 9.69 | 0.05 | 0.31 | 1 | | |
| | 9:48 | 9.62 | 0.07 | 0.38 | 2 | | |
| | 9:50 | 9.53 | 0.09 | 0.47 | 4 | | |
| | 9:54 | 9.39 | 0.14 | 0.61 | 8 | | |
| | 10:01 | 9.24 | 0.15 | 0.76 | 15 | | |
| | 10:16 | 9.03 | 0.19 | 0.97 | 30 | | |
| | 10:46 | 8.76 | 0.27 | 1.34 | 60 | | |
| | 11:46 | *8.44 | 0.32 | 1.66 | 120 | | |
| | 13:46 | 8.14 | 0.30 | 1.96 | 240 | | |
| | 16:58 | 7.90 | 0.24 | 2.20 | 432 | | |
| 12-6-06 | 8:22 | 7.78 | 0.12 | 2.32 | 1356 | | |
| | 15:57 | 7.72 | 0.06 | 2.38 | 1811 | | |
| 12/7 | 0851 | 7.74 | -0.02 | 2.36 | 2825 | | |

REITZ & JENS, INC. Consulting Engineers Sheet ______ of ______

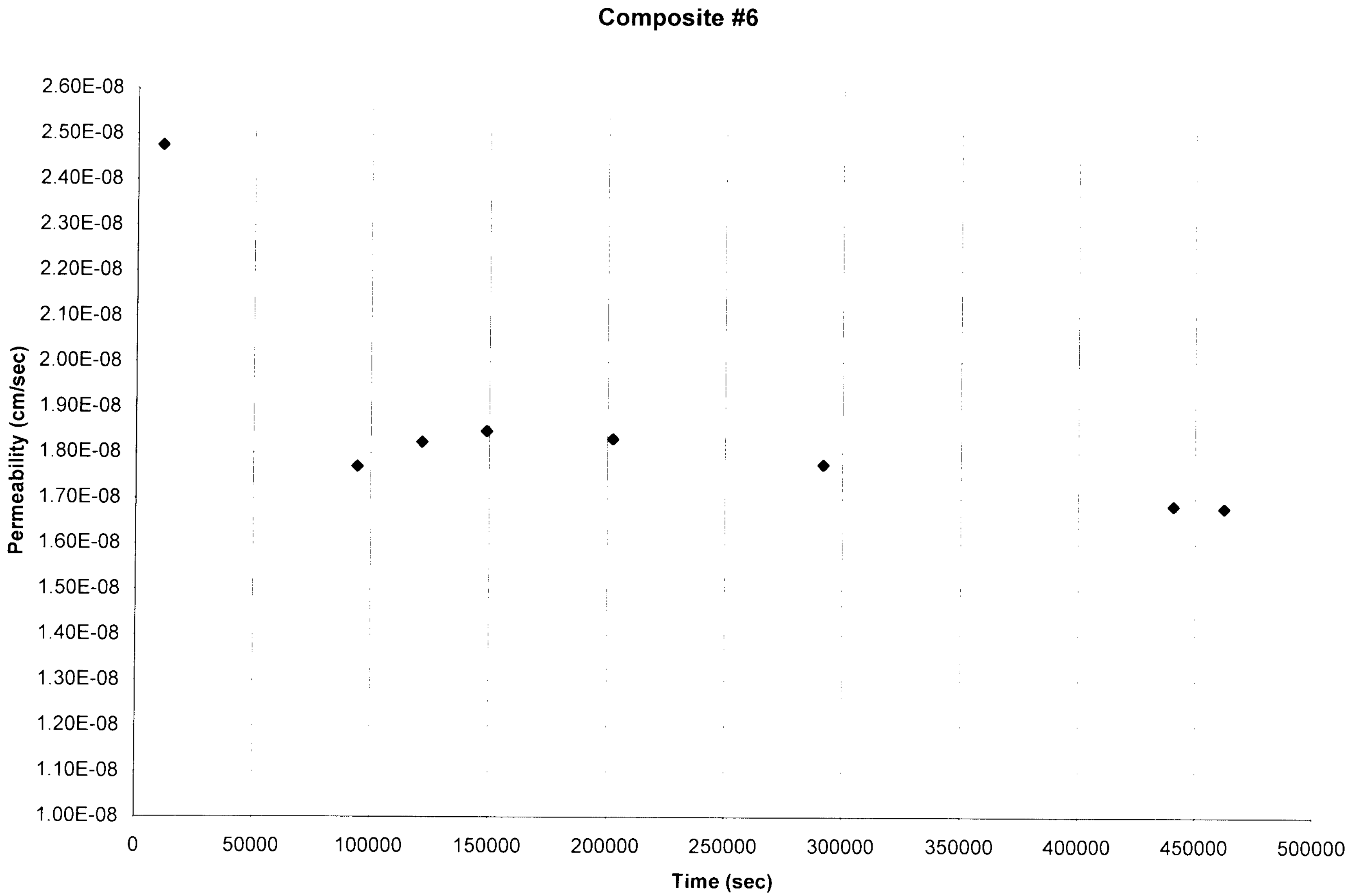

Composite #5
Cell #4
0.1
1
10
100
1000
10000
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2
2.1
2.2
2.3
2.4
2.5

## Ameren, Soiux UWLF
### Project # 2005012477
### Compostite #6
**Hydraulic Conductivity**

| Soil Conditions | |
|---|---|
| **Pre-test conditions** | **Post-test Conditions** |
| Wet Density = 119.2 (lbs/ft^3) | Wet Density = 122.6 (lbs/ft^3) |
| % Moisture = 26.5% | % Moisture = 26.9% |
| Dry Density = 94.2 (lbs/ft^3) | Dry Density = 96.6 (lbs/ft^3) |

| Test Information | |
|---|---|
| a (cm^2)= | 0.19685 |
| L (cm)= | 9.33492 |
| A (cm^2)= | 19.218163 |

| | | | | Base Burette | | Top Burette | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Time | Elapsed Time (seconds) | Cell Burette Reading (ml) | Reading (ml) | Distance from Datum (cm) | Reading (ml) | Distance from Datum (cm) | Total Head Across Sample (cm of water) | Temperature (°C) | Weighted Average Temp. (°C) | Uncorrected Hydraulic Conductivity (cm/sec) | Correction Factor | Corrected Hydraulic Conductivity (cm/sec) |
| 12/21/2006 | 10:25 | 0 | 7.5 | 10.00 | 27.200 | 0.00 | 78.000 | 156.337 | 21.4 | | | | |
| 12/21/2006 | 13:25 | 10800 | 7.5 | 9.90 | 27.708 | 0.08 | 77.594 | 155.423 | 22.6 | 22.00 | 2.60E-08 | 0.9532943 | 2.48E-08 |
| 12/22/2006 | 7:30 | 94200 | 8.6 | 9.43 | 30.096 | 0.52 | 75.358 | 150.800 | 20 | 21.38 | 1.83E-08 | 0.9674437 | 1.77E-08 |
| 12/22/2006 | 15:06 | 121560 | 7.6 | 9.25 | 31.010 | 0.68 | 74.546 | 149.073 | 20 | 21.07 | 1.87E-08 | 0.9746672 | 1.82E-08 |
| 12/22/2006 | 22:40 | 148800 | 7.6 | 9.08 | 31.874 | 0.84 | 73.733 | 147.396 | 21.3 | 20.99 | 1.89E-08 | 0.9764671 | 1.85E-08 |
| 12/23/2006 | 13:29 | 202140 | 8.0 | 8.81 | 33.245 | 1.16 | 72.107 | 144.399 | 21.3 | 21.07 | 1.88E-08 | 0.9745676 | 1.83E-08 |
| 12/24/2006 | 14:21 | 291660 | 8.2 | 8.38 | 35.430 | 1.62 | 69.770 | 139.878 | 21.3 | 21.14 | 1.82E-08 | 0.9729462 | 1.77E-08 |
| 12/26/2006 | 7:45 | 440700 | 8.7 | 7.76 | 38.579 | 2.28 | 66.418 | 133.375 | 20 | 20.98 | 1.72E-08 | 0.9768505 | 1.68E-08 |
| 12/26/2006 | 13:45 | 462300 | 8.7 | 7.68 | 38.986 | 2.39 | 65.859 | 132.410 | 21.2 | 20.96 | 1.72E-08 | 0.9772637 | 1.68E-08 |



Composite #6
Permeability (cm/sec)
2.60E-08
2.50E-08
2.40E-08
2.30E-08
2.20E-08
2.10E-08
2.00E-08
1.90E-08
1.80E-08
1.70E-08
1.60E-08
1.50E-08
1.40E-08
1.30E-08
1.20E-08
1.10E-08
1.00E-08
0
50000
100000
150000
200000
250000
300000
350000
400000
450000
500000
Time (sec)

# Hydraulic Conductivity (ASTM-D 5084)
## Flow Rate Calculation

Job------- American Sioux WLF
Location-
Sample--- Composite #6
Depth-----

a=
A=
L=

Cell No. 4

| Cell Pressure (p.s.i.) | Base Pressure (p.s.i.) | Top Pressure (p.s.i.) |
|---|---|---|
| 80.5 | 75.0 | 75.5 |

| Date | Time | Elapsed Time Minutes | Cell Reading ML | Base Reading ML | Top Reading ML | Top Head CM | Base Head CM | h CM | Temp. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| 12-21-06 | 10:25 | 0 | 7.50 | 10.00 | 0.00 | | | | 21.4 | |
| | 13:25 | 180 | 7.50 | 9.90 | 0.08 | | | | 22.6 | |
| 12-22-06 | 7:30 | 1570 | 8.60 | 9.43 | 0.52 | | | | 20.0 | |
| | 1506 | 2026 | 7.6 | 9.25 | 0.68 | | | | | |
| | 2240 | 2480 | 7.6 | 9.08 | 0.84 | | | | 21.3 | |
| 12/23 | 1329 | 3369 | 8.0 | 8.81 | 1.16 | | | | | |
| 12/24 | 1421 | 4861 | 8.2 | 8.38 | 1.62 | | | | | |
| 12/26 | 745 | 7345 | 8.7 | 7.76 | 2.28 | | | | 20.0 | |
| | 13:45 | 7705 | 8.7 | 7.68 | 2.39 | | | | 21.2 | |

| a x L | t (sec) | 2 x A x t | aL/2At | h1 | h2 | ln(h1/h2) | K | Temp. Cor. | K -Cor. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |

# TRIAXIAL CELL SETUP & TAKEDOWN

Project: Amoco Sioux — Date: 12-19-06

Sample: Composite #6 — Depth: @+ 12% Moisture Stand. Curve

Description: ~~[illegible]~~ Silty Brown Clay (CL)

Type of Test: Hyd. Cond. — Confining Pressure Differential: 5psi

Cell Number: 4 — Saturate (before) after Consolidation

Number of Membranes: 2 — Filter Strips Yes (No)

| MOISTURE CONTENT | INITIAL | | FINAL |
|---|---|---|---|
| Tare No. | M2 | M43 | |
| Wet Wt. + Tare | 123.35 | 119.92 | |
| Dry Wt. + Tare | 102.10 | 99.48 | |
| Wt. Water | 21.25 | 20.44 | |
| Tare Wt. | 21.96 | 22.47 | |
| Dry Soil Wt. | 80.14 | 77.01 | |
| Moisture % | 26.52 | 26.54 | |
| Avg. w % | 26.53 | | |

| LENGTH CHANGE | |
|---|---|
| STRAIN GAUGE at setup | — |
| at saturation start | — |
| at consolidation start | — |
| at axial load start | — |

| MASS PROPERTIES | | |
|---|---|---|
| Wt. Tube + Soil | | gm. |
| Wt. Tube | | gm. |
| Wt. Soil | 351.13 | gm. |
| Tube Diameter | | in. |
| Sample Length | | in |
| tube length | | in. |
| top trim | | in. |
| bottom trim | | in. |
| total trim | | in. |
| sample length | | in. |
| Density constant 4.85/(D^2 * L) | | |
| Wet Density | | pcf. |
| Dry Density | | pcf. |

SPECIMEN DIMENSIONS in. / mm.

| | HEIGHT Initial | HEIGHT Final | DIAMETER Initial | DIAMETER Final |
|---|---|---|---|---|
| 1 | 3.7520 | 3.6295 | T 1.9620 | 1.9575 |
| 2 | 3.7465 | 3.722 | M 1.9500 | 1.9510 |
| 3 | 3.7450 | 3.6740 | B 1.9465 | 1.934 |
| Avg. | 3.747833 in<br>9.51947 | 3.675167 in<br>9.33192 cm | 1.95283<br>4.9602 | 1.9475 in<br>4.94665 cm |

Description After Test: $W_{Final} = 352.29$

Remarks: Initial $\gamma_m = 119.2$, $\gamma_{Dry} = 94.2$, %M = 26.5 — Final $\gamma_m = 122.6$, $\gamma_{Dry} = 96.6$, %M = 26.9

Failure Sketch

Trimmed By: KEK
Trimmed Date: 12-19-06
Setup By: KEK
Setup Date: 12-19-06
Taken Down By:
Take Down Date:

trxSTUP.dwg rev. -/12/98

# TRIAXIAL CELL SATURATION & BETA FACTOR

PROJECT Amercan Sioux UWLF

SAMPLE Composite #6 DEPTH

INITIAL CELL PRESSURE 71.0 START DATE 12-19-06

INITIAL PORE PRESSURE 70.0 CELL NUMBER 4

INITIAL TRANSDUCER READING 71.7 TRANSDUCER NUMBER 4

| TRIAL DATE | TRIAL TIME 12:55 | BASE BURETTE READING | CELL PRESSURE | TRANS-DUCER READING | CHANGE IN PRESSURE (Transducer Constant ) CELL DELTA (1) | TRANSDUCER READING CHANGE | TRANSDUCER PRESSURE CHANGE (2) | BETA FACTOR (2/1) |
|---|---|---|---|---|---|---|---|---|
| 12-20-06 | 0 | 4.64 | 71.0 | 71.2 | | | | |
| | 1 | | 76.0 | 76.1 | 5.0 | | 4.9 | 0.98 |
| | 2 | | 76.0 | 76.1 | 5.0 | | 4.9 | 0.98 |
| | 4 | | 76.0 | 76.1 | 5.0 | | 4.9 | 0.98 |
| | 8 | | 76.0 | 76.1 | 5.0 | | 4.9 | 0.98 |

OK

# TRIAXIAL CELL CONSOLIDATION TEST

PROJECT Ameren Sioux UWLF

SAMPLE Composite #6 DEPTH

CONSOLIDATION CELL PRESSURE 80.0 CELL NUMBER 4

CONSOLIDATION PORE PRESSURE 75.0

| DATE | TIME | BURETTE READING | DELTA VOLUME | SUM DELTA VOLUME | DELTA TIME | TEMP | REMARKS |
|---|---|---|---|---|---|---|---|
| 12-20-06 | 13:10 | 10.00 | | | 0 | | Cell 3.88 |
| | | 9.68 | 0.32 | 0.32 | .1 | | |
| | | 9.63 | 0.05 | 0.37 | .25 | | |
| | | 9.58 | 0.05 | 0.42 | .5 | | |
| | 13:11 | 9.51 | 0.07 | 0.49 | 1 | | |
| | 13:12 | 9.42 | 0.09 | 0.58 | 2 | | |
| | 13:14 | 9.32 | 0.10 | 0.68 | 4 | | |
| | 13:18 | 9.17 | 0.15 | 0.83 | 8 | | |
| | 13:25 | 8.99 | 0.18 | 1.01 | 15 | | |
| | 13:40 | 8.73 | 0.26 | 1.27 | 30 | | |
| | 14:10 | 8.42 | 0.31 | 1.58 | 60 | | |
| | 15:10 | 8.05 | 0.37 | 1.95 | 120 | | |
| | 16:30 | 7.83 | 0.22 | 2.17 | 200 | | |
| 12-21-06 | 8:20 | 8.24 | | | | | |

Dave

Temp Grabbed @ 10

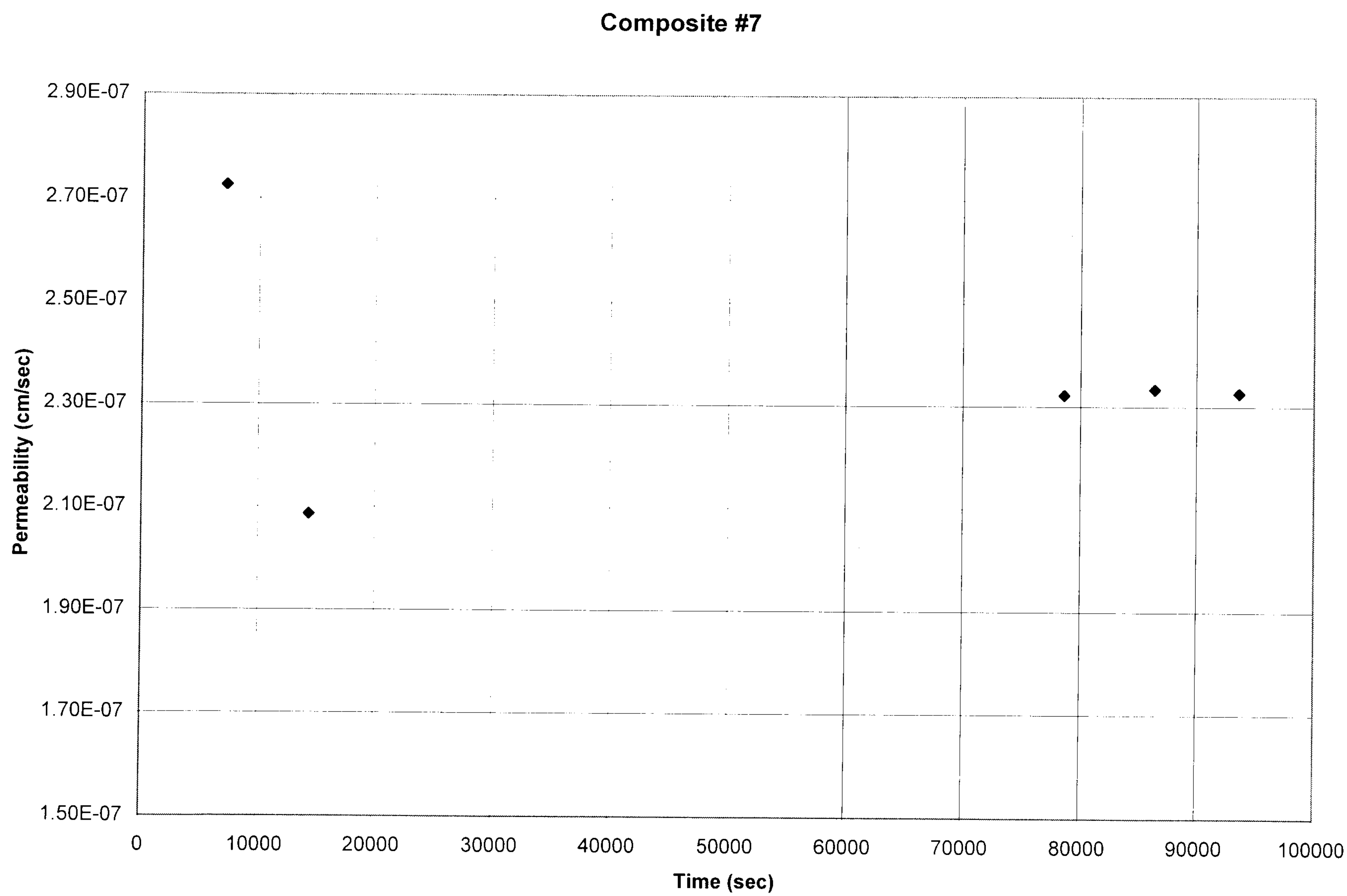
REITZ & JENS, INC. Consulting Engineers Sheet ______ of ______

## Ameren, Soiux UWLF
**Project # 2005012477**
**Compostite #7**
**Hydraulic Conductivity**

| Soil Conditions | |
|---|---|
| **Pre-test conditions** | **Post-test Conditions** |
| Wet Density = 120.2 (lbs/ft^3) | Wet Density = 124.6 (lbs/ft^3) |
| % Moisture = 25.0% | % Moisture = 25.6% |
| Dry Density = 96.1 (lbs/ft^3) | Dry Density = 99.2 (lbs/ft^3) |

| Test Information | |
|---|---|
| a (cm^2)= | 0.19685 |
| L (cm)= | 9.7155 |
| A (cm^2)= | 19.658137 |

| Date | Time | Elapsed Time (seconds) | Cell Burette Reading (ml) | Base Burette Reading (ml) | Base Burette Distance from Datum (cm) | Top Burette Reading (ml) | Top Burette Distance from Datum (cm) | Total Head Across Sample (cm of water) | Temperature (°C) | Weighted Average Temp. (°C) | Uncorrected Hydraulic Conductivity (cm/sec) | Correction Factor | Corrected Hydraulic Conductivity (cm/sec) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12/18/2006 | 11:00 | 0 | 10.4 | 10.00 | 27.200 | 0.14 | 77.289 | 85.269 | 21.5 | | | | |
| | 13:00 | 7200 | 10.4 | 9.61 | 29.181 | 0.44 | 75.765 | 81.764 | 21.8 | 21.65 | 2.84E-07 | 0.9612431 | 2.73E-07 |
| | 15:00 | 14400 | 10.4 | 9.33 | 30.604 | 0.52 | 75.358 | 79.935 | 22.4 | 21.88 | 2.18E-07 | 0.9561208 | 2.09E-07 |
| 12/19/2006 | 8:50 | 78600 | 10.8 | 7.32 | 40.814 | 2.76 | 63.979 | 58.345 | 17.9 | 20.47 | 2.35E-07 | 0.9889614 | 2.32E-07 |
| | 11:00 | 86400 | 10.8 | 7.11 | 41.881 | 2.98 | 62.862 | 56.160 | 19.7 | 20.32 | 2.35E-07 | 0.9925785 | 2.33E-07 |
| | 13:00 | 93600 | 10.7 | 6.92 | 42.846 | 3.15 | 61.998 | 54.332 | 20.3 | 20.29 | 2.34E-07 | 0.9931645 | 2.33E-07 |



Composite #7
Permeability (cm/sec)
2.90E-07
2.70E-07
2.50E-07
2.30E-07
2.10E-07
1.90E-07
1.70E-07
1.50E-07
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
100000
Time (sec)

# Hydraulic Conductivity (ASTM-D 5084)
## Flow Rate Calculation

Job------- American Stone
Location-
Sample--- Composite #7
Depth-----

a=
A=
L=

Cell No. 4

| Cell Pressure (p.s.i.) | Base Pressure (p.s.i.) | Top Pressure (p.s.i.) |
|---|---|---|
| 80.5 | 75.0 | 75.5 |

| Date | Time | Elapsed Time Minutes | Cell Reading ML | Base Reading ML | Top Reading ML | Top Head CM | Base Head CM | h CM | Temp. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| 12-18-06 | 11:00 | 0 | 10.35 | 10.00 | 0.14 | | | | 21.5 | |
| | 13:00 | 120 | 10.35 | 9.61 | 0.44 | | | | 21.8 | |
| | 15:00 | 240 | 10.40 | 9.33 | 0.52 | | | | 22.4 | |
| 12-19-06 | 8:50 | 1310 | 10.75 | 7.32 | 2.76 | | | | 17.9 | |
| | 11:00 | 1440 | 10.80 | 7.11 | 2.98 | | | | 19.7 | |
| | 13:00 | 1560 | 10.70 | 6.92 | 3.15 | | | | 20.3 | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

| a x L | t (sec) | 2 x A x t | aL/2At | h1 | h2 | ln(h1/h2) | K | Temp. Cor. | K -Cor. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

# TRIAXIAL CELL SETUP & TAKEDOWN

Project: Amercan Sioux WWLF  Date: 12-14-06
Sample: Composite #7  Depth: Standard Proctor @ + 10% Moisture
Description: Brown Silty CLAY

Type of Test: Hydr. Conduct.  Confining Pressure Differential: 5 psi
Cell Number: 4  Saturate (before) after Consolidation
Number of Membranes: 2  Filter Strips Yes (No)

**MOISTURE CONTENT**

| | INITIAL | | FINAL |
|---|---|---|---|
| Tare No. | 2 | 45 | |
| Wet Wt. + Tare | 95.30 | 108.50 | |
| Dry Wt. + Tare | 80.71 | 91.11 | |
| Wt. Water | | | |
| Tare Wt. | 22.06 | 22.06 | |
| Dry Soil Wt. | | | |
| Moisture % | 24.876 | 25.185 | |
| Avg. w % | 25.03 | | |

**LENGTH CHANGE**

STRAIN GAUGE at setup —
at saturation start —
at consolidation start —
at axial load start —

**MASS PROPERTIES**

| | | |
|---|---|---|
| Wt. Tube + Soil | | gm. |
| Wt. Tube | | gm. |
| Wt. Soil | 379.62 | gm. |
| Tube Diameter | | in. |
| Sample Length | | in |
| tube length | | in. |
| top trim | | in. |
| bottom trim | | in. |
| total trim | | in. |
| sample length | | in. |
| Density constant | | |
| 4.85/(D^2 * L) | | |
| Wet Density | | pcf. |
| Dry Density | | pcf. |

**SPECIMEN DIMENSIONS in. / mm.**

| | HEIGHT | | DIAMETER | |
|---|---|---|---|---|
| | Initial | Final | Initial | Final |
| 1 | 3.8915 | 3.8055 | T 1.9955 | 1.9690 |
| 2 | 3.8980 | 3.8350 | M 1.9770 | 1.9640 |
| 3 | 3.8985 | 3.8345 | B 1.9755 | 1.9760 |
| Avg. | 3.8960 in | 3.825 in 9.7155 | 1.9827 in | 1.969667 in 5.0029533 cm |

9.89584 cm    5.036058 cm

Description After Test: Dry Wt of Soil = 303.62  Post Test wt = 381.34

Remarks: Initial $\gamma_m$ = 120.2  $\gamma_d$ = 96.1  %m = 25.0%
Final $\gamma_{moist}$ = 124.6  $\gamma_{dry}$ = 99.2  % moisture = 25.6

Failure Sketch

Trimmed By: KGL & JDB
Trimmed Date: 12-14-06
Setup By: KGL & JDB
Setup Date: 12-14-06
Taken Down By: KEK
Take Down Date: 12-19-06

trxSTUP.dwg revb /12/98

RFITZ & JENS, INC. Consulting Engineers  Sheet ______ of ______

# TRIAXIAL CELL SATURATION & BETA FACTOR

PROJECT American Sigma UWLF

SAMPLE Composite #7 DEPTH

INITIAL CELL PRESSURE 71.0 START DATE 12-14-06

INITIAL PORE PRESSURE 70.0 CELL NUMBER 4

INITIAL TRANSDUCER READING 72.6 TRANSDUCER NUMBER 4

| TRIAL DATE | TRIAL TIME | BASE BURETTE READING | CELL PRESSURE | TRANS-DUCER READING | CHANGE IN PRESSURE<br>Transducer Constant | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | CELL DELTA (1) | TRANSDUCER READING CHANGE | TRANSDUCER PRESSURE CHANGE (2) | BETA FACTOR (2/1) |
| 12-15-06 | 0 | 2.98 | 71.0 | 71.7 | | | | |
| | 1 | | 76.0 | 76.6 | 5.0 | | 4.9 | 0.98 |
| | 2 | | 76.0 | 76.6 | 5.0 | | 4.9 | 0.98 |
| | 4 | | 76.0 | 76.6 | 5.0 | | 4.9 | 0.98 |
| | 8 | | 76.0 | 76.6 | 5.0 | | 4.9 | 0.98 |

# TRIAXIAL CELL CONSOLIDATION TEST

PROJECT American Stone UWLF

SAMPLE Composite #7 DEPTH (6.?)

CONSOLIDATION CELL PRESSURE 80.0 CELL NUMBER 4

CONSOLIDATION PORE PRESSURE 75.0

| DATE | TIME | BURETTE READING | DELTA VOLUME | SUM DELTA VOLUME | DELTA TIME | TEMP | REMARKS |
|---|---|---|---|---|---|---|---|
| 12-15-86 | 11:00 | 10.00 | | | 0 | | |
| | | 9.69 | 0.31 | 0.31 | 0.1 | | |
| | | 9.63 | 0.06 | 0.37 | 0.25 | | |
| | | 9.57 | 0.06 | 0.43 | .5 | | |
| | 11:01 | 9.49 | 0.08 | 0.51 | 1 | | 8.10 cell |
| | 11:02 | 9.33 | 0.16 | 0.67 | 2 | | |
| | 11:04 | 9.17 | 0.16 | 0.83 | 4 | | |
| | 11:08 | 8.92 | 0.25 | 1.08 | 8 | | 8.60 cell |
| | 11:15 | 8.66 | 0.26 | 1.34 | 15 | | |
| | 11:38 | 8.36 | 0.30 | 1.64 | 38 | | |
| | 12:00 | 8.26 | 0.10 | 1.74 | 60 | | |
| | 13:00 | 8.17 | 0.09 | 1.83 | 120 | | 9.20 cell |
| | 15:02 | 8.11 | 0.06 | 1.89 | 242 | | |
| 12-16 | 10:55 | 8.32 | | | 1435 | | |

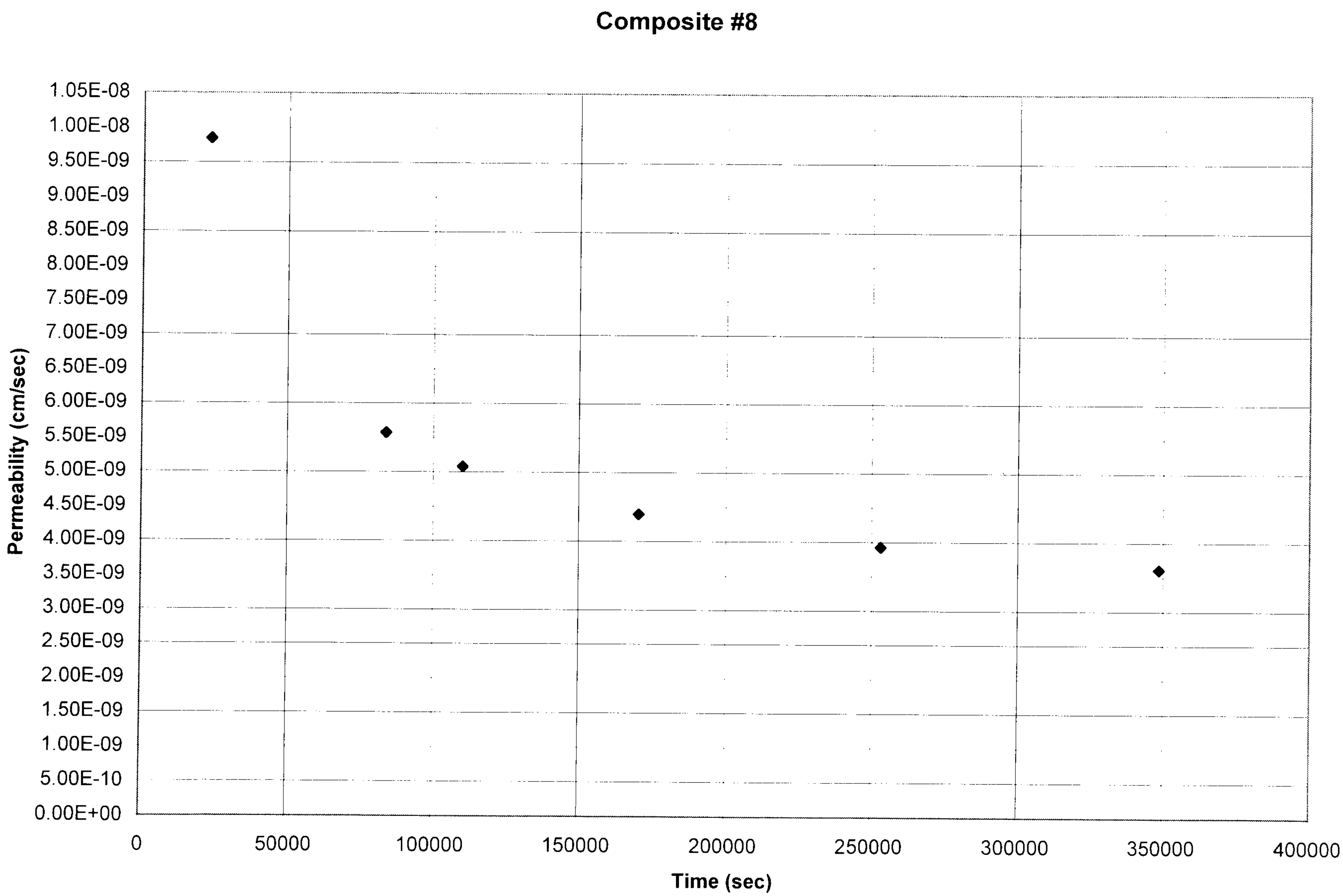
REITZ & JENS, INC. Consulting Engineers Sheet ______ of ______

## Ameren, Soiux UWLF
### Project # 2005012477
### Compostite #8
**Hydraulic Conductivity**

| Soil Conditions | |
|---|---|
| **Pre-test conditions** | **Post-test Conditions** |
| Wet Density = 116.7 (lbs/ft^3) | Wet Density = 120.0 (lbs/ft^3) |
| % Moisture = 27.8% | % Moisture = 34.6% |
| Dry Density = 91.3 (lbs/ft^3) | Dry Density = 89.1 (lbs/ft^3) |

| Test Information | |
|---|---|
| a (cm^2)= | 0.19685 |
| L (cm)= | 8.9983733 |
| A (cm^2)= | 20.315602 |

| Date | Time | Elapsed Time (seconds) | Cell Burette Reading (ml) | Base Burette Reading (ml) | Base Burette Distance from Datum (cm) | Top Burette Reading (ml) | Top Burette Distance from Datum (cm) | Total Head Across Sample (cm of water) | Temperature (°C) | Weighted Average Temp. (°C) | Uncorrected Hydraulic Conductivity (cm/sec) | Correction Factor | Corrected Hydraulic Conductivity (cm/sec) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/2/2007 | 9:10 | 0 | 3.5 | 10.00 | 27.200 | 0.00 | 78.000 | 261.874 | 19.7 | | | | |
| | 15:40 | 23400 | 3.4 | 9.82 | 28.114 | 0.10 | 77.492 | 260.452 | 22.8 | 21.25 | 1.01E-08 | 0.9704616 | 9.85E-09 |
| 1/3/2007 | 8:30 | 84000 | 3.8 | 9.67 | 28.876 | 0.24 | 76.781 | 258.978 | 20.3 | 21.47 | 5.77E-09 | 0.9654557 | 5.57E-09 |
| | 15:45 | 110100 | 3.6 | 9.62 | 29.130 | 0.30 | 76.476 | 258.420 | 22.5 | 21.45 | 5.26E-09 | 0.9658185 | 5.08E-09 |
| 1/4/2007 | 8:30 | 170400 | 3.8 | 9.53 | 29.588 | 0.44 | 75.765 | 257.251 | 20.8 | 21.52 | 4.56E-09 | 0.9641953 | 4.39E-09 |
| 1/5/2007 | 7:30 | 253200 | 3.9 | 9.43 | 30.096 | 0.63 | 74.800 | 255.778 | 21.3 | 21.37 | 4.06E-09 | 0.9677473 | 3.92E-09 |
| 1/6/2007 | 10:00 | 348600 | 4.0 | 9.32 | 30.654 | 0.83 | 73.784 | 254.203 | 20.7 | 21.27 | 3.72E-09 | 0.9700749 | 3.61E-09 |


Composite #8
Permeability (cm/sec)
1.05E-08
1.00E-08
9.50E-09
9.00E-09
8.50E-09
8.00E-09
7.50E-09
7.00E-09
6.50E-09
6.00E-09
5.50E-09
5.00E-09
4.50E-09
4.00E-09
3.50E-09
3.00E-09
2.50E-09
2.00E-09
1.50E-09
1.00E-09
5.00E-10
0.00E+00
0
50000
100000
150000
200000
250000
300000
350000
400000
Time (sec)

# Hydraulic Conductivity (ASTM-D 5084)
## Flow Rate Calculation

Job------- Amazon Sioux WWLF
Location-
Sample--- Composite #8
Depth-----

a=
A=
L=

**Cell No.** 4

| Cell Pressure (p.s.i.) | Base Pressure (p.s.i.) | Top Pressure (p.s.i.) |
|---|---|---|
| 83.0 | 75.0 | 78.0 |

| Date | Time | Elapsed Time Minutes | Cell Reading ML | Base Reading ML | Top Reading ML | Top Head CM | Base Head CM | h CM | Temp. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| 1-2-07 | 9:10 | 0 | 3.45 | 10.00 | 0.00 | | | | 19.7 | |
| | 15:40 | 390 | 3.35 | 9.82 | 0.10 | | | | 22.8 | |
| 1-3-07 | 8:30 | 1400 | 3.75 | 9.67 | 0.24 | | | | 20.3 | |
| | 15:45 | 1835 | 3.55 | 9.62 | 0.30 | | | | 22.5 | |
| 1-4-07 | 8:30 | 2840 | 3.80 | 9.53 | 0.44 | | | | 20.8 | |
| 1-5-07 | 7:30 | 4220 | 3.90 | 9.43 | 0.63 | | | | 21.3 | |
| 1-6-07 | 10:00 | 5810 | 4.00 | 9.32 | 0.83 | | | | 20.7 | |
| | | | | | | | | | | |

| a x L | t (sec) | 2 x A x t | aL/2At | h1 | h2 | ln(h1/h2) | K | Temp. Cor. | K -Cor. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |

# TRIAXIAL CELL SETUP & TAKEDOWN

Project: Ameren Sioux UWLF    Date: 12-26-06

Sample: Composite #8    Depth: 

Description: CH

Type of Test: Hyd Cond. (Flex-wall)    Confining Pressure Differential: 

Cell Number: 4    Saturate before after Consolidation: 

Number of Membranes: 2    Filter Strips Yes No

| MOISTURE CONTENT | INITIAL | | FINAL |
|---|---|---|---|
| Tare No. | 12 | 70 | R/13 |
| Wet Wt. + Tare | 93.13 | 103.82 | 74.35 |
| Dry Wt. + Tare | 77.67 | 85.85 | 69.43 |
| Wt. Water | | | |
| Tare Wt. | 21.90 | 21.55 | 40.80 |
| Dry Soil Wt. | | | |
| Moisture % | 27.721 | 27.947 | |
| Avg. w % | 27.83 | | 34.649 |

| LENGTH CHANGE | |
|---|---|
| STRAIN GAUGE at setup | |
| at saturation start | |
| at consolidation start | |
| at axial load start | |

| MASS PROPERTIES | | |
|---|---|---|
| Wt. Tube + Soil | | gm. |
| Wt. Tube | | gm. |
| Wt. Soil | | gm. |
| Tube Diameter | | in. |
| Sample Length | | in |
| tube length | | in. |
| top trim | | in. |
| bottom trim | | in. |
| total trim | | in. |
| sample length | | in. |
| Density constant 4.85/(D^2 * L) | | |
| Wet Density | | pcf. |
| Dry Density | | pcf. |

SPECIMEN DIMENSIONS in. / mm.

| | HEIGHT Initial | HEIGHT Final | DIAMETER Initial | DIAMETER Final |
|---|---|---|---|---|
| 1 | 3.5365 | 3.5506 | T 1.982 | 1.9965 |
| 2 | 3.5265 | 3.5400 | M 1.9815 | 2.0005 |
| 3 | 3.5310 | 3.5376 | B 1.9805 | 2.0100 |
| Avg. | 3.5313<br>8.969587 | 3.542667<br>8.99837333 | 1.981333<br>5.03259 | 2.002333<br>5.08592667 |

Description After Test: Final wt = 351.48
Dry = 261.03

Remarks: Initial $\gamma_m$ = 116.7    Final $\gamma_m$ = 120.0
$\gamma_{dry}$ = 91.3    $\gamma_{dry}$ = 89.1
%M = 27.8    %M = 34.6

Failure Sketch

Trimmed By: JDB
Trimmed Date: 12-26-06

Setup By: JDB
Setup Date: 12-26-06

Taken Down By: KEK
Take Down Date: 1-6-07

# TRIAXIAL CELL SATURATION & BETA FACTOR

PROJECT Ameren UE Sioux UWLF

SAMPLE Composite #8 DEPTH

INITIAL CELL PRESSURE 71.0 START DATE 12-27-06

INITIAL PORE PRESSURE 70.0 CELL NUMBER 4

INITIAL TRANSDUCER READING 70.4 TRANSDUCER NUMBER 4

| TRIAL DATE | TRIAL TIME | BASE BURETTE READING | CELL PRESSURE | TRANS-DUCER READING | CHANGE IN PRESSURE Transducer Constant | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | CELL DELTA (1) | TRANSDUCER READING CHANGE | TRANSDUCER PRESSURE CHANGE (2) | BETA FACTOR (2/1) |
| 12-29-06 | 0 | 3.56 | 71.0 | 70.9 | | | | |
| | 1 | | 76.0 | 75.7 | 5.0 | | 4.8 | 0.96 |
| | 2 | | " | 75.7 | 5.0 | | 4.8 | 0.96 |
| | 4 | | " | 75.7 | 5.0 | | 4.8 | 0.96 |
| | 8 | | " | ~~75.~~ 75.7 | 5.0 | | 4.8 | 0.96 |

OK

# TRIAXIAL CELL CONSOLIDATION TEST

PROJECT Ameren Sioux UWLF

SAMPLE Composite #8 @ +12% DEPTH

CONSOLIDATION CELL PRESSURE 80 psi CELL NUMBER 4

CONSOLIDATION PORE PRESSURE 75 psi

| DATE | TIME | BURETTE READING | DELTA VOLUME | SUM DELTA VOLUME | DELTA TIME | TEMP | REMARKS |
|---|---|---|---|---|---|---|---|
| 12-29-06 | 9:20 | 10.00 | | | 0 | | |
| | | 9.84 | 0.16 | 0.16 | .1 | | |
| | | 9.82 | 0.02 | 0.18 | .25 | | |
| | | 9.80 | 0.02 | 0.20 | .5 | | |
| | 9:21 | 9.78 | 0.02 | 0.22 | 1 | | |
| | 9:22 | 9.75 | 0.03 | 0.25 | 2 | | |
| | 9:24 | 9.72 | 0.03 | 0.28 | 4 | | |
| | 9:28 | 9.68 | 0.04 | 0.32 | 8 | | |
| | 9:35 | 9.64 | 0.04 | 0.36 | 15 | | |
| | 9:50 | 9.59 | 0.05 | 0.41 | 30 | | |
| | 10:20 | 9.53 | 0.06 | 0.47 | 60 | | |
| | 11:20 | 9.46 | 0.07 | 0.54 | 120 | | |
| | *4 15 | *9.30 | | | | | |
| 1-2-07 | 8:45 | 9.66 | | | | | |

Begin Hid Cond

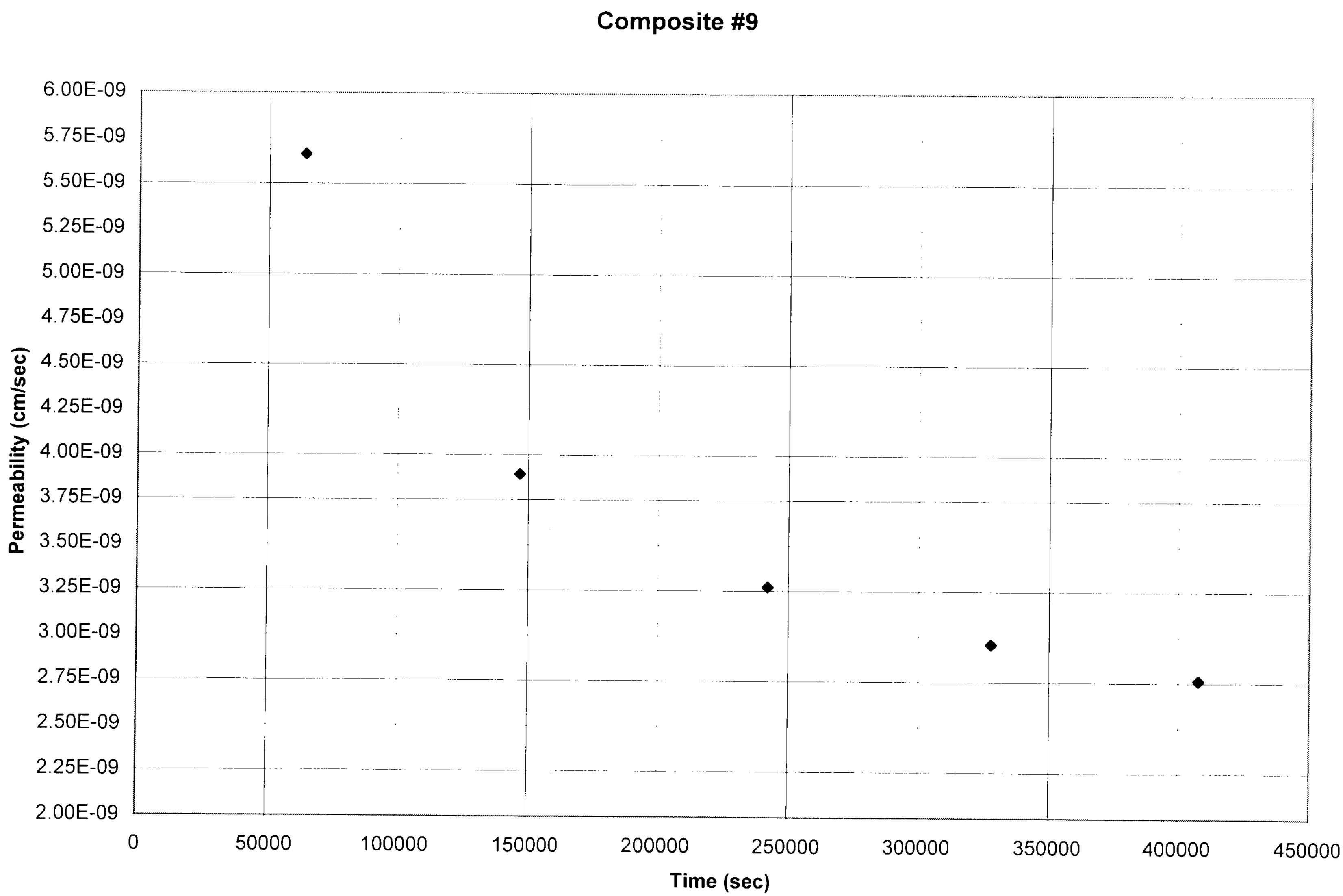
REITZ & JENS, INC. Consulting Engineers Sheet _____ of _____

# Ameren, Soiux UWLF
**Project # 2005012477**
**Compostite #9**
**Hydraulic Conductivity**

| Soil Conditions | |
|---|---|
| **Pre-test conditions** | **Post-test Conditions** |
| Wet Density = 120.4 (lbs/ft^3) | Wet Density = 121.4 (lbs/ft^3) |
| % Moisture = 26.5% | % Moisture = 29.2% |
| Dry Density = 95.2 (lbs/ft^3) | Dry Density = 94.0 (lbs/ft^3) |

| Test Information | |
|---|---|
| a (cm^2)= | 0.19685 |
| L (cm)= | 9.1025133 |
| A (cm^2)= | 20.312218 |

| Date | Time | Elapsed Time (seconds) | Cell Burette Reading (ml) | Base Burette Reading (ml) | Base Burette Distance from Datum (cm) | Top Burette Reading (ml) | Top Burette Distance from Datum (cm) | Total Head Across Sample (cm of water) | Temperature (°C) | Weighted Average Temp. (°C) | Uncorrected Hydraulic Conductivity (cm/sec) | Correction Factor | Corrected Hydraulic Conductivity (cm/sec) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/3/2007 | 14:45 | 0 | 14.7 | 10.00 | 27.200 | 0.00 | 78.000 | 191.516 | 22.4 | | | | |
| 1/4/2007 | 8:30 | 63900 | 15.0 | 9.72 | 28.622 | 0.04 | 77.797 | 189.890 | 20.8 | 21.60 | 5.88E-09 | 0.9623875 | 5.66E-09 |
| 1/5/2007 | 7:30 | 146700 | 15.3 | 9.60 | 29.232 | 0.10 | 77.492 | 188.976 | 21.3 | 21.29 | 4.01E-09 | 0.9695431 | 3.89E-09 |
| 1/6/2007 | 10:00 | 242100 | 15.5 | 9.50 | 29.740 | 0.19 | 77.035 | 188.011 | 20.7 | 21.18 | 3.37E-09 | 0.9721955 | 3.27E-09 |
| 1/7/2007 | 9:50 | 327900 | 15.6 | 9.44 | 30.045 | 0.28 | 76.578 | 187.249 | 20.4 | 21.01 | 3.03E-09 | 0.9760209 | 2.96E-09 |
| 1/8/2007 | 8:00 | 407700 | 15.7 | 9.38 | 30.350 | 0.35 | 76.222 | 186.588 | 20.3 | 20.88 | 2.82E-09 | 0.9790664 | 2.76E-09 |



Composite #9
Permeability (cm/sec)
6.00E-09
5.75E-09
5.50E-09
5.25E-09
5.00E-09
4.75E-09
4.50E-09
4.25E-09
4.00E-09
3.75E-09
3.50E-09
3.25E-09
3.00E-09
2.75E-09
2.50E-09
2.25E-09
2.00E-09
0
50000
100000
150000
200000
250000
300000
350000
400000
450000
Time (sec)

# Hydraulic Conductivity (ASTM-D 5084)
# Flow Rate Calculation

Job------- Ameron Sewer UWLF
Location-
Sample--- Composite #9
Depth-----

a=
A=
L=

Cell No. 2

| Cell Pressure (p.s.i.) | Base Pressure (p.s.i.) | Top Pressure (p.s.i.) |
|---|---|---|
| 82.0 | 75.0 | 77.0 |

| Date | Time | Elapsed Time Minutes | Cell Reading ML | Base Reading ML | Top Reading ML | Top Head CM | Base Head CM | h CM | Temp. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| 1-3-07 | 14:45 | 0 | 14.7 | 10.00 | 0.00 | | | | 22.4 | |
| 1-4-07 | 8:30 | 1065 | 15.0 | 9.72 | 0.04 | | | | 20.8 | |
| 1-5-07 | 9:30 | 2445 | 15.3 | 9.60 | 0.10 | | | | 21.3 | |
| 1-6-07 | 10:00 | 4035 | 15.5 | 9.50 | 0.19 | | | | 20.7 | |
| 1-7-07 | 9:50 | 5465 | 15.6 | 9.44 | 0.28 | | | | 20.4 | |
| 1-8-07 | 8:00 | 6795 | 15.7 | 9.38 | 0.35 | | | | 20.3 | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

| a x L | t (sec) | 2 x A x t | aL/2At | h1 | h2 | ln(h1/h2) | K | Temp. Cor. | K -Cor. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

# TRIAXIAL CELL SETUP & TAKEDOWN

Project: American Sioux — Date: 12-28-06

Sample: Composite #9 — Depth: @+18% Moisture Std. Curve

Description: CLAY (CL-CH), Brown

Type of Test: Hyd. Cond. — Confining Pressure Differential: 5 psi

Cell Number: 2 — Saturate before after Consolidation

Number of Membranes: 2 — Filter Strips Yes No

## LENGTH CHANGE

STRAIN GAUGE at setup: 500

at saturation start: 500

at consolidation start: 492

at axial load start:

## MOISTURE CONTENT

| | INITIAL | | FINAL |
|---|---|---|---|
| Tare No. | M5 | M19 | |
| Wet Wt. + Tare | 110.34 | 111.55 | |
| Dry Wt. + Tare | 91.76 | 92.79 | |
| Wt. Water | | | |
| Tare Wt. | 22.12 | 21.66 | |
| Dry Soil Wt. | | | |
| Moisture % | 26.680 | 26.374 | |
| Avg. w % | 26.53 | | |

## MASS PROPERTIES

| | | |
|---|---|---|
| Wt. Tube + Soil | | gm. |
| Wt. Tube | | gm. |
| Wt. Soil | 352.24 | gm. |
| Tube Diameter | | in. |
| Sample Length | | in |
| tube length | | in. |
| top trim | | in. |
| bottom trim | | in. |
| total trim | | in. |
| sample length | | in. |
| Density constant 4.85/(D^2 * L) | | |
| Wet Density | | pcf. |
| Dry Density | | pcf. |

## SPECIMEN DIMENSIONS in. / mm.

| | HEIGHT | | DIAMETER | | |
|---|---|---|---|---|---|
| | Initial | Final | | Initial | Final |
| 1 | 3.5675 | 3.5905 | T | 1.9940 | 2.0105 |
| 2 | 3.5535 | 3.5800 | M | 1.9925 | 1.9905 |
| 3 | 3.5725 | 3.5985 | B | 1.9980 | 2.0055 |
| Avg. | 3.5645<br>9.05383 | 3.583667<br>9.1025133 | | 1.99483<br>5.06687 | 2.002167<br>5.085503 |

Final wt = 359.67

Description After Test

Remarks: Initial — $\gamma_m$ = 120.4, $\gamma_{dry}$ = 95.2, %M = 26.5

Final — $\gamma_m$ = 121.4, $\gamma_{dry}$ = 94.0, %M = 29.2

Failure Sketch

Trimmed By: KCK
Trimmed Date: 12-28-06

Setup By: KCK
Setup Date: 12-28-06

Taken Down By: KCK
Take Down Date: 1-8-07

trxSTUP.dwg revised 2/12/98

# TRIAXIAL CELL SATURATION & BETA FACTOR

PROJECT American Sioux WWLF

SAMPLE Composite #9 DEPTH

INITIAL CELL PRESSURE 71.0 START DATE 12-28-06

INITIAL PORE PRESSURE 70.0 CELL NUMBER 2

INITIAL TRANSDUCER READING 71.1 TRANSDUCER NUMBER 2

| TRIAL DATE | TRIAL TIME | BASE BURETTE READING | CELL PRESSURE | TRANS-DUCER READING | CHANGE IN PRESSURE Transducer Constant | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | CELL DELTA (1) | TRANSDUCER READING CHANGE | TRANSDUCER PRESSURE CHANGE (2) | BETA FACTOR (2/1) |
| 1-2-07 | 0 | 5.40 | 71.0 | 70.3 | | | | |
| | 1 | | 76.0 | 75.2 | | | 4.9 | 0.98 |
| | 2 | | " | 75.2 | | | 4.9 | 0.98 |
| | 4 | | " | 75.2 | | | 4.9 | 0.98 |
| | 8 | | " | | | | | |
| | | | | | | | | |

OK

REITZ & JENS, INC. Consulting Engineers Sheet ______ of ______

# TRIAXIAL CELL CONSOLIDATION TEST

PROJECT Ameren Sioux UWLF

SAMPLE Composite #9 DEPTH

CONSOLIDATION CELL PRESSURE 80.0 CELL NUMBER 2

CONSOLIDATION PORE PRESSURE 75.0

| DATE | TIME | BURETTE READING | DELTA VOLUME | SUM DELTA VOLUME | DELTA TIME | TEMP | REMARKS |
|---|---|---|---|---|---|---|---|
| 1-2-07 | 13:10 | 10.00 | | | 0 | | |
| | | 9.82 | | | .1 | | |
| | | 9.81 | | | .125 | | |
| | | 9.80 | | | .5 | | |
| | 13:11 | 9.79 | | | 1 | | |
| | 13:12 | 9.78 | | | 2 | | |
| | 13:14 | 9.76 | | | 4 | | |
| | 13:18 | 9.74 | | | 8 | | |
| | 13:25 | 9.71 | | | 15 | | |
| | 13:40 | 9.67 | | | 30 | | |
| | 14:10 | 9.62 | | | 60 | | |
| | 15:40 | 9.53 | | | | | |
| 1-3-07 | 8:30 | 9.40 | | | | | |
| | 14:30 | 9.46 | | | | | |

Done

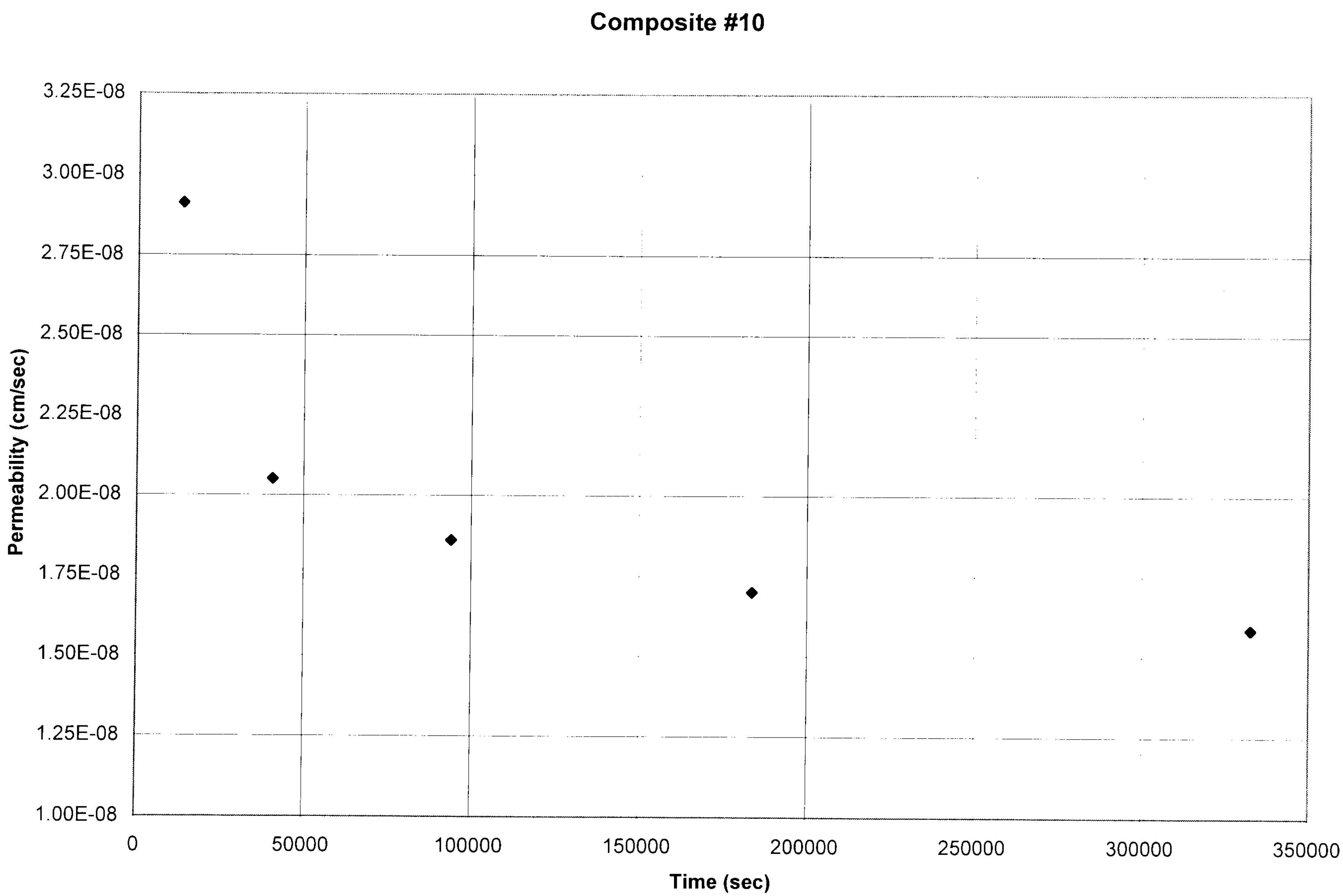
REITZ & JENS, INC. Consulting Engineers Sheet ____ of ____

## Ameren, Soiux UWLF
### Project # 2005012477
### Compostite #10
**Hydraulic Conductivity**

| Soil Conditions | |
|---|---|
| **Pre-test conditions** | **Post-test Conditions** |
| Wet Density = 121.3 (lbs/ft^3) | Wet Density = 124.2 (lbs/ft^3) |
| % Moisture = 22.3% | % Moisture = 26.0% |
| Dry Density = 99.2 (lbs/ft^3) | Dry Density = 98.6 (lbs/ft^3) |

| Test Information | |
|---|---|
| a (cm^2)= | 0.19685 |
| L (cm)= | 9.8743347 |
| A (cm^2)= | 20.005651 |

| | | | | Base Burette | | Top Burette | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Time | Elapsed Time (seconds) | Cell Burette Reading (ml) | Reading (ml) | Distance from Datum (cm) | Reading (ml) | Distance from Datum (cm) | Total Head Across Sample (cm of water) | Temperature (°C) | Weighted Average Temp. (°C) | Uncorrected Hydraulic Conductivity (cm/sec) | Correction Factor | Corrected Hydraulic Conductivity (cm/sec) |
| 12/22/2006 | 11:20 | 0 | 9.8 | 10.00 | 27.200 | 0.00 | 78.000 | 121.158 | 21.3 | | | | |
| 12/22/2006 | 15:07 | 13620 | 10.1 | 9.88 | 27.810 | 0.08 | 77.594 | 120.142 | 21.3 | 21.30 | 3.00E-08 | 0.9693013 | 2.91E-08 |
| 12/22/2006 | 22:40 | 40800 | 10.8 | 9.72 | 28.622 | 0.14 | 77.289 | 119.024 | 21.3 | 21.30 | 2.12E-08 | 0.9693013 | 2.05E-08 |
| 12/23/2006 | 13:28 | 94080 | 12.0 | 9.53 | 29.588 | 0.40 | 75.968 | 116.738 | 21.3 | 21.30 | 1.92E-08 | 0.9693013 | 1.86E-08 |
| 12/24/2006 | 14:20 | 183600 | 13.2 | 9.23 | 31.112 | 0.76 | 74.139 | 113.386 | 21.3 | 21.30 | 1.75E-08 | 0.9693013 | 1.70E-08 |
| 12/26/2006 | 7:45 | 332700 | 14.6 | 8.78 | 33.398 | 1.29 | 71.447 | 108.407 | 20 | 21.01 | 1.62E-08 | 0.9760936 | 1.58E-08 |


Composite #10
Permeability (cm/sec)
3.25E-08
3.00E-08
2.75E-08
2.50E-08
2.25E-08
2.00E-08
1.75E-08
1.50E-08
1.25E-08
1.00E-08
0
50000
100000
150000
200000
250000
300000
350000
Time (sec)

# Hydraulic Conductivity (ASTM-D 5084)
## Flow Rate Calculation

Job------- Amron Sioux
Location-
Sample--- Composite #10
Depth-----

a=
A=
L=

**Cell No.**

| Cell Pressure (p.s.i.) | Base Pressure (p.s.i.) | Top Pressure (p.s.i.) |
|---|---|---|
| 81.0 | 75.0 | 76.0 |

| Date | Time | Elapsed Time Minutes | Cell Reading ML | Base Reading ML | Top Reading ML | Top Head CM | Base Head CM | h CM | Temp. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| 12-22-06 | 11:20 | 0 | 9.80 | 10.00 | 0.00 | | | | 21.3 | |
| 12/22 | 1507 | 227 | 10.1 | 9.88 | 0.08 | | | | | |
| | 2240 | 680 | 10.8 | 9.72 | 0.14 | | | | 21.3 | |
| 12/23 | 1328 | 1568 | 12.0 | 9.53 | 0.40 | | | | | |
| 12/24 | 1420 | 3060 | 13.2 | 9.23 | 0.76 | | | | | |
| 12/26 | 745 | 5545 | 14.6 | 8.78 | 1.29 | | | | 20.0 | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

| a x L | t (sec) | 2 x A x t | aL/2At | h1 | h2 | ln(h1/h2) | K | Temp. Cor. | K -Cor. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

# TRIAXIAL CELL SETUP & TAKEDOWN

Project Aurora Sioux Date 12-20-06

Sample Composite #10 Depth @ +122 [illegible] Standard Proctor

Description

Type of Test Hyd. Cond. Confining Pressure Differential 5 psi

Cell Number #1 Saturate (before) after Consolidation

Number of Membranes 2 Filter Strips Yes (No)

| MOISTURE CONTENT | INITIAL | | FINAL |
|---|---|---|---|
| Tare No. | M38 | M47 | |
| Wet Wt. + Tare | 102.54 | 92.28 | |
| Dry Wt. + Tare | 87.82 | 79.56 | |
| Wt. Water | 14.72 | 12.72 | |
| Tare Wt. | 21.81 | 22.26 | |
| Dry Soil Wt. | 66.01 | 57.3 | |
| Moisture % | 22.30 | 22.20 | |
| Avg. w % | ~~22.25~~ 22.3 | | |

| LENGTH CHANGE | |
|---|---|
| STRAIN GAUGE at setup | 500 |
| at saturation start | 500 |
| at consolidation start | 502 |
| at axial load start | 530 |

| MASS PROPERTIES | | |
|---|---|---|
| Wt. Tube + Soil | | gm. |
| Wt. Tube | | gm. |
| Wt. Soil | | gm. |
| Tube Diameter | | in. |
| Sample Length | | in |
| tube length | | in. |
| top trim | | in. |
| bottom trim | | in. |
| total trim | | in. |
| sample length | | in. |
| Density constant | | |
| 4.85/(D^2 * L) | | |
| Wet Density | | pcf. |
| Dry Density | | pcf. |

SPECIMEN DIMENSIONS in. / mm.

| | HEIGHT Initial | HEIGHT Final | | DIAMETER Initial | DIAMETER Final |
|---|---|---|---|---|---|
| 1 | 3.920 | 3.888 | T | 1.9835 | 1.9935 |
| 2 | 3.910 | 3.887 | M | 1.9790 | 1.9840 |
| 3 | 3.900 | 3.8876 | B | 1.9643 | 1.9835 |
| Avg. | 3.91<br>9.9314 | 3.88753<br>9.87433 | | 1.9755<br>5.01777 | 1.9870<br>5.04698 |

Description After Test $W_{Final}$ = 393.08
Dry = 312.04

Remarks Initial $\gamma_m$ = 121.3
$\gamma_{dry}$ = 99.2
%M = 22.3

Final $\gamma_m$ = 124.2
$\gamma_{dry}$ = 98.6
%M = 25.972

Failure Sketch

Trimmed By KEK
Trimmed Date 12-20-06
Setup By KEK
Setup Date 12-20-06
Taken Down By JPB
Take Down Date 12-26-06

# TRIAXIAL CELL SATURATION & BETA FACTOR

PROJECT Amoroil Sioux UWLF

SAMPLE Composite #10 DEPTH

INITIAL CELL PRESSURE 71.0 START DATE 12-20-06

INITIAL PORE PRESSURE 70.0 CELL NUMBER 1

INITIAL TRANSDUCER READING 71.7 TRANSDUCER NUMBER 1

| TRIAL DATE | TRIAL TIME | BASE BURETTE READING | CELL PRESSURE | TRANS-DUCER READING | CHANGE IN PRESSURE (Transducer Constant ____): CELL DELTA (1) | TRANSDUCER: READING CHANGE | TRANSDUCER: PRESSURE CHANGE (2) | BETA FACTOR (2/1) |
|---|---|---|---|---|---|---|---|---|
| 12-21-06 | 0 | 5.02 | 71.0 | 71.6 | | | | |
| | 1 | | 76.0 | 76.5 | 5.0 | | 4.9 | 0.98 |
| | 2 | | 76.0 | 76.5 | 5.0 | | 4.9 | 0.98 |
| | 4 | | 76.0 | 76.4 | 5.0 | | 4.8 | 0.96 |
| | 8 | | 76.0 | 76.4 | 5.0 | | 4.8 | 0.96 |

OK

# TRIAXIAL CELL CONSOLIDATION TEST

PROJECT Amerian Sioux CWLF

SAMPLE Composite #10 DEPTH

CONSOLIDATION CELL PRESSURE 80.0psi CELL NUMBER 1

CONSOLIDATION PORE PRESSURE 75psi

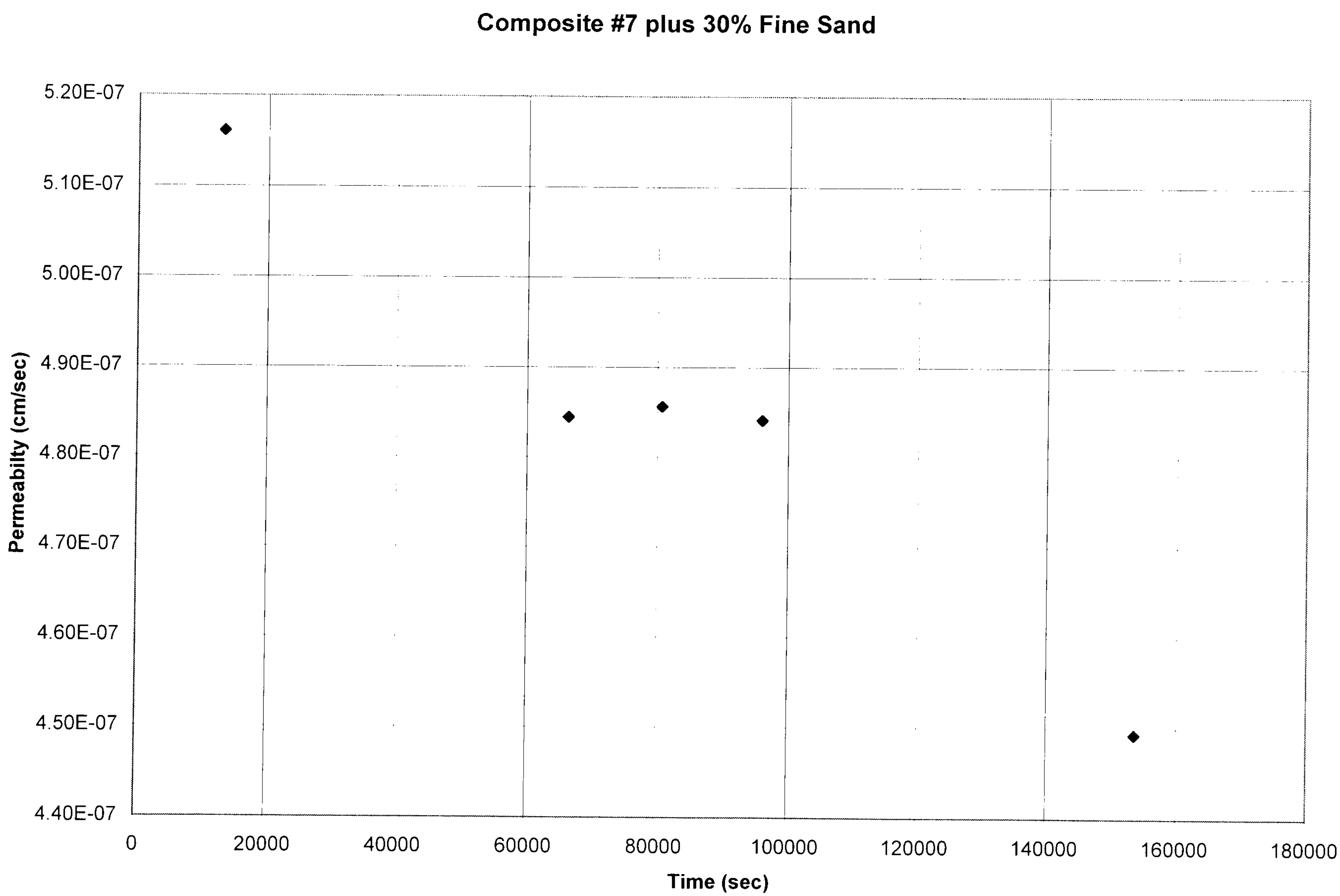
| DATE | TIME | BURETTE READING | DELTA VOLUME | SUM DELTA VOLUME | DELTA TIME | TEMP | REMARKS |
|---|---|---|---|---|---|---|---|
| 12-21-06 | 9:20 | 10.00 | | | 0 | | |
| | | 9.72 | 0.28 | 0.28 | .1 | | |
| | | 9.70 | 0.02 | 0.30 | .25 | | |
| | | 9.67 | 0.03 | 0.33 | .5 | | |
| | 9:21 | 9.64 | 0.03 | 0.36 | 1 | | |
| | 9:22 | 9.60 | 0.04 | 0.40 | 2 | | |
| | 9:24 | 9.54 | 0.06 | 0.46 | 4 | | |
| | 9:28 | 9.47 | 0.07 | 0.53 | 8 | | |
| | 9:35 | 9.39 | 0.08 | 0.61 | 15 | | |
| | 9:50 | 9.22 | 0.17 | 0.78 | 30 | | |
| | 10:20 | 9.04 | 0.18 | 0.96 | 60 | | |
| | 11:20 | 8.84 | 0.20 | 1.16 | 120 | | |
| | 12:20 | 8.70 | 0.14 | 1.30 | 180 | | |
| 12-22 | 7:20 | 8.50 | 0.20 | 1.50 | 1560 | 20.0 | |

## Ameren, Soiux UWLF
### Project # 2005012477
### Compostite #7 plus 30% fine sand
**Hydraulic Conductivity**

| Soil Conditions | |
|---|---|
| **Pre-test conditions** | **Post-test Conditions** |
| Wet Density = 121.3 (lbs/ft^3) | Wet Density = 126.2 (lbs/ft^3) |
| % Moisture = 23.6% | % Moisture = 24.6% |
| Dry Density = 98.1 (lbs/ft^3) | Dry Density = 101.2 (lbs/ft^3) |

| Test Information | |
|---|---|
| a (cm^2)= | 0.19685 |
| L (cm)= | 9.2650733 |
| A (cm^2)= | 19.004949 |

| Date | Time | Elapsed Time (seconds) | Cell Burette Reading (ml) | Base Burette Reading (ml) | Base Burette Distance from Datum (cm) | Top Burette Reading (ml) | Top Burette Distance from Datum (cm) | Total Head Across Sample (cm of water) | Temperature (°C) | Weighted Average Temp. (°C) | Uncorrected Hydraulic Conductivity (cm/sec) | Correction Factor | Corrected Hydraulic Conductivity (cm/sec) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/8/2007 | 13:05 | | 19.9 | 10.00 | 27.200 | 0.00 | 78.000 | 85.979 | 21.8 | | | | |
| | 16:45 | 13200 | 19.7 | 8.79 | 33.347 | 1.15 | 72.158 | 73.990 | 22.9 | 22.35 | 5.46E-07 | 0.9454520 | 5.16E-07 |
| 1/9/2007 | 7:30 | 66300 | 21.1 | 5.75 | 48.790 | 4.27 | 56.308 | 42.697 | 20.6 | 21.87 | 5.07E-07 | 0.9562465 | 4.84E-07 |
| | 11:30 | 80700 | 20.1 | 5.17 | 51.736 | 4.86 | 53.311 | 36.754 | 20.8 | 21.66 | 5.05E-07 | 0.9609966 | 4.86E-07 |
| | 15:45 | 96000 | 20.0 | 4.65 | 54.378 | 5.39 | 50.619 | 31.420 | 21.9 | 21.61 | 5.03E-07 | 0.9621298 | 4.84E-07 |
| 1/10/2007 | 7:45 | 153600 | 20.3 | 3.50 | 60.220 | 6.59 | 44.523 | 19.482 | 19.8 | 21.33 | 4.64E-07 | 0.9687039 | 4.49E-07 |


Composite #7 plus 30% Fine Sand
5.20E-07
5.10E-07
5.00E-07
4.90E-07
4.80E-07
4.70E-07
4.60E-07
4.50E-07
4.40E-07
Permeabilty (cm/sec)
0
20000
40000
60000
80000
100000
120000
140000
160000
180000
Time (sec)

# Hydraulic Conductivity (ASTM-D 5084)
# Flow Rate Calculation

Job------- Anderson UWLF Sioux
Location-
Sample--- Composite #7 + 30% Sand
Depth-----

a=
A=
L=

Cell No. 4

| Cell Pressure (p.s.i.) | Base Pressure (p.s.i.) | Top Pressure (p.s.i.) |
|---|---|---|
| 72.5 | 71.0 | 71.5 |

1105
240
1345

| Date | Time | Elapsed Time Minutes | Cell Reading ML | Base Reading ML | Top Reading ML | Top Head CM | Base Head CM | h CM | Temp. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| 1-8-07 | 13:05 | 0 | 19.85 | 10.00 | 0.00 | | | | 20.8 | |
| | 16:45 | 220 | 19.70 | 8.79 | 1.15 | | | | 22.9 | |
| 1-9-07 | 7:30 | 1105 | 20.10 | 5.75 | 4.27 | | | | 20.6 | |
| | 11:30 | 1345 | 20.05 | 5.17 | 4.86 | | | | 20.8 | |
| | 15:45 | 1600 | 20.00 | 4.65 | 5.39 | | | | 21.9 | |
| 1-10-07 | 7:45 | 2560 | 20.25 | 3.50 | 6.59 | | | | 19.8 | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

| a x L | t (sec) | 2 x A x t | aL/2At | h1 | h2 | ln(h1/h2) | K | Temp. Cor. | K -Cor. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

# TRIAXIAL CELL SETUP & TAKEDOWN

Project: Ameron Sioux UWLF  Date: 1-6-07
Sample: Composite 7 + 30% Silty Sand  Depth: Stand. Proc @ +3% M
Description: Brown clayey SILT w/ FINE Sand

Type of Test: Hyd. Cond.  Confining Pressure Differential: 5psi
Cell Number: 4  Saturate (before) after Consolidation
Number of Membranes: 2  Filter Strips Yes (No)

| MOISTURE CONTENT | INITIAL | | FINAL |
|---|---|---|---|
| Tare No. | B-29 | B-21 | |
| Wet Wt. + Tare | 251.13 | 273.71 | |
| Dry Wt. + Tare | 211.10 | 228.88 | |
| Wt. Water | | | |
| Tare Wt. | 40.58 | 40.68 | |
| Dry Soil Wt. | | | |
| Moisture % | 23.475 | 23.820 | |
| Avg. w % | 23.6475 | | |

| LENGTH CHANGE | |
|---|---|
| STRAIN GAUGE at setup | |
| at saturation start | |
| at consolidation start | |
| at axial load start | |

| MASS PROPERTIES | | |
|---|---|---|
| Wt. Tube + Soil | | gm. |
| Wt. Tube | | gm. |
| Wt. Soil | 352.94 | gm. |
| Tube Diameter | | in. |
| Sample Length | | in |
| tube length | | in. |
| top trim | | in. |
| bottom trim | | in. |
| total trim | | in. |
| sample length | | in. |
| Density constant | | |
| 4.85/(D^2 * L) | | |
| Wet Density | | pcf. |
| Dry Density | | pcf. |

SPECIMEN DIMENSIONS in. / mm.

| | HEIGHT | | DIAMETER | |
|---|---|---|---|---|
| | Initial | Final | Initial | Final |
| 1 | 3.6770 | 3.6380 | T 1.9540 | 1.9375 |
| 2 | 3.6805 | 3.6470 | M 1.9620 | 1.9390 |
| 3 | 3.6805 | 3.6590 | B 1.9600 | 1.9355 |
| Avg. | 3.67933<br>9.34551 | 3.6476667<br>9.2650733 | 1.9586667<br>4.975013 | 1.9366667<br>4.91913373 |

Final wt = 355.96

Description After Test

Remarks: Initial $\gamma_{m}$ = 121.3  Final $\gamma_{m}$ 126.2
$\gamma_{dry}$ = 98.1  $\gamma_{dry}$ 101.2
%M = 23.6  %M 24.6

Failure Sketch

Trimmed By: K.E.K.
Trimmed Date: 1-6-07
Setup By: KEK
Setup Date: 1-6-07
Taken Down By:
Take Down Date:

trixSTUP.dwg revised /12/98

# TRIAXIAL CELL SATURATION & BETA FACTOR

PROJECT Ameren Sioux UWLF

SAMPLE Composite #7 + 30% Silty Fine Sand DEPTH

INITIAL CELL PRESSURE 70.0 START DATE 1-6-07

INITIAL PORE PRESSURE 70.0 CELL NUMBER 4

INITIAL TRANSDUCER READING 70.8 TRANSDUCER NUMBER 4

| TRIAL DATE | TRIAL TIME | BASE BURETTE READING | CELL PRESSURE | TRANS-DUCER READING | CHANGE IN PRESSURE Transducer Constant | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | CELL DELTA (1) | TRANSDUCER READING CHANGE | TRANSDUCER PRESSURE CHANGE (2) | BETA FACTOR (2/1) |
| 1-8-07 | 0 | 4.00 | 71.0 | 70.4 | | | | |
| | 1 | | 76.0 | 75.3 | 5.0 | | 4.9 | 0.98 |
| | 2 | | " | 75.3 | 5.0 | | 4.9 | 0.98 |
| | 4 | | " | 75.3 | 5.0 | | 4.9 | 0.98 |
| | 8 | | " | 75.3 | 5.0 | | 4.9 | 0.98 |
| | | | | | ~~5.0~~ | | | |

REITZ & JENS, INC. Consulting Engineers Sheet ______ of ______

# TRIAXIAL CELL CONSOLIDATION TEST

PROJECT Ameren Sioux UWLF

SAMPLE Composite #7 + 30% Silty Fine Sand DEPTH

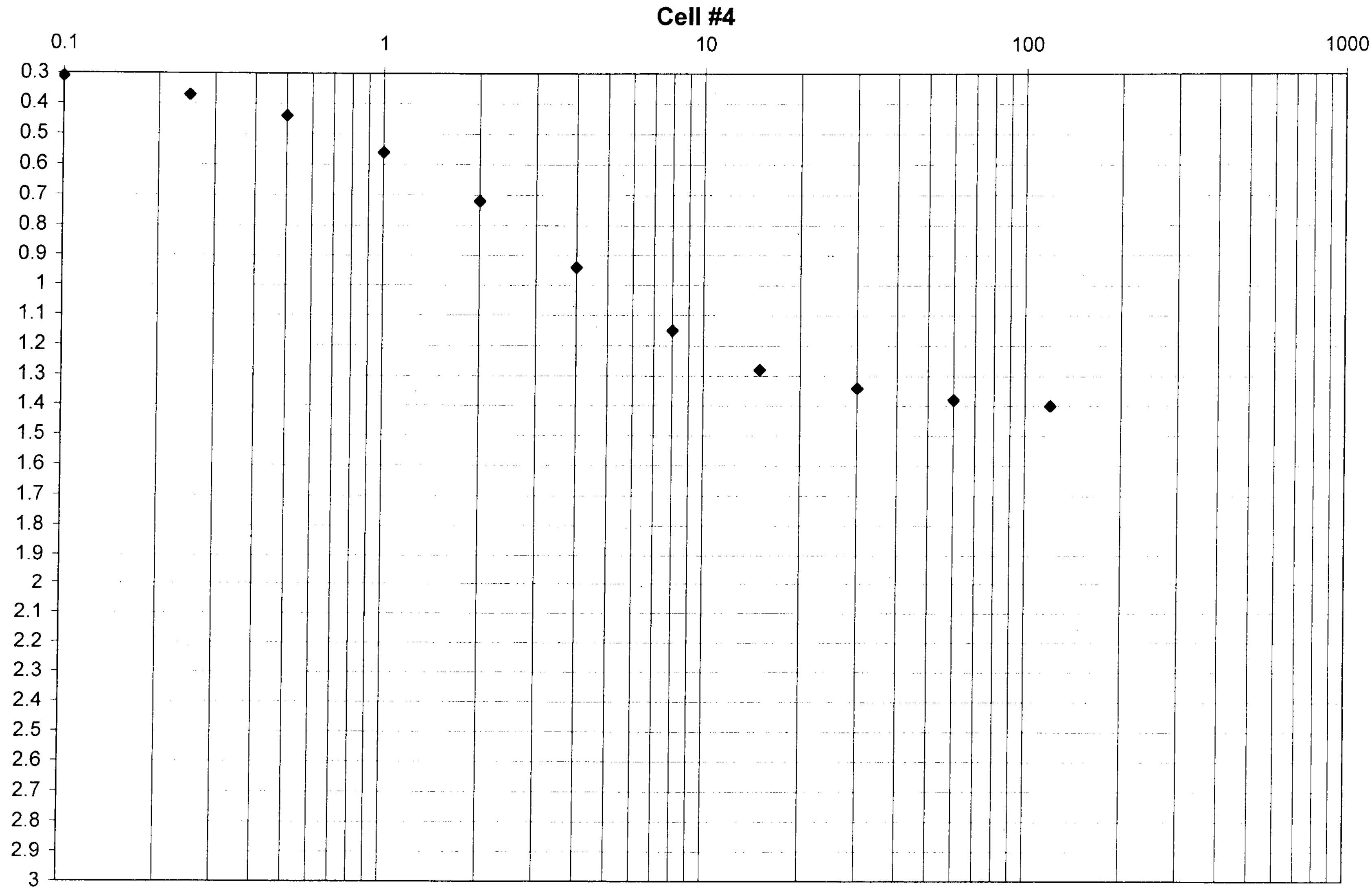
CONSOLIDATION CELL PRESSURE 76.0 CELL NUMBER 4

CONSOLIDATION PORE PRESSURE 71.0

| DATE | TIME | BURETTE READING | DELTA VOLUME | SUM DELTA VOLUME | DELTA TIME | TEMP | REMARKS |
|---|---|---|---|---|---|---|---|
| 1-8-07 | 9:35 | 10.00 | | | 0 | | |
| | | 9.69 | | 0.31 | .1 | | |
| | | 9.63 | | 0.37 | .25 | | |
| | | 9.56 | | 0.44 | .5 | | |
| | 9:36 | 9.44 | | 0.56 | 1 | | |
| | 9:37 | 9.28 | | 0.72 | 2 | | |
| | 9:39 | 9.06 | | 0.94 | 4 | | |
| | 9:43 | 8.85 | | 1.15 | 8 | | |
| | 9:50 | 8.72 | | 1.28 | 15 | | |
| | 10:05 | 8.66 | | 1.34 | 30 | | |
| | 10:35 | 8.62 | | 1.38 | 60 | | |
| | 11:35 | 8.60 | | 1.40 | 120 | | |

REITZ & JENS, INC. Consulting Engineers Sheet ______ of ______

Composite #7 + 30% Fine Sand

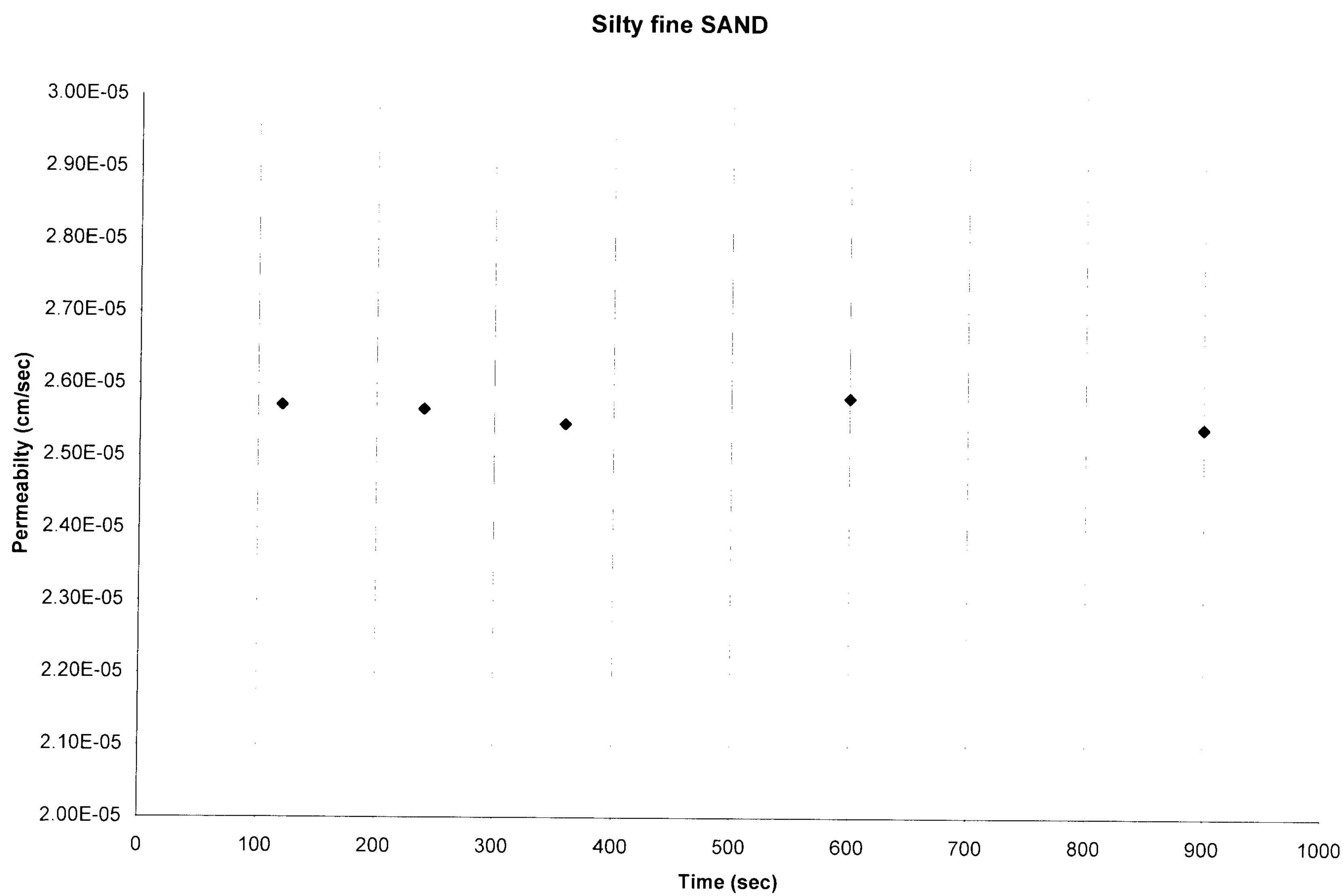


**Ameren, Soiux UWLF**
**Project # 2005012477**
**Silty fine SAND**
**Hydraulic Conductivity**

| Soil Conditions | |
|---|---|
| **Pre-test conditions** | **Post-test Conditions** |
| Wet Density = 118.7 (lbs/ft^3) | Wet Density = 125.1 (lbs/ft^3) |
| % Moisture = 19.1% | % Moisture = 23.8% |
| Dry Density = 99.7 (lbs/ft^3) | Dry Density = 101.1 (lbs/ft^3) |

| Test Information | |
|---|---|
| a (cm^2)= | 0.19685 |
| L (cm)= | 9.03732 |
| A (cm^2)= | 19.781425 |

| Date | Time | Elapsed Time (seconds) | Cell Burette Reading (ml) | Base Burette Reading (ml) | Base Burette Distance from Datum (cm) | Top Burette Reading (ml) | Top Burette Distance from Datum (cm) | Total Head Across Sample (cm of water) | Temperature (°C) | Weighted Average Temp. (°C) | Uncorrected Hydraulic Conductivity (cm/sec) | Correction Factor | Corrected Hydraulic Conductivity (cm/sec) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/11/2007 | 8:10 | | 20.2 | 10.00 | 27.200 | 0.00 | 78.000 | 85.979 | 20.3 | | | | |
| | 8:12 | 120 | 20.2 | 9.44 | 30.045 | 0.57 | 75.104 | 80.239 | 20.3 | 20.30 | 2.59E-05 | 0.9929555 | 2.57E-05 |
| | 8:14 | 240 | 20.2 | 8.91 | 32.737 | 1.09 | 72.463 | 74.905 | 20.3 | 20.30 | 2.58E-05 | 0.9929555 | 2.57E-05 |
| | 8:16 | 360 | 20.2 | 8.43 | 35.176 | 1.57 | 70.024 | 70.028 | 20.3 | 20.30 | 2.56E-05 | 0.9929555 | 2.55E-05 |
| | 8:20 | 600 | 20.2 | 7.52 | 39.798 | 2.48 | 65.402 | 60.782 | 20.3 | 20.30 | 2.60E-05 | 0.9929555 | 2.58E-05 |
| | 8:25 | 900 | 20.2 | 6.61 | 44.421 | 3.39 | 60.779 | 51.537 | 20.3 | 20.30 | 2.56E-05 | 0.9929555 | 2.54E-05 |



Silty fine SAND
Permeabilty (cm/sec)
3.00E-05
2.90E-05
2.80E-05
2.70E-05
2.60E-05
2.50E-05
2.40E-05
2.30E-05
2.20E-05
2.10E-05
2.00E-05
0
100
200
300
400
500
600
700
800
900
1000
Time (sec)

# Hydraulic Conductivity (ASTM-D 5084)
## Flow Rate Calculation

Job------- Ameren Sioux UGW LF
Location-
Sample--- Grab Silty Fine SAND (SP)
Depth-----

a=
A=
L=

**Cell No.** 2

| Cell Pressure (p.s.i.) | Base Pressure (p.s.i.) | Top Pressure (p.s.i.) |
|---|---|---|
| 85.5 | 80.0 | 80.5 |

| Date | Time | Elapsed Time Minutes | Cell Reading ML | Base Reading ML | Top Reading ML | Top Head CM | Base Head CM | h CM | Temp. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| 1-11-07 | 8:10 | 0 | 20.2 | 10.00 | 0.00 | | | | 20.3 | |
| | 8:11 | 1 | 20.2 | 9.71 | 0.30 | | | | 20.3 | |
| | 8:12 | 2 | 20.2 | 9.44 | 0.57 | | | | 20.3 | |
| | 8:13 | 3 | 20.2 | 9.17 | 0.83 | | | | 20.3 | |
| | 8:14 | 4 | 20.2 | 8.91 | 1.09 | | | | 20.3 | |
| | 8:15 | 5 | 20.2 | 8.67 | 1.33 | | | | 20.3 | |
| | 8:16 | 6 | 20.2 | 8.43 | 1.57 | | | | 20.3 | |
| | 8:20 | 10 | 20.2 | 7.52 | 2.48 | | | | 20.3 | |
| | 8:25 | 15 | 20.2 | 6.61 | 3.39 | | | | 20.3 | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

| a x L | t (sec) | 2 x A x t | aL/2At | h1 | h2 | ln(h1/h2) | K | Temp. Cor. | K -Cor. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

# TRIAXIAL CELL SETUP & TAKEDOWN

Project: American Sioux UWLF  Date: 1-8-07

Sample: Silty Sand (SM)  Depth: — C + 89% Stand. Proctor

Description: Sand (SM), Brown, Silty

Type of Test: Hyd. Cond.  Confining Pressure Differential: 5.0 psi

Cell Number: 2  Saturate (before) after Consolidation

Number of Membranes: 2  Filter Strips Yes (No)

| MOISTURE CONTENT | INITIAL | | FINAL (entire sample) |
|---|---|---|---|
| Tare No. | B-14 | 36 | Bowl 18 |
| Wet Wt. + Tare | 247.40 | 277.03 | 929.44 |
| Dry Wt. + Tare | 214.38 | 239.06 | 860.65 |
| Wt. Water | | | 68.79 |
| Tare Wt. | 40.72 | 41.32 | 571.06 |
| Dry Soil Wt. | | | 289.59 |
| Moisture % | 19.014 | 19.202 | 23.75427 |
| Avg. w % | 19.108 | | |

| LENGTH CHANGE | |
|---|---|
| STRAIN GAUGE at setup | 500 |
| at saturation start | 500 |
| at consolidation start | 498 |
| at axial load start | 514 |

| MASS PROPERTIES | | |
|---|---|---|
| Wt. Tube + Soil | | gm. |
| Wt. Tube | | gm. |
| Wt. Soil | No wt. Due to Brittle Sample | gm. |
| Tube Diameter | | in. |
| Sample Length | | in |
| tube length | | in. |
| top trim | | in. |
| bottom trim | | in. |
| total trim | | in. |
| sample length | | in. |
| Density constant 4.85/(D^2 * L) | | |
| Wet Density | | pcf. |
| Dry Density | | pcf. |

| SPECIMEN DIMENSIONS in. / mm. | HEIGHT | | DIAMETER | | |
|---|---|---|---|---|---|
| | Initial | Final | | Initial | Final |
| 1 | 3.5770 | 3.5510 | T | 1.9860 | 1.9685 |
| 2 | 3.5745 | 3.5630 | M | 1.9820 | 1.9715 |
| 3 | 3.5715 | 3.5600 | B | 1.9895 | 1.9875 |
| Avg. | 3.574333 in / 9.078807 cm | 3.55800 / 9.03732 | | 1.985833 / 5.044017 | 1.97583333 / 5.0136167 |

Description After Test

Remarks: Initial $\gamma_m$ 118.7, $\gamma_D$ 99.6, %M 19.1   Final $\gamma_m$ = 125.1, $\gamma_{Dm}$ = 101.1, %M = 23.8

Failure Sketch

Trimmed By: KOK
Trimmed Date: 1-8-07
Setup By: KOR
Setup Date: 1-8-07
Taken Down By:
Take Down Date:

trxSTUP.dwg rev. 2/12/98

REITZ & JENS, INC. Consulting Engineers  Sheet ____ of ____

# TRIAXIAL CELL SATURATION & BETA FACTOR

PROJECT Andrew Sioux UWLF

SAMPLE Silty Fine Sand DEPTH

INITIAL CELL PRESSURE 71.0 START DATE 1-8-07

INITIAL PORE PRESSURE 70.0 CELL NUMBER 2

INITIAL TRANSDUCER READING 71.1 TRANSDUCER NUMBER 2

| TRIAL DATE | TRIAL TIME | BASE BURETTE READING | CELL PRESSURE | TRANS-DUCER READING | CHANGE IN PRESSURE Transducer Constant ___ CELL DELTA (1) | TRANSDUCER READING CHANGE | TRANSDUCER PRESSURE CHANGE (2) | BETA FACTOR (2/1) |
|---|---|---|---|---|---|---|---|---|
| 1-9-07 | 0 | 2.0 | 71.0 | 70.5 | | | | |
| | 1 | | 76.0 | 75.3 | 5.0 | | 4.8 | 0.96 |
| | 2 | | " | 75.2 | 5.0 | | 4.7 | 0.94 |
| | 4 | | " | 75.2 | 5.0 | | 4.7 | 0.94 |
| | 8 | | " | | 5.0 | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| 1-10-07 | 0 | 2.78 | 76.00 | 75.4 | | | | |
| | 1 | | 81.00 | 80.2 | 5.0 | | 4.8 | 0.96 |
| | 2 | | " | 80.2 | 5.0 | | 4.8 | 0.96 |
| | 4 | | " | 80.2 | 5.0 | | 4.8 | 0.96 |
| | 8 | | " | 80.2 | 5.0 | | 4.8 | 0.96 |

# TRIAXIAL CELL CONSOLIDATION TEST

PROJECT Amuron Sioux UWLF

SAMPLE # Silty Fine Sand DEPTH

CONSOLIDATION CELL PRESSURE 85.0 CELL NUMBER 2

CONSOLIDATION PORE PRESSURE 80.0

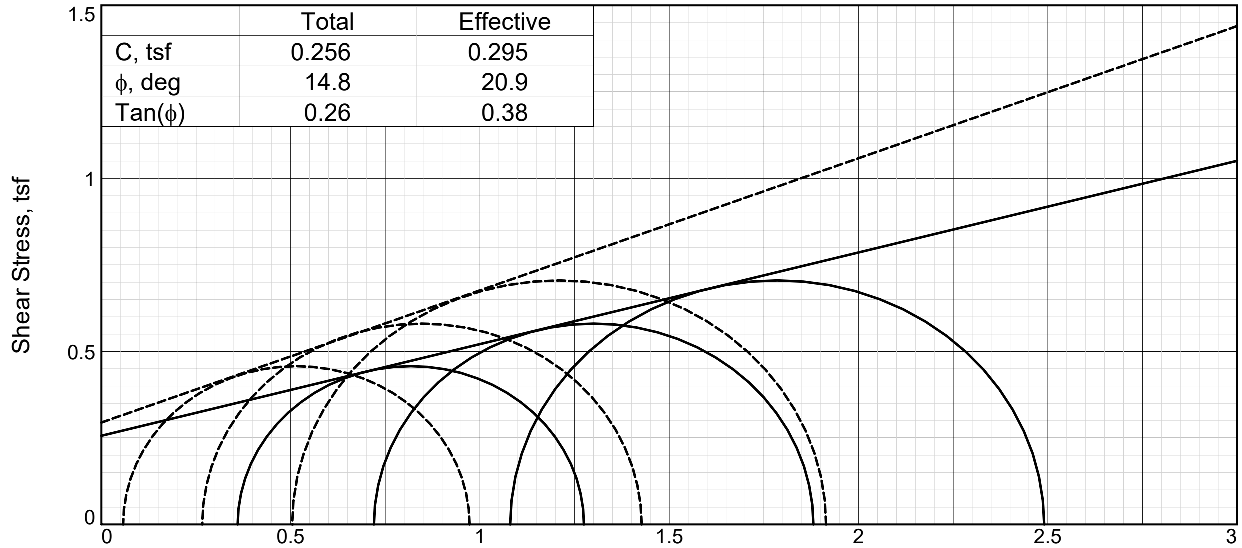
| DATE | TIME | BURETTE READING | DELTA VOLUME | SUM DELTA VOLUME | DELTA TIME | TEMP | REMARKS |
|---|---|---|---|---|---|---|---|
| 1-10-06 | 10:35 | 10.00 | | | 0 | | |
| | | 9.42 | | 0.58 | .1 | | |
| | | 9.38 | | 0.62 | .25 | | |
| | | 9.37 | | 0.63 | .5 | | |
| | 10:36 | 9.36 | | 0.64 | 1 | | |
| | 10:37 | 9.36 | | 0.64 | 2 | | |
| | 10:39 | 9.35 | | 0.65 | 4 | | |
| | 10:43 | 9.34 | | 0.66 | 8 | | |
| | 10:50 | 9.33 | | 0.67 | 15 | | |
| | 11:05 | 9.32 | | 0.68 | 30 | | |
| | 11:35 | 9.33 | | | 60 | | |
| | 13:05 | 9.36 | | | | | |

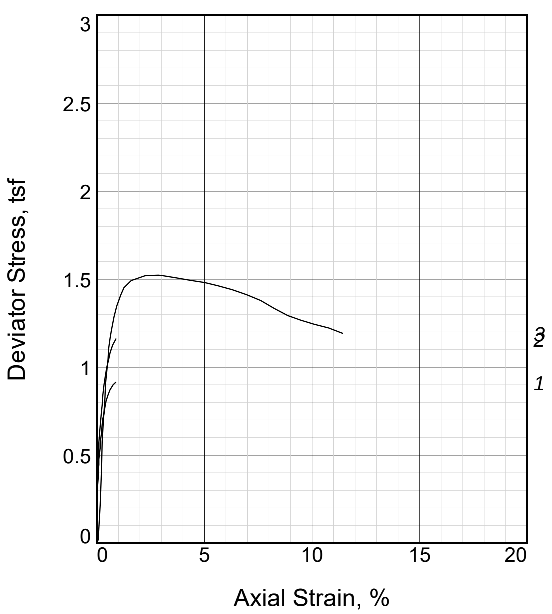
REITZ & JENS, INC. Consulting Engineers Sheet ______ of ______

## Appendix 6

# RESULTS OF TRIAXIAL SHEAR STRENGTH TESTS ON COMPACTED COMPOSITE SAMPLES

| | Total | Effective |
|---|---|---|
| C, tsf | 0.256 | 0.295 |
| ϕ, deg | 14.8 | 20.9 |
| Tan(ϕ) | 0.26 | 0.38 |




| Sample No. | | 1 | 2 | 3 |
|---|---|---|---|---|
| Initial | Water Content, | 34.7 | 35.6 | 35.9 |
| | Dry Density, pcf | 86.7 | 85.6 | 85.3 |
| | Saturation, | 100.0 | 100.0 | 100.0 |
| | Void Ratio | 0.9299 | 0.9541 | 0.9618 |
| | Diameter, in. | 2.02 | 2.03 | 2.03 |
| | Height, in. | 3.29 | 3.28 | 3.25 |
| At Test | Water Content, | 35.6 | 35.9 | 36.2 |
| | Dry Density, pcf | 85.6 | 85.2 | 84.9 |
| | Saturation, | 100.0 | 100.0 | 100.0 |
| | Void Ratio | 0.9546 | 0.9630 | 0.9708 |
| | Diameter, in. | 2.03 | 2.03 | 2.03 |
| | Height, in. | 3.31 | 3.28 | 3.26 |
| Strain rate, %/min. | | 0.04 | 0.04 | 0.04 |
| Back Pressure, tsf | | 5.04 | 5.36 | 5.83 |
| Cell Pressure, tsf | | 5.40 | 6.08 | 6.91 |
| Fail. Stress, tsf | | 0.91 | 1.16 | 1.41 |
| Total Pore Pr., tsf | | 5.34 | 5.82 | 6.41 |
| Ult. Stress, tsf | | | | |
| Total Pore Pr., tsf | | | | |
| $\bar{\sigma}_1$ Failure, tsf | | 0.97 | 1.43 | 1.91 |
| $\bar{\sigma}_3$ Failure, tsf | | 0.06 | 0.27 | 0.50 |

**Type of Test:**
CU with Pore Pressures

**Sample Type:** Compacted (standard)

**Description:** CLAY (CH), dark brownish grey, high plastic

**LL=** 85 **PL=** 23 **PI=** 62

**Assumed Specific Gravity=** 2.68

**Remarks:**

**Figure** ________

**Client:** Ameren Services

**Project:** Sioux Plant UWLF

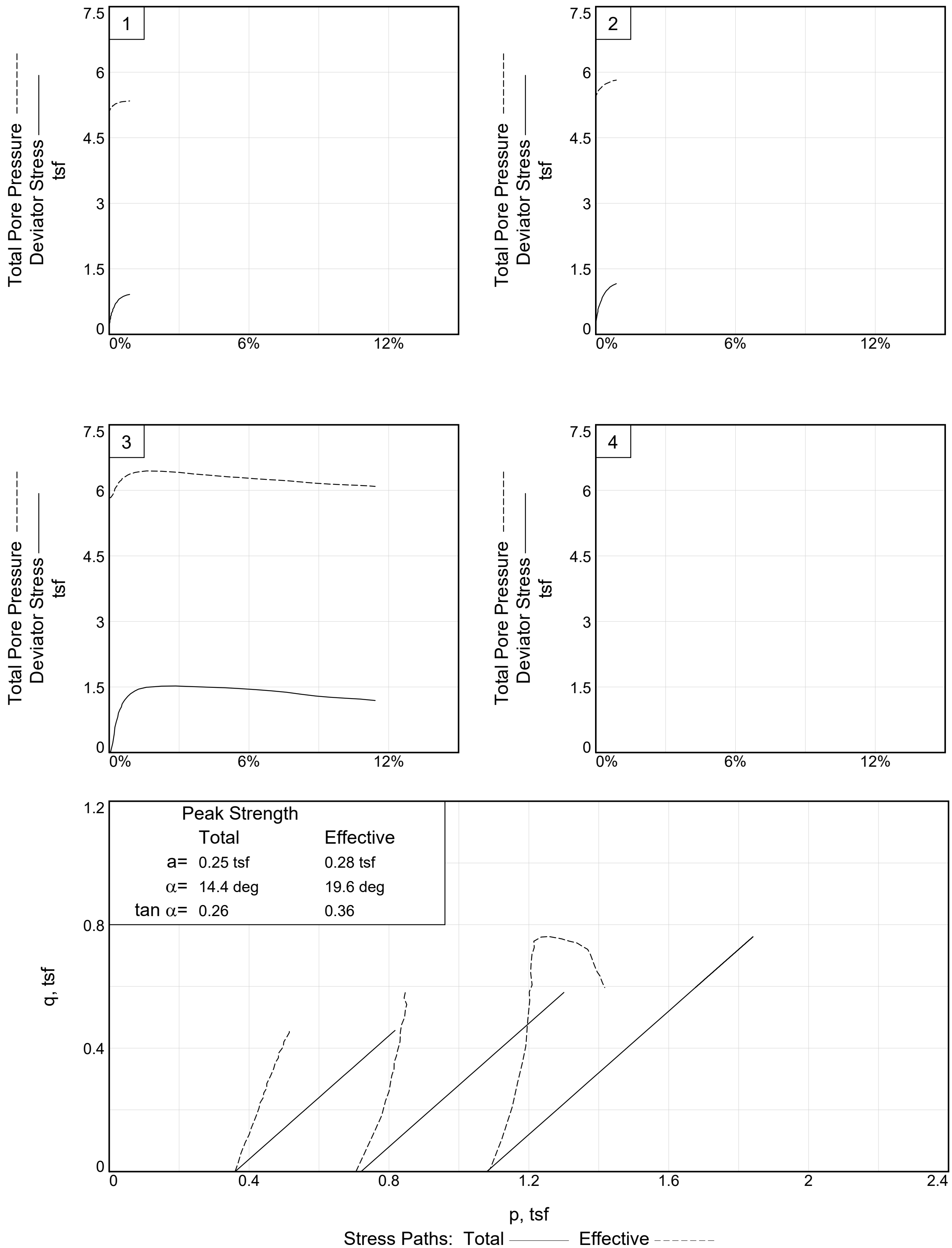
**Source of Sample:** Composite #1

**Sample Number:** 1

**Proj. No.:** 2005012477 **Date:**

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Tested By:** K. Kocher **Checked By:** J. Fouse




**Client:** Ameren Services

**Project:** Sioux Plant UWLF

**Source of Sample:** Composite #1 **Sample Number:** 1

**Project No.:** 2005012477 **Figure** _______

**REITZ & JENS, INC.**

**Tested By:** K. Kocher **Checked By:** J. Fouse

# TRIAXIAL COMPRESSION TEST

CU with Pore Pressures

1/18/2007
7:58 AM

**Date:**
**Client:** Ameren Services
**Project:** Sioux Plant UWLF
**Project No.:** 2005012477
**Location:** Composite #1
**Sample Number:** 1
**Description:** CLAY (CH), dark brownish grey, high plastic
**Remarks:**
**Type of Sample:** Compacted (standard)
**Assumed Specific Gravity=**2.68 **LL=**85 **PL=**23 **PI=**62
**Test Method:** COE uniform strain

## Parameters for Specimen No. 1

| Specimen Parameter | Initial | Saturated | Consolidated | Final |
|---|---|---|---|---|
| Moisture content: Moist soil+tare, gms. | 134.700 | | | 0.000 |
| Moisture content: Dry soil+tare, gms. | 100.000 | | | 0.000 |
| Moisture content: Tare, gms. | 0.000 | | | 0.000 |
| Moisture, % | 34.7 | 35.0 | 35.6 | |
| Moist specimen weight, gms. | 323.1 | | | |
| Diameter, in. | 2.02 | 2.02 | 2.03 | |
| Area, in.$^2$ | 3.20 | 3.21 | 3.23 | |
| Height, in. | 3.29 | 3.30 | 3.31 | |
| Net decrease in height, in. | | 0.00 | -0.01 | |
| Wet Density, pcf | 116.8 | 116.6 | 116.1 | |
| Dry density, pcf | 86.7 | 86.4 | 85.6 | |
| Void ratio | 0.9299 | 0.9369 | 0.9546 | |
| Saturation, % | 100.0 | 100.0 | 100.0 | |

## Test Readings for Specimen No. 1

**Consolidation cell pressure =** 75.00 psi (5.400 tsf)
**Consolidation back pressure =** 70.00 psi (5.040 tsf)
**Consolidation effective confining stress =** 0.360 tsf
**Strain rate, %/min. =** 0.04
**Fail. Stress =** 0.915 tsf **at reading no.** 23

## Test Readings for Specimen No. 1

| No. | Def. Dial in. | Load Dial | Load lbs. | Strain % | Deviator Stress tsf | Minor Eff. Stress tsf | Major Eff. Stress tsf | 1:3 Ratio | Pore Press. psi | P tsf | Q tsf |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.0000 | 20.50 | 0.0 | 0.0 | 0.000 | 0.360 | 0.360 | 1.00 | 70.00 | 0.360 | 0.000 |
| 1 | 0.0000 | 23.30 | 2.8 | 0.0 | 0.062 | 0.338 | 0.401 | 1.18 | 70.30 | 0.370 | 0.031 |
| 2 | 0.0000 | 25.90 | 5.4 | 0.0 | 0.120 | 0.317 | 0.437 | 1.38 | 70.60 | 0.377 | 0.060 |
| 3 | 0.0000 | 28.90 | 8.4 | 0.0 | 0.187 | 0.295 | 0.482 | 1.63 | 70.90 | 0.389 | 0.094 |
| 4 | 0.0000 | 31.20 | 10.7 | 0.0 | 0.239 | 0.281 | 0.519 | 1.85 | 71.10 | 0.400 | 0.119 |
| 5 | 0.0010 | 33.00 | 12.5 | 0.0 | 0.279 | 0.266 | 0.545 | 2.05 | 71.30 | 0.406 | 0.139 |
| 6 | 0.0010 | 35.00 | 14.5 | 0.0 | 0.323 | 0.252 | 0.575 | 2.28 | 71.50 | 0.414 | 0.162 |
| 7 | 0.0020 | 37.00 | 16.5 | 0.1 | 0.368 | 0.238 | 0.605 | 2.55 | 71.70 | 0.421 | 0.184 |
| 8 | 0.0020 | 38.90 | 18.4 | 0.1 | 0.410 | 0.223 | 0.633 | 2.84 | 71.90 | 0.428 | 0.205 |
| 9 | 0.0030 | 40.50 | 20.0 | 0.1 | 0.445 | 0.209 | 0.654 | 3.13 | 72.10 | 0.432 | 0.223 |
| 10 | 0.0030 | 41.90 | 21.4 | 0.1 | 0.477 | 0.202 | 0.678 | 3.36 | 72.20 | 0.440 | 0.238 |
| 11 | 0.0040 | 43.40 | 22.9 | 0.1 | 0.510 | 0.187 | 0.697 | 3.72 | 72.40 | 0.442 | 0.255 |
| 12 | 0.0050 | 44.80 | 24.3 | 0.2 | 0.541 | 0.180 | 0.721 | 4.00 | 72.50 | 0.450 | 0.270 |
| 13 | 0.0050 | 46.10 | 25.6 | 0.2 | 0.570 | 0.166 | 0.735 | 4.44 | 72.70 | 0.451 | 0.285 |
| 14 | 0.0070 | 48.40 | 27.9 | 0.2 | 0.621 | 0.151 | 0.772 | 5.10 | 72.90 | 0.462 | 0.310 |
| 15 | 0.0080 | 50.50 | 30.0 | 0.2 | 0.667 | 0.137 | 0.804 | 5.88 | 73.10 | 0.470 | 0.334 |
| 16 | 0.0090 | 52.20 | 31.7 | 0.3 | 0.705 | 0.122 | 0.827 | 6.76 | 73.30 | 0.475 | 0.352 |
| 17 | 0.0110 | 53.70 | 33.2 | 0.3 | 0.738 | 0.115 | 0.853 | 7.40 | 73.40 | 0.484 | 0.369 |
| 18 | 0.0120 | 55.00 | 34.5 | 0.4 | 0.766 | 0.101 | 0.867 | 8.60 | 73.60 | 0.484 | 0.383 |
| 19 | 0.0140 | 56.90 | 36.4 | 0.4 | 0.808 | 0.094 | 0.902 | 9.63 | 73.70 | 0.498 | 0.404 |
| 20 | 0.0170 | 58.40 | 37.9 | 0.5 | 0.841 | 0.079 | 0.920 | 11.61 | 73.90 | 0.499 | 0.420 |
| 21 | 0.0200 | 59.80 | 39.3 | 0.6 | 0.871 | 0.072 | 0.943 | 13.09 | 74.00 | 0.507 | 0.435 |
| 22 | 0.0250 | 61.20 | 40.7 | 0.8 | 0.900 | 0.065 | 0.965 | 14.90 | 74.10 | 0.515 | 0.450 |
| 23 | 0.0290 | 61.90 | 41.4 | 0.9 | 0.915 | 0.058 | 0.972 | 16.88 | 74.20 | 0.515 | 0.457 |

## Parameters for Specimen No. 2

| Specimen Parameter | Initial | Saturated | Consolidated | Final |
|---|---|---|---|---|
| **Moisture content: Moist soil+tare, gms.** | 135.600 | | | 0.000 |
| **Moisture content: Dry soil+tare, gms.** | 100.000 | | | 0.000 |
| **Moisture content: Tare, gms.** | 0.000 | | | 0.000 |
| **Moisture, %** | 35.6 | 35.6 | 35.9 | |
| **Moist specimen weight, gms.** | 323.1 | | | |
| **Diameter, in.** | 2.03 | 2.03 | 2.03 | |
| **Area, in.²** | 3.24 | 3.24 | 3.25 | |
| **Height, in.** | 3.28 | 3.28 | 3.28 | |
| **Net decrease in height, in.** | | 0.00 | -0.01 | |
| **Wet Density, pcf** | 116.1 | 116.1 | 115.9 | |
| **Dry density, pcf** | 85.6 | 85.6 | 85.2 | |
| **Void ratio** | 0.9541 | 0.9541 | 0.9630 | |
| **Saturation, %** | 100.0 | 100.0 | 100.0 | |

## Test Readings for Specimen No. 2

**Consolidation cell pressure =** 84.50 psi (6.084 tsf)

**Consolidation back pressure =** 74.50 psi (5.364 tsf)

**Consolidation effective confining stress =** 0.720 tsf

**Strain rate, %/min. =** 0.04

**Fail. Stress =** 1.161 tsf **at reading no.** 18

| No. | Def. Dial in. | Load Dial | Load lbs. | Strain % | Deviator Stress tsf | Minor Eff. Stress tsf | Major Eff. Stress tsf | 1:3 Ratio | Pore Press. psi | P tsf | Q tsf |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.0000 | 23.10 | 0.0 | 0.0 | 0.000 | 0.706 | 0.706 | 1.00 | 74.70 | 0.706 | 0.000 |
| 1 | 0.0000 | 34.10 | 11.0 | 0.0 | 0.244 | 0.634 | 0.878 | 1.39 | 75.70 | 0.756 | 0.122 |
| 2 | 0.0010 | 39.50 | 16.4 | 0.0 | 0.364 | 0.598 | 0.961 | 1.61 | 76.20 | 0.779 | 0.182 |
| 3 | 0.0020 | 43.70 | 20.6 | 0.1 | 0.457 | 0.562 | 1.018 | 1.81 | 76.70 | 0.790 | 0.228 |
| 4 | 0.0030 | 46.60 | 23.5 | 0.1 | 0.521 | 0.540 | 1.061 | 1.96 | 77.00 | 0.800 | 0.260 |
| 5 | 0.0030 | 48.90 | 25.8 | 0.1 | 0.572 | 0.518 | 1.090 | 2.10 | 77.30 | 0.804 | 0.286 |
| 6 | 0.0040 | 51.20 | 28.1 | 0.1 | 0.622 | 0.497 | 1.119 | 2.25 | 77.60 | 0.808 | 0.311 |
| 7 | 0.0050 | 53.10 | 30.0 | 0.2 | 0.664 | 0.482 | 1.147 | 2.38 | 77.80 | 0.815 | 0.332 |
| 8 | 0.0060 | 55.10 | 32.0 | 0.2 | 0.708 | 0.461 | 1.169 | 2.54 | 78.10 | 0.815 | 0.354 |
| 9 | 0.0070 | 57.00 | 33.9 | 0.2 | 0.750 | 0.446 | 1.197 | 2.68 | 78.30 | 0.822 | 0.375 |
| 10 | 0.0080 | 58.60 | 35.5 | 0.2 | 0.785 | 0.432 | 1.217 | 2.82 | 78.50 | 0.825 | 0.393 |
| 11 | 0.0090 | 61.20 | 38.1 | 0.3 | 0.843 | 0.410 | 1.253 | 3.05 | 78.80 | 0.832 | 0.421 |
| 12 | 0.0110 | 63.90 | 40.8 | 0.3 | 0.902 | 0.382 | 1.283 | 3.36 | 79.20 | 0.833 | 0.451 |
| 13 | 0.0130 | 66.20 | 43.1 | 0.4 | 0.952 | 0.360 | 1.312 | 3.64 | 79.50 | 0.836 | 0.476 |
| 14 | 0.0150 | 68.30 | 45.2 | 0.5 | 0.998 | 0.346 | 1.343 | 3.89 | 79.70 | 0.845 | 0.499 |
| 15 | 0.0180 | 70.50 | 47.4 | 0.5 | 1.045 | 0.324 | 1.369 | 4.23 | 80.00 | 0.847 | 0.523 |
| 16 | 0.0200 | 72.20 | 49.1 | 0.6 | 1.082 | 0.310 | 1.392 | 4.50 | 80.20 | 0.851 | 0.541 |
| 17 | 0.0240 | 74.20 | 51.1 | 0.7 | 1.125 | 0.281 | 1.406 | 5.01 | 80.60 | 0.843 | 0.563 |
| 18 | 0.0290 | 75.90 | 52.8 | 0.9 | 1.161 | 0.266 | 1.427 | 5.36 | 80.80 | 0.847 | 0.580 |

## Parameters for Specimen No. 3

| Specimen Parameter | Initial | Saturated | Consolidated | Final |
|---|---|---|---|---|
| Moisture content: Moist soil+tare, gms. | 135.900 | | | 0.000 |
| Moisture content: Dry soil+tare, gms. | 100.000 | | | 0.000 |
| Moisture content: Tare, gms. | 0.000 | | | 0.000 |
| Moisture, % | 35.9 | 35.9 | 36.2 | |
| Moist specimen weight, gms. | 320.2 | | | |
| Diameter, in. | 2.03 | 2.03 | 2.03 | |
| Area, in.² | 3.24 | 3.24 | 3.25 | |
| Height, in. | 3.25 | 3.25 | 3.26 | |
| Net decrease in height, in. | | 0.00 | -0.01 | |
| Wet Density, pcf | 115.9 | 115.9 | 115.6 | |
| Dry density, pcf | 85.3 | 85.3 | 84.9 | |
| Void ratio | 0.9618 | 0.9618 | 0.9708 | |
| Saturation, % | 100.0 | 100.0 | 100.0 | |

## Test Readings for Specimen No. 3

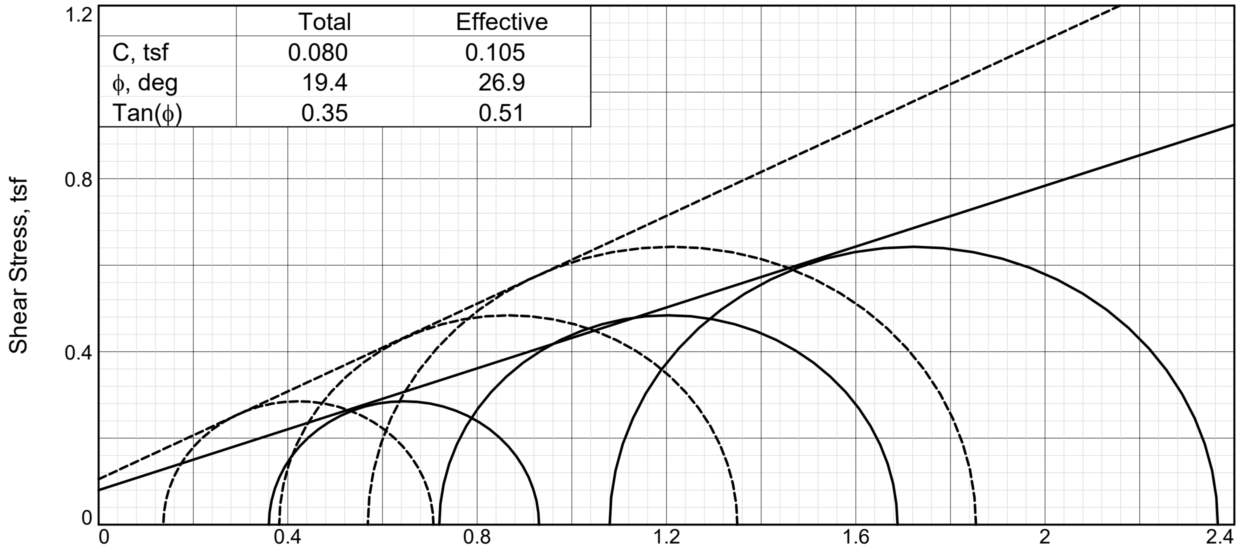
**Consolidation cell pressure =** 96.00 psi (6.912 tsf)
**Consolidation back pressure =** 81.00 psi (5.832 tsf)
**Consolidation effective confining stress =** 1.080 tsf
**Strain rate, %/min. =** 0.04
**Fail. Stress =** 1.410 tsf **at reading no.** 15

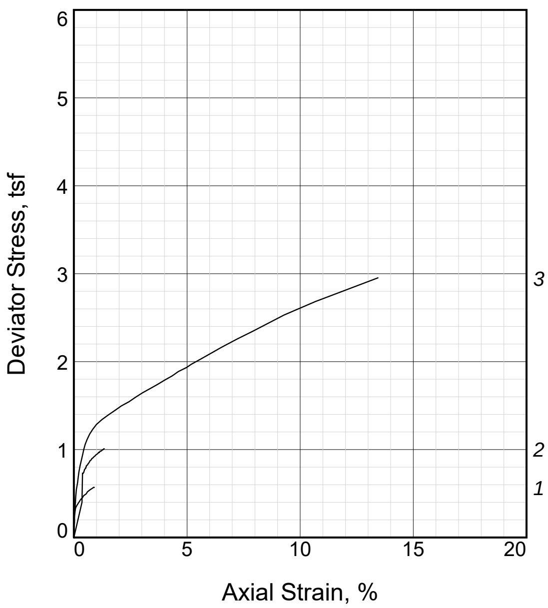
| No. | Def. Dial in. | Load Dial | Load lbs. | Strain % | Deviator Stress tsf | Minor Eff. Stress tsf | Major Eff. Stress tsf | 1:3 Ratio | Pore Press. psi | P tsf | Q tsf |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.0100 | 26.60 | 0.0 | 0.0 | 0.000 | 1.080 | 1.080 | 1.00 | 81.00 | 1.080 | 0.000 |
| 1 | 0.0120 | 27.50 | 0.9 | 0.1 | 0.020 | 1.080 | 1.100 | 1.02 | 81.00 | 1.090 | 0.010 |
| 2 | 0.0150 | 36.40 | 9.8 | 0.2 | 0.217 | 1.015 | 1.232 | 1.21 | 81.90 | 1.124 | 0.109 |
| 3 | 0.0170 | 45.50 | 18.9 | 0.2 | 0.418 | 0.943 | 1.361 | 1.44 | 82.90 | 1.152 | 0.209 |
| 4 | 0.0180 | 52.80 | 26.2 | 0.2 | 0.580 | 0.878 | 1.458 | 1.66 | 83.80 | 1.168 | 0.290 |
| 5 | 0.0200 | 58.60 | 32.0 | 0.3 | 0.708 | 0.828 | 1.536 | 1.85 | 84.50 | 1.182 | 0.354 |
| 6 | 0.0220 | 63.40 | 36.8 | 0.4 | 0.813 | 0.785 | 1.598 | 2.04 | 85.10 | 1.191 | 0.407 |
| 7 | 0.0230 | 67.60 | 41.0 | 0.4 | 0.906 | 0.742 | 1.647 | 2.22 | 85.70 | 1.194 | 0.453 |
| 8 | 0.0250 | 71.10 | 44.5 | 0.5 | 0.982 | 0.706 | 1.688 | 2.39 | 86.20 | 1.197 | 0.491 |
| 9 | 0.0270 | 74.00 | 47.4 | 0.5 | 1.046 | 0.677 | 1.723 | 2.55 | 86.60 | 1.200 | 0.523 |
| 10 | 0.0280 | 76.90 | 50.3 | 0.6 | 1.109 | 0.648 | 1.757 | 2.71 | 87.00 | 1.203 | 0.555 |
| 11 | 0.0300 | 79.40 | 52.8 | 0.6 | 1.164 | 0.619 | 1.783 | 2.88 | 87.40 | 1.201 | 0.582 |
| 12 | 0.0320 | 81.50 | 54.9 | 0.7 | 1.209 | 0.605 | 1.814 | 3.00 | 87.60 | 1.209 | 0.605 |
| 13 | 0.0360 | 85.10 | 58.5 | 0.8 | 1.287 | 0.562 | 1.849 | 3.29 | 88.20 | 1.205 | 0.644 |
| 14 | 0.0400 | 87.90 | 61.3 | 0.9 | 1.347 | 0.533 | 1.880 | 3.53 | 88.60 | 1.206 | 0.673 |
| 15 | 0.0460 | 90.90 | 64.3 | 1.1 | 1.410 | 0.504 | 1.914 | 3.80 | 89.00 | 1.209 | 0.705 |
| 16 | 0.0510 | 92.90 | 66.3 | 1.3 | 1.452 | 0.490 | 1.941 | 3.97 | 89.20 | 1.216 | 0.726 |
| 17 | 0.0620 | 95.00 | 68.4 | 1.6 | 1.493 | 0.468 | 1.961 | 4.19 | 89.50 | 1.214 | 0.746 |
| 18 | 0.0830 | 96.70 | 70.1 | 2.2 | 1.520 | 0.475 | 1.995 | 4.20 | 89.40 | 1.235 | 0.760 |
| 19 | 0.1030 | 97.30 | 70.7 | 2.9 | 1.523 | 0.497 | 2.020 | 4.07 | 89.10 | 1.258 | 0.762 |
| 20 | 0.1090 | 97.30 | 70.7 | 3.0 | 1.520 | 0.504 | 2.024 | 4.02 | 89.00 | 1.264 | 0.760 |
| 21 | 0.1300 | 97.20 | 70.6 | 3.7 | 1.508 | 0.540 | 2.048 | 3.79 | 88.50 | 1.294 | 0.754 |
| 22 | 0.1520 | 97.00 | 70.4 | 4.4 | 1.493 | 0.569 | 2.062 | 3.63 | 88.10 | 1.315 | 0.747 |
| 23 | 0.1730 | 96.90 | 70.3 | 5.0 | 1.481 | 0.598 | 2.079 | 3.48 | 87.70 | 1.338 | 0.741 |
| 24 | 0.1930 | 96.50 | 69.9 | 5.6 | 1.463 | 0.619 | 2.082 | 3.36 | 87.40 | 1.351 | 0.732 |
| 25 | 0.2150 | 95.90 | 69.3 | 6.3 | 1.440 | 0.648 | 2.088 | 3.22 | 87.00 | 1.368 | 0.720 |
| 26 | 0.2370 | 95.00 | 68.4 | 7.0 | 1.411 | 0.670 | 2.081 | 3.11 | 86.70 | 1.375 | 0.706 |

## Test Readings for Specimen No. 3

| No. | Def. Dial in. | Load Dial | Load lbs. | Strain % | Deviator Stress tsf | Minor Eff. Stress tsf | Major Eff. Stress tsf | 1:3 Ratio | Pore Press. psi | P tsf | Q tsf |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 | 0.2580 | 93.90 | 67.3 | 7.6 | 1.379 | 0.691 | 2.070 | 2.99 | 86.40 | 1.381 | 0.689 |
| 28 | 0.2780 | 92.20 | 65.6 | 8.2 | 1.335 | 0.720 | 2.055 | 2.85 | 86.00 | 1.388 | 0.668 |
| 29 | 0.2990 | 90.60 | 64.0 | 8.9 | 1.293 | 0.749 | 2.042 | 2.73 | 85.60 | 1.396 | 0.647 |
| 30 | 0.3190 | 89.70 | 63.1 | 9.5 | 1.267 | 0.770 | 2.037 | 2.64 | 85.30 | 1.404 | 0.633 |
| 31 | 0.3390 | 89.00 | 62.4 | 10.1 | 1.244 | 0.785 | 2.029 | 2.59 | 85.10 | 1.407 | 0.622 |
| 32 | 0.3610 | 88.40 | 61.8 | 10.8 | 1.223 | 0.799 | 2.022 | 2.53 | 84.90 | 1.411 | 0.611 |
| 33 | 0.3820 | 87.30 | 60.7 | 11.4 | 1.192 | 0.821 | 2.013 | 2.45 | 84.60 | 1.417 | 0.596 |

| | Total | Effective |
|---|---|---|
| C, tsf | 0.080 | 0.105 |
| ϕ, deg | 19.4 | 26.9 |
| Tan(ϕ) | 0.35 | 0.51 |




| Sample No. | | 1 | 2 | 3 |
|---|---|---|---|---|
| Initial | Water Content, | 24.3 | 24.0 | 24.4 |
| | Dry Density, pcf | 99.9 | 101.8 | 101.2 |
| | Saturation, | 96.6 | 100.0 | 100.0 |
| | Void Ratio | 0.6747 | 0.6431 | 0.6539 |
| | Diameter, in. | 1.98 | 1.96 | 1.96 |
| | Height, in. | 3.70 | 3.64 | 3.60 |
| At Test | Water Content, | 24.0 | 24.4 | 25.4 |
| | Dry Density, pcf | 101.9 | 101.2 | 99.5 |
| | Saturation, | 100.0 | 100.0 | 100.0 |
| | Void Ratio | 0.6423 | 0.6539 | 0.6816 |
| | Diameter, in. | 1.96 | 1.96 | 1.97 |
| | Height, in. | 3.67 | 3.65 | 3.62 |
| Strain rate, %/min. | | 0.20 | 0.20 | 0.20 |
| Back Pressure, tsf | | 4.68 | 4.90 | 5.26 |
| Cell Pressure, tsf | | 5.04 | 5.62 | 6.34 |
| Fail. Stress, tsf | | 0.57 | 0.97 | 1.29 |
| Total Pore Pr., tsf | | 4.90 | 5.24 | 5.77 |
| Ult. Stress, tsf | | | | |
| Total Pore Pr., tsf | | | | |
| $\bar{\sigma}_1$ Failure, tsf | | 0.71 | 1.35 | 1.85 |
| $\bar{\sigma}_3$ Failure, tsf | | 0.14 | 0.38 | 0.57 |

**Type of Test:**
CU with Pore Pressures

**Sample Type:** Compacted (standard)

**Description:** CLAY (CL), brown, silty

**Assumed Specific Gravity=** 2.68

**Remarks:**

**Figure** ________

**Client:** Ameren Services

**Project:** Sioux Plant UWLF

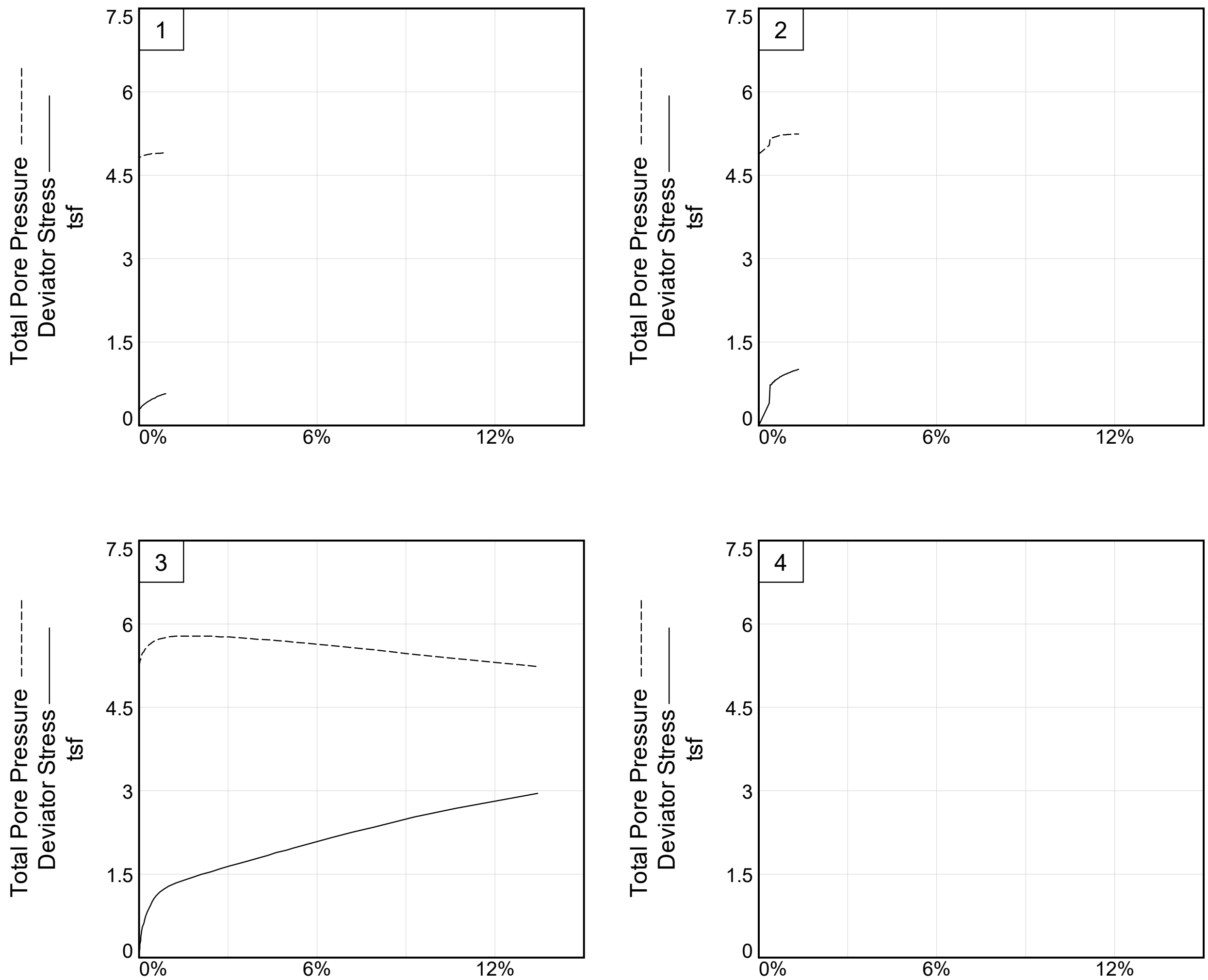
**Source of Sample:** Composite #7

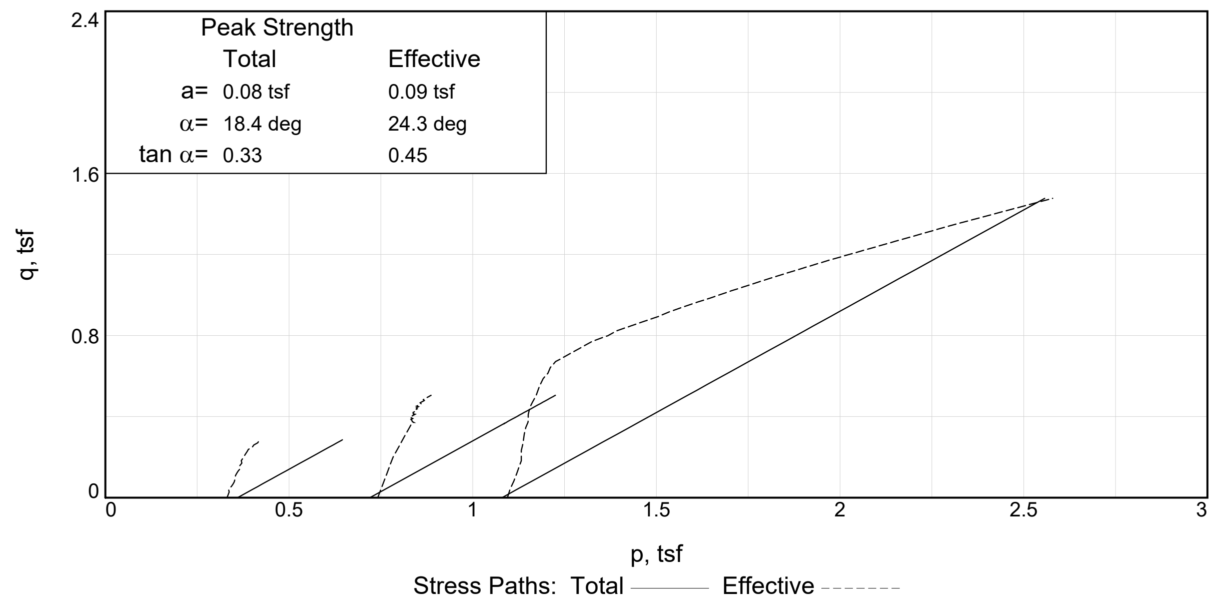
**Sample Number:** 1

**Proj. No.:** 2005012477 **Date:**

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Tested By:** K. Kocher **Checked By:** J. Fouse




| Peak Strength | Total | Effective |
|---|---|---|
| a= | 0.08 tsf | 0.09 tsf |
| α= | 18.4 deg | 24.3 deg |
| tan α= | 0.33 | 0.45 |

**Client:** Ameren Services
**Project:** Sioux Plant UWLF
**Source of Sample:** Composite #7 **Sample Number:** 1
**Project No.:** 2005012477 **Figure** _______

**REITZ & JENS, INC.**

**Tested By:** K. Kocher **Checked By:** J. Fouse

## TRIAXIAL COMPRESSION TEST

CU with Pore Pressures

1/16/2007
11:51 AM

**Date:**
**Client:** Ameren Services
**Project:** Sioux Plant UWLF
**Project No.:** 2005012477
**Location:** Composite #7
**Sample Number:** 1
**Description:** CLAY (CL), brown, silty
**Remarks:**
**Type of Sample:** Compacted (standard)
**Assumed Specific Gravity=**2.68 **LL=** **PL=** **PI=**
**Test Method:** COE uniform strain

### Parameters for Specimen No. 1

| Specimen Parameter | Initial | Saturated | Consolidated | Final |
|---|---|---|---|---|
| Moisture content: Moist soil+tare, gms. | 31.760 | | | 0.000 |
| Moisture content: Dry soil+tare, gms. | 29.800 | | | 0.000 |
| Moisture content: Tare, gms. | 21.740 | | | 0.000 |
| Moisture, % | 24.3 | 24.6 | 24.0 | |
| Moist specimen weight, gms. | 369.6 | | | |
| Diameter, in. | 1.98 | 1.97 | 1.96 | |
| Area, in.² | 3.07 | 3.05 | 3.03 | |
| Height, in. | 3.70 | 3.69 | 3.67 | |
| Net decrease in height, in. | | 0.01 | 0.01 | |
| Wet Density, pcf | 124.2 | 125.6 | 126.3 | |
| Dry density, pcf | 99.9 | 100.8 | 101.9 | |
| Void ratio | 0.6747 | 0.6598 | 0.6423 | |
| Saturation, % | 96.6 | 100.0 | 100.0 | |

### Test Readings for Specimen No. 1

**Consolidation cell pressure =** 70.00 psi (5.040 tsf)
**Consolidation back pressure =** 65.00 psi (4.680 tsf)
**Consolidation effective confining stress =** 0.360 tsf
**Strain rate, %/min. =** 0.20
**Fail. Stress =** 0.571 tsf **at reading no.** 24

## Test Readings for Specimen No. 1

| No. | Def. Dial in. | Load Dial | Load lbs. | Strain % | Deviator Stress tsf | Minor Eff. Stress tsf | Major Eff. Stress tsf | 1:3 Ratio | Pore Press. psi | P tsf | Q tsf |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.0000 | 17.70 | 0.0 | 0.0 | 0.000 | 0.331 | 0.331 | 1.00 | 65.40 | 0.331 | 0.000 |
| 1 | 0.0000 | 20.00 | 2.3 | 0.0 | 0.055 | 0.310 | 0.364 | 1.18 | 65.70 | 0.337 | 0.027 |
| 2 | 0.0000 | 21.10 | 3.4 | 0.0 | 0.081 | 0.295 | 0.376 | 1.27 | 65.90 | 0.336 | 0.040 |
| 3 | 0.0000 | 22.30 | 4.6 | 0.0 | 0.109 | 0.288 | 0.397 | 1.38 | 66.00 | 0.343 | 0.055 |
| 4 | 0.0000 | 23.30 | 5.6 | 0.0 | 0.133 | 0.281 | 0.414 | 1.47 | 66.10 | 0.347 | 0.067 |
| 5 | 0.0000 | 24.20 | 6.5 | 0.0 | 0.155 | 0.274 | 0.428 | 1.57 | 66.20 | 0.351 | 0.077 |
| 6 | 0.0000 | 25.60 | 7.9 | 0.0 | 0.188 | 0.259 | 0.447 | 1.73 | 66.40 | 0.353 | 0.094 |
| 7 | 0.0000 | 26.90 | 9.2 | 0.0 | 0.219 | 0.245 | 0.464 | 1.89 | 66.60 | 0.354 | 0.109 |
| 8 | 0.0000 | 27.80 | 10.1 | 0.0 | 0.240 | 0.238 | 0.478 | 2.01 | 66.70 | 0.358 | 0.120 |
| 9 | 0.0000 | 28.70 | 11.0 | 0.0 | 0.262 | 0.230 | 0.492 | 2.14 | 66.80 | 0.361 | 0.131 |
| 10 | 0.0000 | 29.80 | 12.1 | 0.0 | 0.288 | 0.223 | 0.511 | 2.29 | 66.90 | 0.367 | 0.144 |
| 11 | 0.0020 | 30.90 | 13.2 | 0.1 | 0.314 | 0.209 | 0.523 | 2.50 | 67.10 | 0.366 | 0.157 |
| 12 | 0.0030 | 32.00 | 14.3 | 0.1 | 0.340 | 0.202 | 0.542 | 2.69 | 67.20 | 0.372 | 0.170 |
| 13 | 0.0050 | 33.10 | 15.4 | 0.1 | 0.366 | 0.187 | 0.553 | 2.95 | 67.40 | 0.370 | 0.183 |
| 14 | 0.0070 | 34.10 | 16.4 | 0.2 | 0.389 | 0.180 | 0.569 | 3.16 | 67.50 | 0.375 | 0.195 |
| 15 | 0.0090 | 35.00 | 17.3 | 0.2 | 0.411 | 0.173 | 0.583 | 3.38 | 67.60 | 0.378 | 0.205 |
| 16 | 0.0110 | 35.90 | 18.2 | 0.3 | 0.432 | 0.166 | 0.597 | 3.61 | 67.70 | 0.381 | 0.216 |
| 17 | 0.0140 | 36.90 | 19.2 | 0.4 | 0.455 | 0.158 | 0.614 | 3.87 | 67.80 | 0.386 | 0.228 |
| 18 | 0.0160 | 37.80 | 20.1 | 0.4 | 0.476 | 0.151 | 0.627 | 4.15 | 67.90 | 0.389 | 0.238 |
| 19 | 0.0200 | 38.70 | 21.0 | 0.5 | 0.497 | 0.151 | 0.648 | 4.29 | 67.90 | 0.400 | 0.248 |
| 20 | 0.0220 | 39.70 | 22.0 | 0.6 | 0.520 | 0.144 | 0.664 | 4.61 | 68.00 | 0.404 | 0.260 |
| 21 | 0.0260 | 40.60 | 22.9 | 0.7 | 0.541 | 0.144 | 0.685 | 4.76 | 68.00 | 0.415 | 0.271 |
| 22 | 0.0310 | 41.70 | 24.0 | 0.8 | 0.566 | 0.137 | 0.703 | 5.14 | 68.10 | 0.420 | 0.283 |
| 23 | 0.0320 | 41.90 | 24.2 | 0.9 | 0.571 | 0.137 | 0.708 | 5.17 | 68.10 | 0.422 | 0.285 |
| 24 | 0.0330 | 41.90 | 24.2 | 0.9 | 0.571 | 0.137 | 0.707 | 5.17 | 68.10 | 0.422 | 0.285 |

## Parameters for Specimen No. 2

| Specimen Parameter | Initial | Saturated | Consolidated | Final |
|---|---|---|---|---|
| **Moisture content: Moist soil+tare, gms.** | 124.000 | | | 0.000 |
| **Moisture content: Dry soil+tare, gms.** | 100.000 | | | 0.000 |
| **Moisture content: Tare, gms.** | 0.000 | | | 0.000 |
| **Moisture, %** | 24.0 | 24.0 | 24.4 | |
| **Moist specimen weight, gms.** | 364.1 | | | |
| **Diameter, in.** | 1.96 | 1.96 | 1.96 | |
| **Area, in.²** | 3.02 | 3.02 | 3.03 | |
| **Height, in.** | 3.64 | 3.64 | 3.65 | |
| **Net decrease in height, in.** | | 0.00 | -0.01 | |
| **Wet Density, pcf** | 126.3 | 126.3 | 125.8 | |
| **Dry density, pcf** | 101.8 | 101.8 | 101.2 | |
| **Void ratio** | 0.6431 | 0.6431 | 0.6539 | |
| **Saturation, %** | 100.0 | 100.0 | 100.0 | |

## Test Readings for Specimen No. 2

**Consolidation cell pressure =** 78.10 psi (5.623 tsf)

**Consolidation back pressure =** 68.10 psi (4.903 tsf)

**Consolidation effective confining stress =** 0.720 tsf

**Strain rate, %/min. =** 0.20

**Fail. Stress =** 0.968 tsf **at reading no.** 32

| No. | Def. Dial in. | Load Dial | Load lbs. | Strain % | Deviator Stress tsf | Minor Eff. Stress tsf | Major Eff. Stress tsf | 1:3 Ratio | Pore Press. psi | P tsf | Q tsf |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.0030 | 20.00 | 0.0 | 0.0 | 0.000 | 0.742 | 0.742 | 1.00 | 67.80 | 0.742 | 0.000 |
| 1 | 0.0160 | 36.90 | 16.9 | 0.4 | 0.400 | 0.583 | 0.983 | 1.69 | 70.00 | 0.783 | 0.200 |
| 2 | 0.0170 | 50.90 | 30.9 | 0.4 | 0.731 | 0.468 | 1.199 | 2.56 | 71.60 | 0.834 | 0.366 |
| 3 | 0.0180 | 50.90 | 30.9 | 0.4 | 0.731 | 0.468 | 1.199 | 2.56 | 71.60 | 0.834 | 0.366 |
| 4 | 0.0190 | 51.40 | 31.4 | 0.4 | 0.743 | 0.468 | 1.211 | 2.59 | 71.60 | 0.839 | 0.371 |
| 5 | 0.0190 | 51.70 | 31.7 | 0.4 | 0.750 | 0.461 | 1.211 | 2.63 | 71.70 | 0.836 | 0.375 |
| 6 | 0.0200 | 52.20 | 32.2 | 0.5 | 0.761 | 0.454 | 1.215 | 2.68 | 71.80 | 0.834 | 0.381 |
| 7 | 0.0200 | 52.60 | 32.6 | 0.5 | 0.771 | 0.446 | 1.217 | 2.73 | 71.90 | 0.832 | 0.385 |
| 8 | 0.0210 | 53.00 | 33.0 | 0.5 | 0.780 | 0.446 | 1.227 | 2.75 | 71.90 | 0.836 | 0.390 |
| 9 | 0.0220 | 53.30 | 33.3 | 0.5 | 0.787 | 0.439 | 1.226 | 2.79 | 72.00 | 0.833 | 0.394 |
| 10 | 0.0220 | 53.70 | 33.7 | 0.5 | 0.797 | 0.439 | 1.236 | 2.81 | 72.00 | 0.837 | 0.398 |
| 11 | 0.0230 | 54.00 | 34.0 | 0.5 | 0.803 | 0.432 | 1.235 | 2.86 | 72.10 | 0.834 | 0.402 |
| 12 | 0.0230 | 54.40 | 34.4 | 0.5 | 0.813 | 0.432 | 1.245 | 2.88 | 72.10 | 0.838 | 0.406 |
| 13 | 0.0240 | 54.80 | 34.8 | 0.6 | 0.822 | 0.432 | 1.254 | 2.90 | 72.10 | 0.843 | 0.411 |
| 14 | 0.0250 | 55.00 | 35.0 | 0.6 | 0.827 | 0.425 | 1.251 | 2.95 | 72.20 | 0.838 | 0.413 |
| 15 | 0.0260 | 55.60 | 35.6 | 0.6 | 0.840 | 0.418 | 1.258 | 3.01 | 72.30 | 0.838 | 0.420 |
| 16 | 0.0270 | 55.90 | 35.9 | 0.7 | 0.847 | 0.418 | 1.265 | 3.03 | 72.30 | 0.841 | 0.424 |
| 17 | 0.0280 | 56.40 | 36.4 | 0.7 | 0.859 | 0.410 | 1.269 | 3.09 | 72.40 | 0.840 | 0.429 |
| 18 | 0.0290 | 57.00 | 37.0 | 0.7 | 0.873 | 0.410 | 1.283 | 3.13 | 72.40 | 0.847 | 0.436 |
| 19 | 0.0300 | 57.20 | 37.2 | 0.7 | 0.877 | 0.410 | 1.288 | 3.14 | 72.40 | 0.849 | 0.439 |
| 20 | 0.0310 | 57.60 | 37.6 | 0.8 | 0.886 | 0.403 | 1.290 | 3.20 | 72.50 | 0.846 | 0.443 |
| 21 | 0.0320 | 58.10 | 38.1 | 0.8 | 0.898 | 0.403 | 1.301 | 3.23 | 72.50 | 0.852 | 0.449 |
| 22 | 0.0330 | 58.30 | 38.3 | 0.8 | 0.902 | 0.396 | 1.298 | 3.28 | 72.60 | 0.847 | 0.451 |
| 23 | 0.0340 | 58.60 | 38.6 | 0.8 | 0.909 | 0.396 | 1.305 | 3.30 | 72.60 | 0.851 | 0.455 |
| 24 | 0.0350 | 58.90 | 38.9 | 0.9 | 0.916 | 0.396 | 1.312 | 3.31 | 72.60 | 0.854 | 0.458 |
| 25 | 0.0360 | 59.20 | 39.2 | 0.9 | 0.923 | 0.396 | 1.319 | 3.33 | 72.60 | 0.857 | 0.461 |
| 26 | 0.0370 | 59.40 | 39.4 | 0.9 | 0.927 | 0.396 | 1.323 | 3.34 | 72.60 | 0.860 | 0.464 |

## Test Readings for Specimen No. 2

| No. | Def. Dial in. | Load Dial | Load lbs. | Strain % | Deviator Stress tsf | Minor Eff. Stress tsf | Major Eff. Stress tsf | 1:3 Ratio | Pore Press. psi | P tsf | Q tsf |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 | 0.0380 | 59.80 | 39.8 | 1.0 | 0.937 | 0.389 | 1.325 | 3.41 | 72.70 | 0.857 | 0.468 |
| 28 | 0.0390 | 60.10 | 40.1 | 1.0 | 0.943 | 0.389 | 1.332 | 3.43 | 72.70 | 0.860 | 0.472 |
| 29 | 0.0400 | 60.30 | 40.3 | 1.0 | 0.948 | 0.389 | 1.337 | 3.44 | 72.70 | 0.863 | 0.474 |
| 30 | 0.0410 | 60.50 | 40.5 | 1.0 | 0.952 | 0.389 | 1.341 | 3.45 | 72.70 | 0.865 | 0.476 |
| 31 | 0.0420 | 60.80 | 40.8 | 1.1 | 0.959 | 0.389 | 1.348 | 3.47 | 72.70 | 0.868 | 0.480 |
| 32 | 0.0430 | 61.20 | 41.2 | 1.1 | 0.968 | 0.382 | 1.350 | 3.54 | 72.80 | 0.866 | 0.484 |
| 33 | 0.0440 | 61.20 | 41.2 | 1.1 | 0.968 | 0.382 | 1.349 | 3.54 | 72.80 | 0.866 | 0.484 |
| 34 | 0.0450 | 61.70 | 41.7 | 1.2 | 0.979 | 0.382 | 1.361 | 3.57 | 72.80 | 0.871 | 0.490 |
| 35 | 0.0460 | 61.90 | 41.9 | 1.2 | 0.984 | 0.382 | 1.365 | 3.58 | 72.80 | 0.873 | 0.492 |
| 36 | 0.0470 | 61.90 | 41.9 | 1.2 | 0.983 | 0.382 | 1.365 | 3.58 | 72.80 | 0.873 | 0.492 |
| 37 | 0.0480 | 62.20 | 42.2 | 1.2 | 0.990 | 0.382 | 1.372 | 3.60 | 72.80 | 0.877 | 0.495 |
| 38 | 0.0490 | 62.50 | 42.5 | 1.3 | 0.997 | 0.382 | 1.379 | 3.61 | 72.80 | 0.880 | 0.499 |
| 39 | 0.0500 | 62.60 | 42.6 | 1.3 | 0.999 | 0.382 | 1.381 | 3.62 | 72.80 | 0.881 | 0.500 |
| 40 | 0.0510 | 63.00 | 43.0 | 1.3 | 1.008 | 0.382 | 1.390 | 3.64 | 72.80 | 0.886 | 0.504 |
| 41 | 0.0520 | 63.10 | 43.1 | 1.3 | 1.010 | 0.382 | 1.392 | 3.65 | 72.80 | 0.887 | 0.505 |

## Parameters for Specimen No. 3

| Specimen Parameter | Initial | Saturated | Consolidated | Final |
|---|---|---|---|---|
| Moisture content: Moist soil+tare, gms. | 124.400 | | | 0.000 |
| Moisture content: Dry soil+tare, gms. | 100.000 | | | 0.000 |
| Moisture content: Tare, gms. | 0.000 | | | 0.000 |
| Moisture, % | 24.4 | 24.4 | 25.4 | |
| Moist specimen weight, gms. | 358.5 | | | |
| Diameter, in. | 1.96 | 1.96 | 1.97 | |
| Area, in.² | 3.02 | 3.02 | 3.05 | |
| Height, in. | 3.60 | 3.60 | 3.62 | |
| Net decrease in height, in. | | 0.00 | -0.02 | |
| Wet Density, pcf | 125.8 | 125.8 | 124.8 | |
| Dry density, pcf | 101.2 | 101.2 | 99.5 | |
| Void ratio | 0.6539 | 0.6539 | 0.6816 | |
| Saturation, % | 100.0 | 100.0 | 100.0 | |

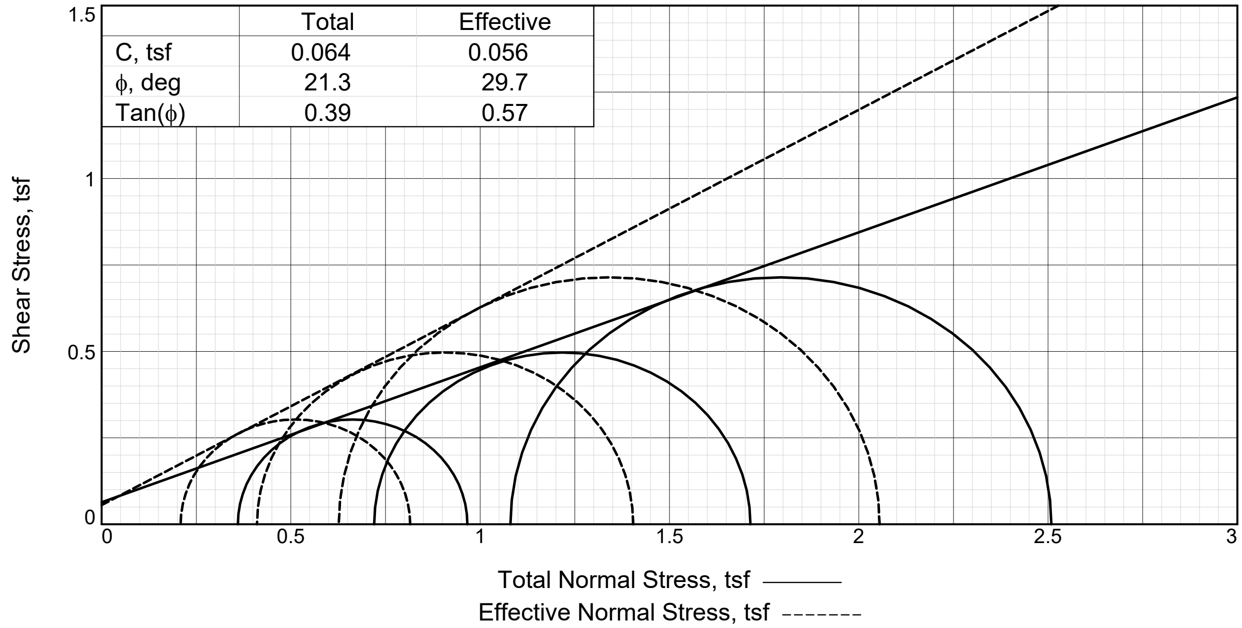
## Test Readings for Specimen No. 3

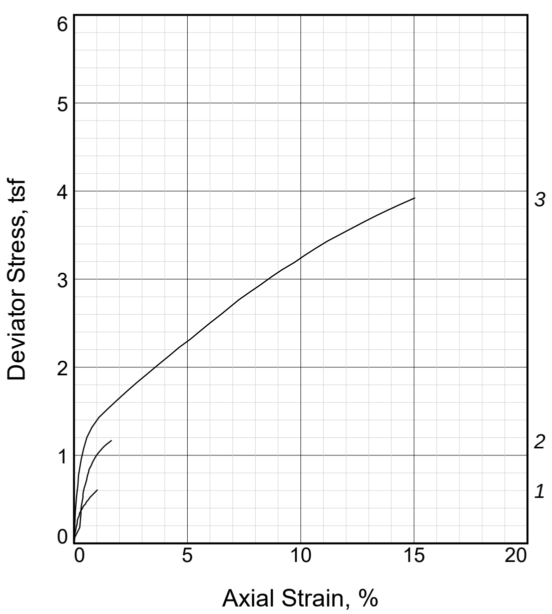
**Consolidation cell pressure =** 88.00 psi (6.336 tsf)
**Consolidation back pressure =** 73.00 psi (5.256 tsf)
**Consolidation effective confining stress =** 1.080 tsf
**Strain rate, %/min. =** 0.20
**Fail. Stress =** 1.285 tsf **at reading no.** 19

| No. | Def. Dial in. | Load Dial | Load lbs. | Strain % | Deviator Stress tsf | Minor Eff. Stress tsf | Major Eff. Stress tsf | 1:3 Ratio | Pore Press. psi | P tsf | Q tsf |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.0140 | 24.40 | 0.0 | 0.0 | 0.000 | 1.094 | 1.094 | 1.00 | 72.80 | 1.094 | 0.000 |
| 1 | 0.0140 | 28.10 | 3.7 | 0.0 | 0.087 | 1.058 | 1.146 | 1.08 | 73.30 | 1.102 | 0.044 |
| 2 | 0.0150 | 31.40 | 7.0 | 0.0 | 0.165 | 1.030 | 1.195 | 1.16 | 73.70 | 1.112 | 0.083 |
| 3 | 0.0150 | 34.50 | 10.1 | 0.0 | 0.238 | 1.001 | 1.239 | 1.24 | 74.10 | 1.120 | 0.119 |
| 4 | 0.0160 | 37.50 | 13.1 | 0.1 | 0.309 | 0.972 | 1.281 | 1.32 | 74.50 | 1.127 | 0.155 |
| 5 | 0.0160 | 39.80 | 15.4 | 0.1 | 0.363 | 0.950 | 1.314 | 1.38 | 74.80 | 1.132 | 0.182 |
| 6 | 0.0170 | 44.10 | 19.7 | 0.1 | 0.465 | 0.900 | 1.365 | 1.52 | 75.50 | 1.132 | 0.232 |
| 7 | 0.0180 | 47.60 | 23.2 | 0.1 | 0.547 | 0.864 | 1.411 | 1.63 | 76.00 | 1.137 | 0.273 |
| 8 | 0.0200 | 50.90 | 26.5 | 0.2 | 0.624 | 0.828 | 1.452 | 1.75 | 76.50 | 1.140 | 0.312 |
| 9 | 0.0210 | 53.70 | 29.3 | 0.2 | 0.690 | 0.799 | 1.489 | 1.86 | 76.90 | 1.144 | 0.345 |
| 10 | 0.0220 | 56.10 | 31.7 | 0.2 | 0.746 | 0.778 | 1.524 | 1.96 | 77.20 | 1.151 | 0.373 |
| 11 | 0.0240 | 59.20 | 34.8 | 0.3 | 0.819 | 0.742 | 1.561 | 2.10 | 77.70 | 1.151 | 0.410 |
| 12 | 0.0260 | 62.00 | 37.6 | 0.3 | 0.884 | 0.713 | 1.597 | 2.24 | 78.10 | 1.155 | 0.442 |
| 13 | 0.0280 | 64.50 | 40.1 | 0.4 | 0.943 | 0.691 | 1.634 | 2.36 | 78.40 | 1.163 | 0.471 |
| 14 | 0.0300 | 67.20 | 42.8 | 0.4 | 1.006 | 0.670 | 1.675 | 2.50 | 78.70 | 1.172 | 0.503 |
| 15 | 0.0320 | 69.50 | 45.1 | 0.5 | 1.059 | 0.648 | 1.707 | 2.63 | 79.00 | 1.178 | 0.530 |
| 16 | 0.0350 | 71.90 | 47.5 | 0.6 | 1.115 | 0.626 | 1.741 | 2.78 | 79.30 | 1.184 | 0.557 |
| 17 | 0.0390 | 74.50 | 50.1 | 0.7 | 1.174 | 0.605 | 1.779 | 2.94 | 79.60 | 1.192 | 0.587 |
| 18 | 0.0440 | 76.90 | 52.5 | 0.8 | 1.229 | 0.590 | 1.819 | 3.08 | 79.80 | 1.205 | 0.614 |
| 19 | 0.0500 | 79.40 | 55.0 | 1.0 | 1.285 | 0.569 | 1.854 | 3.26 | 80.10 | 1.211 | 0.643 |
| 20 | 0.0590 | 82.00 | 57.6 | 1.2 | 1.342 | 0.554 | 1.897 | 3.42 | 80.30 | 1.226 | 0.671 |
| 21 | 0.0690 | 84.40 | 60.0 | 1.5 | 1.395 | 0.554 | 1.949 | 3.52 | 80.30 | 1.252 | 0.697 |
| 22 | 0.0800 | 86.90 | 62.5 | 1.8 | 1.448 | 0.554 | 2.003 | 3.61 | 80.30 | 1.278 | 0.724 |
| 23 | 0.0900 | 89.20 | 64.8 | 2.1 | 1.497 | 0.554 | 2.052 | 3.70 | 80.30 | 1.303 | 0.749 |
| 24 | 0.1020 | 91.50 | 67.1 | 2.4 | 1.545 | 0.554 | 2.099 | 3.79 | 80.30 | 1.327 | 0.773 |
| 25 | 0.1130 | 94.00 | 69.6 | 2.7 | 1.598 | 0.569 | 2.166 | 3.81 | 80.10 | 1.368 | 0.799 |
| 26 | 0.1240 | 96.40 | 72.0 | 3.0 | 1.648 | 0.569 | 2.216 | 3.90 | 80.10 | 1.393 | 0.824 |

## Test Readings for Specimen No. 3

| No. | Def. Dial in. | Load Dial | Load lbs. | Strain % | Deviator Stress tsf | Minor Eff. Stress tsf | Major Eff. Stress tsf | 1:3 Ratio | Pore Press. psi | P tsf | Q tsf |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 | 0.1360 | 98.70 | 74.3 | 3.4 | 1.694 | 0.583 | 2.278 | 3.91 | 79.90 | 1.430 | 0.847 |
| 28 | 0.1480 | 101.10 | 76.7 | 3.7 | 1.743 | 0.598 | 2.341 | 3.92 | 79.70 | 1.469 | 0.872 |
| 29 | 0.1590 | 103.40 | 79.0 | 4.0 | 1.790 | 0.612 | 2.402 | 3.92 | 79.50 | 1.507 | 0.895 |
| 30 | 0.1710 | 105.80 | 81.4 | 4.3 | 1.838 | 0.619 | 2.457 | 3.97 | 79.40 | 1.538 | 0.919 |
| 31 | 0.1810 | 108.30 | 83.9 | 4.6 | 1.889 | 0.634 | 2.522 | 3.98 | 79.20 | 1.578 | 0.944 |
| 32 | 0.1940 | 110.60 | 86.2 | 5.0 | 1.933 | 0.648 | 2.581 | 3.98 | 79.00 | 1.615 | 0.967 |
| 33 | 0.2020 | 112.50 | 88.1 | 5.2 | 1.971 | 0.662 | 2.634 | 3.98 | 78.80 | 1.648 | 0.986 |
| 34 | 0.2200 | 116.20 | 91.8 | 5.7 | 2.043 | 0.684 | 2.727 | 3.99 | 78.50 | 1.706 | 1.022 |
| 35 | 0.2500 | 122.50 | 98.1 | 6.5 | 2.164 | 0.727 | 2.891 | 3.98 | 77.90 | 1.809 | 1.082 |
| 36 | 0.2750 | 127.50 | 103.1 | 7.2 | 2.258 | 0.763 | 3.021 | 3.96 | 77.40 | 1.892 | 1.129 |
| 37 | 0.3000 | 132.30 | 107.9 | 7.9 | 2.345 | 0.799 | 3.144 | 3.93 | 76.90 | 1.972 | 1.173 |
| 38 | 0.3500 | 142.60 | 118.2 | 9.3 | 2.530 | 0.886 | 3.416 | 3.86 | 75.70 | 2.151 | 1.265 |
| 39 | 0.4000 | 151.70 | 127.3 | 10.7 | 2.684 | 0.958 | 3.641 | 3.80 | 74.70 | 2.299 | 1.342 |
| 40 | 0.5000 | 169.00 | 144.6 | 13.4 | 2.954 | 1.102 | 4.056 | 3.68 | 72.70 | 2.579 | 1.477 |




| Sample No. | | 1 | 2 | 3 |
|---|---|---|---|---|
| Initial | Water Content, | 24.6 | 23.5 | 23.6 |
| | Dry Density, pcf | 100.4 | 102.7 | 102.5 |
| | Saturation, | 99.0 | 100.0 | 100.0 |
| | Void Ratio | 0.6660 | 0.6296 | 0.6324 |
| | Diameter, in. | 1.94 | 1.92 | 1.92 |
| | Height, in. | 3.65 | 3.58 | 3.52 |
| At Test | Water Content, | 23.5 | 23.6 | 25.7 |
| | Dry Density, pcf | 102.6 | 102.5 | 99.1 |
| | Saturation, | 100.0 | 100.0 | 100.0 |
| | Void Ratio | 0.6305 | 0.6323 | 0.6884 |
| | Diameter, in. | 1.92 | 1.92 | 1.94 |
| | Height, in. | 3.62 | 3.58 | 3.56 |
| Strain rate, %/min. | | 0.50 | 0.50 | 0.50 |
| Back Pressure, tsf | | 4.39 | 4.57 | 5.04 |
| Cell Pressure, tsf | | 4.75 | 5.29 | 6.12 |
| Fail. Stress, tsf | | 0.61 | 0.99 | 1.43 |
| Total Pore Pr., tsf | | 4.54 | 4.88 | 5.49 |
| Ult. Stress, tsf | | | | |
| Total Pore Pr., tsf | | | | |
| $\bar{\sigma}_1$ Failure, tsf | | 0.81 | 1.40 | 2.05 |
| $\bar{\sigma}_3$ Failure, tsf | | 0.21 | 0.41 | 0.63 |

**Type of Test:**
CU with Pore Pressures

**Sample Type:** Compacted (standard

**Description:** SILT, (ML) brown, slightly clayey with very fine sand
70% Composite #7 with 30% silty fine sand

**Assumed Specific Gravity=** 2.68

**Remarks:**

**Figure** ________

**Client:** Ameren Services

**Project:** Sioux Plant UWLF

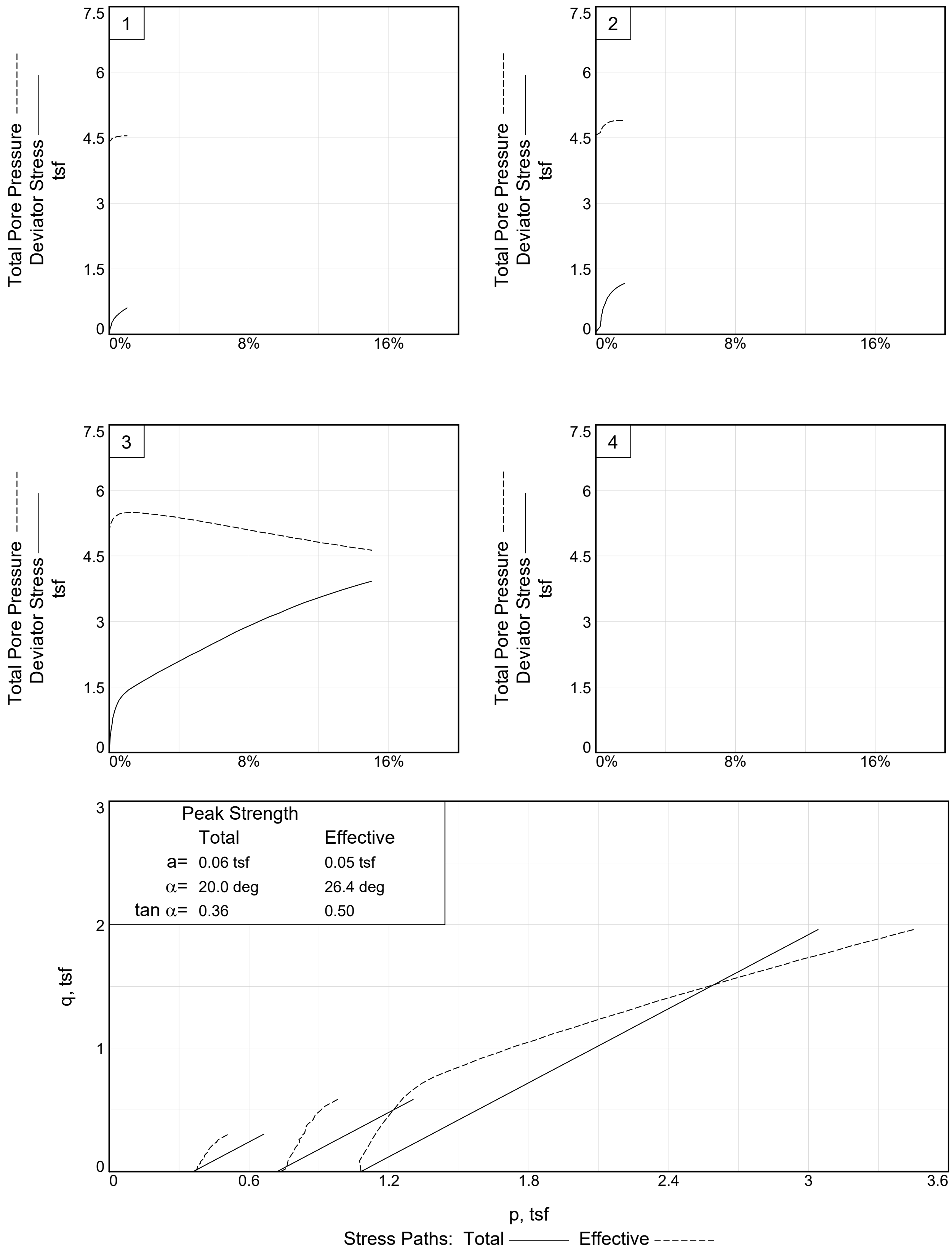
**Source of Sample:** Composite#7(70%) & silty fine sand(30%)

**Sample Number:** 1

**Proj. No.:** 2005012477 **Date:**

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Tested By:** K. Kocher **Checked By:** J. Fouse




**Client:** Ameren Services

**Project:** Sioux Plant UWLF

**Source of Sample:** Composite#7(70%) & silty fine sand(30%) **Sample Number:** 1

**Project No.:** 2005012477 **Figure** _______

**REITZ & JENS, INC.**

**Tested By:** K. Kocher **Checked By:** J. Fouse

## TRIAXIAL COMPRESSION TEST

CU with Pore Pressures

1/16/2007
10:20 AM

**Date:**

**Client:** Ameren Services

**Project:** Sioux Plant UWLF

**Project No.:** 2005012477

**Location:** Composite#7(70%) & silty fine sand(30%)

**Sample Number:** 1

**Description:** SILT, (ML) brown, slightly clayey with very fine sand
70% Composite #7 with 30% silty fine sand

**Remarks:**

**Type of Sample:** Compacted (standard

**Assumed Specific Gravity=**2.68 **LL=** **PL=** **PI=**

**Test Method:** COE uniform strain

### Parameters for Specimen No. 1

| Specimen Parameter | Initial | Saturated | Consolidated | Final |
|---|---|---|---|---|
| **Moisture content: Moist soil+tare, gms.** | 124.600 | | | 0.000 |
| **Moisture content: Dry soil+tare, gms.** | 100.000 | | | 0.000 |
| **Moisture content: Tare, gms.** | 0.000 | | | 0.000 |
| **Moisture, %** | 24.6 | 24.0 | 23.5 | |
| **Moist specimen weight, gms.** | 352.9 | | | |
| **Diameter, in.** | 1.94 | 1.93 | 1.92 | |
| **Area, in.²** | 2.95 | 2.92 | 2.90 | |
| **Height, in.** | 3.65 | 3.63 | 3.62 | |
| **Net decrease in height, in.** | | 0.02 | 0.01 | |
| **Wet Density, pcf** | 125.1 | 126.2 | 126.8 | |
| **Dry density, pcf** | 100.4 | 101.8 | 102.6 | |
| **Void ratio** | 0.6660 | 0.6441 | 0.6305 | |
| **Saturation, %** | 99.0 | 100.0 | 100.0 | |

### Test Readings for Specimen No. 1

**Consolidation cell pressure =** 66.00 psi (4.752 tsf)

**Consolidation back pressure =** 61.00 psi (4.392 tsf)

**Consolidation effective confining stress =** 0.360 tsf

**Strain rate, %/min. =** 0.50

**Fail. Stress =** 0.606 tsf **at reading no.** 21

## Test Readings for Specimen No. 1

| No. | Def. Dial in. | Load Dial | Load lbs. | Strain % | Deviator Stress tsf | Minor Eff. Stress tsf | Major Eff. Stress tsf | 1:3 Ratio | Pore Press. psi | P tsf | Q tsf |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.0070 | 16.90 | 0.0 | 0.0 | 0.000 | 0.367 | 0.367 | 1.00 | 60.90 | 0.367 | 0.000 |
| 1 | 0.0080 | 18.90 | 2.0 | 0.0 | 0.050 | 0.353 | 0.402 | 1.14 | 61.10 | 0.378 | 0.025 |
| 2 | 0.0080 | 20.80 | 3.9 | 0.0 | 0.097 | 0.331 | 0.428 | 1.29 | 61.40 | 0.380 | 0.048 |
| 3 | 0.0090 | 22.30 | 5.4 | 0.1 | 0.134 | 0.324 | 0.458 | 1.41 | 61.50 | 0.391 | 0.067 |
| 4 | 0.0100 | 23.60 | 6.7 | 0.1 | 0.166 | 0.310 | 0.476 | 1.54 | 61.70 | 0.393 | 0.083 |
| 5 | 0.0110 | 25.00 | 8.1 | 0.1 | 0.201 | 0.302 | 0.503 | 1.66 | 61.80 | 0.403 | 0.100 |
| 6 | 0.0120 | 26.10 | 9.2 | 0.1 | 0.228 | 0.295 | 0.523 | 1.77 | 61.90 | 0.409 | 0.114 |
| 7 | 0.0120 | 27.20 | 10.3 | 0.1 | 0.255 | 0.281 | 0.536 | 1.91 | 62.10 | 0.408 | 0.128 |
| 8 | 0.0130 | 28.10 | 11.2 | 0.2 | 0.277 | 0.274 | 0.551 | 2.01 | 62.20 | 0.412 | 0.139 |
| 9 | 0.0150 | 29.50 | 12.6 | 0.2 | 0.312 | 0.266 | 0.578 | 2.17 | 62.30 | 0.422 | 0.156 |
| 10 | 0.0160 | 30.80 | 13.9 | 0.2 | 0.344 | 0.252 | 0.596 | 2.36 | 62.50 | 0.424 | 0.172 |
| 11 | 0.0180 | 31.90 | 15.0 | 0.3 | 0.371 | 0.245 | 0.616 | 2.51 | 62.60 | 0.430 | 0.185 |
| 12 | 0.0200 | 32.80 | 15.9 | 0.4 | 0.393 | 0.238 | 0.630 | 2.65 | 62.70 | 0.434 | 0.196 |
| 13 | 0.0220 | 34.10 | 17.2 | 0.4 | 0.425 | 0.230 | 0.655 | 2.84 | 62.80 | 0.443 | 0.212 |
| 14 | 0.0250 | 35.00 | 18.1 | 0.5 | 0.447 | 0.223 | 0.670 | 3.00 | 62.90 | 0.446 | 0.223 |
| 15 | 0.0270 | 36.10 | 19.2 | 0.6 | 0.473 | 0.223 | 0.697 | 3.12 | 62.90 | 0.460 | 0.237 |
| 16 | 0.0300 | 37.00 | 20.1 | 0.6 | 0.495 | 0.216 | 0.711 | 3.29 | 63.00 | 0.464 | 0.248 |
| 17 | 0.0320 | 38.00 | 21.1 | 0.7 | 0.520 | 0.209 | 0.728 | 3.49 | 63.10 | 0.469 | 0.260 |
| 18 | 0.0350 | 38.90 | 22.0 | 0.8 | 0.541 | 0.209 | 0.750 | 3.59 | 63.10 | 0.479 | 0.271 |
| 19 | 0.0380 | 39.80 | 22.9 | 0.9 | 0.563 | 0.209 | 0.772 | 3.70 | 63.10 | 0.490 | 0.281 |
| 20 | 0.0420 | 40.90 | 24.0 | 1.0 | 0.589 | 0.209 | 0.798 | 3.82 | 63.10 | 0.503 | 0.295 |
| 21 | 0.0440 | 41.60 | 24.7 | 1.0 | 0.606 | 0.209 | 0.815 | 3.90 | 63.10 | 0.512 | 0.303 |

## Parameters for Specimen No. 2

| Specimen Parameter | Initial | Saturated | Consolidated | Final |
|---|---|---|---|---|
| Moisture content: Moist soil+tare, gms. | 123.500 | | | 0.000 |
| Moisture content: Dry soil+tare, gms. | 100.000 | | | 0.000 |
| Moisture content: Tare, gms. | 0.000 | | | 0.000 |
| Moisture, % | 23.5 | 23.5 | 23.6 | |
| Moist specimen weight, gms. | 344.8 | | | |
| Diameter, in. | 1.92 | 1.92 | 1.92 | |
| Area, in.² | 2.90 | 2.90 | 2.90 | |
| Height, in. | 3.58 | 3.58 | 3.58 | |
| Net decrease in height, in. | | 0.00 | 0.00 | |
| Wet Density, pcf | 126.8 | 126.8 | 126.7 | |
| Dry density, pcf | 102.7 | 102.7 | 102.5 | |
| Void ratio | 0.6296 | 0.6296 | 0.6323 | |
| Saturation, % | 100.0 | 100.0 | 100.0 | |

## Test Readings for Specimen No. 2

**Consolidation cell pressure =** 73.50 psi (5.292 tsf)
**Consolidation back pressure =** 63.50 psi (4.572 tsf)
**Consolidation effective confining stress =** 0.720 tsf
**Strain rate, %/min. =** 0.50
**Fail. Stress =** 0.994 tsf **at reading no.** 21

| No. | Def. Dial in. | Load Dial | Load lbs. | Strain % | Deviator Stress tsf | Minor Eff. Stress tsf | Major Eff. Stress tsf | 1:3 Ratio | Pore Press. psi | P tsf | Q tsf |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.0010 | 16.60 | 0.0 | 0.0 | 0.000 | 0.734 | 0.734 | 1.00 | 63.30 | 0.734 | 0.000 |
| 1 | 0.0010 | 17.00 | 0.4 | 0.0 | 0.010 | 0.734 | 0.744 | 1.01 | 63.30 | 0.739 | 0.005 |
| 2 | 0.0010 | 18.70 | 2.1 | 0.0 | 0.052 | 0.734 | 0.787 | 1.07 | 63.30 | 0.760 | 0.026 |
| 3 | 0.0100 | 23.90 | 7.3 | 0.3 | 0.181 | 0.677 | 0.858 | 1.27 | 64.10 | 0.767 | 0.090 |
| 4 | 0.0110 | 27.30 | 10.7 | 0.3 | 0.265 | 0.648 | 0.913 | 1.41 | 64.50 | 0.781 | 0.133 |
| 5 | 0.0120 | 30.10 | 13.5 | 0.3 | 0.334 | 0.626 | 0.961 | 1.53 | 64.80 | 0.794 | 0.167 |
| 6 | 0.0120 | 32.20 | 15.6 | 0.3 | 0.386 | 0.605 | 0.991 | 1.64 | 65.10 | 0.798 | 0.193 |
| 7 | 0.0130 | 34.40 | 17.8 | 0.3 | 0.441 | 0.590 | 1.031 | 1.75 | 65.30 | 0.811 | 0.220 |
| 8 | 0.0140 | 36.10 | 19.5 | 0.4 | 0.483 | 0.576 | 1.059 | 1.84 | 65.50 | 0.817 | 0.241 |
| 9 | 0.0150 | 37.60 | 21.0 | 0.4 | 0.520 | 0.554 | 1.074 | 1.94 | 65.80 | 0.814 | 0.260 |
| 10 | 0.0150 | 39.20 | 22.6 | 0.4 | 0.559 | 0.547 | 1.106 | 2.02 | 65.90 | 0.827 | 0.280 |
| 11 | 0.0160 | 40.60 | 24.0 | 0.4 | 0.594 | 0.533 | 1.126 | 2.11 | 66.10 | 0.830 | 0.297 |
| 12 | 0.0170 | 41.90 | 25.3 | 0.4 | 0.626 | 0.526 | 1.151 | 2.19 | 66.20 | 0.838 | 0.313 |
| 13 | 0.0190 | 43.90 | 27.3 | 0.5 | 0.675 | 0.504 | 1.179 | 2.34 | 66.50 | 0.841 | 0.337 |
| 14 | 0.0210 | 45.90 | 29.3 | 0.6 | 0.724 | 0.482 | 1.206 | 2.50 | 66.80 | 0.844 | 0.362 |
| 15 | 0.0220 | 47.60 | 31.0 | 0.6 | 0.766 | 0.468 | 1.234 | 2.64 | 67.00 | 0.851 | 0.383 |
| 16 | 0.0240 | 49.40 | 32.8 | 0.6 | 0.810 | 0.461 | 1.270 | 2.76 | 67.10 | 0.866 | 0.405 |
| 17 | 0.0250 | 50.80 | 34.2 | 0.7 | 0.844 | 0.454 | 1.297 | 2.86 | 67.20 | 0.876 | 0.422 |
| 18 | 0.0280 | 52.30 | 35.7 | 0.8 | 0.880 | 0.439 | 1.319 | 3.00 | 67.40 | 0.879 | 0.440 |
| 19 | 0.0300 | 53.90 | 37.3 | 0.8 | 0.919 | 0.425 | 1.344 | 3.16 | 67.60 | 0.884 | 0.460 |
| 20 | 0.0330 | 55.50 | 38.9 | 0.9 | 0.958 | 0.418 | 1.375 | 3.29 | 67.70 | 0.896 | 0.479 |
| 21 | 0.0360 | 57.00 | 40.4 | 1.0 | 0.994 | 0.410 | 1.404 | 3.42 | 67.80 | 0.907 | 0.497 |
| 22 | 0.0390 | 58.30 | 41.7 | 1.1 | 1.025 | 0.403 | 1.428 | 3.54 | 67.90 | 0.916 | 0.512 |
| 23 | 0.0430 | 59.70 | 43.1 | 1.2 | 1.058 | 0.396 | 1.454 | 3.67 | 68.00 | 0.925 | 0.529 |
| 24 | 0.0470 | 61.10 | 44.5 | 1.3 | 1.091 | 0.396 | 1.487 | 3.76 | 68.00 | 0.942 | 0.546 |
| 25 | 0.0520 | 62.50 | 45.9 | 1.4 | 1.124 | 0.396 | 1.520 | 3.84 | 68.00 | 0.958 | 0.562 |
| 26 | 0.0580 | 63.90 | 47.3 | 1.6 | 1.156 | 0.396 | 1.552 | 3.92 | 68.00 | 0.974 | 0.578 |

## Test Readings for Specimen No. 2

| No. | Def. Dial in. | Load Dial | Load lbs. | Strain % | Deviator Stress tsf | Minor Eff. Stress tsf | Major Eff. Stress tsf | 1:3 Ratio | Pore Press. psi | P tsf | Q tsf |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 | 0.0600 | 64.40 | 47.8 | 1.6 | 1.168 | 0.396 | 1.564 | 3.95 | 68.00 | 0.980 | 0.584 |

## Parameters for Specimen No. 3

| Specimen Parameter | Initial | Saturated | Consolidated | Final |
|---|---|---|---|---|
| **Moisture content: Moist soil+tare, gms.** | 123.600 | | | 0.000 |
| **Moisture content: Dry soil+tare, gms.** | 100.000 | | | 0.000 |
| **Moisture content: Tare, gms.** | 0.000 | | | 0.000 |
| **Moisture, %** | 23.6 | 23.6 | 25.7 | |
| **Moist specimen weight, gms.** | 338.9 | | | |
| **Diameter, in.** | 1.92 | 1.92 | 1.94 | |
| **Area, in.²** | 2.90 | 2.90 | 2.96 | |
| **Height, in.** | 3.52 | 3.52 | 3.56 | |
| **Net decrease in height, in.** | | 0.00 | -0.04 | |
| **Wet Density, pcf** | 126.7 | 126.7 | 124.5 | |
| **Dry density, pcf** | 102.5 | 102.5 | 99.1 | |
| **Void ratio** | 0.6324 | 0.6324 | 0.6884 | |
| **Saturation, %** | 100.0 | 100.0 | 100.0 | |

## Test Readings for Specimen No. 3

**Consolidation cell pressure =** 85.00 psi (6.120 tsf)

**Consolidation back pressure =** 70.00 psi (5.040 tsf)

**Consolidation effective confining stress =** 1.080 tsf

**Strain rate, %/min. =** 0.50

**Fail. Stress =** 1.429 tsf **at reading no.** 10

| No. | Def. Dial in. | Load Dial | Load lbs. | Strain % | Deviator Stress tsf | Minor Eff. Stress tsf | Major Eff. Stress tsf | 1:3 Ratio | Pore Press. psi | P tsf | Q tsf |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.0040 | 28.70 | 0.0 | 0.0 | 0.000 | 1.080 | 1.080 | 1.00 | 70.00 | 1.080 | 0.000 |
| 1 | 0.0050 | 35.90 | 7.2 | 0.0 | 0.175 | 0.986 | 1.161 | 1.18 | 71.30 | 1.074 | 0.088 |
| 2 | 0.0060 | 43.70 | 15.0 | 0.1 | 0.365 | 0.922 | 1.286 | 1.40 | 72.20 | 1.104 | 0.182 |
| 3 | 0.0080 | 50.60 | 21.9 | 0.1 | 0.532 | 0.864 | 1.396 | 1.62 | 73.00 | 1.130 | 0.266 |
| 4 | 0.0100 | 55.90 | 27.2 | 0.2 | 0.660 | 0.821 | 1.481 | 1.80 | 73.60 | 1.151 | 0.330 |
| 5 | 0.0110 | 60.60 | 31.9 | 0.2 | 0.774 | 0.785 | 1.559 | 1.99 | 74.10 | 1.172 | 0.387 |
| 6 | 0.0150 | 67.80 | 39.1 | 0.3 | 0.948 | 0.734 | 1.682 | 2.29 | 74.80 | 1.208 | 0.474 |
| 7 | 0.0190 | 73.10 | 44.4 | 0.4 | 1.075 | 0.698 | 1.773 | 2.54 | 75.30 | 1.236 | 0.538 |
| 8 | 0.0240 | 78.40 | 49.7 | 0.6 | 1.202 | 0.662 | 1.864 | 2.81 | 75.80 | 1.263 | 0.601 |
| 9 | 0.0320 | 83.30 | 54.6 | 0.8 | 1.317 | 0.641 | 1.958 | 3.06 | 76.10 | 1.299 | 0.659 |
| 10 | 0.0430 | 88.10 | 59.4 | 1.1 | 1.429 | 0.626 | 2.055 | 3.28 | 76.30 | 1.341 | 0.714 |
| 11 | 0.0570 | 92.50 | 63.8 | 1.5 | 1.528 | 0.626 | 2.155 | 3.44 | 76.30 | 1.391 | 0.764 |
| 12 | 0.0720 | 97.00 | 68.3 | 1.9 | 1.629 | 0.641 | 2.270 | 3.54 | 76.10 | 1.455 | 0.815 |
| 13 | 0.0880 | 101.70 | 73.0 | 2.4 | 1.733 | 0.662 | 2.396 | 3.62 | 75.80 | 1.529 | 0.867 |
| 14 | 0.1030 | 106.10 | 77.4 | 2.8 | 1.830 | 0.677 | 2.506 | 3.70 | 75.60 | 1.592 | 0.915 |
| 15 | 0.1200 | 110.80 | 82.1 | 3.3 | 1.931 | 0.706 | 2.637 | 3.74 | 75.20 | 1.671 | 0.966 |
| 16 | 0.1370 | 115.60 | 86.9 | 3.7 | 2.034 | 0.727 | 2.761 | 3.80 | 74.90 | 1.744 | 1.017 |
| 17 | 0.1540 | 120.30 | 91.6 | 4.2 | 2.133 | 0.763 | 2.897 | 3.80 | 74.40 | 1.830 | 1.067 |
| 18 | 0.1690 | 124.70 | 96.0 | 4.6 | 2.226 | 0.785 | 3.011 | 3.84 | 74.10 | 1.898 | 1.113 |
| 19 | 0.1870 | 129.30 | 100.6 | 5.1 | 2.320 | 0.821 | 3.141 | 3.83 | 73.60 | 1.981 | 1.160 |
| 20 | 0.2020 | 133.70 | 105.0 | 5.6 | 2.411 | 0.850 | 3.261 | 3.84 | 73.20 | 2.055 | 1.206 |
| 21 | 0.2170 | 138.10 | 109.4 | 6.0 | 2.501 | 0.878 | 3.379 | 3.85 | 72.80 | 2.129 | 1.250 |

## Test Readings for Specimen No. 3

| No. | Def. Dial in. | Load Dial | Load lbs. | Strain % | Deviator Stress tsf | Minor Eff. Stress tsf | Major Eff. Stress tsf | 1:3 Ratio | Pore Press. psi | P tsf | Q tsf |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 22 | 0.2330 | 142.50 | 113.8 | 6.4 | 2.589 | 0.914 | 3.503 | 3.83 | 72.30 | 2.209 | 1.295 |
| 23 | 0.2480 | 147.00 | 118.3 | 6.9 | 2.679 | 0.943 | 3.623 | 3.84 | 71.90 | 2.283 | 1.340 |
| 24 | 0.2630 | 151.40 | 122.7 | 7.3 | 2.766 | 0.972 | 3.738 | 3.85 | 71.50 | 2.355 | 1.383 |
| 25 | 0.2800 | 155.90 | 127.2 | 7.8 | 2.853 | 1.008 | 3.861 | 3.83 | 71.00 | 2.435 | 1.427 |
| 26 | 0.2970 | 160.30 | 131.6 | 8.2 | 2.937 | 1.044 | 3.981 | 3.81 | 70.50 | 2.512 | 1.468 |
| 27 | 0.3140 | 165.00 | 136.3 | 8.7 | 3.026 | 1.080 | 4.106 | 3.80 | 70.00 | 2.593 | 1.513 |
| 28 | 0.3310 | 169.50 | 140.8 | 9.2 | 3.109 | 1.109 | 4.218 | 3.80 | 69.60 | 2.663 | 1.555 |
| 29 | 0.3500 | 174.00 | 145.3 | 9.7 | 3.190 | 1.145 | 4.334 | 3.79 | 69.10 | 2.740 | 1.595 |
| 30 | 0.3660 | 178.40 | 149.7 | 10.2 | 3.270 | 1.181 | 4.451 | 3.77 | 68.60 | 2.816 | 1.635 |
| 31 | 0.3830 | 182.80 | 154.1 | 10.6 | 3.348 | 1.217 | 4.565 | 3.75 | 68.10 | 2.891 | 1.674 |
| 32 | 0.4020 | 187.60 | 158.9 | 11.2 | 3.432 | 1.246 | 4.677 | 3.76 | 67.70 | 2.961 | 1.716 |
| 33 | 0.4210 | 192.00 | 163.3 | 11.7 | 3.506 | 1.289 | 4.794 | 3.72 | 67.10 | 3.042 | 1.753 |
| 34 | 0.4400 | 196.40 | 167.7 | 12.2 | 3.578 | 1.325 | 4.903 | 3.70 | 66.60 | 3.114 | 1.789 |
| 35 | 0.4600 | 201.00 | 172.3 | 12.8 | 3.653 | 1.354 | 5.006 | 3.70 | 66.20 | 3.180 | 1.826 |
| 36 | 0.4790 | 205.40 | 176.7 | 13.3 | 3.723 | 1.390 | 5.113 | 3.68 | 65.70 | 3.251 | 1.862 |
| 37 | 0.4980 | 209.60 | 180.9 | 13.9 | 3.788 | 1.426 | 5.214 | 3.66 | 65.20 | 3.320 | 1.894 |
| 38 | 0.5180 | 214.00 | 185.3 | 14.4 | 3.855 | 1.454 | 5.309 | 3.65 | 64.80 | 3.382 | 1.928 |
| 39 | 0.5390 | 218.50 | 189.8 | 15.0 | 3.921 | 1.490 | 5.412 | 3.63 | 64.30 | 3.451 | 1.961 |

**Appendix 7**

# RESULTS OF LIQUEFACTION ANALYSES

LIQUEFACTION ANALYSES

LIQUEFACTION ANALYSES BASED ON N-VALUES

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Project: | AmerenUE Sioux Power Plant Utility Waste Landfill | | | | | | |
| Calc. by: | C Cook | Groundwater Elevation (ft) | 417 | Unit Wt. FGD | 110 | # High Risk | 51 |
| Checked | J Fouse | Ground Motion Ratio ($a_{max}/g$): | 0.268 | Depth (ft) | 0 | | |
| | | Earthquake Magnitude: | 7.5 | FGD Stress (psf) | 0 | | |
| | | Hammer Efficiency: | 60 % | | | | |

| B-58 | | B-59 | | B-60 | | B-61 | | B-62 | | B-63 | | B-64 | | B-65 | | B-66 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 5 | n.a. |
| 7.5 | n.a. | 10 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 10 | 0.59 |
| 10 | n.a. | 14 | n.a. | 10 | n.a. | 10 | 1.02 | 10 | n.a. | 10 | 0.82 | 10 | 1.10 | 10 | n.a. | 14 | n.a. |
| 18.5 | 0.73 | 19 | n.a. | 15 | 0.90 | 15 | 1.22 | 14 | n.a. | 15 | 1.05 | 14 | 0.82 | 15 | n.a. | 19 | 0.73 |
| 24 | 1.06 | 24 | 0.38 | 19 | 0.60 | 19 | 0.81 | 19 | 0.79 | 19 | 1.85 | 19 | 1.69 | 19 | 0.97 | 24 | 0.56 |
| 29 | 0.70 | 29 | 0.89 | 24 | 0.74 | 24 | 0.40 | 24 | 1.13 | 23 | 1.63 | 24 | 2.83 | 24 | 0.62 | 29 | 0.72 |
| 36 | 0.85 | | | 29 | 0.99 | 29 | 0.83 | 29 | 0.72 | 29 | 0.68 | 29 | 1.96 | 29 | 0.69 | | |
| 41 | 2.72 | | | | | | | | | | | | | | | | |
| 44 | 1.47 | | | | | | | | | | | | | | | | |
| 49 | 0.97 | | | | | | | | | | | | | | | | |
| 59 | n.a. | | | | | | | | | | | | | | | | |
| 69 | n.a. | | | | | | | | | | | | | | | | |
| 79 | n.a. | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| FS | 0.70 | FS | 0.38 | FS | 0.60 | FS | 0.40 | FS | 0.72 | FS | 0.68 | FS | 0.82 | FS | 0.62 | FS | 0.56 |
| Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

| B-67 | | B-68 | | B-69 | | B-70 | | B-71 | | B-72 | | B-73 | | B-74 | | B-75 | | B-76 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 4.5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 4 | n.a. | 6.5 | n.a. | 5 | n.a. | 7 | n.a. |
| 10 | n.a. | 10 | n.a. | 10 | n.a. | 14 | n.a. | 10 | 1.06 | 10 | n.a. | 10 | n.a. | 9 | n.a. | 10 | n.a. | 15 | 0.91 |
| 14 | n.a. | 14 | n.a. | 14 | 1.01 | 19 | n.a. | 14 | 1.24 | 14 | 1.64 | 14 | 0.72 | 14 | 1.23 | 13 | 1.15 | 20 | 0.85 |
| 19 | 4.60 | 19 | 2.76 | 19 | 0.57 | 24 | 1.90 | 19 | n.a. | 19 | 4.52 | 19 | 0.71 | 19 | 1.15 | 19 | 0.78 | 25 | 0.61 |
| 24 | 3.02 | 24 | 1.04 | 24 | n.a. | 29 | 0.83 | 24 | 0.97 | 24 | 1.07 | 24 | 0.83 | 24 | 1.28 | 24 | 1.54 | 29 | 0.50 |
| 29 | 1.00 | 29 | 2.65 | 29 | 0.96 | | | 29 | 0.60 | 29 | 0.73 | 29 | 0.93 | 29 | 1.35 | 29 | 0.99 | | |
| | | | | | | | | | | | | | | | | 34 | 1.18 | | |
| | | | | | | | | | | | | | | | | 39 | 0.53 | | |
| | | | | | | | | | | | | | | | | 44 | 1.33 | | |
| | | | | | | | | | | | | | | | | 49 | 0.86 | | |
| | | | | | | | | | | | | | | | | 59 | n.a. | | |
| | | | | | | | | | | | | | | | | 69 | n.a. | | |
| | | | | | | | | | | | | | | | | 79 | n.a. | | |
| | | | | | | | | | | | | | | | | 89 | n.a. | | |
| | | | | | | | | | | | | | | | | 99 | n.a. | | |
| FS | 1.00 | FS | 1.04 | FS | 0.57 | FS | 0.83 | FS | 0.60 | FS | 0.73 | FS | 0.71 | FS | 1.15 | FS | 0.53 | FS | 0.50 |
| Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

| B-77 | | B-78 | | B-79 | | B-80 | | B-81 | | B-82 | | B-83 | | B-84 | | B-85 | | B-86 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 10 | 0.50 | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 15 | 1.16 | 10 | n.a. | 10 | n.a. | 10 | n.a. | 14 | 2.68 | 10 | 1.34 | 10 | 2.75 | 10 | n.a. | 10 | 5.54 | 10 | 1.54 |
| 20 | 1.25 | 15 | 1.04 | 15 | 0.98 | 15 | 2.65 | 19 | 1.18 | 15 | 0.75 | 14 | 2.38 | 14 | 0.79 | 14 | 4.06 | 14 | 1.03 |
| 25 | 0.74 | 20 | 0.88 | 20 | 0.83 | 20 | 1.31 | 24 | 1.07 | 20 | 0.72 | 19 | 0.72 | 19 | 0.65 | 19 | 0.58 | 19 | 0.72 |
| 30 | 0.65 | 25 | 0.61 | 25 | 1.14 | 25 | 0.95 | 29 | 1.10 | 25 | 1.96 | 24 | 1.06 | 24 | 0.42 | 24 | 0.68 | 24 | 1.06 |
| | | 30 | 0.55 | 30 | 0.58 | 30 | 0.87 | | | 30 | 0.58 | 29 | 0.79 | 29 | 1.94 | 29 | 1.21 | 29 | 0.87 |
| FS | 0.65 | FS | 0.55 | FS | 0.58 | FS | 0.87 | FS | 0.50 | FS | 0.58 | FS | 0.72 | FS | 0.42 | FS | 0.58 | FS | 0.72 |
| Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

| B-87 | | B-88 | | B-89 | | B-90 | | B-91 | | B-92 | | B-93 | | B-94 | | B-95 | | B-96 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. |
| 14 | 0.64 | 14 | 0.85 | 14 | 5.04 | 14 | 0.73 | 14 | 3.88 | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | 1.27 |
| 19 | 2.19 | 19 | 0.75 | 19 | 2.25 | 19 | 1.37 | 19 | 0.89 | 19 | n.a. | 19 | 0.86 | 19 | n.a. | 19 | 0.37 | 19 | 1.94 |
| 24 | 0.86 | 24 | 1.29 | 24 | 1.00 | 24 | 2.56 | 24 | 1.22 | 24 | n.a. | 24 | 0.63 | 24 | n.a. | 24 | 0.70 | 24 | 0.35 |
| 29 | 1.99 | 29 | 1.22 | 29 | 0.84 | 29 | 1.05 | 29 | 0.99 | 29 | 1.22 | 29 | 2.12 | 29 | 1.43 | 29 | 0.90 | 29 | 0.30 |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| FS | 0.64 | FS | 0.75 | FS | 0.84 | FS | 0.73 | FS | 0.89 | FS | 1.22 | FS | 0.63 | FS | 1.43 | FS | 0.37 | FS | 0.30 |
| Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | Low | Risk | HIGH | Risk | Low | Risk | HIGH | Risk | HIGH |

Ameren Missouri Sioux Energy Center Utility Waste Landfill

LIQUEFACTION ANALYSES

| B-97 | | B-98 | | B-99 | | B-100 | | B-101 | | B-102 | | B-103 | | B-104 | | B-105 | | B-106 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. |
| 14 | 1.47 | 14 | 1.40 | 14 | 3.08 | 14 | n.a. | 14 | 0.70 | 14 | 1.48 | 14 | 0.94 | 14 | 1.49 | 14 | n.a. | 14 | n.a. |
| 19 | 1.16 | 19 | 1.12 | 19 | 2.31 | 19 | 1.07 | 19 | 0.81 | 19 | 0.85 | 19 | 1.97 | 19 | 1.19 | 19 | 0.72 | 19 | n.a. |
| 24 | 0.79 | 24 | 0.86 | 24 | 3.05 | 24 | 4.25 | 24 | 2.43 | 24 | 2.05 | 24 | 0.43 | 24 | 2.11 | 24 | 2.11 | 24 | 1.20 |
| 29 | 0.51 | 29 | 0.66 | 29 | 1.10 | 29 | 0.77 | 29 | 0.78 | 29 | 1.11 | 29 | 0.60 | 29 | 2.03 | 29 | 1.75 | 29 | 0.84 |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| FS | 0.51 | FS | 0.66 | FS | 1.10 | FS | 0.77 | FS | 0.70 | FS | 0.85 | FS | 0.43 | FS | 1.19 | FS | 0.72 | FS | 0.84 |
| Risk | HIGH | Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

| B-107 | | B-108 | | B-109 | | B-110 | | B-111 | | B-112 | | B-113 | | B-114 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 5 | n.a. | 2.5 | n.a. |
| 5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 10 | n.a. | 14 | 1.34 | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. |
| 14 | 2.67 | 19 | 1.14 | 14 | n.a. | 14 | n.a. | 14 | 1.11 | 14 | 1.29 | 14 | 0.78 | 14 | 1.72 |
| 19 | 1.33 | 24 | 0.16 | 19 | n.a. | 19 | 0.65 | 19 | 1.83 | 19 | 2.95 | 19 | 1.44 | 19 | 0.87 |
| 24 | 0.80 | 29 | 0.82 | 24 | 1.04 | 24 | 0.34 | 24 | 2.28 | 24 | 0.85 | 24 | 0.74 | 24 | 1.01 |
| 29 | 2.01 | | | 29 | 0.88 | 29 | 0.66 | 29 | 0.60 | 29 | 0.77 | 29 | 1.60 | 29 | 0.51 |
| | | | | | | | | | | | | 34 | 1.79 | | |
| | | | | | | | | | | | | 39 | 1.64 | | |
| | | | | | | | | | | | | 44 | 0.86 | | |
| | | | | | | | | | | | | 49 | 2.03 | | |
| | | | | | | | | | | | | 59 | n.a. | | |
| | | | | | | | | | | | | 69 | n.a. | | |
| | | | | | | | | | | | | 79 | n.a. | | |
| | | | | | | | | | | | | 89 | n.a. | | |
| | | | | | | | | | | | | 99 | n.a. | | |
| FS | 0.80 | FS | 0.16 | FS | 0.88 | FS | 0.34 | FS | 0.60 | FS | 0.77 | FS | 0.74 | FS | 0.51 |
| Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

LIQUEFACTION ANALYSES BASED ON N-VALUES

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Project: | AmerenUE Sioux Power Plant Utility Waste Landfill | | | | | | |
| Calc. by: | C Cook | Groundwater Elevation (ft) | 417 | Unit Wt. FGD | 110 | # High Risk | 51 |
| Checked | J Fouse | Ground Motion Ratio ($a_{max}$/g): | 0.268 | Depth (ft) | 10 | | |
| | | Earthquake Magnitude: | 7.5 | FGD Stress (psf) | 476 | | |
| | | Hammer Efficiency: | 60 % | | | | |

| B-58 | | B-59 | | B-60 | | B-61 | | B-62 | | B-63 | | B-64 | | B-65 | | B-66 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 5 | n.a. |
| 7.5 | n.a. | 10 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 10 | 0.57 |
| 10 | n.a. | 14 | n.a. | 10 | n.a. | 10 | 0.88 | 10 | n.a. | 10 | 0.71 | 10 | 1.00 | 10 | n.a. | 14 | n.a. |
| 18.5 | 0.68 | 19 | n.a. | 15 | 0.90 | 15 | 1.11 | 14 | n.a. | 15 | 1.00 | 14 | 0.76 | 15 | n.a. | 19 | 0.74 |
| 24 | 1.01 | 24 | 0.40 | 19 | 0.58 | 19 | 0.81 | 19 | 0.80 | 19 | 1.44 | 19 | 1.37 | 19 | 0.95 | 24 | 0.55 |
| 29 | 0.69 | 29 | 0.89 | 24 | 0.69 | 24 | 0.39 | 24 | 1.06 | 23 | 1.41 | 24 | 3.00 | 24 | 0.59 | 29 | 0.74 |
| 36 | 0.89 | | | 29 | 0.97 | 29 | 0.84 | 29 | 0.74 | 29 | 0.69 | 29 | 2.20 | 29 | 0.69 | | |
| 41 | n.a. | | | | | | | | | | | | | | | | |
| 44 | n.a. | | | | | | | | | | | | | | | | |
| 49 | n.a. | | | | | | | | | | | | | | | | |
| 59 | n.a. | | | | | | | | | | | | | | | | |
| 69 | n.a. | | | | | | | | | | | | | | | | |
| 79 | n.a. | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| FS | 0.68 | FS | 0.40 | FS | 0.58 | FS | 0.39 | FS | 0.74 | FS | 0.69 | FS | 0.76 | FS | 0.59 | FS | 0.55 |
| Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

| B-67 | | B-68 | | B-69 | | B-70 | | B-71 | | B-72 | | B-73 | | B-74 | | B-75 | | B-76 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 4.5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 4 | n.a. | 6.5 | n.a. | 5 | n.a. | 7 | n.a. |
| 10 | n.a. | 10 | n.a. | 10 | n.a. | 14 | n.a. | 10 | 0.98 | 10 | n.a. | 10 | n.a. | 9 | n.a. | 10 | n.a. | 15 | 0.88 |
| 14 | n.a. | 14 | n.a. | 14 | 0.95 | 19 | n.a. | 14 | 1.20 | 14 | 1.38 | 14 | 0.69 | 14 | 1.15 | 13 | 1.06 | 20 | 0.83 |
| 19 | 2.30 | 19 | 2.30 | 19 | 0.57 | 24 | 1.38 | 19 | n.a. | 19 | 4.95 | 19 | 0.72 | 19 | 1.14 | 19 | 0.76 | 25 | 0.63 |
| 24 | 3.31 | 24 | 1.01 | 24 | n.a. | 29 | 0.83 | 24 | 0.95 | 24 | 1.01 | 24 | 0.83 | 24 | 1.17 | 24 | 1.37 | 29 | 0.51 |
| 29 | 1.00 | 29 | 2.63 | 29 | 0.97 | | | 29 | 0.58 | 29 | 0.74 | 29 | 0.93 | 29 | 1.29 | 29 | 0.96 | | |
| | | | | | | | | | | | | | | | | 34 | 1.18 | | |
| | | | | | | | | | | | | | | | | 39 | 0.55 | | |
| | | | | | | | | | | | | | | | | 44 | n.a. | | |
| | | | | | | | | | | | | | | | | 49 | n.a. | | |
| | | | | | | | | | | | | | | | | 59 | n.a. | | |
| | | | | | | | | | | | | | | | | 69 | n.a. | | |
| | | | | | | | | | | | | | | | | 79 | n.a. | | |
| | | | | | | | | | | | | | | | | 89 | n.a. | | |
| | | | | | | | | | | | | | | | | 99 | n.a. | | |
| FS | 1.00 | FS | 1.01 | FS | 0.57 | FS | 0.83 | FS | 0.58 | FS | 0.74 | FS | 0.69 | FS | 1.14 | FS | 0.55 | FS | 0.51 |
| Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | HIGH |

Ameren Missouri Sioux Energy Center Utility Waste Landfill

LIQUEFACTION ANALYSES

| **B-77** | | **B-78** | | **B-79** | | **B-80** | | **B-81** | | **B-82** | | **B-83** | | **B-84** | | **B-85** | | **B-86** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 10 | 0.45 | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 15 | 1.08 | 10 | n.a. | 10 | n.a. | 10 | n.a. | 14 | 2.74 | 10 | 1.23 | 10 | 1.78 | 10 | n.a. | 10 | 2.79 | 10 | 1.30 |
| 20 | 1.15 | 15 | 1.00 | 15 | 0.96 | 15 | 1.66 | 19 | 1.10 | 15 | 0.70 | 14 | 2.58 | 14 | 0.73 | 14 | 4.12 | 14 | 0.98 |
| 25 | 0.76 | 20 | 0.88 | 20 | 0.84 | 20 | 1.18 | 24 | 1.01 | 20 | 0.72 | 19 | 0.68 | 19 | 0.61 | 19 | 0.57 | 19 | 0.68 |
| 30 | 0.62 | 25 | 0.63 | 25 | 1.07 | 25 | 0.93 | 29 | 1.07 | 25 | 2.21 | 24 | 1.00 | 24 | 0.42 | 24 | 0.64 | 24 | 1.00 |
| | | 30 | 0.59 | 30 | 0.56 | 30 | 0.88 | | | 30 | 0.56 | 29 | 0.80 | 29 | 2.18 | 29 | 1.17 | 29 | 0.88 |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| FS | 0.62 | FS | 0.59 | FS | 0.56 | FS | 0.88 | FS | 0.45 | FS | 0.56 | FS | 0.68 | FS | 0.42 | FS | 0.57 | FS | 0.68 |
| Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

| B-87 | | B-88 | | B-89 | | B-90 | | B-91 | | B-92 | | B-93 | | B-94 | | B-95 | | B-96 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. |
| 14 | 0.61 | 14 | 0.79 | 14 | 5.40 | 14 | 0.73 | 14 | 2.60 | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | 1.18 |
| 19 | 2.42 | 19 | 0.68 | 19 | 2.47 | 19 | 1.21 | 19 | 0.87 | 19 | n.a. | 19 | 0.85 | 19 | n.a. | 19 | 0.38 | 19 | 1.58 |
| 24 | 0.87 | 24 | 1.17 | 24 | 0.97 | 24 | 2.28 | 24 | 1.18 | 24 | n.a. | 24 | 0.60 | 24 | n.a. | 24 | 0.65 | 24 | 0.35 |
| 29 | 2.14 | 29 | 1.18 | 29 | 0.85 | 29 | 1.01 | 29 | 0.97 | 29 | 1.18 | 29 | 1.92 | 29 | 1.28 | 29 | 0.90 | 29 | 0.30 |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| FS | 0.61 | FS | 0.68 | FS | 0.85 | FS | 0.73 | FS | 0.87 | FS | 1.18 | FS | 0.60 | FS | 1.28 | FS | 0.38 | FS | 0.30 |
| Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | Low | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

| B-97 | | B-98 | | B-99 | | B-100 | | B-101 | |
|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. |
| 14 | 1.32 | 14 | 1.29 | 14 | 1.98 | 14 | n.a. | 14 | 0.68 |
| 19 | 1.15 | 19 | 1.07 | 19 | 1.50 | 19 | 1.06 | 19 | 0.76 |
| 24 | 0.78 | 24 | 0.85 | 24 | 3.34 | 24 | 4.68 | 24 | 1.99 |
| 29 | 0.52 | 29 | 0.63 | 29 | 1.07 | 29 | 0.78 | 29 | 0.79 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| FS | 0.52 | FS | 0.63 | FS | 1.07 | FS | 0.78 | FS | 0.68 |
| Risk | HIGH | Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | HIGH |

| B-102 | | B-103 | | B-104 | | B-105 | | B-106 | |
|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. |
| 14 | 1.34 | 14 | 0.90 | 14 | 1.33 | 14 | n.a. | 14 | n.a. |
| 19 | 0.83 | 19 | 1.39 | 19 | 1.10 | 19 | 0.74 | 19 | n.a. |
| 24 | 1.43 | 24 | 0.42 | 24 | 1.83 | 24 | 2.33 | 24 | 1.12 |
| 29 | 1.07 | 29 | 0.58 | 29 | 2.25 | 29 | 1.41 | 29 | 0.85 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| FS | 0.83 | FS | 0.42 | FS | 1.10 | FS | 0.74 | FS | 0.85 |
| Risk | HIGH | Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

| B-107 | | B-108 | | B-109 | | B-110 | | B-111 | | B-112 | | B-113 | | B-114 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 5 | n.a. | 2.5 | n.a. |
| 5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 10 | n.a. | 14 | 1.19 | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. |
| 14 | 1.76 | 19 | 1.07 | 14 | n.a. | 14 | n.a. | 14 | 1.04 | 14 | 1.23 | 14 | 0.75 | 14 | 1.43 |
| 19 | 1.24 | 24 | 0.16 | 19 | n.a. | 19 | 0.65 | 19 | 1.47 | 19 | 1.64 | 19 | 1.32 | 19 | 0.84 |
| 24 | 0.80 | 29 | 0.82 | 24 | 1.00 | 24 | 0.33 | 24 | 1.53 | 24 | 0.86 | 24 | 0.71 | 24 | 0.98 |
| 29 | 2.10 | | | 29 | 0.89 | 29 | 0.63 | 29 | 0.58 | 29 | 0.78 | 29 | 1.41 | 29 | 0.52 |
| | | | | | | | | | | | | 34 | 1.48 | | |
| | | | | | | | | | | | | 39 | 1.64 | | |
| | | | | | | | | | | | | 44 | n.a. | | |
| | | | | | | | | | | | | 49 | n.a. | | |
| | | | | | | | | | | | | 59 | n.a. | | |
| | | | | | | | | | | | | 69 | n.a. | | |
| | | | | | | | | | | | | 79 | n.a. | | |
| | | | | | | | | | | | | 89 | n.a. | | |
| | | | | | | | | | | | | 99 | n.a. | | |
| FS | 0.80 | FS | 0.16 | FS | 0.89 | FS | 0.33 | FS | 0.58 | FS | 0.78 | FS | 0.71 | FS | 0.52 |
| Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

LIQUEFACTION ANALYSES BASED ON N-VALUES

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Project: | AmerenUE Sioux Power Plant Utility Waste Landfill | | | | | | | |
| Calc. by: | C Cook | Groundwater Elevation (ft) | 417 | | Unit Wt. FGD | 110 | # High Risk | 50 |
| Checked | J Fouse | Ground Motion Ratio ($a_{max}/g$): | 0.268 | | Depth (ft) | 20 | | |
| | | Earthquake Magnitude: | 7.5 | | FGD Stress (psf) | 952 | | |
| | | Hammer Efficiency: | 60 | % | | | | |

| B-58 | | B-59 | | B-60 | | B-61 | | B-62 | | B-63 | | B-64 | | B-65 | | B-66 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 5 | n.a. |
| 7.5 | n.a. | 10 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 10 | 0.56 |
| 10 | n.a. | 14 | n.a. | 10 | n.a. | 10 | 0.82 | 10 | n.a. | 10 | 0.67 | 10 | 0.97 | 10 | n.a. | 14 | n.a. |
| 18.5 | 0.68 | 19 | n.a. | 15 | 0.89 | 15 | 1.08 | 14 | n.a. | 15 | 0.97 | 14 | 0.71 | 15 | n.a. | 19 | 0.75 |
| 24 | 1.02 | 24 | 0.42 | 19 | 0.57 | 19 | 0.77 | 19 | 0.81 | 19 | 1.36 | 19 | 1.27 | 19 | 0.94 | 24 | 0.56 |
| 29 | 0.69 | 29 | 0.93 | 24 | 0.70 | 24 | 0.40 | 24 | 1.06 | 23 | 1.36 | 24 | 2.98 | 24 | 0.60 | 29 | 0.75 |
| 36 | n.a. | | | 29 | 1.01 | 29 | 0.88 | 29 | 0.75 | 29 | 0.69 | 29 | 1.83 | 29 | 0.69 | | |
| 41 | n.a. | | | | | | | | | | | | | | | | |
| 44 | n.a. | | | | | | | | | | | | | | | | |
| 49 | n.a. | | | | | | | | | | | | | | | | |
| 59 | n.a. | | | | | | | | | | | | | | | | |
| 69 | n.a. | | | | | | | | | | | | | | | | |
| 79 | n.a. | | | | | | | | | | | | | | | | |
| FS | 0.68 | FS | 0.42 | FS | 0.57 | FS | 0.40 | FS | 0.75 | FS | 0.67 | FS | 0.71 | FS | 0.60 | FS | 0.56 |
| Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH |

Ameren Missouri Sioux Energy Center Utility Waste Landfill

LIQUEFACTION ANALYSES

| B-67 | | B-68 | | B-69 | | B-70 | | B-71 | | B-72 | | B-73 | | B-74 | | B-75 | | B-76 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 4.5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 4 | n.a. | 6.5 | n.a. | 5 | n.a. | 7 | n.a. |
| 10 | n.a. | 10 | n.a. | 10 | n.a. | 14 | n.a. | 10 | 0.95 | 10 | n.a. | 10 | n.a. | 9 | n.a. | 10 | n.a. | 15 | 0.80 |
| 14 | n.a. | 14 | n.a. | 14 | 0.94 | 19 | n.a. | 14 | 1.16 | 14 | 1.28 | 14 | 0.67 | 14 | 1.11 | 13 | 1.03 | 20 | 0.80 |
| 19 | 1.91 | 19 | 1.68 | 19 | 0.59 | 24 | 1.32 | 19 | n.a. | 19 | 3.73 | 19 | 0.73 | 19 | 1.13 | 19 | 0.70 | 25 | 0.67 |
| 24 | 3.61 | 24 | 1.03 | 24 | n.a. | 29 | 0.88 | 24 | 0.97 | 24 | 1.03 | 24 | 0.84 | 24 | 1.14 | 24 | 1.34 | 29 | 0.53 |
| 29 | 1.03 | 29 | 1.74 | 29 | 1.00 | | | 29 | 0.60 | 29 | 0.75 | 29 | 0.96 | 29 | 1.30 | 29 | 1.00 | | |
| | | | | | | | | | | | | | | | | 34 | n.a. | | |
| | | | | | | | | | | | | | | | | 39 | n.a. | | |
| | | | | | | | | | | | | | | | | 44 | n.a. | | |
| | | | | | | | | | | | | | | | | 49 | n.a. | | |
| | | | | | | | | | | | | | | | | 59 | n.a. | | |
| | | | | | | | | | | | | | | | | 69 | n.a. | | |
| | | | | | | | | | | | | | | | | 79 | n.a. | | |
| | | | | | | | | | | | | | | | | 89 | n.a. | | |
| | | | | | | | | | | | | | | | | 99 | n.a. | | |
| FS | 1.03 | FS | 1.03 | FS | 0.59 | FS | 0.88 | FS | 0.60 | FS | 0.75 | FS | 0.67 | FS | 1.11 | FS | 0.70 | FS | 0.53 |
| Risk | Moderate | Risk | Moderate | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

| B-77 | | B-78 | | B-79 | | B-80 | | B-81 | | B-82 | | B-83 | | B-84 | | B-85 | | B-86 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 10 | 0.42 | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 15 | 1.04 | 10 | n.a. | 10 | n.a. | 10 | n.a. | 14 | 2.15 | 10 | 1.17 | 10 | 1.59 | 10 | n.a. | 10 | 2.09 | 10 | 1.20 |
| 20 | 1.13 | 15 | 0.99 | 15 | 0.97 | 15 | 1.44 | 19 | 1.07 | 15 | 0.66 | 14 | 1.98 | 14 | 0.68 | 14 | 2.06 | 14 | 0.96 |
| 25 | 0.80 | 20 | 0.91 | 20 | 0.82 | 20 | 1.15 | 24 | 1.02 | 20 | 0.68 | 19 | 0.65 | 19 | 0.60 | 19 | 0.56 | 19 | 0.65 |
| 30 | 0.64 | 25 | 0.67 | 25 | 1.07 | 25 | 0.94 | 29 | 1.08 | 25 | 1.65 | 24 | 1.02 | 24 | 0.42 | 24 | 0.64 | 24 | 1.02 |
| | | 30 | 0.64 | 30 | 0.59 | 30 | 0.92 | | | 30 | 0.59 | 29 | 0.84 | 29 | 2.46 | 29 | 1.18 | 29 | 0.92 |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| FS | 0.64 | FS | 0.64 | FS | 0.59 | FS | 0.92 | FS | 0.42 | FS | 0.59 | FS | 0.65 | FS | 0.42 | FS | 0.56 | FS | 0.65 |
| Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

| B-87 | | B-88 | | B-89 | | B-90 | | B-91 | | B-92 | | B-93 | | B-94 | | B-95 | | B-96 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. |
| 14 | 0.59 | 14 | 0.76 | 14 | 5.76 | 14 | 0.73 | 14 | 1.78 | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | 1.12 |
| 19 | 2.42 | 19 | 0.66 | 19 | 2.35 | 19 | 1.18 | 19 | 0.85 | 19 | n.a. | 19 | 0.85 | 19 | n.a. | 19 | 0.41 | 19 | 1.45 |
| 24 | 0.86 | 24 | 1.18 | 24 | 0.98 | 24 | 1.63 | 24 | 1.18 | 24 | n.a. | 24 | 0.61 | 24 | n.a. | 24 | 0.65 | 24 | 0.36 |
| 29 | 1.68 | 29 | 1.18 | 29 | 0.89 | 29 | 1.05 | 29 | 1.01 | 29 | 1.18 | 29 | 1.68 | 29 | 1.27 | 29 | 0.94 | 29 | 0.31 |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| FS | 0.59 | FS | 0.66 | FS | 0.89 | FS | 0.73 | FS | 0.85 | FS | 1.18 | FS | 0.61 | FS | 1.27 | FS | 0.41 | FS | 0.31 |
| Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | Low | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

| B-97 | | B-98 | | B-99 | | B-100 | | B-101 | | B-102 | | B-103 | | B-104 | | B-105 | | B-106 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. |
| 14 | 1.23 | 14 | 1.22 | 14 | 1.63 | 14 | n.a. | 14 | 0.67 | 14 | 1.30 | 14 | 0.82 | 14 | 1.22 | 14 | n.a. | 14 | n.a. |
| 19 | 1.12 | 19 | 1.05 | 19 | 1.35 | 19 | 1.04 | 19 | 0.71 | 19 | 0.78 | 19 | 1.28 | 19 | 1.07 | 19 | 0.76 | 19 | n.a. |
| 24 | 0.75 | 24 | 0.87 | 24 | 3.67 | 24 | 5.09 | 24 | 1.90 | 24 | 1.34 | 24 | 0.42 | 24 | 1.60 | 24 | 2.29 | 24 | 1.11 |
| 29 | 0.53 | 29 | 0.64 | 29 | 1.09 | 29 | 0.82 | 29 | 0.82 | 29 | 1.09 | 29 | 0.61 | 29 | 2.53 | 29 | 1.42 | 29 | 0.89 |
| FS | 0.53 | FS | 0.64 | FS | 1.09 | FS | 0.82 | FS | 0.67 | FS | 0.78 | FS | 0.42 | FS | 1.07 | FS | 0.76 | FS | 0.89 |
| Risk | HIGH | Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

| B-107 | | B-108 | | B-109 | | B-110 | | B-111 | | B-112 | | B-113 | | B-114 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 5 | n.a. | 2.5 | n.a. |
| 5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 10 | n.a. | 14 | 1.14 | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. |
| 14 | 1.51 | 19 | 1.05 | 14 | n.a. | 14 | n.a. | 14 | 1.00 | 14 | 1.18 | 14 | 0.71 | 14 | 1.33 |
| 19 | 1.16 | 24 | 0.16 | 19 | n.a. | 19 | 0.65 | 19 | 1.35 | 19 | 1.44 | 19 | 1.24 | 19 | 0.78 |
| 24 | 0.82 | 29 | 0.86 | 24 | 1.01 | 24 | 0.33 | 24 | 1.44 | 24 | 0.85 | 24 | 0.69 | 24 | 1.01 |
| 29 | 1.68 | | | 29 | 0.93 | 29 | 0.65 | 29 | 0.61 | 29 | 0.81 | 29 | 1.42 | 29 | 0.53 |
| | | | | | | | | | | | | 34 | n.a. | | |
| | | | | | | | | | | | | 39 | n.a. | | |
| | | | | | | | | | | | | 44 | n.a. | | |
| | | | | | | | | | | | | 49 | n.a. | | |
| | | | | | | | | | | | | 59 | n.a. | | |
| | | | | | | | | | | | | 69 | n.a. | | |
| | | | | | | | | | | | | 79 | n.a. | | |
| | | | | | | | | | | | | 89 | n.a. | | |
| | | | | | | | | | | | | 99 | n.a. | | |
| FS | 0.82 | FS | 0.16 | FS | 0.93 | FS | 0.33 | FS | 0.61 | FS | 0.81 | FS | 0.69 | FS | 0.53 |
| Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

LIQUEFACTION ANALYSES BASED ON N-VALUES

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Project: | AmerenUE Sioux Power Plant Utility Waste Landfill | | | | | | |
| Calc. by: | C Cook | Groundwater Elevation (ft) | 417 | Unit Wt. FGD | 110 | # High Risk | 35 |
| Checked | J Fouse | Ground Motion Ratio ($a_{max}$/g): | 0.268 | Depth (ft) | 30 | | |
| | | Earthquake Magnitude: | 7.5 | FGD Stress (psf) | 1428 | | |
| | | Hammer Efficiency: | 60 % | | | | |

| B-58 | | B-59 | | B-60 | | B-61 | |
|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. |
| 7.5 | n.a. | 10 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 10 | n.a. | 14 | n.a. | 10 | n.a. | 10 | 0.79 |
| 18.5 | 0.70 | 19 | n.a. | 15 | 0.92 | 15 | 1.07 |
| 24 | n.a. | 24 | n.a. | 19 | 0.58 | 19 | 0.75 |
| 29 | n.a. | 29 | n.a. | 24 | n.a. | 24 | n.a. |
| 36 | n.a. | | | 29 | n.a. | 29 | n.a. |
| 41 | n.a. | | | | | | |
| 44 | n.a. | | | | | | |
| 49 | n.a. | | | | | | |
| 59 | n.a. | | | | | | |
| 69 | n.a. | | | | | | |
| 79 | n.a. | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| FS | 0.70 | FS | 0.00 | FS | 0.58 | FS | 0.75 |
| Risk | HIGH | Risk | n.a. | Risk | HIGH | Risk | HIGH |

| B-62 | | B-63 | | B-64 | |
|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 10 | n.a. | 10 | 0.63 | 10 | 0.94 |
| 14 | n.a. | 15 | 0.98 | 14 | 0.71 |
| 19 | 0.84 | 19 | 1.34 | 19 | 1.26 |
| 24 | n.a. | 23 | n.a. | 24 | n.a. |
| 29 | n.a. | 29 | n.a. | 29 | n.a. |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| FS | 0.84 | FS | 0.63 | FS | 0.71 |
| Risk | HIGH | Risk | HIGH | Risk | HIGH |

| B-65 | | B-66 | |
|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. |
| 7.5 | n.a. | 10 | 0.57 |
| 10 | n.a. | 14 | n.a. |
| 15 | n.a. | 19 | 0.79 |
| 19 | 0.97 | 24 | n.a. |
| 24 | n.a. | 29 | n.a. |
| 29 | n.a. | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| FS | 0.97 | FS | 0.57 |
| Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

| B-67 | | B-68 | | B-69 | | B-70 | | B-71 | | B-72 | | B-73 | | B-74 | | B-75 | | B-76 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 4.5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 4 | n.a. | 6.5 | n.a. | 5 | n.a. | 7 | n.a. |
| 10 | n.a. | 10 | n.a. | 10 | n.a. | 14 | n.a. | 10 | 0.93 | 10 | n.a. | 10 | n.a. | 9 | n.a. | 10 | n.a. | 15 | 0.77 |
| 14 | n.a. | 14 | n.a. | 14 | 0.94 | 19 | n.a. | 14 | 1.15 | 14 | 1.25 | 14 | 0.66 | 14 | 1.08 | 13 | 0.96 | 20 | 0.83 |
| 19 | 1.72 | 19 | 1.60 | 19 | 0.62 | 24 | n.a. | 19 | n.a. | 19 | 3.80 | 19 | 0.76 | 19 | 1.15 | 19 | 0.72 | 25 | n.a. |
| 24 | n.a. | 24 | n.a. | 24 | n.a. | 29 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 29 | n.a. |
| 29 | n.a. | 29 | n.a. | 29 | n.a. | | | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | | |
| | | | | | | | | | | | | | | | | 34 | n.a. | | |
| | | | | | | | | | | | | | | | | 39 | n.a. | | |
| | | | | | | | | | | | | | | | | 44 | n.a. | | |
| | | | | | | | | | | | | | | | | 49 | n.a. | | |
| | | | | | | | | | | | | | | | | 59 | n.a. | | |
| | | | | | | | | | | | | | | | | 69 | n.a. | | |
| | | | | | | | | | | | | | | | | 79 | n.a. | | |
| | | | | | | | | | | | | | | | | 89 | n.a. | | |
| | | | | | | | | | | | | | | | | 99 | n.a. | | |
| FS | 1.72 | FS | 1.60 | FS | 0.62 | FS | 0.00 | FS | 0.93 | FS | 1.25 | FS | 0.66 | FS | 1.08 | FS | 0.72 | FS | 0.77 |
| Risk | Low | Risk | Low | Risk | HIGH | Risk | n.a. | Risk | HIGH | Risk | Low | Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

| B-77 | | B-78 | | B-79 | | B-80 | | B-81 | | B-82 | | B-83 | | B-84 | | B-85 | | B-86 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 10 | 0.40 | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 15 | 1.04 | 10 | n.a. | 10 | n.a. | 10 | n.a. | 14 | 1.75 | 10 | 1.12 | 10 | 1.43 | 10 | n.a. | 10 | 1.76 | 10 | 1.15 |
| 20 | 1.16 | 15 | 1.02 | 15 | 1.00 | 15 | 1.41 | 19 | 1.09 | 15 | 0.67 | 14 | 1.81 | 14 | 0.68 | 14 | 1.79 | 14 | 0.93 |
| 25 | n.a. | 20 | 0.96 | 20 | 0.82 | 20 | 1.17 | 24 | n.a. | 20 | 0.70 | 19 | 0.67 | 19 | 0.62 | 19 | 0.57 | 19 | 0.67 |
| 30 | n.a. | 25 | n.a. | 25 | n.a. | 25 | n.a. | 29 | n.a. | 25 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. |
| | | 30 | n.a. | 30 | n.a. | 30 | n.a. | | | 30 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| FS | 1.04 | FS | 0.96 | FS | 0.82 | FS | 1.17 | FS | 0.40 | FS | 0.67 | FS | 0.67 | FS | 0.62 | FS | 0.57 | FS | 0.67 |
| Risk | Moderate | Risk | HIGH | Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

| B-87 | | B-88 | | B-89 | | B-90 | | B-91 | | B-92 | | B-93 | | B-94 | | B-95 | | B-96 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. |
| 14 | 0.57 | 14 | 0.75 | 14 | 6.21 | 14 | 0.76 | 14 | 1.62 | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | 1.13 |
| 19 | 1.92 | 19 | 0.68 | 19 | 1.92 | 19 | 1.19 | 19 | 0.83 | 19 | n.a. | 19 | 0.89 | 19 | n.a. | 19 | 0.44 | 19 | 1.46 |
| 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. |
| 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| FS | 0.57 | FS | 0.68 | FS | 1.92 | FS | 0.76 | FS | 0.83 | FS | 0.00 | FS | 0.89 | FS | 0.00 | FS | 0.44 | FS | 1.13 |
| Risk | HIGH | Risk | HIGH | Risk | Low | Risk | HIGH | Risk | HIGH | Risk | n.a. | Risk | HIGH | Risk | n.a. | Risk | HIGH | Risk | Moderate |

Ameren Missouri Sioux Energy Center Utility Waste Landfill



LIQUEFACTION ANALYSES

| B-97 | | B-98 | | B-99 | | B-100 | | B-101 | | B-102 | | B-103 | | B-104 | | B-105 | | B-106 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. |
| 14 | 1.23 | 14 | 1.22 | 14 | 1.58 | 14 | n.a. | 14 | 0.68 | 14 | 1.27 | 14 | 0.78 | 14 | 1.20 | 14 | n.a. | 14 | n.a. |
| 19 | 1.15 | 19 | 1.09 | 19 | 1.36 | 19 | 1.08 | 19 | 0.72 | 19 | 0.76 | 19 | 1.30 | 19 | 1.09 | 19 | 0.81 | 19 | n.a. |
| 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. |
| 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| FS | 1.15 | FS | 1.09 | FS | 1.36 | FS | 1.08 | FS | 0.68 | FS | 0.76 | FS | 0.78 | FS | 1.09 | FS | 0.81 | FS | 0.00 |
| Risk | Moderate | Risk | Moderate | Risk | Low | Risk | Moderate | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | n.a. |

LIQUEFACTION ANALYSES

| B-107 | | B-108 | | B-109 | | B-110 | | B-111 | | B-112 | | B-113 | | B-114 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 5 | n.a. | 2.5 | n.a. |
| 5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 10 | n.a. | 14 | 1.12 | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. |
| 14 | 1.42 | 19 | 1.08 | 14 | n.a. | 14 | n.a. | 14 | 0.96 | 14 | 1.17 | 14 | 0.70 | 14 | 1.30 |
| 19 | 1.18 | 24 | n.a. | 19 | n.a. | 19 | 0.68 | 19 | 1.33 | 19 | 1.42 | 19 | 1.25 | 19 | 0.77 |
| 24 | n.a. | 29 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. |
| 29 | n.a. | | | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. |
| | | | | | | | | | | | | 34 | n.a. | | |
| | | | | | | | | | | | | 39 | n.a. | | |
| | | | | | | | | | | | | 44 | n.a. | | |
| | | | | | | | | | | | | 49 | n.a. | | |
| | | | | | | | | | | | | 59 | n.a. | | |
| | | | | | | | | | | | | 69 | n.a. | | |
| | | | | | | | | | | | | 79 | n.a. | | |
| | | | | | | | | | | | | 89 | n.a. | | |
| | | | | | | | | | | | | 99 | n.a. | | |
| FS | 1.18 | FS | 1.08 | FS | 0.00 | FS | 0.68 | FS | 0.96 | FS | 1.17 | FS | 0.70 | FS | 0.77 |
| Risk | Moderate | Risk | Moderate | Risk | n.a. | Risk | HIGH | Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

LIQUEFACTION ANALYSES BASED ON N-VALUES

Project: AmerenUE Sioux Power Plant Utility Waste Landfill

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Calc. by: | C Cook | Groundwater Elevation (ft) | 417 | Unit Wt. FGD | 110 | # High Risk | 6 |
| Checked | J Fouse | Ground Motion Ratio ($a_{max}$/g): | 0.268 | Depth (ft) | 40 | | |
| | | Earthquake Magnitude: | 7.5 | FGD Stress (psf) | 1904 | | |
| | | Hammer Efficiency: | 60 % | | | | |

| B-58 | | B-59 | | B-60 | | B-61 | | B-62 | | B-63 | | B-64 | | B-65 | | B-66 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 5 | n.a. |
| 7.5 | n.a. | 10 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 10 | 0.60 |
| 10 | n.a. | 14 | n.a. | 10 | n.a. | 10 | 0.79 | 10 | n.a. | 10 | 0.63 | 10 | 0.96 | 10 | n.a. | 14 | n.a. |
| 18.5 | n.a. | 19 | n.a. | 15 | n.a. | 15 | n.a. | 14 | n.a. | 15 | n.a. | 14 | n.a. | 15 | n.a. | 19 | n.a. |
| 24 | n.a. | 24 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 24 | n.a. |
| 29 | n.a. | 29 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 23 | n.a. | 24 | n.a. | 24 | n.a. | 29 | n.a. |
| 36 | n.a. | | | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | | |
| 41 | n.a. | | | | | | | | | | | | | | | | |
| 44 | n.a. | | | | | | | | | | | | | | | | |
| 49 | n.a. | | | | | | | | | | | | | | | | |
| 59 | n.a. | | | | | | | | | | | | | | | | |
| 69 | n.a. | | | | | | | | | | | | | | | | |
| 79 | n.a. | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.79 | FS | 0.00 | FS | 0.63 | FS | 0.96 | FS | 0.00 | FS | 0.60 |
| Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | HIGH | Risk | n.a. | Risk | HIGH | Risk | HIGH | Risk | n.a. | Risk | HIGH |

LIQUEFACTION ANALYSES

| B-67 | | B-68 | | B-69 | | B-70 | | B-71 | | B-72 | | B-73 | | B-74 | | B-75 | | B-76 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 4.5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 4 | n.a. | 6.5 | n.a. | 5 | n.a. | 7 | n.a. |
| 10 | n.a. | 10 | n.a. | 10 | n.a. | 14 | n.a. | 10 | 0.96 | 10 | n.a. | 10 | n.a. | 9 | n.a. | 10 | n.a. | 15 | n.a. |
| 14 | n.a. | 14 | n.a. | 14 | n.a. | 19 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 13 | n.a. | 20 | n.a. |
| 19 | n.a. | 19 | n.a. | 19 | n.a. | 24 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 25 | n.a. |
| 24 | n.a. | 24 | n.a. | 24 | n.a. | 29 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 29 | n.a. |
| 29 | n.a. | 29 | n.a. | 29 | n.a. | | | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | | |
| | | | | | | | | | | | | | | | | 34 | n.a. | | |
| | | | | | | | | | | | | | | | | 39 | n.a. | | |
| | | | | | | | | | | | | | | | | 44 | n.a. | | |
| | | | | | | | | | | | | | | | | 49 | n.a. | | |
| | | | | | | | | | | | | | | | | 59 | n.a. | | |
| | | | | | | | | | | | | | | | | 69 | n.a. | | |
| | | | | | | | | | | | | | | | | 79 | n.a. | | |
| | | | | | | | | | | | | | | | | 89 | n.a. | | |
| | | | | | | | | | | | | | | | | 99 | n.a. | | |
| FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.96 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 |
| Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | HIGH | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. |

Ameren Missouri Sioux Energy Center Utility Waste Landfill



LIQUEFACTION ANALYSES

| B-77 | | B-78 | | B-79 | | B-80 | | B-81 | | B-82 | | B-83 | | B-84 | | B-85 | | B-86 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 10 | 0.41 | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 15 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 14 | n.a. | 10 | 1.14 | 10 | 1.42 | 10 | n.a. | 10 | 1.72 | 10 | 1.15 |
| 20 | n.a. | 15 | n.a. | 15 | n.a. | 15 | n.a. | 19 | n.a. | 15 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. |
| 25 | n.a. | 20 | n.a. | 20 | n.a. | 20 | n.a. | 24 | n.a. | 20 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. |
| 30 | n.a. | 25 | n.a. | 25 | n.a. | 25 | n.a. | 29 | n.a. | 25 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. |
| | | 30 | n.a. | 30 | n.a. | 30 | n.a. | | | 30 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. |
| FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.41 | FS | 1.14 | FS | 1.42 | FS | 0.00 | FS | 1.72 | FS | 1.15 |
| Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | HIGH | Risk | Moderate | Risk | Low | Risk | n.a. | Risk | Low | Risk | Moderate |

LIQUEFACTION ANALYSES

| **B-87** | | **B-88** | | **B-89** | | **B-90** | | **B-91** | | **B-92** | | **B-93** | | **B-94** | | **B-95** | | **B-96** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. |
| 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. |
| 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. |
| 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. |
| 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 |
| Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. |

LIQUEFACTION ANALYSES

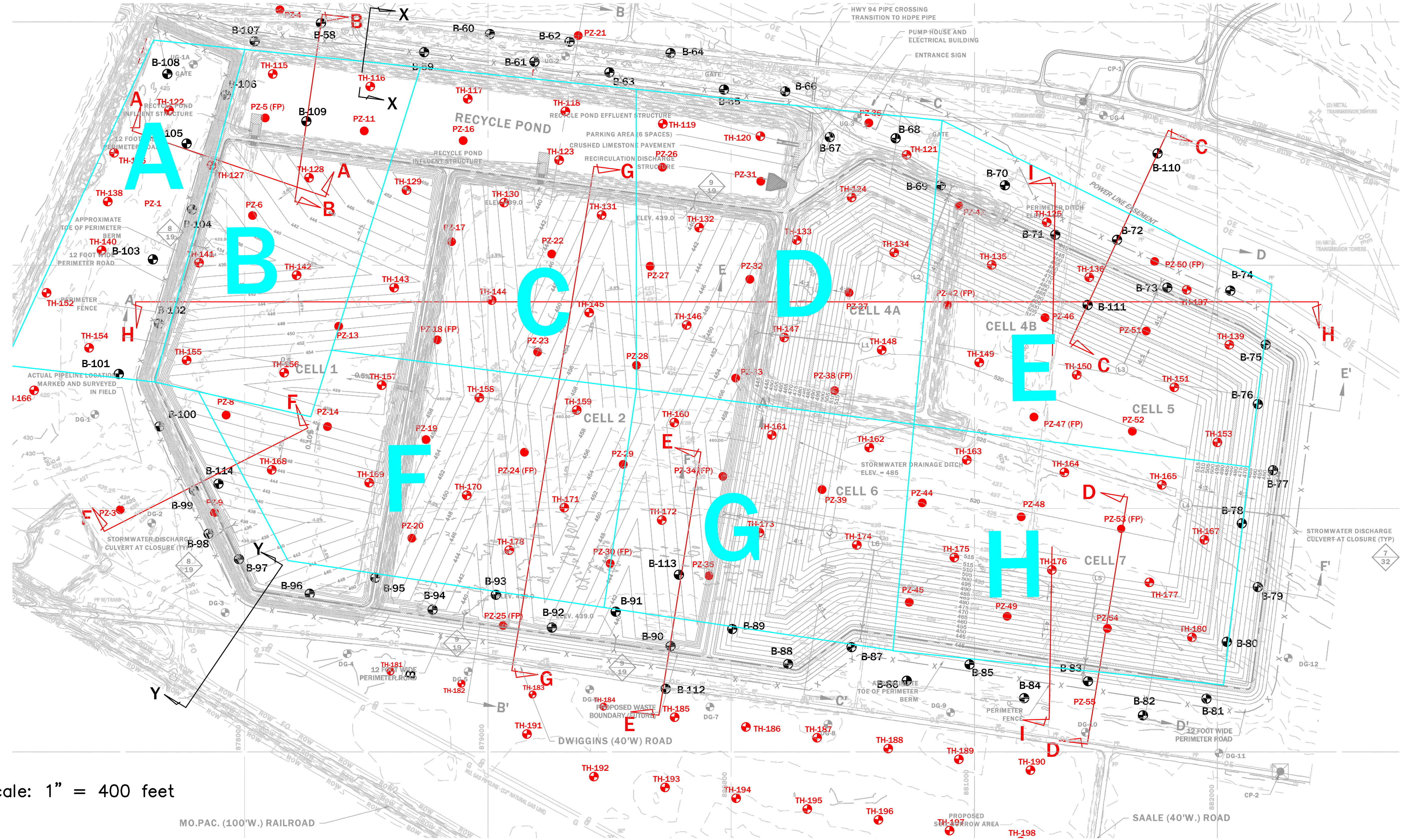
| B-97 | | B-98 | | B-99 | | B-100 | | B-101 | | B-102 | | B-103 | | B-104 | | B-105 | | B-106 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. |
| 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. |
| 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. |
| 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. |
| 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 |
| Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. |

LIQUEFACTION ANALYSES

| B-107 | | B-108 | | B-109 | | B-110 | | B-111 | | B-112 | | B-113 | | B-114 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 5 | n.a. | 2.5 | n.a. |
| 5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 10 | n.a. | 14 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. |
| 14 | n.a. | 19 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. |
| 19 | n.a. | 24 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. |
| 24 | n.a. | 29 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. |
| 29 | n.a. | | | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. |
| | | | | | | | | | | | | 34 | n.a. | | |
| | | | | | | | | | | | | 39 | n.a. | | |
| | | | | | | | | | | | | 44 | n.a. | | |
| | | | | | | | | | | | | 49 | n.a. | | |
| | | | | | | | | | | | | 59 | n.a. | | |
| | | | | | | | | | | | | 69 | n.a. | | |
| | | | | | | | | | | | | 79 | n.a. | | |
| | | | | | | | | | | | | 89 | n.a. | | |
| | | | | | | | | | | | | 99 | n.a. | | |
| FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 |
| Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. |

**Appendix 8**

# RESULTS OF SLOPE STABILITY ANALYSES



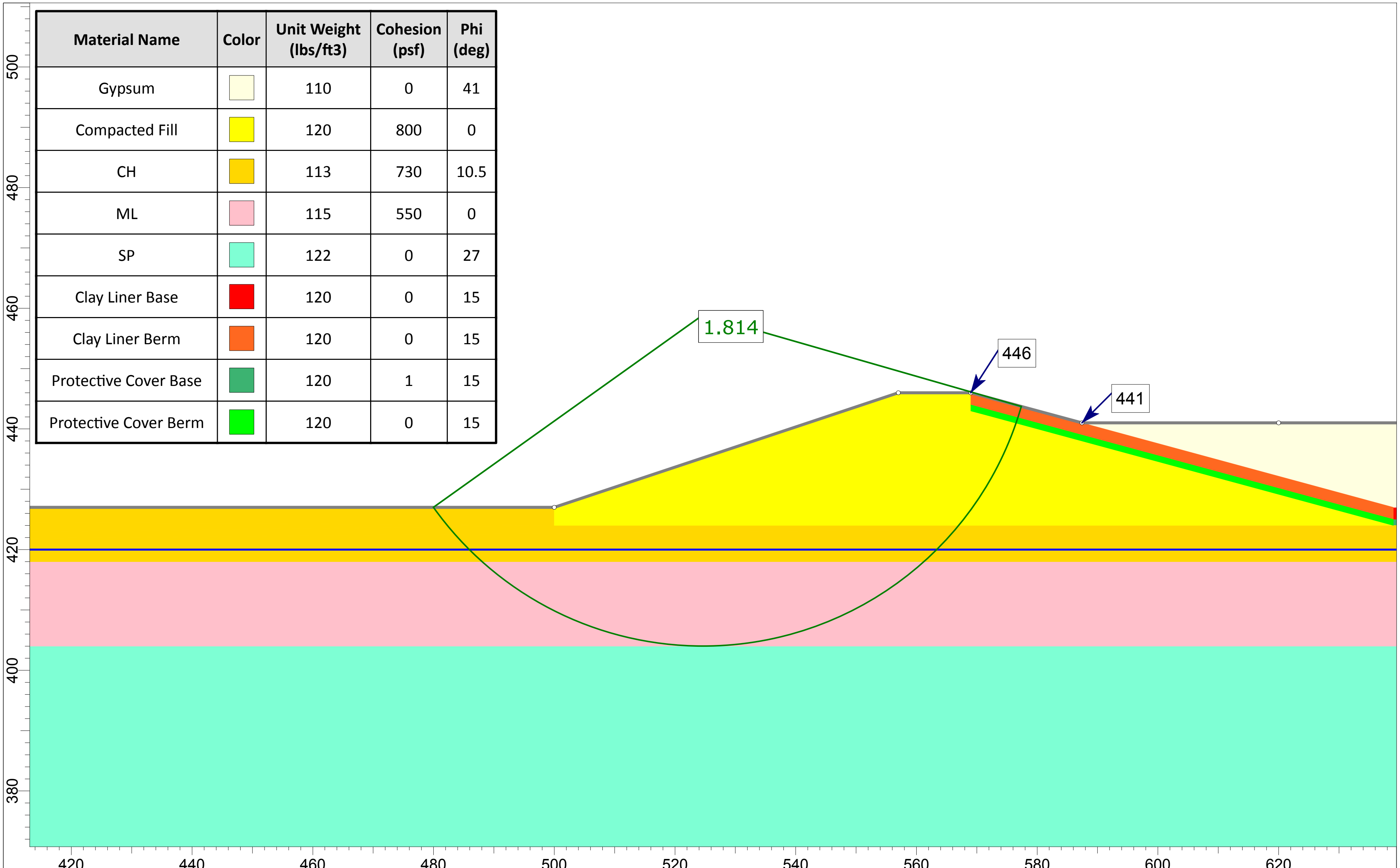

Scale: 1" = 400 feet

Note: Sections A–A through F–F for stability analyses shown in red. Sections G–G through I–I for settlement profiles shown in red. Sections X–X and Y–Y refer to erosion protection calculations in Appendix 11. Other sections in gray are for permit drawings.

REITZ & JENS, INC.

Ameren Missouri Sioux Energy Center UWL
PLAN OF SECTIONS AND BORING COMPOSITE AREAS

Figure 8–0




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Gypsum | | 110 | 0 | 41 |
| Compacted Fill | | 120 | 800 | 0 |
| CH | | 113 | 730 | 10.5 |
| ML | | 115 | 550 | 0 |
| SP | | 122 | 0 | 27 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 1 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |

Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELL 1, WEST BERM (SECTION A-A)
SHORT TERM - INITIAL FILLING

REITZ & JENS, INC.

Figure 8-1

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | rand |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

## Materials

| Property | Gypsum | Compacted Fill | CH | ML | SP | Clay Liner Base | Clay Liner Berm | Protective Cover Base |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 110 | 120 | 113 | 115 | 122 | 120 | 120 | 120 |
| Cohesion [psf] | 0 | 800 | 730 | 550 | 0 | 0 | 0 | 1 |
| Friction Angle [°] | 41 | 0 | 10.5 | 0 | 27 | 15 | 15 | 15 |
| Water Surface | Piezometric Line 2 | None | None | None | None | None | None | None |
| Hu Value | 1 | | | | | | | |
| Ru Value | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Property | Protective Cover Berm |
|---|---|
| Color | |
| Strength Type | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 |
| Cohesion [psf] | 0 |
| Friction Angle [°] | 15 |
| Water Surface | None |
| Ru Value | 0 |

## Entity Information

## Piezoline

| X | Y |
|---|---|
| 0 | 420 |
| 1370 | 420 |

## External Boundary

| X | Y |
|---|---|
| 587.421 | 441 |
| 569 | 446 |
| 557 | 446 |
| 500 | 427 |
| 0 | 427 |
| 0 | 418 |
| 0 | 404 |
| 0 | 327 |
| 1370 | 327 |
| 1370 | 404 |
| 1370 | 418 |
| 1370 | 424 |
| 1370 | 425 |
| 1370 | 427 |
| 1370 | 441 |
| 620 | 441 |

## Material Boundary

| X | Y |
|---|---|
| 587.421 | 441 |
| 639 | 427 |
| 1370 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 500 | 427 |
| 500 | 424 |
| 639 | 424 |
| 1370 | 424 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 418 |
| 1370 | 418 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 404 |
| 1370 | 404 |

## Material Boundary

| X | Y |
|---|---|
| 569 | 443 |
| 569 | 444 |
| 569 | 446 |

## Material Boundary

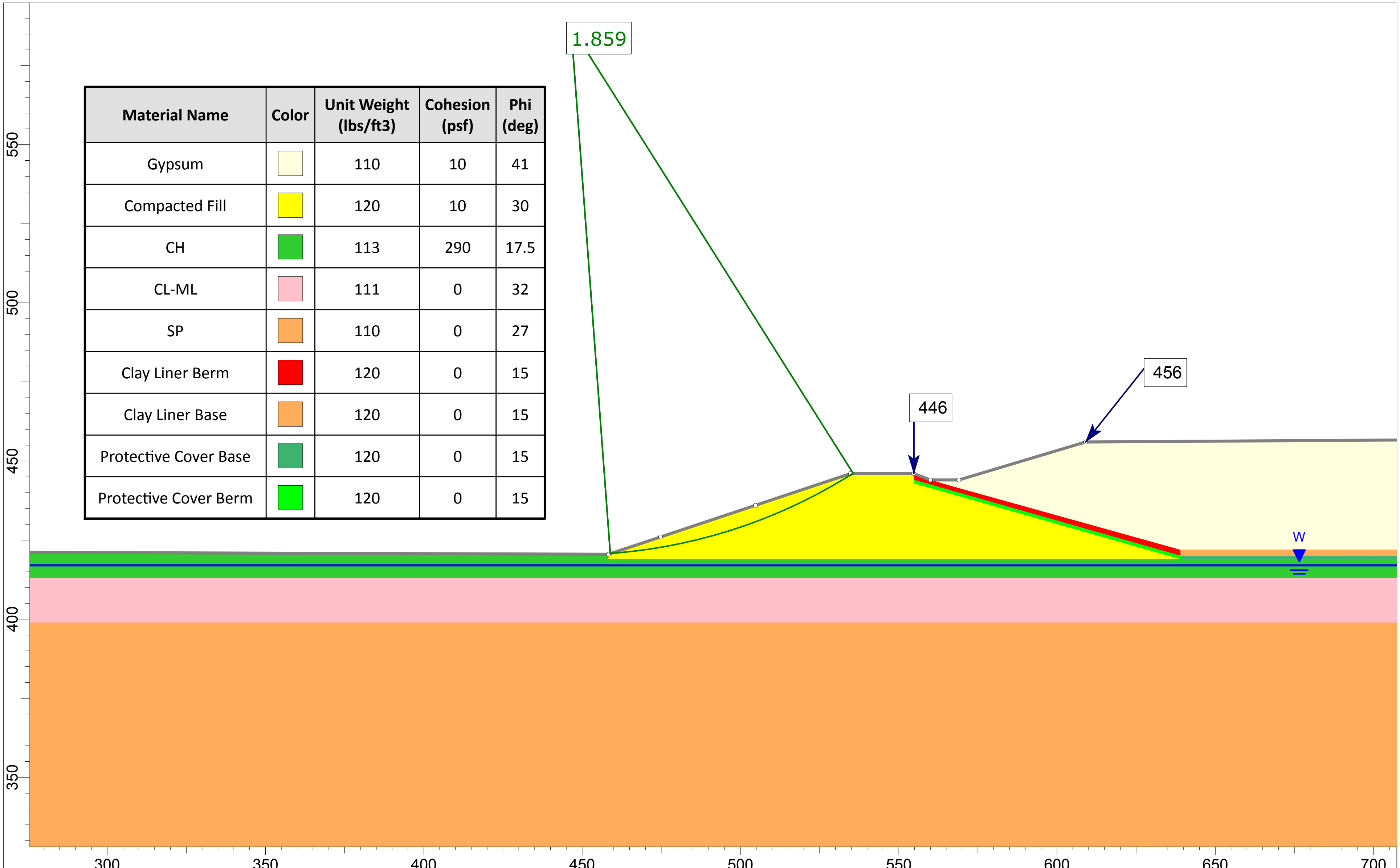
| X | Y |
|---|---|
| 569 | 443 |
| 639 | 424 |
| 639 | 425 |
| 639 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 569 | 444 |
| 639 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 639 | 425 |
| 1370 | 425 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Gypsum | | 110 | 10 | 41 |
| Compacted Fill | | 120 | 10 | 30 |
| CH | | 113 | 290 | 17.5 |
| CL-ML | | 111 | 0 | 32 |
| SP | | 110 | 0 | 27 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Clay Liner Base | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |

Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELL 1, WEST BERM (SECTION A-A)
LONG TERM - CLOSED CELL

REITZ & JENS, INC.

Figure 8-2

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

| | |
|---|---|
| Slices Type: | Vertical |

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | rand |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 30 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Enabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

## Materials

| Property | Gypsum | Compacted Fill | CH | CL-ML | SP | Clay Liner Berm | Clay Liner Base | Protective Cover Base |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 110 | 120 | 113 | 111 | 110 | 120 | 120 | 120 |
| Cohesion [psf] | 10 | 10 | 290 | 0 | 0 | 0 | 0 | 0 |
| Friction Angle [°] | 41 | 30 | 17.5 | 32 | 27 | 15 | 15 | 15 |
| Water Surface | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table |
| Hu Value | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |

| Property | Protective Cover Berm |
|---|---|
| Color | |
| Strength Type | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 |
| Cohesion [psf] | 0 |
| Friction Angle [°] | 15 |
| Water Surface | Water Table |
| Hu Value | 0 |

## Entity Information

### Water Table

| X | Y |
|---|---|
| -16.95 | 417 |

| | |
|---|---|
| 1370 | 417 |

## External Boundary

| X | Y |
|---|---|
| 554.774 | 446 |
| 534.774 | 446 |
| 504.774 | 436 |
| 474.774 | 426 |
| 458.343 | 420.523 |
| 0 | 422 |
| 0 | 413 |
| 0 | 399 |
| 0 | 322 |
| 1370 | 322 |
| 1370 | 399 |
| 1370 | 413 |
| 1370 | 419 |
| 1370 | 420 |
| 1370 | 422 |
| 1370 | 458 |
| 926 | 458 |
| 609 | 456 |
| 569 | 444 |
| 560 | 444 |

## Material Boundary

| X | Y |
|---|---|
| 560 | 444 |
| 639 | 422 |
| 1370 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 458.343 | 420.523 |
| 458.343 | 419 |
| 639 | 419 |
| 1370 | 419 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 413 |
| 1370 | 413 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 399 |
| 1370 | 399 |

## Material Boundary

| X | Y |
|---|---|
| 554.774 | 443 |
| 554.774 | 444 |
| 554.774 | 446 |

## Material Boundary

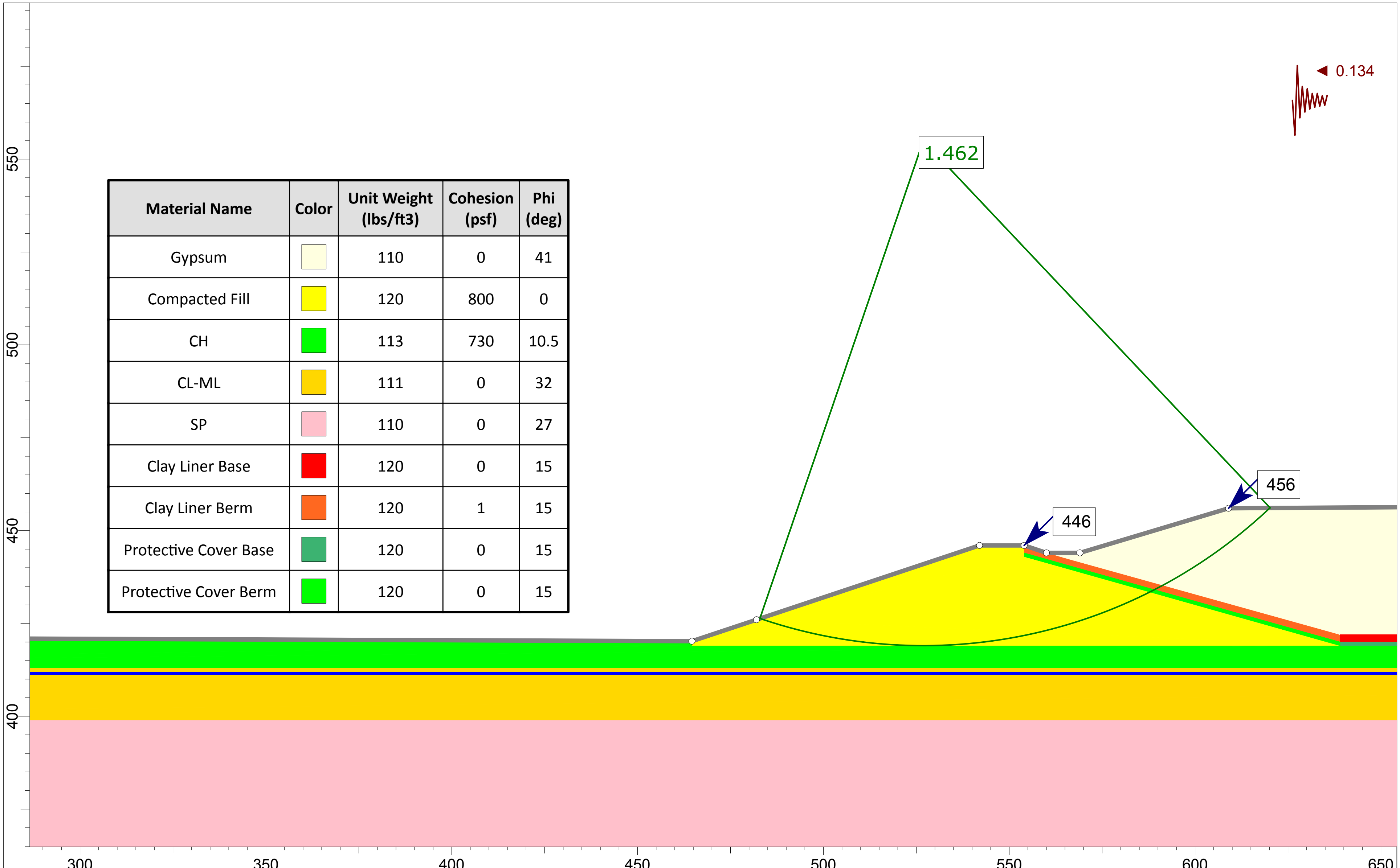
| X | Y |
|---|---|
| 554.774 | 443 |
| 639 | 419 |
| 639 | 420 |
| 639 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 554.774 | 444 |
| 639 | 420 |

## Material Boundary

| X | Y |
|---|---|
| 639 | 420 |
| 1370 | 420 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Gypsum | | 110 | 0 | 41 |
| Compacted Fill | | 120 | 800 | 0 |
| CH | | 113 | 730 | 10.5 |
| CL-ML | | 111 | 0 | 32 |
| SP | | 110 | 0 | 27 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 1 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |

Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELL 1, WEST BERM (SECTION A-A)
SEISMIC - CLOSED CELL

REITZ & JENS, INC.

Figure 8-3

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| GLE/Morgenstern-Price with interslice force function (Half Sine) |
| Spencer |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | rand |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

Advanced seismic analysis: No
Staged pseudostatic analysis: No

Seismic Load Coefficient (Horizontal): 0.134

## Materials

| Property | Gypsum | Compacted Fill | CH | CL-ML | SP | Clay Liner Base | Clay Liner Berm | Protective Cover Base |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 110 | 120 | 113 | 111 | 110 | 120 | 120 | 120 |
| Cohesion [psf] | 0 | 800 | 730 | 0 | 0 | 0 | 1 | 0 |
| Friction Angle [°] | 41 | 0 | 10.5 | 32 | 27 | 15 | 15 | 15 |
| Water Surface | Piezometric Line 2 | None | None | None | None | None | None | None |
| Hu Value | 1 | | | | | | | |
| Ru Value | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Property | Protective Cover Berm |
|---|---|
| Color | |
| Strength Type | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 |
| Cohesion [psf] | 0 |
| Friction Angle [°] | 15 |
| Water Surface | None |
| Ru Value | 0 |

## Entity Information

## Piezoline

| X | Y |
|---|---|
| 0 | 411.5 |
| 1370 | 411.5 |

## External Boundary

| X | Y |
|---|---|
| 609 | 456 |
| 569 | 444 |
| 560 | 444 |
| 554 | 446 |
| 542 | 446 |
| 482 | 426 |
| 464.603 | 420.201 |
| 0 | 422 |
| 0 | 413 |
| 0 | 399 |
| 0 | 322 |
| 1370 | 322 |
| 1370 | 399 |
| 1370 | 413 |
| 1370 | 419 |
| 1370 | 420 |
| 1370 | 422 |
| 1370 | 458 |
| 926 | 458 |

## Material Boundary

| X | Y |
|---|---|
| 560 | 444 |
| 639 | 422 |
| 1370 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 464.603 | 420.201 |
| 464.603 | 419 |
| 639 | 419 |
| 1370 | 419 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 413 |
| 1370 | 413 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 399 |
| 1370 | 399 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 443 |
| 554 | 444 |
| 554 | 446 |

## Material Boundary

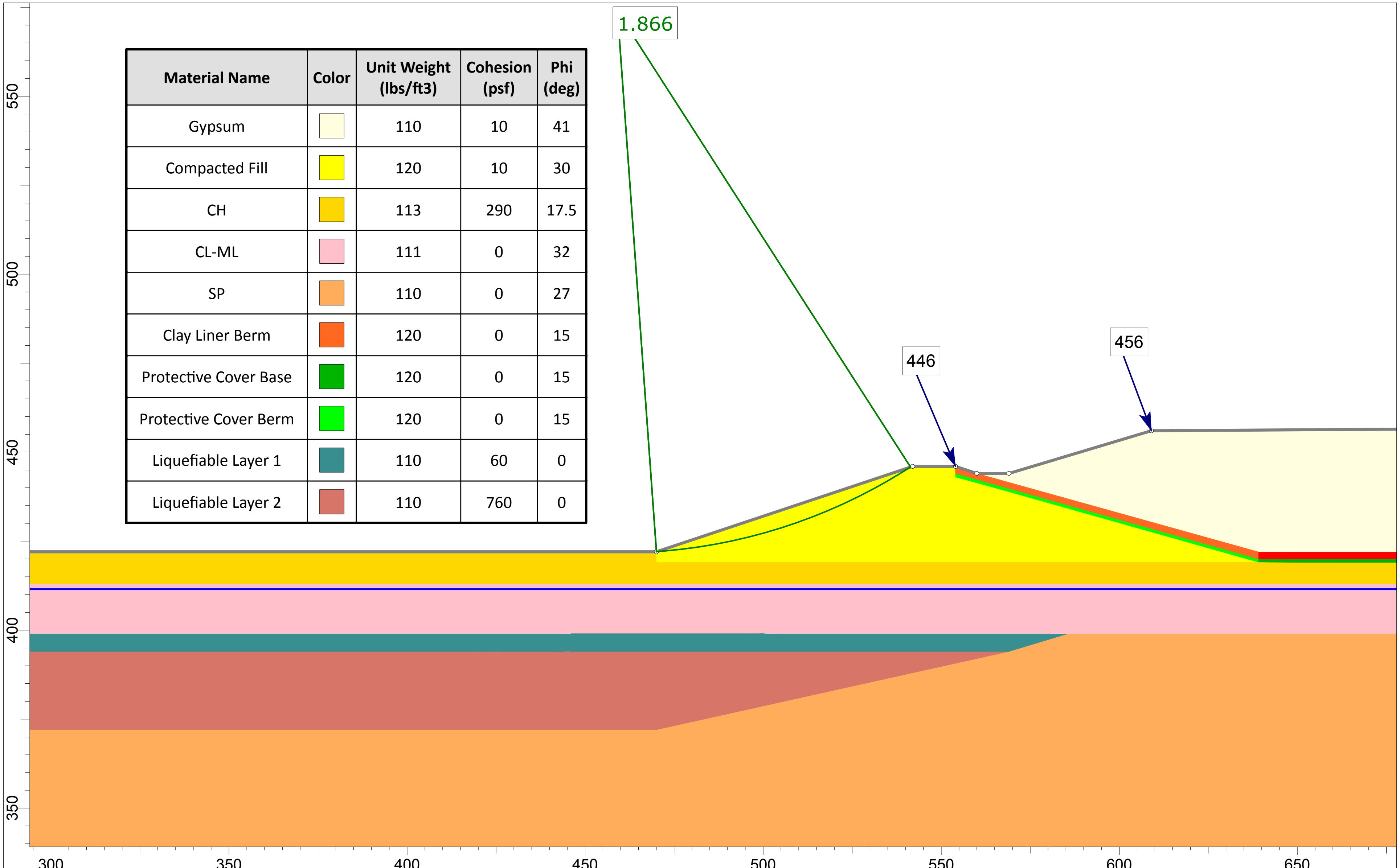
| X | Y |
|---|---|
| 554 | 443 |
| 639 | 419 |
| 639 | 420 |
| 639 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 444 |
| 639 | 420 |

## Material Boundary

| X | Y |
|---|---|
| 639 | 420 |
| 1370 | 420 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Gypsum | | 110 | 10 | 41 |
| Compacted Fill | | 120 | 10 | 30 |
| CH | | 113 | 290 | 17.5 |
| CL-ML | | 111 | 0 | 32 |
| SP | | 110 | 0 | 27 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |
| Liquefiable Layer 1 | | 110 | 60 | 0 |
| Liquefiable Layer 2 | | 110 | 760 | 0 |

Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELL 1, WEST BERM (SECTION A-A)
WITH LIQUEFACTION - CLOSED CELL

REITZ & JENS, INC.

Figure 8-4

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

| | |
|---|---|
| Slices Type: | Vertical |

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | rand |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

## Materials

| Property | Gypsum | Compacted Fill | CH | CL-ML | SP | Clay Liner Base | Clay Liner Berm | Protective Cover Base |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 110 | 120 | 113 | 111 | 110 | 120 | 120 | 120 |
| Cohesion [psf] | 10 | 10 | 290 | 0 | 0 | 0 | 0 | 0 |
| Friction Angle [°] | 41 | 30 | 17.5 | 32 | 27 | 15 | 15 | 15 |
| Water Surface | Piezometric Line 2 | None | None | None | None | None | None | None |
| Hu Value | 1 | | | | | | | |
| Ru Value | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Property | Protective Cover Berm | Liquefiable Layer 1 | Liquefiable Layer 2 |
|---|---|---|---|
| Color | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 | 110 | 110 |
| Cohesion [psf] | 0 | 60 | 760 |
| Friction Angle [°] | 15 | 0 | 0 |
| Water Surface | None | None | None |
| Ru Value | 0 | 0 | 0 |

## Entity Information

## Piezoline

| X | Y |
|---|---|
| 0 | 411.5 |
| 1370 | 411.5 |

## External Boundary

| X | Y |
|---|---|
| 609 | 456 |
| 569 | 444 |
| 560 | 444 |
| 554 | 446 |
| 542 | 446 |
| 470 | 422 |
| 0 | 422 |
| 0 | 413 |
| 0 | 399 |
| 0 | 394 |
| 0 | 372 |
| 0 | 322 |
| 1370 | 322 |
| 1370 | 399 |
| 1370 | 413 |
| 1370 | 419 |
| 1370 | 420 |
| 1370 | 422 |
| 1370 | 458 |
| 926 | 458 |

## Material Boundary

| X | Y |
|---|---|
| 560 | 444 |
| 639 | 422 |
| 1370 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 470 | 422 |
| 470 | 419 |
| 639 | 419 |
| 1370 | 419 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 413 |
| 1370 | 413 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 399 |
| 446.064 | 399 |
| 500 | 399 |
| 585.667 | 399 |
| 1370 | 399 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 444 |
| 554 | 446 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 444 |
| 639 | 420 |
| 639 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 639 | 420 |
| 1370 | 420 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 443 |
| 554 | 444 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 443 |
| 639 | 419 |
| 639 | 420 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 372 |
| 470 | 372 |
| 569 | 394 |
| 585.667 | 399 |

## Material Boundary

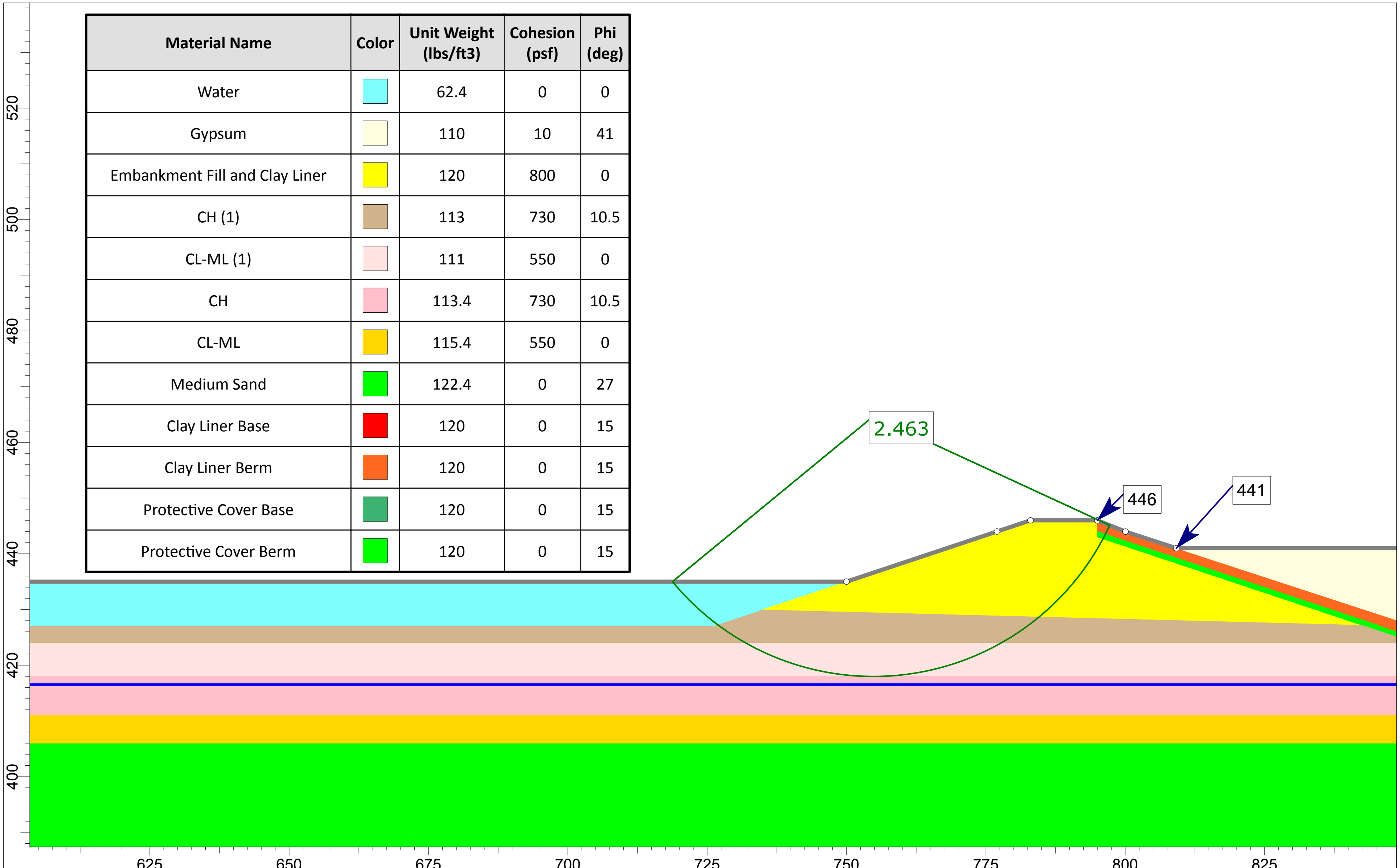
| X | Y |
|---|---|
| 0 | 394 |

| | |
|---|---|
| 446.064 | 394 |

## Material Boundary

| X | Y |
|---|---|
| 446.064 | 394 |
| 569 | 394 |

| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Water | | 62.4 | 0 | 0 |
| Gypsum | | 110 | 10 | 41 |
| Embankment Fill and Clay Liner | | 120 | 800 | 0 |
| CH (1) | | 113 | 730 | 10.5 |
| CL-ML (1) | | 111 | 550 | 0 |
| CH | | 113.4 | 730 | 10.5 |
| CL-ML | | 115.4 | 550 | 0 |
| Medium Sand | | 122.4 | 0 | 27 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |




Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELL 2, NORTH BERM AT RECYCLE POND (SECTION B-B)
SHORT-TERM, INITIAL FILLING, LOW RECYCLE POND

REITZ & JENS, INC.

Figure 8-5

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.03

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

| | |
|---|---|
| Slices Type: | Vertical |

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | rand |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

## Materials

| Property | Water | Gypsum | Embankment Fill and Clay Liner | CH (1) | CL-ML (1) | CH | CL-ML | Medium Sand |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 62.4 | 110 | 120 | 113 | 111 | 113.4 | 115.4 | 122.4 |
| Cohesion [psf] | 0 | 10 | 800 | 730 | 550 | 730 | 550 | 0 |
| Friction Angle [°] | 0 | 41 | 0 | 10.5 | 0 | 10.5 | 0 | 27 |
| Water Surface | None | None | None | None | None | Piezometric Line 2 | Piezometric Line 2 | Piezometric Line 2 |
| Hu Value | | | | | | 1 | 1 | 1 |
| Ru Value | 0 | 0 | 0 | 0 | 0 | | | |

| Property | Clay Liner Base | Clay Liner Berm | Protective Cover Base | Protective Cover Berm |
|---|---|---|---|---|
| Color | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 | 120 | 120 | 120 |
| Cohesion [psf] | 0 | 0 | 0 | 0 |
| Friction Angle [°] | 15 | 15 | 15 | 15 |
| Water Surface | None | None | None | None |
| Ru Value | 0 | 0 | 0 | 0 |

## Entity Information

## Piezoline

| X | Y |
|---|---|
| -500 | 416.5 |
| 3324 | 416.5 |

## External Boundary

| X | Y |
|---|---|
| 1603.05 | 441 |
| 809.171 | 441 |
| 800.052 | 443.981 |
| 795 | 446 |
| 783 | 446 |
| 777 | 444 |
| 750 | 435 |
| 302 | 435 |
| 275 | 444 |
| 269 | 446 |
| 257 | 446 |
| 200 | 427 |
| -500 | 427 |
| -500 | 421 |
| -500 | 418 |
| -500 | 411 |
| -500 | 406 |
| -500 | 327 |
| 1603.05 | 327 |
| 1603.05 | 406 |
| 1603.05 | 411 |
| 1603.05 | 418 |
| 1603.05 | 424 |
| 1603.05 | 425 |
| 1603.05 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 302 | 435 |
| 317 | 430 |
| 326 | 427 |
| 726 | 427 |
| 735 | 430 |
| 750 | 435 |

## Material Boundary

| X | Y |
|---|---|
| 809.171 | 441 |
| 852 | 427 |
| 1603.05 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 200 | 427 |
| 200 | 424 |
| 317 | 430 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 421 |
| 200 | 424 |
| 852 | 424 |
| 1603.05 | 424 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 418 |
| 1603.05 | 418 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 411 |
| 1603.05 | 411 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 406 |
| 1603.05 | 406 |

## Material Boundary

| X | Y |
|---|---|
| 735 | 430 |
| 842.25 | 427.25 |
| 845.5 | 427.167 |
| 852 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 795 | 443 |
| 795 | 444 |
| 795 | 446 |

## Material Boundary

| X | Y |
|---|---|
| 795 | 443 |

| | |
|---|---|
| 842.25 | 427.25 |
| 852 | 424 |
| 852 | 425 |
| 852 | 427 |

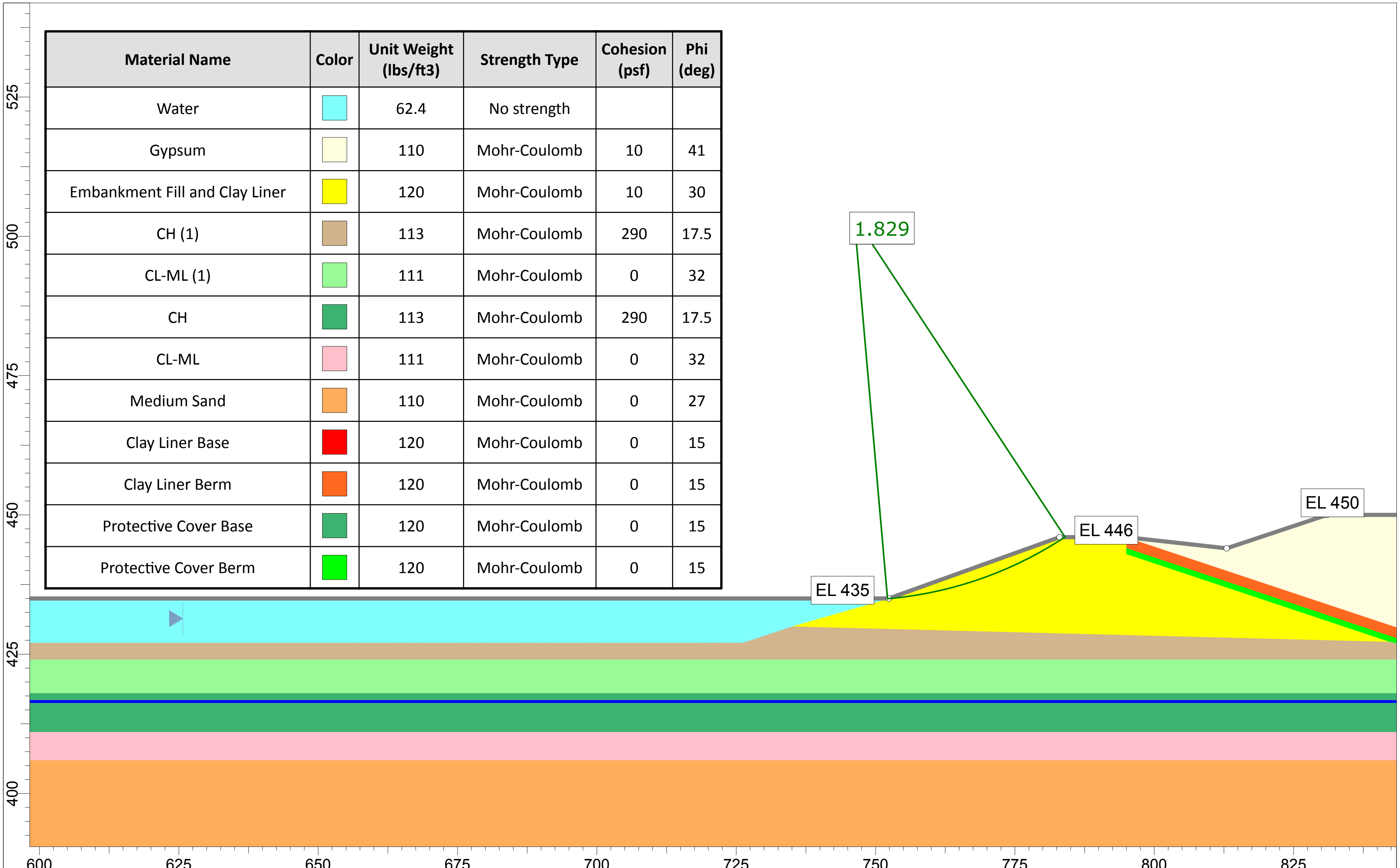
## Material Boundary

| X | Y |
|---|---|
| 795 | 444 |
| 845.5 | 427.167 |
| 852 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 852 | 425 |
| 1603.05 | 425 |

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|---|
| Water | | 62.4 | No strength | | |
| Gypsum | | 110 | Mohr-Coulomb | 10 | 41 |
| Embankment Fill and Clay Liner | | 120 | Mohr-Coulomb | 10 | 30 |
| CH (1) | | 113 | Mohr-Coulomb | 290 | 17.5 |
| CL-ML (1) | | 111 | Mohr-Coulomb | 0 | 32 |
| CH | | 113 | Mohr-Coulomb | 290 | 17.5 |
| CL-ML | | 111 | Mohr-Coulomb | 0 | 32 |
| Medium Sand | | 110 | Mohr-Coulomb | 0 | 27 |
| Clay Liner Base | | 120 | Mohr-Coulomb | 0 | 15 |
| Clay Liner Berm | | 120 | Mohr-Coulomb | 0 | 15 |
| Protective Cover Base | | 120 | Mohr-Coulomb | 0 | 15 |
| Protective Cover Berm | | 120 | Mohr-Coulomb | 0 | 15 |




Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELL 2, NORTH BERM AT RECYCLE POND (SECTION B-B)
LONG-TERM, CLOSED CELL, LOW RECYCLE POND

REITZ & JENS, INC.

Figure 8-6

# Slide Analysis Information

# Sioux UWL

## Project Summary

| | |
|---|---|
| Slide Modeler Version: | 8.03 |
| Compute Time: | 00h:00m:05.699s |

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

| | |
|---|---|
| Slices Type: | Vertical |

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | rand |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 50 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |

| | |
|---|---|
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

## Materials

| Property | Water | Gypsum | Embankment Fill and Clay Liner | CH (1) | CL-ML (1) | CH | CL-ML | Medium Sand |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | No strength | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 62.4 | 110 | 120 | 113 | 111 | 113 | 111 | 110 |
| Cohesion [psf] | | 10 | 10 | 290 | 0 | 290 | 0 | 0 |
| Friction Angle [°] | | 41 | 30 | 17.5 | 32 | 17.5 | 32 | 27 |
| Water Surface | None | Piezometric Line 2 | None | None | None | None | None | None |
| Hu Value | | 1 | | | | | | |
| Ru Value | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |

| Property | Clay Liner Base | Clay Liner Berm | Protective Cover Base | Protective Cover Berm |
|---|---|---|---|---|
| Color | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 | 120 | 120 | 120 |
| Cohesion [psf] | 0 | 0 | 0 | 0 |
| Friction Angle [°] | 15 | 15 | 15 | 15 |
| Water Surface | None | None | None | None |
| Ru Value | 0 | 0 | 0 | 0 |

## Global Minimums

### Method: spencer

| FS | 1.955830 |
|---|---|
| Center: | 745.057, 507.303 |
| Radius: | 72.587 |
| Left Slip Surface Endpoint: | 749.570, 434.857 |
| Right Slip Surface Endpoint: | 783.926, 446.000 |
| Left Slope Intercept: | 749.570 435.000 |
| Right Slope Intercept: | 783.926 446.000 |
| Resisting Moment: | 316924 lb-ft |
| Driving Moment: | 162041 lb-ft |
| Resisting Horizontal Force: | 4127.28 lb |
| Driving Horizontal Force: | 2110.24 lb |
| Total Slice Area: | 60.295 ft2 |
| Surface Horizontal Width: | 34.3557 ft |
| Surface Average Height: | 1.75502 ft |

## Valid/Invalid Surfaces

### Method: spencer

Number of Valid Surfaces: 60345
Number of Invalid Surfaces: 0

## Slice Data

**Global Minimum Query (spencer) - Safety Factor**: 1.95583

| Slice Number | Width [ft] | Weight [lbs] | Angle of Slice Base [degrees] | Base Material | Base Cohesion [psf] | Base Friction Angle [degrees] | Shear Stress [psf] | Shear Strength [psf] | Base Normal Stress [psf] | Pore Pressure [psf] | Effective Normal Stress [psf] | Base Vertical Stress [psf] | Effective Vertical Stress [psf] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.687114 | 9.46658 | 3.83653 | Embankment Fill and Clay Liner | 10 | 30 | 9.88935 | 19.3419 | 16.1806 | 0 | 16.1806 | 16.8438 | 16.8438 |
| 2 | 0.687114 | 22.3583 | 4.3803 | Embankment Fill and Clay Liner | 10 | 30 | 15.5617 | 30.436 | 35.3961 | 0 | 35.3961 | 36.5881 | 36.5881 |
| 3 | 0.687114 | 36.6328 | 4.92447 | Embankment Fill and Clay Liner | 10 | 30 | 21.8745 | 42.7829 | 56.7816 | 0 | 56.7816 | 58.6664 | 58.6664 |
| 4 | 0.687114 | 50.3649 | 5.46908 | Embankment Fill and Clay Liner | 10 | 30 | 27.8697 | 54.5083 | 77.0905 | 0 | 77.0905 | 79.7589 | 79.7589 |
| 5 | 0.687114 | 63.5532 | 6.01419 | Embankment Fill and Clay Liner | 10 | 30 | 33.5516 | 65.6213 | 96.3388 | 0 | 96.3388 | 99.8736 | 99.8736 |
| 6 | 0.687114 | 76.1963 | 6.55985 | Embankment Fill and Clay Liner | 10 | 30 | 38.9251 | 76.1308 | 114.542 | 0 | 114.542 | 119.018 | 119.018 |
| 7 | 0.687114 | 88.2924 | 7.1061 | Embankment Fill and Clay Liner | 10 | 30 | 43.9944 | 86.0455 | 131.715 | 0 | 131.715 | 137.199 | 137.199 |
| 8 | 0.687114 | 99.8396 | 7.65301 | Embankment Fill and Clay Liner | 10 | 30 | 48.7636 | 95.3734 | 147.87 | 0 | 147.87 | 154.423 | 154.423 |
| 9 | 0.687114 | 110.836 | 8.20061 | Embankment Fill and Clay Liner | 10 | 30 | 53.237 | 104.123 | 163.025 | 0 | 163.025 | 170.697 | 170.697 |
| 10 | 0.687114 | 121.279 | 8.74898 | Embankment Fill and Clay Liner | 10 | 30 | 57.4186 | 112.301 | 177.19 | 0 | 177.19 | 186.026 | 186.026 |
| 11 | 0.687114 | 131.167 | 9.29815 | Embankment Fill and Clay Liner | 10 | 30 | 61.3116 | 119.915 | 190.378 | 0 | 190.378 | 200.416 | 200.416 |
| 12 | 0.687114 | 140.496 | 9.84818 | Embankment Fill and Clay Liner | 10 | 30 | 64.9198 | 126.972 | 202.601 | 0 | 202.601 | 213.871 | 213.871 |
| 13 | 0.687114 | 149.265 | 10.3991 | Embankment Fill and Clay Liner | 10 | 30 | 68.2467 | 133.479 | 213.873 | 0 | 213.873 | 226.397 | 226.397 |
| 14 | 0.687114 | 157.47 | 10.9511 | Embankment Fill and Clay Liner | 10 | 30 | 71.2961 | 139.443 | 224.202 | 0 | 224.202 | 237.998 | 237.998 |
| 15 | 0.687114 | 165.109 | 11.504 | Embankment Fill and Clay Liner | 10 | 30 | 74.0709 | 144.87 | 233.601 | 0 | 233.601 | 248.676 | 248.676 |
| 16 | 0.687114 | 172.177 | 12.0581 | Embankment Fill and Clay Liner | 10 | 30 | 76.5736 | 149.765 | 242.08 | 0 | 242.08 | 258.437 | 258.437 |
| 17 | 0.687114 | 178.672 | 12.6133 | Embankment Fill and Clay Liner | 10 | 30 | 78.808 | 154.135 | 249.65 | 0 | 249.65 | 267.285 | 267.285 |
| 18 | 0.687114 | 184.59 | 13.1697 | Embankment Fill and Clay Liner | 10 | 30 | 80.7764 | 157.985 | 256.318 | 0 | 256.318 | 275.219 | 275.219 |
| 19 | 0.687114 | 189.927 | 13.7273 | Embankment Fill and Clay Liner | 10 | 30 | 82.4821 | 161.321 | 262.096 | 0 | 262.096 | 282.244 | 282.244 |
| 20 | 0.687114 | 194.679 | 14.2863 | Embankment Fill and Clay Liner | 10 | 30 | 83.9275 | 164.148 | 266.992 | 0 | 266.992 | 288.363 | 288.363 |
| 21 | 0.687114 | 198.841 | 14.8467 | Embankment Fill and Clay Liner | 10 | 30 | 85.1148 | 166.47 | 271.015 | 0 | 271.015 | 293.578 | 293.578 |
| 22 | 0.687114 | 202.41 | 15.4086 | Embankment Fill and Clay Liner | 10 | 30 | 86.0474 | 168.294 | 274.173 | 0 | 274.173 | 297.888 | 297.888 |
| 23 | 0.687114 | 205.38 | 15.9719 | Embankment Fill and Clay Liner | 10 | 30 | 86.7264 | 169.622 | 276.474 | 0 | 276.474 | 301.296 | 301.296 |
| 24 | 0.687114 | 207.746 | 16.5369 | Embankment Fill and Clay Liner | 10 | 30 | 87.1548 | 170.46 | 277.925 | 0 | 277.925 | 303.803 | 303.803 |
| 25 | 0.687114 | 209.504 | 17.1035 | Embankment Fill and Clay Liner | 10 | 30 | 87.3348 | 170.812 | 278.535 | 0 | 278.535 | 305.409 | 305.409 |
| 26 | 0.687114 | 210.647 | 17.6719 | Embankment Fill and Clay Liner | 10 | 30 | 87.2683 | 170.682 | 278.309 | 0 | 278.309 | 306.113 | 306.113 |
| 27 | 0.687114 | 211.17 | 18.242 | Embankment Fill and Clay Liner | 10 | 30 | 86.9575 | 170.074 | 277.257 | 0 | 277.257 | 305.918 | 305.918 |
| 28 | 0.687114 | 211.067 | 18.814 | Embankment Fill and Clay Liner | 10 | 30 | 86.4042 | 168.992 | 275.382 | 0 | 275.382 | 304.82 | 304.82 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 29 | 0.687114 | 210.332 | 19.388 | Embankment Fill and Clay Liner | 10 | 30 | 85.6102 | 167.439 | 272.693 | 0 | 272.693 | 302.821 | 302.821 |
| 30 | 0.687114 | 208.958 | 19.964 | Embankment Fill and Clay Liner | 10 | 30 | 84.5774 | 165.419 | 269.194 | 0 | 269.194 | 299.918 | 299.918 |
| 31 | 0.687114 | 206.938 | 20.5421 | Embankment Fill and Clay Liner | 10 | 30 | 83.3079 | 162.936 | 264.892 | 0 | 264.892 | 296.109 | 296.109 |
| 32 | 0.687114 | 204.264 | 21.1225 | Embankment Fill and Clay Liner | 10 | 30 | 81.8026 | 159.992 | 259.793 | 0 | 259.793 | 291.395 | 291.395 |
| 33 | 0.687114 | 200.93 | 21.7051 | Embankment Fill and Clay Liner | 10 | 30 | 80.0632 | 156.59 | 253.901 | 0 | 253.901 | 285.77 | 285.77 |
| 34 | 0.687114 | 196.927 | 22.29 | Embankment Fill and Clay Liner | 10 | 30 | 78.0917 | 152.734 | 247.223 | 0 | 247.223 | 279.235 | 279.235 |
| 35 | 0.687114 | 192.247 | 22.8774 | Embankment Fill and Clay Liner | 10 | 30 | 75.8895 | 148.427 | 239.763 | 0 | 239.763 | 271.785 | 271.785 |
| 36 | 0.687114 | 186.881 | 23.4674 | Embankment Fill and Clay Liner | 10 | 30 | 73.4578 | 143.671 | 231.525 | 0 | 231.525 | 263.416 | 263.416 |
| 37 | 0.687114 | 180.82 | 24.06 | Embankment Fill and Clay Liner | 10 | 30 | 70.7981 | 138.469 | 222.514 | 0 | 222.514 | 254.124 | 254.124 |
| 38 | 0.687114 | 174.055 | 24.6554 | Embankment Fill and Clay Liner | 10 | 30 | 67.9113 | 132.823 | 212.736 | 0 | 212.736 | 243.908 | 243.908 |
| 39 | 0.687114 | 166.575 | 25.2536 | Embankment Fill and Clay Liner | 10 | 30 | 64.7991 | 126.736 | 202.192 | 0 | 202.192 | 232.759 | 232.759 |
| 40 | 0.687114 | 158.37 | 25.8548 | Embankment Fill and Clay Liner | 10 | 30 | 61.4624 | 120.21 | 190.89 | 0 | 190.89 | 220.675 | 220.675 |
| 41 | 0.687114 | 149.43 | 26.4591 | Embankment Fill and Clay Liner | 10 | 30 | 57.9028 | 113.248 | 178.831 | 0 | 178.831 | 207.648 | 207.648 |
| 42 | 0.687114 | 139.741 | 27.0665 | Embankment Fill and Clay Liner | 10 | 30 | 54.121 | 105.852 | 166.02 | 0 | 166.02 | 193.675 | 193.675 |
| 43 | 0.687114 | 129.293 | 27.6773 | Embankment Fill and Clay Liner | 10 | 30 | 50.1181 | 98.0225 | 152.459 | 0 | 152.459 | 178.746 | 178.746 |
| 44 | 0.687114 | 118.073 | 28.2915 | Embankment Fill and Clay Liner | 10 | 30 | 45.8952 | 89.7633 | 138.154 | 0 | 138.154 | 162.857 | 162.857 |
| 45 | 0.687114 | 106.067 | 28.9093 | Embankment Fill and Clay Liner | 10 | 30 | 41.4533 | 81.0757 | 123.107 | 0 | 123.107 | 145.999 | 145.999 |
| 46 | 0.687114 | 93.2613 | 29.5307 | Embankment Fill and Clay Liner | 10 | 30 | 36.7934 | 71.9617 | 107.321 | 0 | 107.321 | 128.164 | 128.164 |
| 47 | 0.687114 | 79.6414 | 30.156 | Embankment Fill and Clay Liner | 10 | 30 | 31.9164 | 62.4231 | 90.7995 | 0 | 90.7995 | 109.343 | 109.343 |
| 48 | 0.687114 | 65.1917 | 30.7853 | Embankment Fill and Clay Liner | 10 | 30 | 26.8232 | 52.4616 | 73.5458 | 0 | 73.5458 | 89.5263 | 89.5263 |
| 49 | 0.687114 | 48.7585 | 31.4188 | Embankment Fill and Clay Liner | 10 | 30 | 21.1328 | 41.3321 | 54.2687 | 0 | 54.2687 | 67.1777 | 67.1777 |
| 50 | 0.687114 | 17.7399 | 32.0565 | Embankment Fill and Clay Liner | 10 | 30 | 10.7359 | 20.9976 | 19.0484 | 0 | 19.0484 | 25.7717 | 25.7717 |

## *Interslice Data*

**Global Minimum Query (spencer) - Safety Factor**: 1.95583

| Slice Number | X coordinate [ft] | Y coordinate - Bottom [ft] | Interslice Normal Force [lbs] | Interslice Shear Force [lbs] | Interslice Force Angle [degrees] |
|---|---|---|---|---|---|
| 1 | 749.57 | 434.857 | 0.641241 | 0 | 0 |
| 2 | 750.257 | 434.903 | 6.69018 | 2.11567 | 17.5488 |
| 3 | 750.944 | 434.955 | 15.5189 | 4.90761 | 17.5487 |
| 4 | 751.631 | 435.015 | 27.1863 | 8.59725 | 17.5488 |
| 5 | 752.318 | 435.08 | 41.2626 | 13.0487 | 17.5488 |
| 6 | 753.005 | 435.153 | 57.3403 | 18.133 | 17.5488 |
| 7 | 753.693 | 435.232 | 75.0335 | 23.7282 | 17.5488 |
| 8 | 754.38 | 435.317 | 93.9775 | 29.719 | 17.5488 |
| 9 | 755.067 | 435.41 | 113.828 | 35.9964 | 17.5488 |
| 10 | 755.754 | 435.509 | 134.262 | 42.4583 | 17.5488 |
| 11 | 756.441 | 435.614 | 154.974 | 49.0083 | 17.5488 |
| 12 | 757.128 | 435.727 | 175.682 | 55.5567 | 17.5487 |
| 13 | 757.815 | 435.846 | 196.119 | 62.0196 | 17.5488 |
| 14 | 758.502 | 435.972 | 216.039 | 68.3191 | 17.5488 |

| | | | | | |
|---|---|---|---|---|---|
| 15 | 759.19 | 436.105 | 235.215 | 74.3832 | 17.5488 |
| 16 | 759.877 | 436.245 | 253.437 | 80.1458 | 17.5488 |
| 17 | 760.564 | 436.392 | 270.515 | 85.5465 | 17.5488 |
| 18 | 761.251 | 436.546 | 286.276 | 90.5305 | 17.5488 |
| 19 | 761.938 | 436.706 | 300.564 | 95.0488 | 17.5488 |
| 20 | 762.625 | 436.874 | 313.241 | 99.0578 | 17.5488 |
| 21 | 763.312 | 437.049 | 324.189 | 102.52 | 17.5488 |
| 22 | 763.999 | 437.231 | 333.304 | 105.402 | 17.5487 |
| 23 | 764.686 | 437.421 | 340.502 | 107.679 | 17.5488 |
| 24 | 765.374 | 437.617 | 345.715 | 109.327 | 17.5487 |
| 25 | 766.061 | 437.821 | 348.895 | 110.333 | 17.5488 |
| 26 | 766.748 | 438.033 | 350.008 | 110.685 | 17.5488 |
| 27 | 767.435 | 438.252 | 349.04 | 110.379 | 17.5488 |
| 28 | 768.122 | 438.478 | 345.994 | 109.416 | 17.5489 |
| 29 | 768.809 | 438.712 | 340.892 | 107.802 | 17.5488 |
| 30 | 769.496 | 438.954 | 333.771 | 105.55 | 17.5488 |
| 31 | 770.183 | 439.204 | 324.689 | 102.678 | 17.5488 |
| 32 | 770.87 | 439.461 | 313.722 | 99.21 | 17.5488 |
| 33 | 771.558 | 439.727 | 300.964 | 95.1754 | 17.5488 |
| 34 | 772.245 | 440 | 286.528 | 90.6103 | 17.5488 |
| 35 | 772.932 | 440.282 | 270.547 | 85.5565 | 17.5488 |
| 36 | 773.619 | 440.572 | 253.173 | 80.0622 | 17.5488 |
| 37 | 774.306 | 440.87 | 234.578 | 74.1819 | 17.5488 |
| 38 | 774.993 | 441.177 | 214.956 | 67.9767 | 17.5488 |
| 39 | 775.68 | 441.492 | 194.52 | 61.5141 | 17.5488 |
| 40 | 776.367 | 441.816 | 173.506 | 54.8688 | 17.5488 |
| 41 | 777.054 | 442.149 | 152.173 | 48.1224 | 17.5488 |
| 42 | 777.742 | 442.491 | 130.8 | 41.3637 | 17.5488 |
| 43 | 778.429 | 442.842 | 109.694 | 34.689 | 17.5487 |
| 44 | 779.116 | 443.203 | 89.1816 | 28.2024 | 17.5488 |
| 45 | 779.803 | 443.573 | 69.619 | 22.016 | 17.5488 |
| 46 | 780.49 | 443.952 | 51.3866 | 16.2502 | 17.5487 |
| 47 | 781.177 | 444.341 | 34.8924 | 11.0342 | 17.5488 |
| 48 | 781.864 | 444.741 | 20.5731 | 6.50595 | 17.5488 |
| 49 | 782.551 | 445.15 | 8.89517 | 2.81296 | 17.5488 |
| 50 | 783.238 | 445.57 | 0.63655 | 0.2013 | 17.5488 |
| 51 | 783.926 | 446 | 0 | 0 | 0 |

## Entity Information

### Piezoline

| X | Y |
|---|---|
| -500 | 416.5 |
| 3324 | 416.5 |

### External Boundary

| X | Y |
|---|---|
| 1228 | 440 |
| 902 | 450 |
| 831 | 450 |
| 813 | 444 |
| 795 | 446 |
| 783 | 446 |
| 777 | 444 |
| 750 | 435 |
| 302 | 435 |
| 275 | 444 |
| 269 | 446 |
| 257 | 446 |
| 200 | 427 |

| | |
|---|---|
| -500 | 427 |
| -500 | 421 |
| -500 | 418 |
| -500 | 411 |
| -500 | 406 |
| -500 | 327 |
| 1604.19 | 327 |
| 1604.19 | 406 |
| 1604.19 | 411 |
| 1604.19 | 418 |
| 1604.19 | 424 |
| 1604.19 | 425.211 |
| 1604.19 | 426.211 |
| 1604.19 | 428.211 |
| 1604.19 | 440 |

## Material Boundary

| X | Y |
|---|---|
| 302 | 435 |
| 317 | 430 |
| 326 | 427 |
| 726 | 427 |
| 735 | 430 |
| 750 | 435 |

## Material Boundary

| X | Y |
|---|---|
| 795 | 446 |
| 852 | 427 |
| 1604.19 | 428.211 |

## Material Boundary

| X | Y |
|---|---|
| 200 | 427 |
| 200 | 424 |
| 317 | 430 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 421 |
| 200 | 424 |
| 852 | 424 |
| 1604.19 | 424 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 418 |
| 1604.19 | 418 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 411 |
| 1604.19 | 411 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 406 |
| 1604.19 | 406 |

## Material Boundary

| X | Y |
|---|---|
| 735 | 430 |
| 842.25 | 427.25 |
| 845.5 | 427.167 |
| 852 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 795 | 443 |
| 795 | 444 |
| 795 | 446 |

## Material Boundary

| X | Y |
|---|---|
| 795 | 443 |
| 842.25 | 427.25 |
| 852 | 424 |
| 852 | 425 |
| 852 | 427 |

## Material Boundary

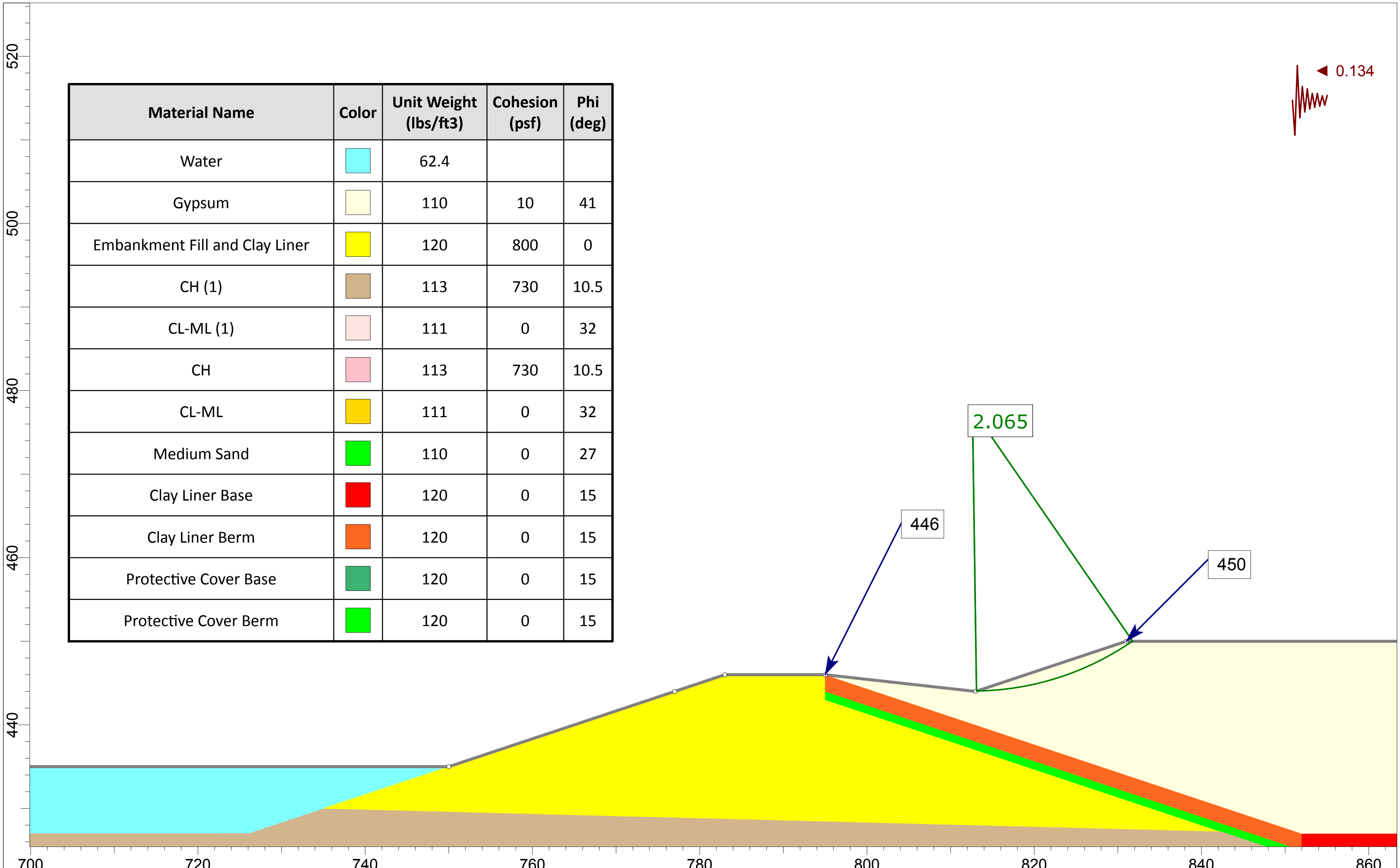
| X | Y |
|---|---|
| 795 | 444 |
| 845.5 | 427.167 |
| 852 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 852 | 424 |
| 1604.19 | 425.211 |

## Material Boundary

| X | Y |
|---|---|
| 852 | 425 |
| 1604.19 | 426.211 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Water | | 62.4 | | |
| Gypsum | | 110 | 10 | 41 |
| Embankment Fill and Clay Liner | | 120 | 800 | 0 |
| CH (1) | | 113 | 730 | 10.5 |
| CL-ML (1) | | 111 | 0 | 32 |
| CH | | 113 | 730 | 10.5 |
| CL-ML | | 111 | 0 | 32 |
| Medium Sand | | 110 | 0 | 27 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |

Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELL 2, NORTH BERM AT RECYCLE POND (SECTION B-B)
SEISMIC, CLOSED CELL, LOW RECYCLE POND

REITZ & JENS, INC.

Figure 8-7

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.03

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | rand |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

Seismic Load Coefficient (Horizontal): 0.134

## Materials

| Property | Water | Gypsum | Embankment Fill and Clay Liner | CH (1) | CL-ML (1) | CH | CL-ML | Medium Sand |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | No strength | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 62.4 | 110 | 120 | 113 | 111 | 113 | 111 | 110 |
| Cohesion [psf] | | 10 | 800 | 730 | 0 | 730 | 0 | 0 |
| Friction Angle [°] | | 41 | 0 | 10.5 | 32 | 10.5 | 32 | 27 |
| Water Surface | None | Piezometric Line 2 | None | None | None | None | None | None |
| Hu Value | | 1 | | | | | | |
| Ru Value | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |

| Property | Clay Liner Base | Clay Liner Berm | Protective Cover Base | Protective Cover Berm |
|---|---|---|---|---|
| Color | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 | 120 | 120 | 120 |
| Cohesion [psf] | 0 | 0 | 0 | 0 |
| Friction Angle [°] | 15 | 15 | 15 | 15 |
| Water Surface | None | None | None | None |
| Ru Value | 0 | 0 | 0 | 0 |

## Entity Information

## Piezoline

| X | Y |
|---|---|
| -500 | 416.5 |
| 3324 | 416.5 |

## External Boundary

| X | Y |
|---|---|
| 1603.97 | 337.937 |
| 1603.97 | 406 |
| 1603.97 | 411 |
| 1603.97 | 418 |
| 1604.05 | 424 |
| 1604.07 | 425 |
| 1604.09 | 427 |
| 1604.01 | 425 |
| 1603.97 | 424 |
| 1603.97 | 425 |
| 1603.97 | 427 |
| 1603.97 | 440 |
| 1208 | 440 |
| 902 | 450 |
| 831 | 450 |
| 813 | 444 |
| 795 | 446 |
| 783 | 446 |
| 777 | 444 |
| 750 | 435 |
| 302 | 435 |
| 275 | 444 |
| 269 | 446 |
| 257 | 446 |
| 200 | 427 |
| -500 | 427 |
| -500 | 421 |
| -500 | 418 |
| -500 | 411 |
| -500 | 406 |
| -500 | 327 |

## Material Boundary

| X | Y |
|---|---|
| 302 | 435 |
| 317 | 430 |
| 326 | 427 |
| 726 | 427 |
| 735 | 430 |
| 750 | 435 |

## Material Boundary

| X | Y |
|---|---|
| 795 | 446 |
| 852 | 427 |
| 1603.97 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 200 | 427 |
| 200 | 424 |
| 317 | 430 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 421 |
| 200 | 424 |
| 852 | 424 |
| 1603.97 | 424 |
| 1604.05 | 424 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 418 |
| 1603.97 | 418 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 411 |
| 1603.97 | 411 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 406 |
| 1603.97 | 406 |

## Material Boundary

| X | Y |
|---|---|
| 735 | 430 |
| 842.25 | 427.25 |
| 845.5 | 427.167 |
| 852 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 1603.97 | 418 |

| | |
|---|---|
| 1603.97 | 424 |

## Material Boundary

| X | Y |
|---|---|
| 795 | 443 |
| 795 | 444 |
| 795 | 446 |

## Material Boundary

| X | Y |
|---|---|
| 795 | 443 |
| 842.25 | 427.25 |
| 852 | 424 |
| 852 | 425 |
| 852 | 427 |

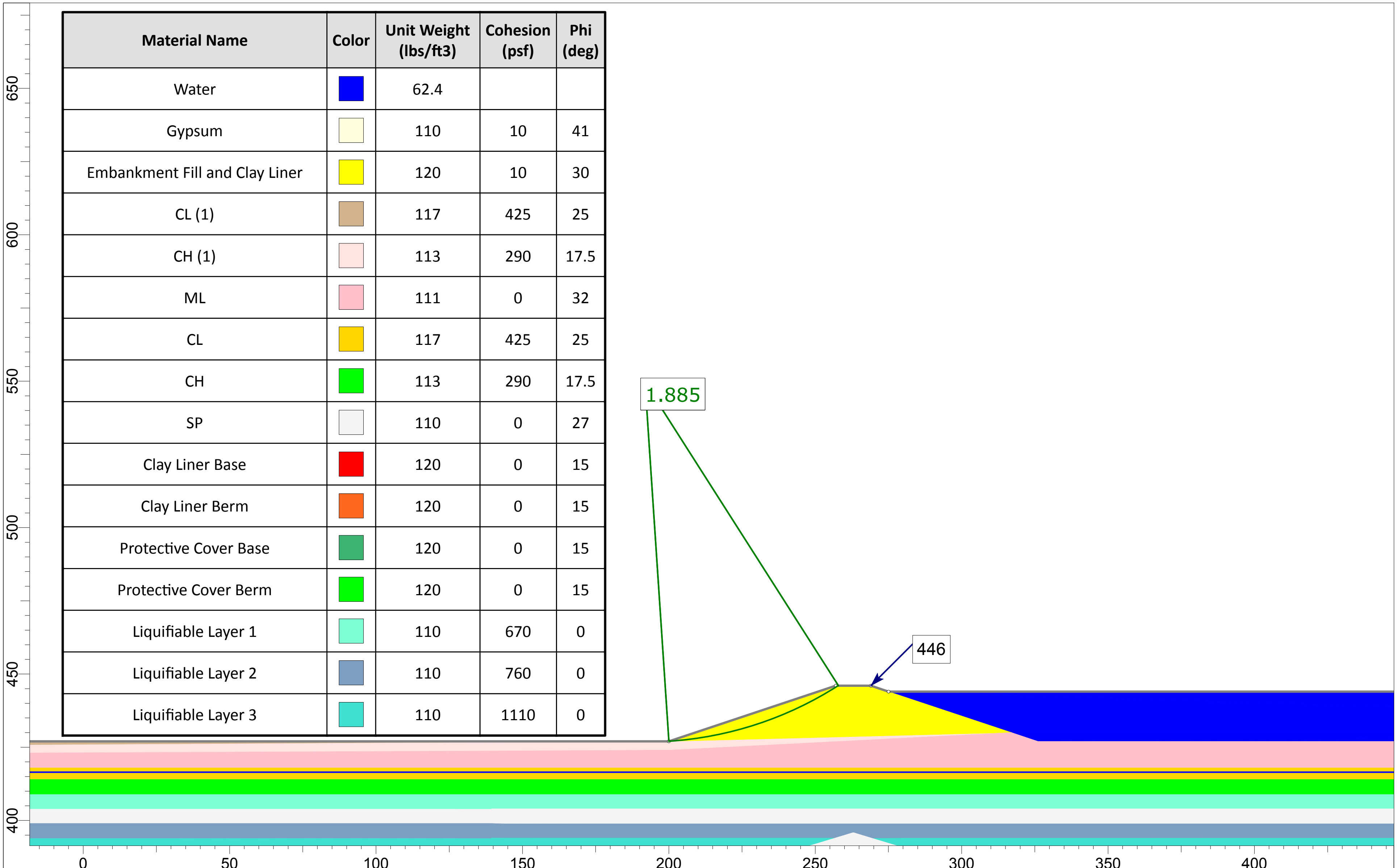
## Material Boundary

| X | Y |
|---|---|
| 795 | 444 |
| 845.5 | 427.167 |
| 852 | 425 |
| 1603.97 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 1604.01 | 425 |
| 1604.07 | 425 |

| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Water | | 62.4 | | |
| Gypsum | | 110 | 10 | 41 |
| Embankment Fill and Clay Liner | | 120 | 10 | 30 |
| CL (1) | | 117 | 425 | 25 |
| CH (1) | | 113 | 290 | 17.5 |
| ML | | 111 | 0 | 32 |
| CL | | 117 | 425 | 25 |
| CH | | 113 | 290 | 17.5 |
| SP | | 110 | 0 | 27 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |
| Liquifiable Layer 1 | | 110 | 670 | 0 |
| Liquifiable Layer 2 | | 110 | 760 | 0 |
| Liquifiable Layer 3 | | 110 | 1110 | 0 |




Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELL 2, NORTH BERM AT RECYCLE POND (SECTION B-B)
WITH LIQUEFACTION, NORTH BERM OF RECYCLE POND

REITZ & JENS, INC.

Figure 8-8

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | rand |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 50 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

## Materials

| Property | Water | Gypsum | Embankment Fill and Clay Liner | CL (1) | CH (1) | ML | CL | CH |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | No strength | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 62.4 | 110 | 120 | 117 | 113 | 111 | 117 | 113 |
| Cohesion [psf] | | 10 | 10 | 425 | 290 | 0 | 425 | 290 |
| Friction Angle [°] | | 41 | 30 | 25 | 17.5 | 32 | 25 | 17.5 |
| Water Surface | Piezometric Line 1 | Piezometric Line 1 | Piezometric Line 1 | Piezometric Line 1 | Piezometric Line 1 | Piezometric Line 1 | Piezometric Line 1 | Piezometric Line 1 |
| Hu Value | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| Property | SP | Clay Liner Base | Clay Liner Berm | Protective Cover Base | Protective Cover Berm | Liquifiable Layer 1 | Liquifiable Layer 2 | Liquifiable Layer 3 |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 110 | 120 | 120 | 120 | 120 | 110 | 110 | 110 |
| Cohesion [psf] | 0 | 0 | 0 | 0 | 0 | 670 | 760 | 1110 |
| Friction Angle [°] | 27 | 15 | 15 | 15 | 15 | 0 | 0 | 0 |
| Water Surface | Piezometric Line 1 | None | None | None | None | Piezometric Line 1 | None | None |
| Hu Value | 1 | | | | | 1 | | |
| Ru Value | | 0 | 0 | 0 | 0 | | 0 | 0 |

# Entity Information

## Piezoline

| X | Y |
|---|---|
| -500 | 416.5 |
| 3324 | 416.5 |

## External Boundary

| X | Y |
|---|---|
| 1220 | 440 |
| 902 | 450 |
| 831 | 450 |
| 813 | 444 |
| 795 | 446 |
| 783 | 446 |
| 777 | 444 |
| 275 | 444 |
| 269 | 446 |
| 257 | 446 |
| 200 | 427 |
| -500 | 427 |
| -500 | 423 |
| -500 | 421 |
| -500 | 418 |
| -500 | 414 |
| -500 | 409 |
| -500 | 404 |
| -500 | 399 |
| -500 | 394 |
| -500 | 389 |
| -500 | 379 |
| -500 | 377 |
| -500 | 327 |
| 1603.92 | 327 |
| 1603.92 | 390 |
| 1603.92 | 394 |
| 1603.92 | 399 |
| 1603.92 | 404 |
| 1603.92 | 409 |
| 1603.92 | 414 |
| 1603.92 | 418 |
| 1603.92 | 424 |
| 1603.92 | 425 |
| 1603.92 | 427 |
| 1603.92 | 440 |

## Material Boundary

| X | Y |
|---|---|

| | |
|---|---|
| 275 | 444 |
| 317 | 430 |
| 326 | 427 |
| 726 | 427 |
| 735 | 430 |
| 777 | 444 |

## Material Boundary

| X | Y |
|---|---|
| 795 | 446 |
| 852 | 427 |
| 1603.92 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 200 | 427 |
| 200 | 424 |
| 317 | 430 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 423 |
| 200 | 427 |
| 317 | 430 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 421 |
| 200 | 424 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 418 |
| 1603.92 | 418 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 414 |
| 1603.92 | 414 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 409 |
| 1603.92 | 409 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 404 |
| 139.448 | 404 |
| 888 | 404 |
| 1603.92 | 404 |

## Material Boundary

| X | Y |
|---|---|
| 735 | 430 |
| 842.25 | 427.25 |
| 845.5 | 427.167 |
| 852 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 795 | 443 |
| 795 | 444 |
| 795 | 446 |

## Material Boundary

| X | Y |
|---|---|
| 795 | 443 |
| 842.25 | 427.25 |
| 852 | 424 |
| 852 | 425 |
| 852 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 795 | 444 |
| 845.5 | 427.167 |
| 852 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 852 | 424 |
| 1603.92 | 424 |

## Material Boundary

| X | Y |
|---|---|
| 852 | 425 |
| 1603.92 | 425 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 377 |
| 200 | 377 |
| 206.629 | 379 |
| 239.777 | 389 |
| 256.351 | 394 |
| 262.98 | 396 |
| 269.614 | 394 |
| 286.198 | 389 |
| 319.366 | 379 |
| 326 | 377 |
| 726 | 377 |
| 732.348 | 379 |
| 764.091 | 389 |
| 779.962 | 394 |
| 786.31 | 396 |
| 819.827 | 399 |
| 831 | 400 |
| 869.9 | 399 |
| 1064.4 | 394 |
| 1220 | 390 |
| 1603.92 | 390 |

## Material Boundary

| X | Y |
|---|---|
| 139.448 | 379 |
| 139.448 | 389 |
| 139.448 | 394 |
| 139.448 | 399 |
| 139.448 | 404 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 379 |
| 139.448 | 379 |

## Material Boundary

| X | Y |
|---|---|
| 139.448 | 379 |
| 206.629 | 379 |
| 319.366 | 379 |
| 732.348 | 379 |

## Material Boundary

| X | Y |
|---|---|

| | |
|---|---|
| -500 | 399 |
| 139.448 | 399 |

## Material Boundary

| X | Y |
|---|---|
| 139.448 | 399 |
| 819.827 | 399 |
| 869.9 | 399 |
| 1603.92 | 399 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 394 |
| 139.448 | 394 |

## Material Boundary

| X | Y |
|---|---|
| 139.448 | 394 |
| 256.351 | 394 |
| 269.614 | 394 |
| 779.962 | 394 |
| 1064.4 | 394 |
| 1603.92 | 394 |

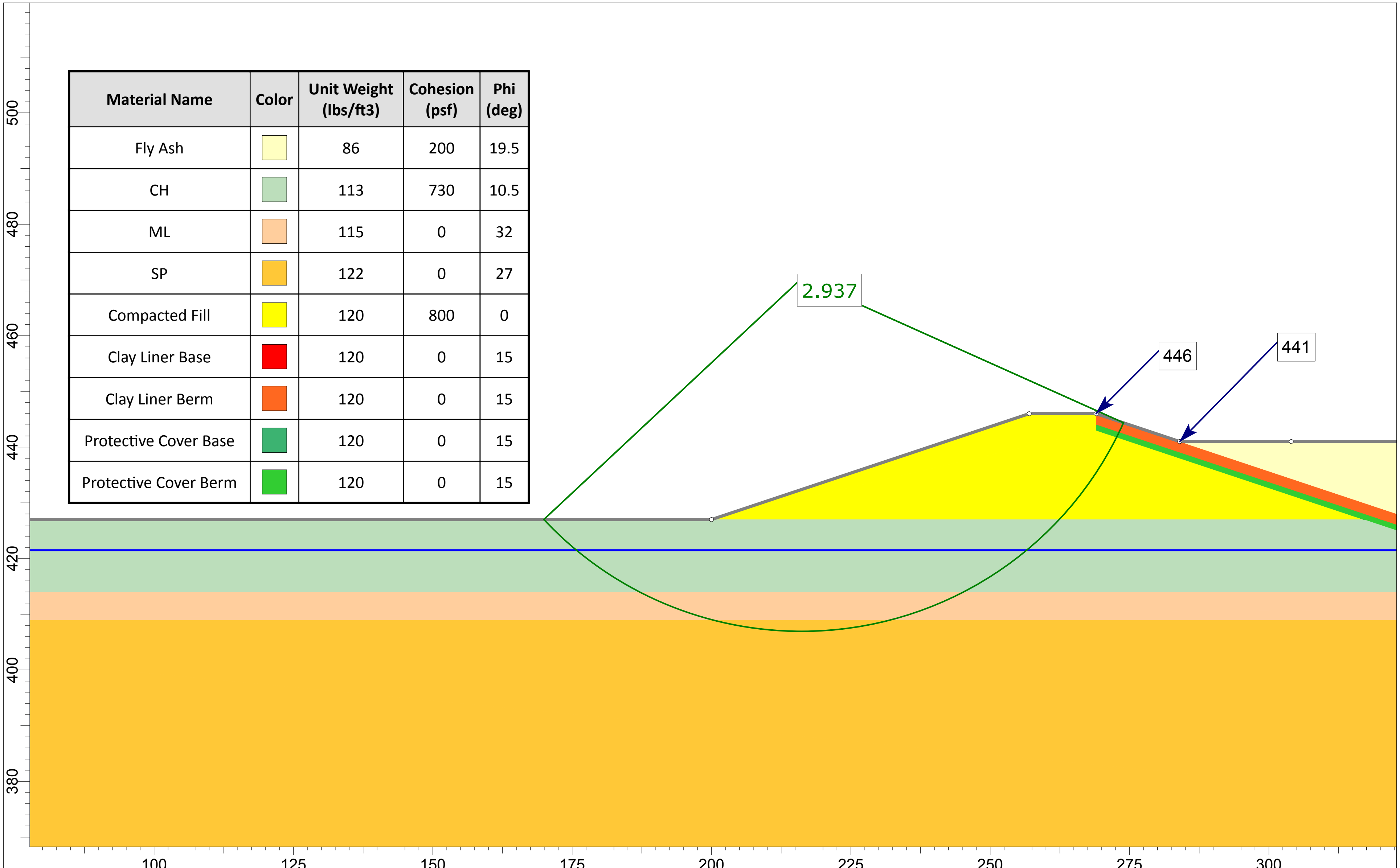
## Material Boundary

| X | Y |
|---|---|
| -500 | 389 |
| 139.448 | 389 |

## Material Boundary

| X | Y |
|---|---|
| 139.448 | 389 |
| 239.777 | 389 |
| 286.198 | 389 |
| 764.091 | 389 |

| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Fly Ash | | 86 | 200 | 19.5 |
| CH | | 113 | 730 | 10.5 |
| ML | | 115 | 0 | 32 |
| SP | | 122 | 0 | 27 |
| Compacted Fill | | 120 | 800 | 0 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |




Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELLS 4 & 5, NORTH BERM (SECTION C-C)
SHORT-TERM, INITIAL FILLING

REITZ & JENS, INC.

Figure 8-9

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 25 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 1 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | Park and Miller v.3 |

# Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 10 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth [ft]: | 2 |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

# Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

# Materials

| Property | Fly Ash | CH | ML | SP | Compacted Fill | Clay Liner Base | Clay Liner Berm | Protective Cover Base |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 86 | 113 | 115 | 122 | 120 | 120 | 120 | 120 |
| Cohesion [psf] | 200 | 730 | 0 | 0 | 800 | 0 | 0 | 0 |
| Friction Angle [°] | 19.5 | 10.5 | 32 | 27 | 0 | 15 | 15 | 15 |
| Water Surface | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table |
| Hu Value | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| Property | Protective Cover Berm |
|---|---|
| Color | |
| Strength Type | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 |
| Cohesion [psf] | 0 |
| Friction Angle [°] | 15 |
| Water Surface | Water Table |
| Hu Value | 1 |

# Entity Information

## Water Table

| X | Y |
|---|---|
| 0.362071 | 421.482 |

| | |
|---|---|
| 920.362 | 421.482 |

## External Boundary

| X | Y |
|---|---|
| 0 | 320 |
| 920 | 320 |
| 920 | 409 |
| 920 | 414 |
| 920 | 424 |
| 920 | 425 |
| 920 | 427 |
| 920 | 441 |
| 304 | 441 |
| 284 | 441 |
| 269 | 446 |
| 257 | 446 |
| 200 | 427 |
| 0 | 427 |
| 0 | 414 |
| 0 | 409 |

## Material Boundary

| X | Y |
|---|---|
| 200 | 427 |
| 317 | 427 |
| 320 | 427 |
| 326 | 427 |
| 920 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 284 | 441 |
| 326 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 414 |
| 920 | 414 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 409 |
| 920 | 409 |

## Material Boundary

| X | Y |
|---|---|

| | |
|---|---|
| 269 | 443 |
| 269 | 444 |
| 269 | 446 |

## Material Boundary

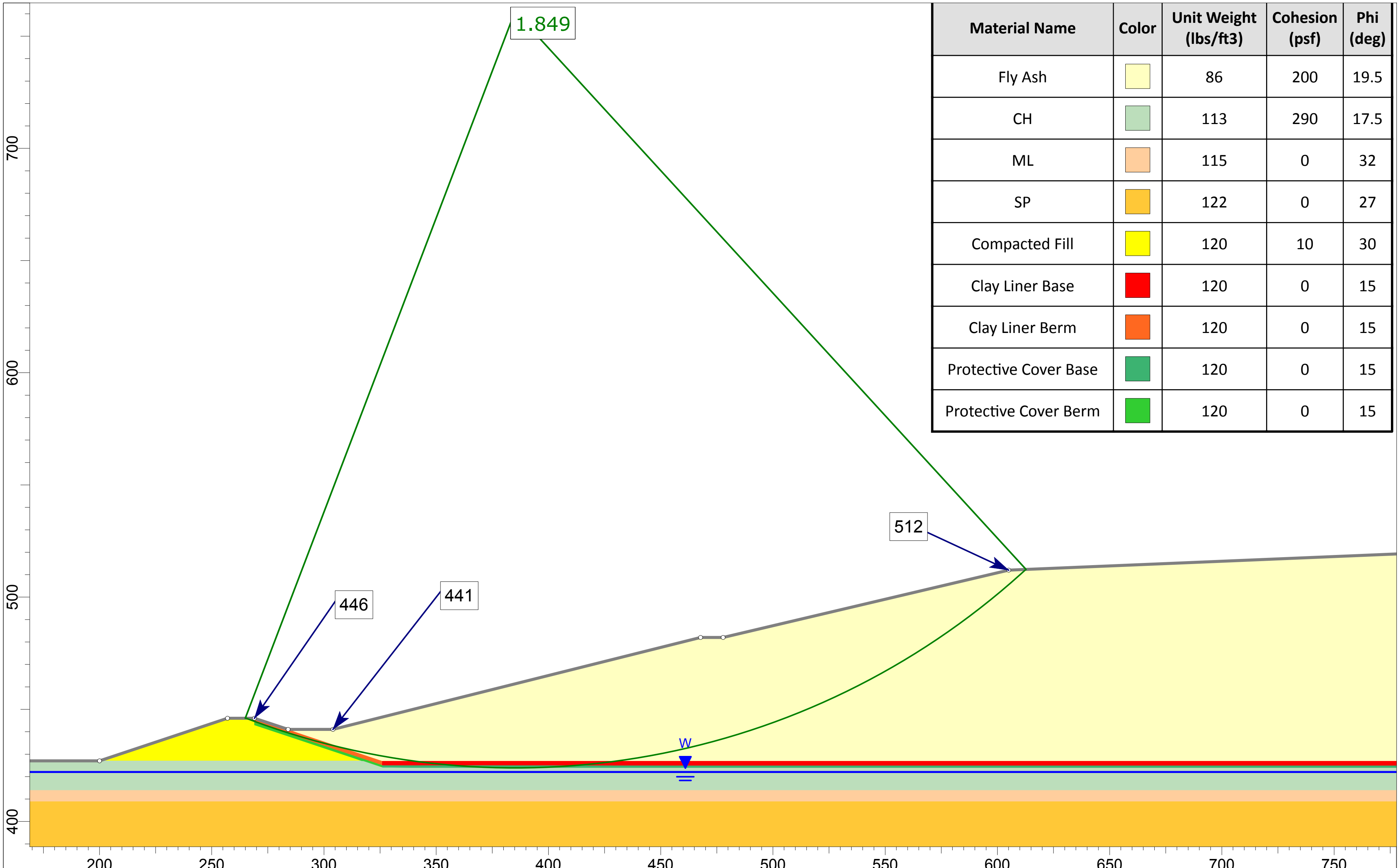
| X | Y |
|---|---|
| 269 | 443 |
| 317 | 427 |
| 326 | 424 |
| 326 | 425 |
| 326 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 326 | 424 |
| 920 | 424 |

## Material Boundary

| X | Y |
|---|---|
| 269 | 444 |
| 320 | 427 |
| 326 | 425 |
| 920 | 425 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Fly Ash | | 86 | 200 | 19.5 |
| CH | | 113 | 290 | 17.5 |
| ML | | 115 | 0 | 32 |
| SP | | 122 | 0 | 27 |
| Compacted Fill | | 120 | 10 | 30 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |

Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELLS 4 & 5, NORTH BERM (SECTION C-C)
LONG-TERM, CLOSED CELL

REITZ & JENS, INC.

Figure 8-10

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 25 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 1 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | Park and Miller v.3 |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

## Materials

| Property | Fly Ash | CH | ML | SP | Compacted Fill | Clay Liner Base | Clay Liner Berm | Protective Cover Base |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 86 | 113 | 115 | 122 | 120 | 120 | 120 | 120 |
| Cohesion [psf] | 200 | 290 | 0 | 0 | 10 | 0 | 0 | 0 |
| Friction Angle [°] | 19.5 | 17.5 | 32 | 27 | 30 | 15 | 15 | 15 |
| Water Surface | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table |
| Hu Value | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| Property | Protective Cover Berm |
|---|---|
| Color | |
| Strength Type | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 |
| Cohesion [psf] | 0 |
| Friction Angle [°] | 15 |
| Water Surface | Water Table |
| Hu Value | 1 |

## Entity Information

### Water Table

| X | Y |
|---|---|
| 0.983889 | 422.014 |

| | |
|---|---|
| 920.984 | 422.014 |

## External Boundary

| X | Y |
|---|---|
| 0 | 320 |
| 920 | 320 |
| 920 | 409 |
| 920 | 414 |
| 920 | 424 |
| 920 | 425 |
| 920 | 427 |
| 920 | 525 |
| 916 | 525 |
| 605 | 512 |
| 477.785 | 482 |
| 467.785 | 482 |
| 304 | 441 |
| 284 | 441 |
| 269 | 446 |
| 257 | 446 |
| 200 | 427 |
| 0 | 427 |
| 0 | 414 |
| 0 | 409 |

## Material Boundary

| X | Y |
|---|---|
| 200 | 427 |
| 317 | 427 |
| 320 | 427 |
| 326 | 427 |
| 920 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 284 | 441 |
| 326 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 414 |
| 920 | 414 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 409 |
| 920 | 409 |

## Material Boundary

| X | Y |
|---|---|
| 605 | 512 |
| 920 | 525 |

## Material Boundary

| X | Y |
|---|---|
| 269 | 443 |
| 269 | 444 |
| 269 | 446 |

## Material Boundary

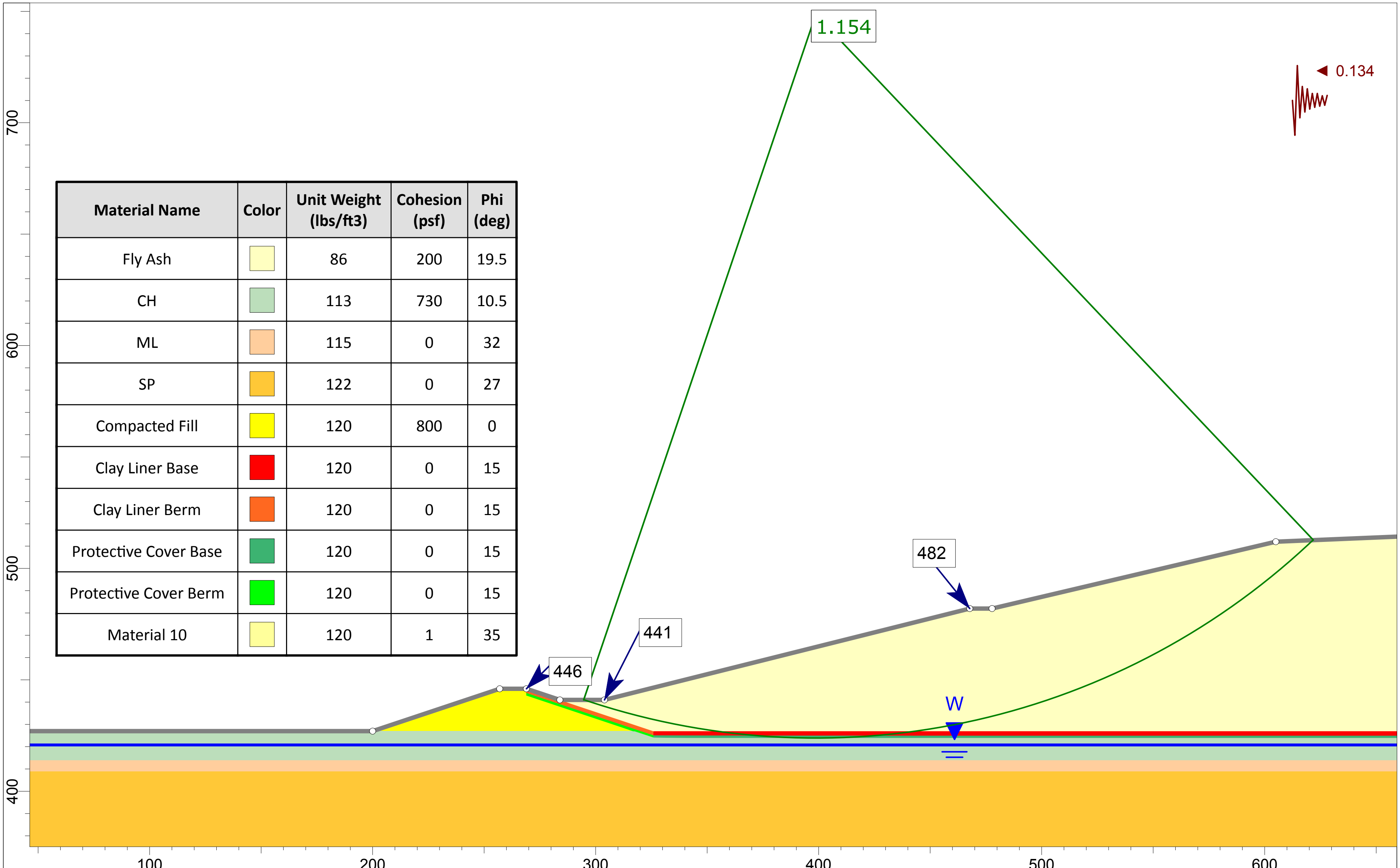
| X | Y |
|---|---|
| 269 | 443 |
| 317 | 427 |
| 326 | 424 |
| 326 | 425 |
| 326 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 326 | 424 |
| 920 | 424 |

## Material Boundary

| X | Y |
|---|---|
| 269 | 444 |
| 320 | 427 |
| 326 | 425 |
| 920 | 425 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Fly Ash | | 86 | 200 | 19.5 |
| CH | | 113 | 730 | 10.5 |
| ML | | 115 | 0 | 32 |
| SP | | 122 | 0 | 27 |
| Compacted Fill | | 120 | 800 | 0 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |
| Material 10 | | 120 | 1 | 35 |

Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELLS 4 & 5, NORTH BERM (SECTION C-C)
SEISMIC, CLOSED CELL

REITZ & JENS, INC.

Figure 8-11

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

| | |
|---|---|
| Slices Type: | Vertical |

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 25 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 1 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | Park and Miller v.3 |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

Advanced seismic analysis: No
Staged pseudostatic analysis: No

Seismic Load Coefficient (Horizontal): 0.134

## Materials

| Property | Fly Ash | CH | ML | SP | Compacted Fill | Clay Liner Base | Clay Liner Berm | Protective Cover Base |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 86 | 113 | 115 | 122 | 120 | 120 | 120 | 120 |
| Cohesion [psf] | 200 | 730 | 0 | 0 | 800 | 0 | 0 | 0 |
| Friction Angle [°] | 19.5 | 10.5 | 32 | 27 | 0 | 15 | 15 | 15 |
| Water Surface | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table |
| Hu Value | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| Property | Protective Cover Berm |
|---|---|
| Color | |
| Strength Type | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 |
| Cohesion [psf] | 0 |
| Friction Angle [°] | 15 |
| Water Surface | Water Table |
| Hu Value | 1 |

## Entity Information

### Water Table

| X | Y |
|---|---|
| 0.978654 | 420.786 |
| 920.979 | 420.786 |

## External Boundary

| X | Y |
|---|---|
| 0 | 320 |
| 920 | 320 |
| 920 | 409 |
| 920 | 414 |
| 920 | 424 |
| 920 | 425 |
| 920 | 427 |
| 920 | 525 |
| 916 | 525 |
| 605 | 512 |
| 477.785 | 482 |
| 467.785 | 482 |
| 304 | 441 |
| 284 | 441 |
| 269 | 446 |
| 257 | 446 |
| 200 | 427 |
| 0 | 427 |
| 0 | 414 |
| 0 | 409 |

## Material Boundary

| X | Y |
|---|---|
| 200 | 427 |
| 317 | 427 |
| 320 | 427 |
| 326 | 427 |
| 920 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 284 | 441 |
| 326 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 414 |
| 920 | 414 |

## Material Boundary

| X | Y |
|---|---|

| | |
|---|---|
| 0 | 409 |
| 920 | 409 |

## Material Boundary

| X | Y |
|---|---|
| 269 | 443 |
| 269 | 444 |
| 269 | 446 |

## Material Boundary

| X | Y |
|---|---|
| 326 | 424 |
| 326 | 425 |
| 326 | 427 |

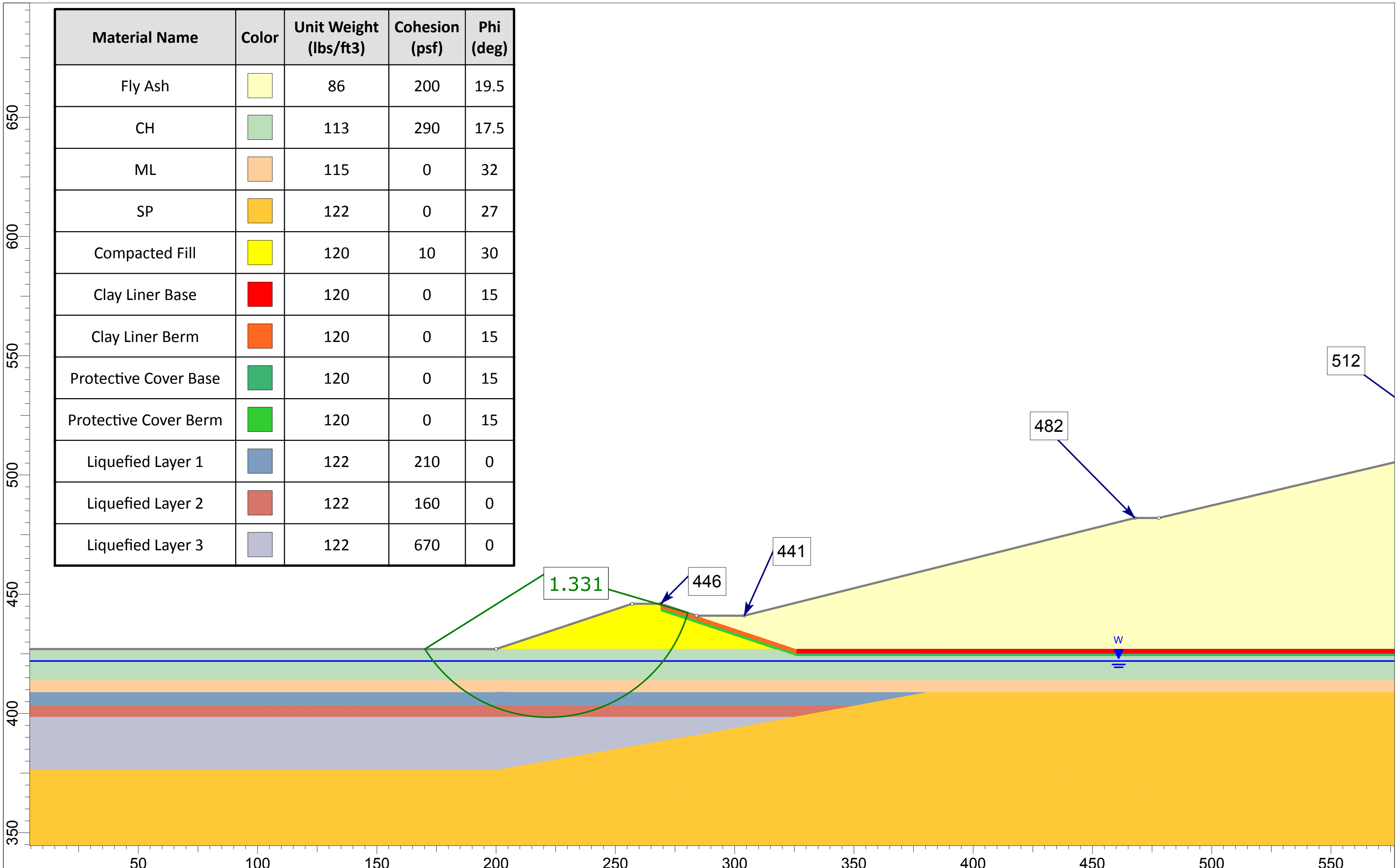
## Material Boundary

| X | Y |
|---|---|
| 269 | 443 |
| 317 | 427 |
| 326 | 424 |
| 920 | 424 |

## Material Boundary

| X | Y |
|---|---|
| 269 | 444 |
| 320 | 427 |
| 326 | 425 |
| 920 | 425 |

| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Fly Ash | | 86 | 200 | 19.5 |
| CH | | 113 | 290 | 17.5 |
| ML | | 115 | 0 | 32 |
| SP | | 122 | 0 | 27 |
| Compacted Fill | | 120 | 10 | 30 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |
| Liquefied Layer 1 | | 122 | 210 | 0 |
| Liquefied Layer 2 | | 122 | 160 | 0 |
| Liquefied Layer 3 | | 122 | 670 | 0 |




Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELLS 4 & 5, NORTH BERM (SECTION C-C)
WITH LIQUEFACTION, CLOSED CELL

REITZ & JENS, INC.

Figure 8-12

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 25 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 1 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | Park and Miller v.3 |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

## Materials

| Property | Fly Ash | CH | ML | SP | Compacted Fill | Clay Liner Base | Clay Liner Berm | Protective Cover Base |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 86 | 113 | 115 | 122 | 120 | 120 | 120 | 120 |
| Cohesion [psf] | 200 | 290 | 0 | 0 | 10 | 0 | 0 | 0 |
| Friction Angle [°] | 19.5 | 17.5 | 32 | 27 | 30 | 15 | 15 | 15 |
| Water Surface | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table |
| Hu Value | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| Property | Protective Cover Berm | Liquefied Layer 1 | Liquefied Layer 2 | Liquefied Layer 3 |
|---|---|---|---|---|
| Color | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 | 122 | 122 | 122 |
| Cohesion [psf] | 0 | 210 | 160 | 670 |
| Friction Angle [°] | 15 | 0 | 0 | 0 |
| Water Surface | Water Table | Water Table | Water Table | Water Table |
| Hu Value | 1 | 1 | 1 | 1 |

## Entity Information

### Water Table

| X | Y |
|---|---|
| 0.983889 | 422.014 |

| | |
|---|---|
| 920.984 | 422.014 |

## External Boundary

| X | Y |
|---|---|
| 0 | 320 |
| 920 | 320 |
| 920 | 409 |
| 920 | 414 |
| 920 | 424 |
| 920 | 425 |
| 920 | 427 |
| 920 | 525 |
| 916 | 525 |
| 605 | 512 |
| 477.785 | 482 |
| 467.785 | 482 |
| 304 | 441 |
| 284 | 441 |
| 269 | 446 |
| 257 | 446 |
| 200 | 427 |
| 0 | 427 |
| 0 | 414 |
| 0 | 409 |
| 0 | 403.5 |
| 0 | 398.5 |
| 0 | 376.244 |

## Material Boundary

| X | Y |
|---|---|
| 200 | 427 |
| 317 | 427 |
| 320 | 427 |
| 326 | 427 |
| 920 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 284 | 441 |
| 326 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 414 |
| 200 | 414 |
| 920 | 414 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 409 |
| 200 | 409 |
| 380.664 | 409 |
| 920 | 409 |

## Material Boundary

| X | Y |
|---|---|
| 605 | 512 |
| 920 | 525 |

## Material Boundary

| X | Y |
|---|---|
| 269 | 443 |
| 269 | 444 |
| 269 | 446 |

## Material Boundary

| X | Y |
|---|---|
| 269 | 443 |
| 317 | 427 |
| 326 | 424 |
| 326 | 425 |
| 326 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 326 | 424 |
| 920 | 424 |

## Material Boundary

| X | Y |
|---|---|
| 269 | 444 |
| 320 | 427 |
| 326 | 425 |
| 920 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 403.5 |
| 200 | 403.5 |

## Material Boundary

| X | Y |
|---|---|

| | |
|---|---|
| 0 | 376.244 |
| 200 | 376.244 |

## Material Boundary

| X | Y |
|---|---|
| 200 | 376.244 |
| 284 | 391 |
| 324.277 | 398.5 |
| 351.128 | 403.5 |
| 380.664 | 409 |
| 381.182 | 409.096 |

## Material Boundary

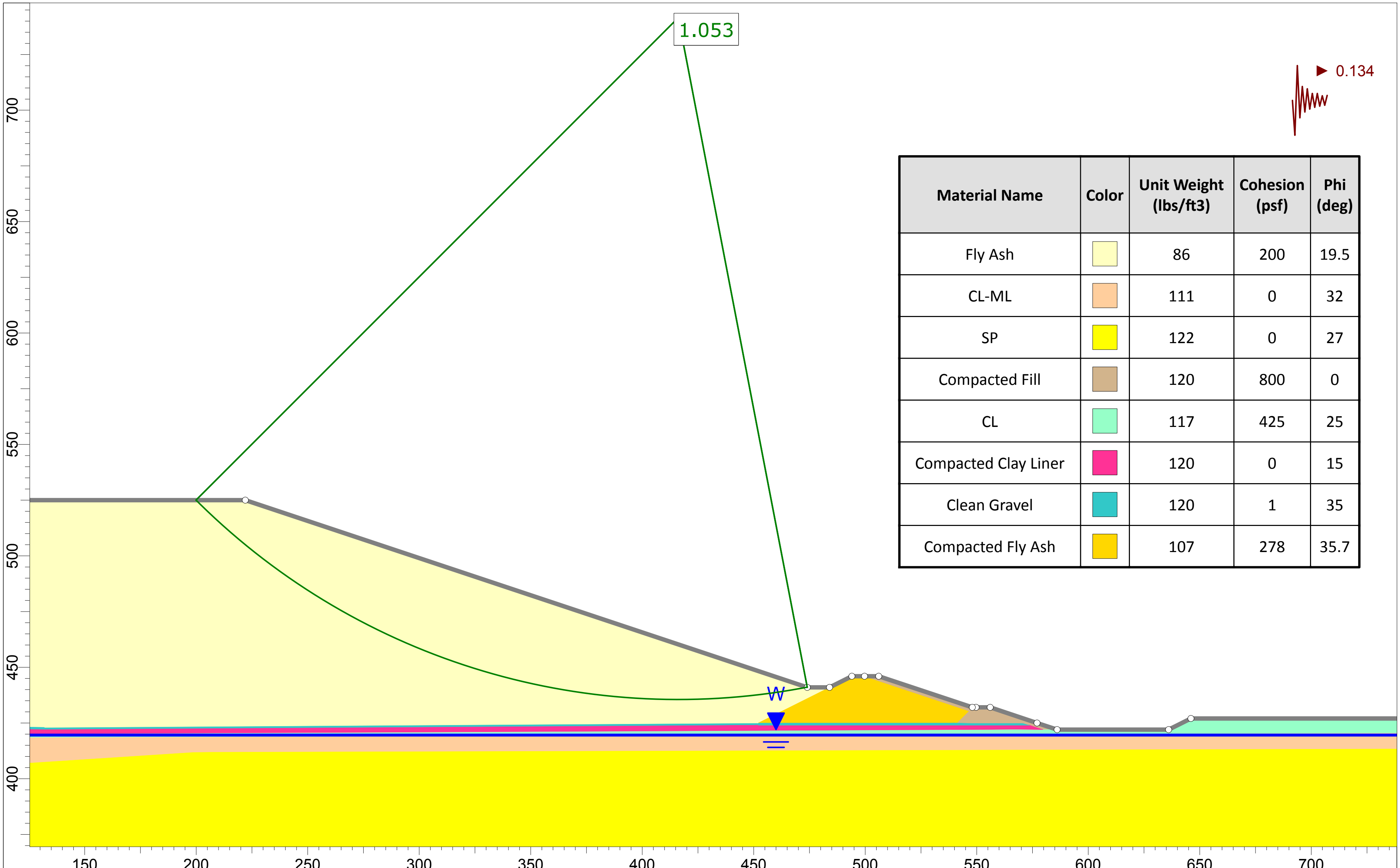
| X | Y |
|---|---|
| 200 | 403.5 |
| 351.128 | 403.5 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 398.5 |
| 200 | 398.5 |

## Material Boundary

| X | Y |
|---|---|
| 200 | 398.5 |
| 324.277 | 398.5 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Fly Ash | | 86 | 200 | 19.5 |
| CL-ML | | 111 | 0 | 32 |
| SP | | 122 | 0 | 27 |
| Compacted Fill | | 120 | 800 | 0 |
| CL | | 117 | 425 | 25 |
| Compacted Clay Liner | | 120 | 0 | 15 |
| Clean Gravel | | 120 | 1 | 35 |
| Compacted Fly Ash | | 107 | 278 | 35.7 |

Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELLS 4A, EAST TEMPORARY CCR BERM
SEISMIC, FULL CELL 4A

REITZ & JENS, INC.

Figure 8-13

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Left to Right |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 25 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 1 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | Park and Miller v.3 |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

Advanced seismic analysis: No
Staged pseudostatic analysis: No

Seismic Load Coefficient (Horizontal): 0.131

## Materials

| Property | Fly Ash | CL-ML | SP | Compacted Fill | CL | Compacted Clay Liner | Clean Gravel | Compacted Fly Ash |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unsaturated Unit Weight [lbs/ft3] | | | | | | | | 107 |
| Saturated Unit Weight [lbs/ft3] | | | | | | | | 107 |
| Cohesion [psf] | 200 | 0 | 0 | 800 | 425 | 0 | 1 | 278 |
| Friction Angle [°] | 19.5 | 32 | 27 | 0 | 25 | 15 | 35 | 35.7 |
| Water Surface | None | Water Table | Water Table | Water Table | Water Table | Water Table | None | None |
| Hu Value | | 1 | 1 | 1 | 1 | 1 | | |
| Ru Value | 0 | | | | | | 0 | 0 |

## Entity Information

### Water Table

| X | Y |
|---|---|
| -0.0025923 | 419.574 |
| 919.997 | 419.574 |

## Block Search Polyline

| X | Y |
|---|---|
| 132 | 422 |
| 449.766 | 423.986 |

## External Boundary

| X | Y |
|---|---|
| 0 | 425 |
| 0 | 424 |
| 0 | 422 |
| 2.13163e-14 | 418 |
| 7.10543e-15 | 399 |
| 0 | 320 |
| 920 | 320 |
| 920 | 409 |
| 920 | 414 |
| 920 | 421 |
| 920 | 423 |
| 920 | 427 |
| 646 | 427 |
| 636 | 422 |
| 586 | 422 |
| 577 | 425 |
| 556 | 432 |
| 549.675 | 432 |
| 548 | 432 |
| 506 | 446 |
| 499.675 | 446 |
| 494 | 446 |
| 484 | 441 |
| 474 | 441 |
| 222 | 525 |
| 0 | 525 |

## Material Boundary

| X | Y |
|---|---|
| 7.10543e-15 | 399 |
| 200 | 412 |
| 920 | 414 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 422 |
| 132 | 420 |

## Material Boundary

| X | Y |
|---|---|
| 132 | 420 |

| | |
|---|---|
| 132 | 422 |
| 132 | 423 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 424 |
| 132 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 132 | 422 |
| 452 | 424 |

## Material Boundary

| X | Y |
|---|---|
| 452 | 425 |
| 541 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 570.675 | 425 |
| 577 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 132 | 423 |
| 452 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 132 | 420 |
| 579.675 | 422 |
| 586 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 425 |
| 132 | 423 |

## Material Boundary

| X | Y |
|---|---|
| 2.13163e-14 | 418 |
| 920 | 421 |

## Material Boundary

| X | Y |
|---|---|
| 452 | 425 |
| 484 | 441 |

## Material Boundary

| X | Y |
|---|---|
| 541 | 425 |
| 546.419 | 430.419 |
| 548 | 432 |

## Material Boundary

| X | Y |
|---|---|
| 499.675 | 446 |
| 546.419 | 430.419 |

## Material Boundary

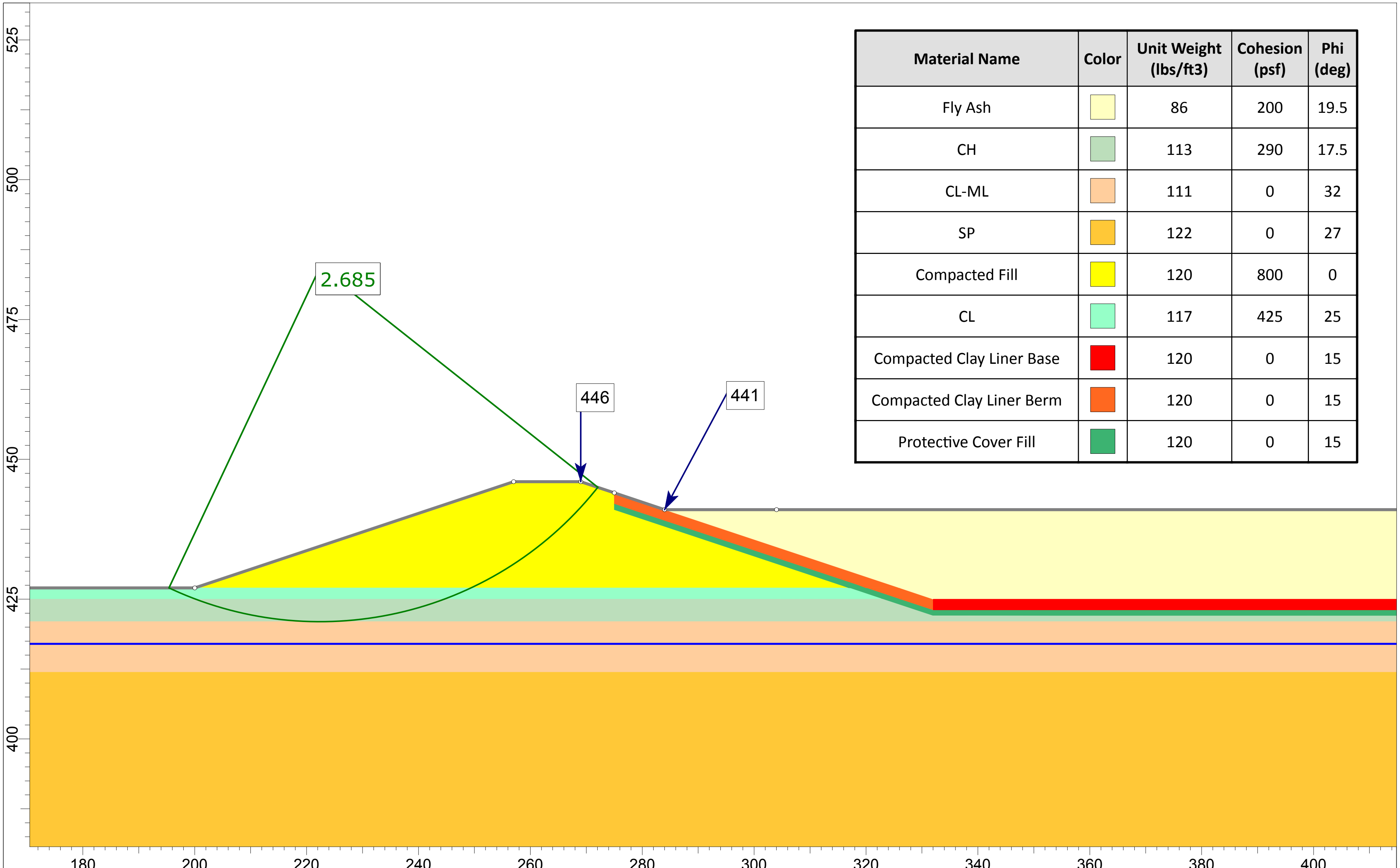
| X | Y |
|---|---|
| 570.675 | 425 |
| 573.675 | 424 |
| 579.675 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 541 | 425 |
| 570.675 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 452 | 424 |
| 573.675 | 424 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Fly Ash | | 86 | 200 | 19.5 |
| CH | | 113 | 290 | 17.5 |
| CL-ML | | 111 | 0 | 32 |
| SP | | 122 | 0 | 27 |
| Compacted Fill | | 120 | 800 | 0 |
| CL | | 117 | 425 | 25 |
| Compacted Clay Liner Base | | 120 | 0 | 15 |
| Compacted Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Fill | | 120 | 0 | 15 |

Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELLS 6 & 7, SOUTH BERM (SECTION D-D)
SHORT-TERM, INITIAL FILLING

REITZ & JENS, INC.

Figure 8-14

# Slide Analysis Information
# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 25 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 1 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | Park and Miller v.3 |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 10 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

## Materials

| Property | Fly Ash | CH | CL-ML | SP | Compacted Fill | CL | Compacted Clay Liner Base | Compacted Clay Liner Berm |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 86 | 113 | 111 | 122 | 120 | 117 | 120 | 120 |
| Cohesion [psf] | 200 | 290 | 0 | 0 | 800 | 425 | 0 | 0 |
| Friction Angle [°] | 19.5 | 17.5 | 32 | 27 | 0 | 25 | 15 | 15 |
| Water Surface | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table |
| Hu Value | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| Property | Protective Cover Fill |
|---|---|
| Color | |
| Strength Type | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 |
| Cohesion [psf] | 0 |
| Friction Angle [°] | 15 |
| Water Surface | Water Table |
| Hu Value | 1 |

## Entity Information

### Water Table

| X | Y |
|---|---|
| 0 | 417 |
| 920 | 417 |

## External Boundary

| X | Y |
|---|---|
| 0 | 320 |
| 920 | 320 |
| 920 | 409 |
| 920 | 412 |
| 920 | 414 |
| 920 | 421 |
| 920 | 422 |
| 920 | 423 |
| 920 | 425 |
| 920 | 427 |
| 920 | 441 |
| 304 | 441 |
| 284 | 441 |
| 275 | 444 |
| 269 | 446 |
| 257 | 446 |
| 200 | 427 |
| 0 | 427 |
| 0 | 425 |
| 0 | 421 |
| 0 | 414 |
| 0 | 412 |
| 0 | 409 |

## Material Boundary

| X | Y |
|---|---|
| 200 | 427 |
| 317 | 427 |
| 320.006 | 427 |
| 326 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 421 |
| 920 | 421 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 412 |
| 920 | 412 |

## Material Boundary

| X | Y |
|---|---|
| 275 | 444 |
| 275 | 442 |
| 320.006 | 427 |
| 326.003 | 425 |
| 332 | 423 |
| 920 | 423 |

## Material Boundary

| X | Y |
|---|---|
| 284 | 441 |
| 326 | 427 |
| 332 | 425 |
| 920 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 425 |
| 323 | 425 |
| 326.003 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 275 | 441 |
| 275 | 442 |

## Material Boundary

| X | Y |
|---|---|
| 275 | 441 |
| 317 | 427 |
| 323 | 425 |
| 332 | 422 |
| 332 | 423 |

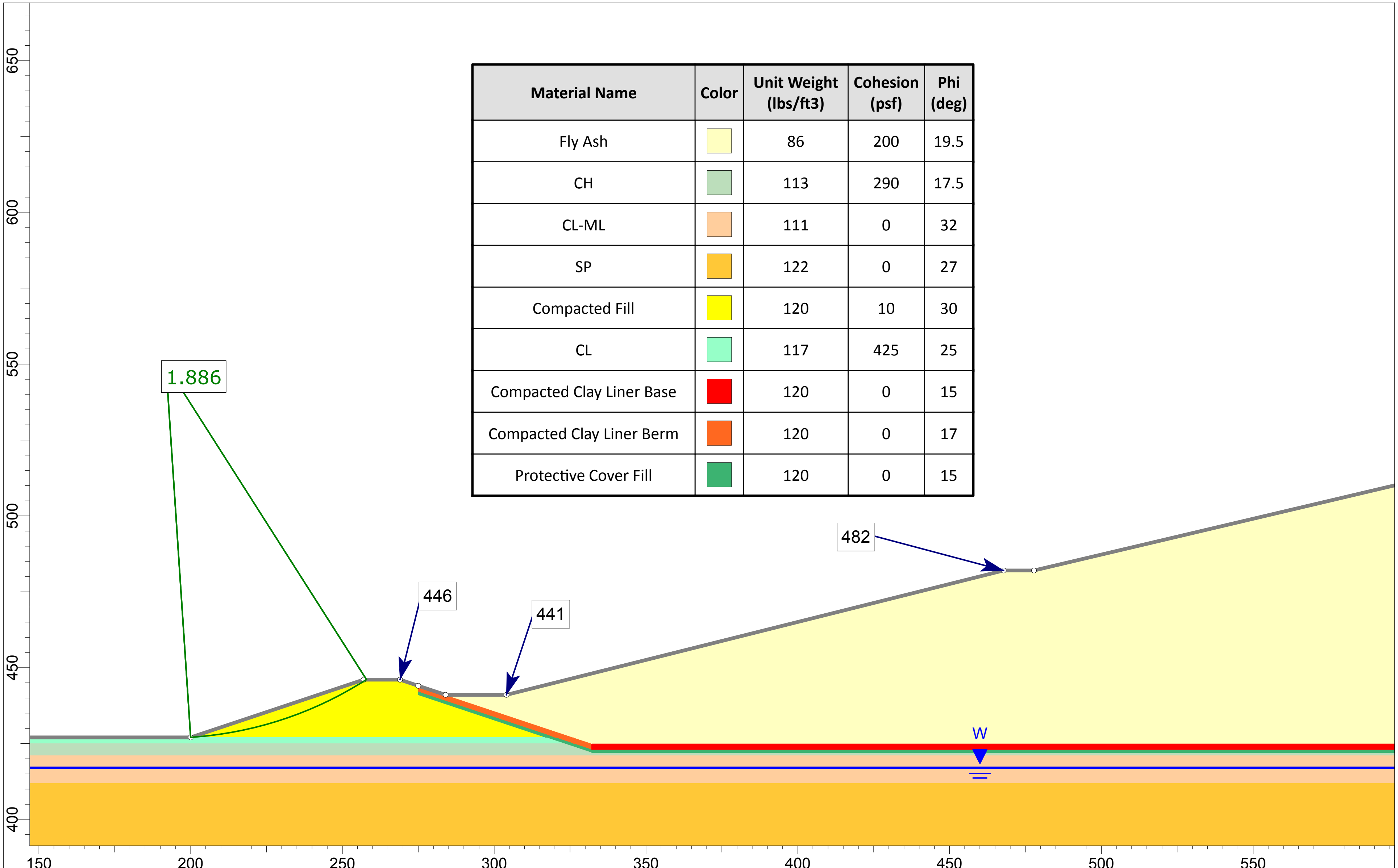
## Material Boundary

| X | Y |
|---|---|
| 332 | 422 |
| 920 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 332 | 423 |
| 332 | 425 |

| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Fly Ash | | 86 | 200 | 19.5 |
| CH | | 113 | 290 | 17.5 |
| CL-ML | | 111 | 0 | 32 |
| SP | | 122 | 0 | 27 |
| Compacted Fill | | 120 | 10 | 30 |
| CL | | 117 | 425 | 25 |
| Compacted Clay Liner Base | | 120 | 0 | 15 |
| Compacted Clay Liner Berm | | 120 | 0 | 17 |
| Protective Cover Fill | | 120 | 0 | 15 |




Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELLS 6 & 7, SOUTH BERM (SECTION D-D)
LONG-TERM, CLOSED CELL

REITZ & JENS, INC.

Figure 8-15

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 25 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 1 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | Park and Miller v.3 |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 10 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

## Materials

| Property | Fly Ash | CH | CL-ML | SP | Compacted Fill | CL | Compacted Clay Liner Base | Compacted Clay Liner Berm |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 86 | 113 | 111 | 122 | 120 | 117 | 120 | 120 |
| Cohesion [psf] | 200 | 290 | 0 | 0 | 10 | 425 | 0 | 0 |
| Friction Angle [°] | 19.5 | 17.5 | 32 | 27 | 30 | 25 | 15 | 17 |
| Water Surface | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table |
| Hu Value | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| Property | Protective Cover Fill |
|---|---|
| Color | |
| Strength Type | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 |
| Cohesion [psf] | 0 |
| Friction Angle [°] | 15 |
| Water Surface | Water Table |
| Hu Value | 1 |

## Entity Information

### Water Table

| X | Y |
|---|---|
| 0 | 417 |
| 920 | 417 |

## External Boundary

| X | Y |
|---|---|
| 0 | 320 |
| 920 | 320 |
| 920 | 409 |
| 920 | 412 |
| 920 | 414 |
| 920 | 421 |
| 920 | 422 |
| 920 | 423 |
| 920 | 425 |
| 920 | 427 |
| 920 | 428 |
| 920 | 525 |
| 916 | 525 |
| 605 | 512 |
| 477.785 | 482 |
| 467.785 | 482 |
| 304 | 441 |
| 284 | 441 |
| 275 | 444 |
| 269 | 446 |
| 257 | 446 |
| 200 | 427 |
| 0 | 427 |
| 0 | 425 |
| 0 | 421 |
| 0 | 414 |
| 0 | 412 |
| 0 | 409 |

## Material Boundary

| X | Y |
|---|---|
| 200 | 427 |
| 317 | 427 |
| 320.006 | 427 |
| 326 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 421 |
| 920 | 421 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 412 |
| 920 | 412 |

## Material Boundary

| X | Y |
|---|---|
| 275 | 444 |
| 275 | 442 |
| 320.006 | 427 |
| 326.003 | 425 |
| 332 | 423 |
| 920 | 423 |

## Material Boundary

| X | Y |
|---|---|
| 284 | 441 |
| 326 | 427 |
| 332 | 425 |
| 920 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 425 |
| 323 | 425 |
| 326.003 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 275 | 441 |
| 275 | 442 |

## Material Boundary

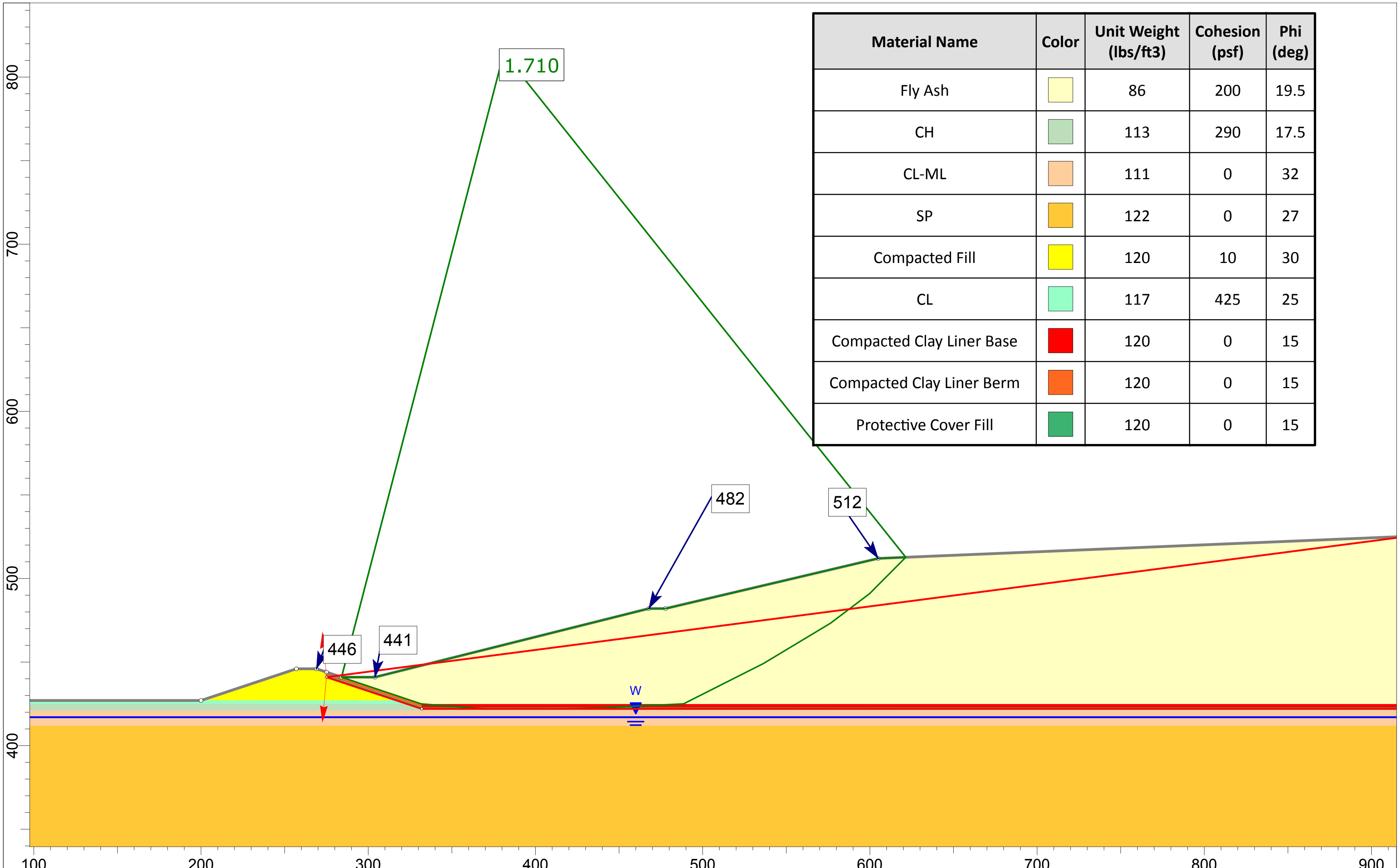
| X | Y |
|---|---|
| 275 | 441 |
| 317 | 427 |
| 323 | 425 |
| 332 | 422 |
| 332 | 423 |

## Material Boundary

| X | Y |
|---|---|
| 332 | 422 |
| 920 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 332 | 423 |
| 332 | 425 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Fly Ash | | 86 | 200 | 19.5 |
| CH | | 113 | 290 | 17.5 |
| CL-ML | | 111 | 0 | 32 |
| SP | | 122 | 0 | 27 |
| Compacted Fill | | 120 | 10 | 30 |
| CL | | 117 | 425 | 25 |
| Compacted Clay Liner Base | | 120 | 0 | 15 |
| Compacted Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Fill | | 120 | 0 | 15 |

Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELLS 6 & 7, SOUTH BERM (SECTION D-D)
LONG-TERM, CLOSED CELL, SLIDING ALONG AQUICLUDE

REITZ & JENS, INC.

Figure 8-16

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 25 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 1 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | Park and Miller v.3 |

## Surface Options

| | |
|---|---|
| Surface Type: | Non-Circular Block Search |
| Number of Surfaces: | 100000 |
| Multiple Groups: | Disabled |
| Pseudo-Random Surfaces: | Enabled |
| Convex Surfaces Only: | Disabled |
| Left Projection Angle (Start Angle) [°]: | 95 |
| Left Projection Angle (End Angle) [°]: | 265 |
| Right Projection Angle (Start Angle) [°]: | -85 |
| Right Projection Angle (End Angle) [°]: | 85 |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

Advanced seismic analysis: No
Staged pseudostatic analysis: No

Seismic Load Coefficient (Horizontal): 0.131

## Materials

| Property | Fly Ash | CH | CL-ML | SP | Compacted Fill | CL | Clay Liner Base | Clay Liner Berm |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 86 | 113 | 111 | 122 | 120 | 117 | 120 | 120 |
| Cohesion [psf] | 200 | 730 | 1400 | 0 | 800 | 750 | 0 | 0 |
| Friction Angle [°] | 19.5 | 10.5 | 15 | 29 | 0 | 10 | 15 | 15 |
| Water Surface | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table |
| Hu Value | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| Property | Protective Fill Base | Protective Fill Berm |
|---|---|---|
| Color | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 | 120 |
| Cohesion [psf] | 0 | 0 |
| Friction Angle [°] | 15 | 15 |
| Water Surface | Water Table | Water Table |
| Hu Value | 1 | 1 |

## Entity Information

## Water Table

| X | Y |
|---|---|
| 0 | 422.655 |
| 920 | 422.655 |

## Block Search Window

| X | Y |
|---|---|
| 269 | 443 |
| 326 | 424 |
| 920 | 424 |
| 920 | 525 |

## External Boundary

| X | Y |
|---|---|
| 0 | 320 |
| 920 | 320 |
| 920 | 409 |
| 920 | 412 |
| 920 | 414 |
| 920 | 421 |
| 920 | 424 |
| 920 | 425 |
| 920 | 427 |
| 920 | 525 |
| 916 | 525 |
| 605 | 512 |
| 477.785 | 482 |
| 467.785 | 482 |
| 304 | 441 |
| 284 | 441 |
| 269 | 446 |
| 257 | 446 |
| 200 | 427 |
| 0 | 427 |
| 0 | 425 |
| 0 | 421 |
| 0 | 414 |
| 0 | 412 |
| 0 | 409 |

## Material Boundary

| X | Y |
|---|---|
| 200 | 427 |
| 317 | 427 |
| 320 | 427 |
| 326 | 427 |
| 920 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 284 | 441 |
| 326 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 425 |
| 323 | 425 |
| 326 | 425 |
| 920 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 421 |
| 920 | 421 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 412 |
| 920 | 412 |

## Material Boundary

| X | Y |
|---|---|
| 269 | 443 |
| 269 | 444 |
| 269 | 446 |

## Material Boundary

| X | Y |
|---|---|
| 326 | 424 |
| 326 | 425 |
| 326 | 427 |

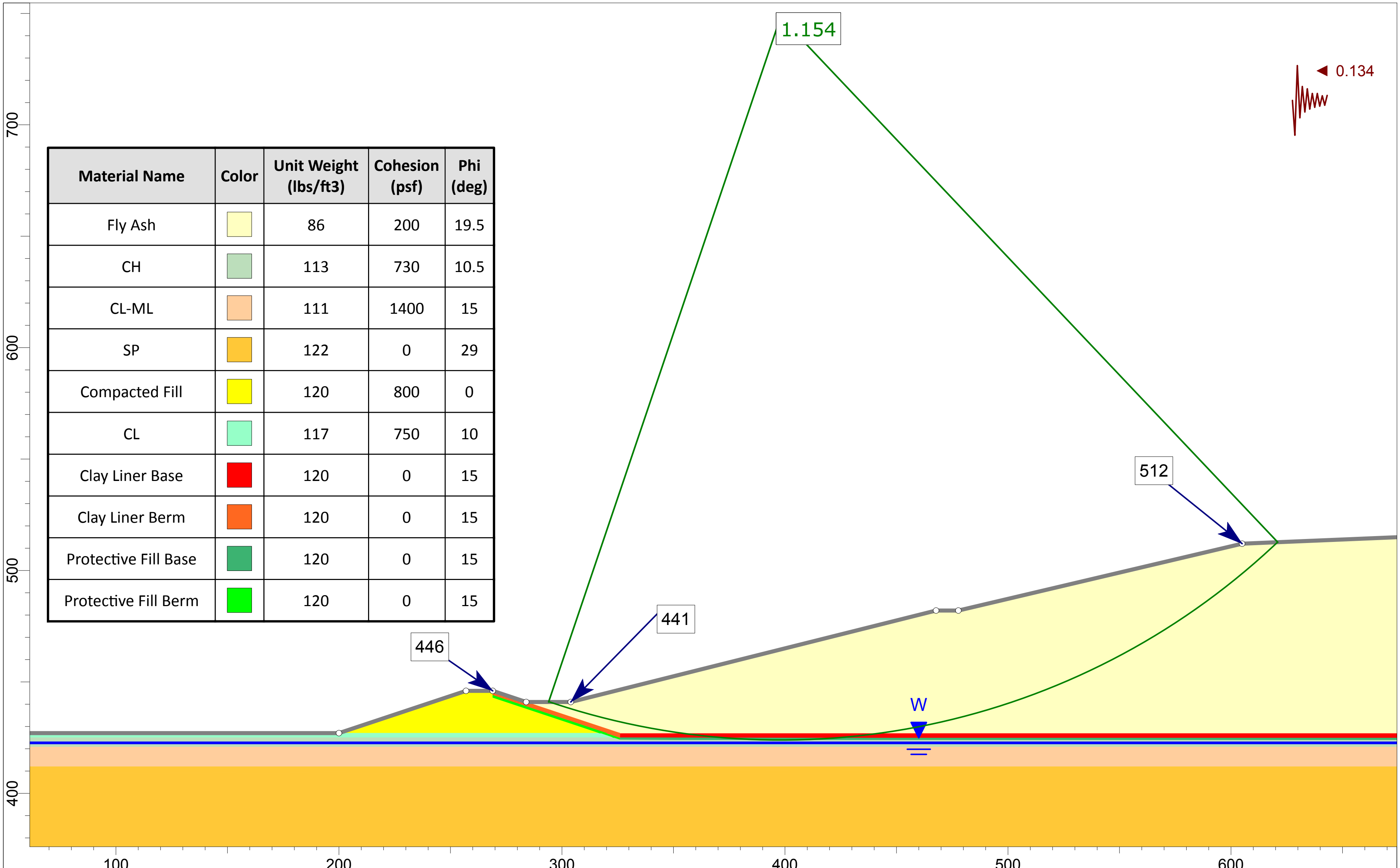
## Material Boundary

| X | Y |
|---|---|
| 269 | 443 |
| 317 | 427 |
| 323 | 425 |
| 326 | 424 |
| 920 | 424 |

## Material Boundary

| X | Y |
|---|---|

| | |
|---|---|
| 269 | 444 |
| 320 | 427 |
| 326 | 425 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Fly Ash | | 86 | 200 | 19.5 |
| CH | | 113 | 730 | 10.5 |
| CL-ML | | 111 | 1400 | 15 |
| SP | | 122 | 0 | 29 |
| Compacted Fill | | 120 | 800 | 0 |
| CL | | 117 | 750 | 10 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Fill Base | | 120 | 0 | 15 |
| Protective Fill Berm | | 120 | 0 | 15 |

Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELLS 6 & 7, SOUTH BERM (SECTION D-D)
SEISMIC, CLOSED CELL

REITZ & JENS, INC.

Figure 8-17

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

| | |
|---|---|
| Slices Type: | Vertical |

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 25 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 1 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | Park and Miller v.3 |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 10 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

Advanced seismic analysis: No
Staged pseudostatic analysis: No

Seismic Load Coefficient (Horizontal): 0.134

## Materials

| Property | Fly Ash | CH | CL-ML | SP | Compacted Fill | CL | Clay Liner Base | Clay Liner Berm |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 86 | 113 | 111 | 122 | 120 | 117 | 120 | 120 |
| Cohesion [psf] | 200 | 730 | 1400 | 0 | 800 | 750 | 0 | 0 |
| Friction Angle [°] | 19.5 | 10.5 | 15 | 29 | 0 | 10 | 15 | 15 |
| Water Surface | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table |
| Hu Value | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| Property | Protective Fill Base | Protective Fill Berm |
|---|---|---|
| Color | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 | 120 |
| Cohesion [psf] | 0 | 0 |
| Friction Angle [°] | 15 | 15 |
| Water Surface | Water Table | Water Table |
| Hu Value | 1 | 1 |

## Entity Information

### Water Table

| X | Y |
|---|---|
| 0 | 422.655 |
| 920 | 422.655 |

## External Boundary

| X | Y |
|---|---|
| 0 | 320 |
| 920 | 320 |
| 920 | 409 |
| 920 | 412 |
| 920 | 414 |
| 920 | 421 |
| 920 | 424 |
| 920 | 425 |
| 920 | 427 |
| 920 | 525 |
| 916 | 525 |
| 605 | 512 |
| 477.785 | 482 |
| 467.785 | 482 |
| 304 | 441 |
| 284 | 441 |
| 269 | 446 |
| 257 | 446 |
| 200 | 427 |
| 0 | 427 |
| 0 | 425 |
| 0 | 421 |
| 0 | 414 |
| 0 | 412 |
| 0 | 409 |

## Material Boundary

| X | Y |
|---|---|
| 200 | 427 |
| 317 | 427 |
| 320 | 427 |
| 326 | 427 |
| 920 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 284 | 441 |
| 326 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 425 |

| | |
|---|---|
| 323 | 425 |
| 326 | 425 |
| 920 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 421 |
| 920 | 421 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 412 |
| 920 | 412 |

## Material Boundary

| X | Y |
|---|---|
| 269 | 443 |
| 269 | 444 |
| 269 | 446 |

## Material Boundary

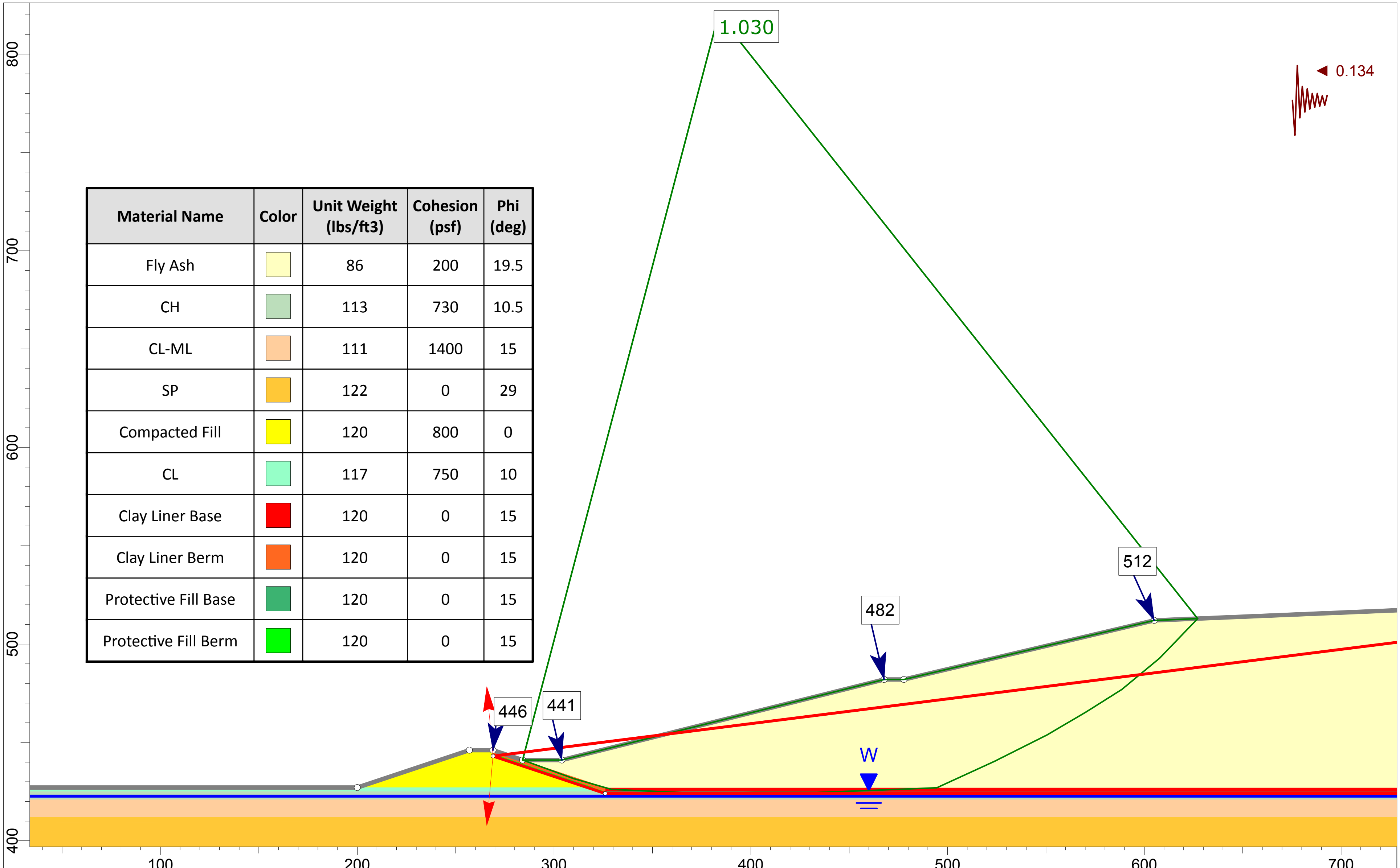
| X | Y |
|---|---|
| 326 | 424 |
| 326 | 425 |
| 326 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 269 | 443 |
| 317 | 427 |
| 323 | 425 |
| 326 | 424 |
| 920 | 424 |

## Material Boundary

| X | Y |
|---|---|
| 269 | 444 |
| 320 | 427 |
| 326 | 425 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Fly Ash | | 86 | 200 | 19.5 |
| CH | | 113 | 730 | 10.5 |
| CL-ML | | 111 | 1400 | 15 |
| SP | | 122 | 0 | 29 |
| Compacted Fill | | 120 | 800 | 0 |
| CL | | 117 | 750 | 10 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Fill Base | | 120 | 0 | 15 |
| Protective Fill Berm | | 120 | 0 | 15 |

Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELLS 6 & 7, SOUTH BERM (SECTION D-D)
SEISMIC, CLOSED CELL, SLIDING ALONG AQUICLUDE

REITZ & JENS, INC.

Figure 8-18

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 25 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 1 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | Park and Miller v.3 |

## Surface Options

| | |
|---|---|
| Surface Type: | Non-Circular Block Search |
| Number of Surfaces: | 100000 |
| Multiple Groups: | Disabled |
| Pseudo-Random Surfaces: | Enabled |
| Convex Surfaces Only: | Disabled |
| Left Projection Angle (Start Angle) [°]: | 95 |
| Left Projection Angle (End Angle) [°]: | 265 |
| Right Projection Angle (Start Angle) [°]: | -85 |
| Right Projection Angle (End Angle) [°]: | 85 |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

Advanced seismic analysis: No
Staged pseudostatic analysis: No

Seismic Load Coefficient (Horizontal): 0.134

## Materials

| Property | Fly Ash | CH | CL-ML | SP | Compacted Fill | CL | Clay Liner Base | Clay Liner Berm |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 86 | 113 | 111 | 122 | 120 | 117 | 120 | 120 |
| Cohesion [psf] | 200 | 730 | 1400 | 0 | 800 | 750 | 0 | 0 |
| Friction Angle [°] | 19.5 | 10.5 | 15 | 29 | 0 | 10 | 15 | 15 |
| Water Surface | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table |
| Hu Value | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| Property | Protective Fill Base | Protective Fill Berm |
|---|---|---|
| Color | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 | 120 |
| Cohesion [psf] | 0 | 0 |
| Friction Angle [°] | 15 | 15 |
| Water Surface | Water Table | Water Table |
| Hu Value | 1 | 1 |

## Entity Information

## Water Table

| X | Y |
|---|---|
| 0 | 422.655 |
| 920 | 422.655 |

## Block Search Window

| X | Y |
|---|---|
| 269 | 443 |
| 326 | 424 |
| 920 | 424 |
| 920 | 525 |

## External Boundary

| X | Y |
|---|---|
| 0 | 320 |
| 920 | 320 |
| 920 | 409 |
| 920 | 412 |
| 920 | 414 |
| 920 | 421 |
| 920 | 424 |
| 920 | 425 |
| 920 | 427 |
| 920 | 525 |
| 916 | 525 |
| 605 | 512 |
| 477.785 | 482 |
| 467.785 | 482 |
| 304 | 441 |
| 284 | 441 |
| 269 | 446 |
| 257 | 446 |
| 200 | 427 |
| 0 | 427 |
| 0 | 425 |
| 0 | 421 |
| 0 | 414 |
| 0 | 412 |
| 0 | 409 |

## Material Boundary

| X | Y |
|---|---|
| 200 | 427 |
| 317 | 427 |
| 320 | 427 |
| 326 | 427 |
| 920 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 284 | 441 |
| 326 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 425 |
| 323 | 425 |
| 326 | 425 |
| 920 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 421 |
| 920 | 421 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 412 |
| 920 | 412 |

## Material Boundary

| X | Y |
|---|---|
| 269 | 443 |
| 269 | 444 |
| 269 | 446 |

## Material Boundary

| X | Y |
|---|---|
| 326 | 424 |
| 326 | 425 |
| 326 | 427 |

## Material Boundary

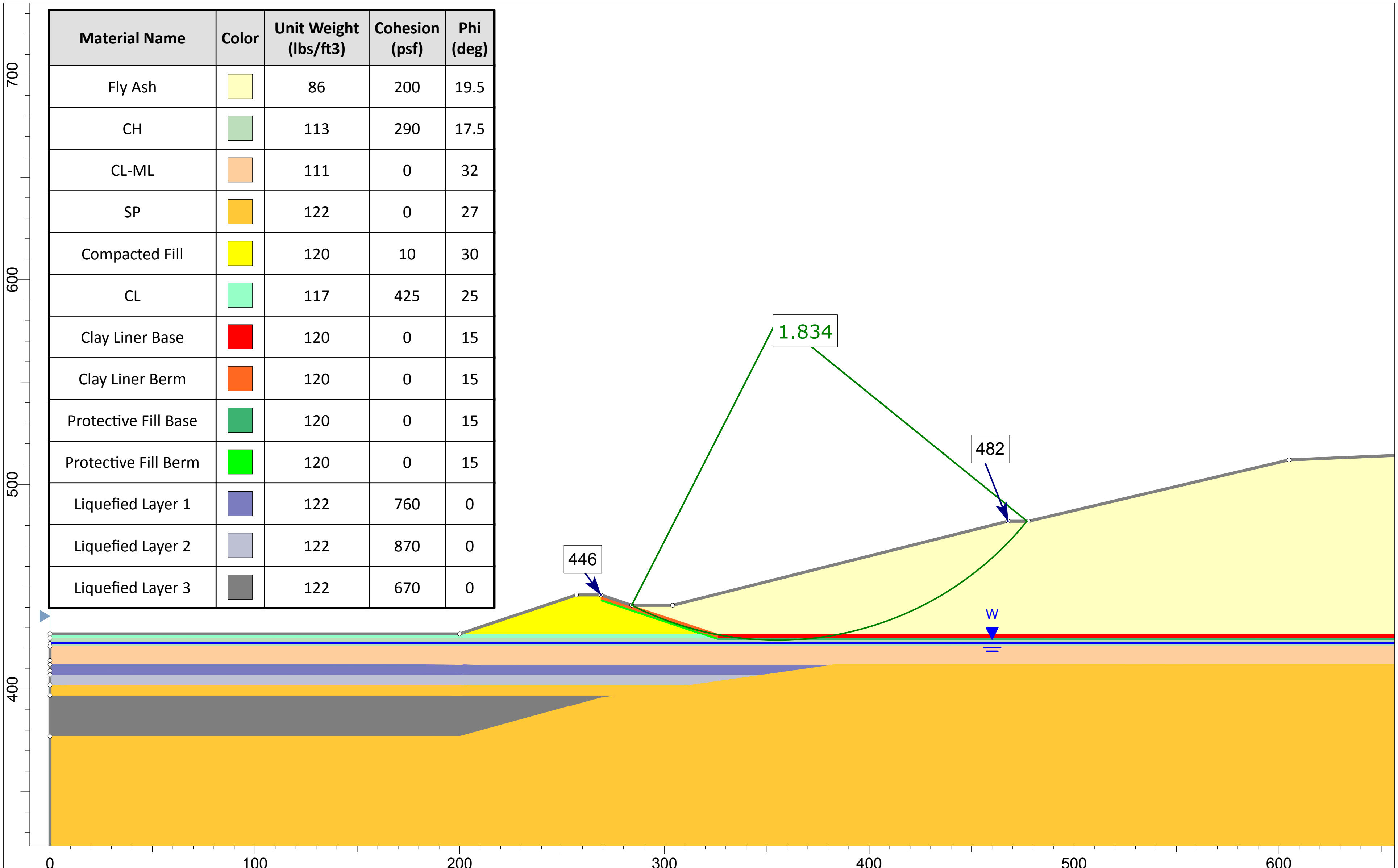
| X | Y |
|---|---|
| 269 | 443 |
| 317 | 427 |
| 323 | 425 |
| 326 | 424 |
| 920 | 424 |

## Material Boundary

| X | Y |
|---|---|

| | |
|---|---|
| 269 | 444 |
| 320 | 427 |
| 326 | 425 |

| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Fly Ash | | 86 | 200 | 19.5 |
| CH | | 113 | 290 | 17.5 |
| CL-ML | | 111 | 0 | 32 |
| SP | | 122 | 0 | 27 |
| Compacted Fill | | 120 | 10 | 30 |
| CL | | 117 | 425 | 25 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Fill Base | | 120 | 0 | 15 |
| Protective Fill Berm | | 120 | 0 | 15 |
| Liquefied Layer 1 | | 122 | 760 | 0 |
| Liquefied Layer 2 | | 122 | 870 | 0 |
| Liquefied Layer 3 | | 122 | 670 | 0 |




Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELLS 6 & 7, SOUTH BERM (SECTION D-D)
WITH LIQUEFACTION, CLOSED CELL

REITZ & JENS, INC.

Figure 8-19

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 25 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 1 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | Park and Miller v.3 |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 50 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

## Materials

| Property | Fly Ash | CH | CL-ML | SP | Compacted Fill | CL | Clay Liner Base | Clay Liner Berm |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 86 | 113 | 111 | 122 | 120 | 117 | 120 | 120 |
| Cohesion [psf] | 200 | 290 | 0 | 0 | 10 | 425 | 0 | 0 |
| Friction Angle [°] | 19.5 | 17.5 | 32 | 27 | 30 | 25 | 15 | 15 |
| Water Surface | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table |
| Hu Value | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| Property | Protective Fill Base | Protective Fill Berm | Liquefied Layer 1 | Liquefied Layer 2 | Liquefied Layer 3 |
|---|---|---|---|---|---|
| Color | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 | 120 | 122 | 122 | 122 |
| Cohesion [psf] | 0 | 0 | 760 | 870 | 670 |
| Friction Angle [°] | 15 | 15 | 0 | 0 | 0 |
| Water Surface | Water Table | Water Table | Water Table | Water Table | Water Table |
| Hu Value | 1 | 1 | 1 | 1 | 1 |

## Entity Information

### Water Table

| X | Y |
|---|---|
| 0 | 422.655 |

| | |
|---|---|
| 920 | 422.655 |

## External Boundary

| X | Y |
|---|---|
| 0 | 320 |
| 920 | 320 |
| 920 | 409 |
| 920 | 412 |
| 920 | 414 |
| 920 | 421 |
| 920 | 424 |
| 920 | 425 |
| 920 | 427 |
| 920 | 525 |
| 916 | 525 |
| 605 | 512 |
| 477.785 | 482 |
| 467.785 | 482 |
| 304 | 441 |
| 284 | 441 |
| 269 | 446 |
| 257 | 446 |
| 200 | 427 |
| 0 | 427 |
| 0 | 425 |
| 0 | 421 |
| 0 | 414 |
| 0 | 412 |
| 0 | 409 |
| 0 | 407 |
| 0 | 402 |
| 0 | 397 |
| 0 | 377 |

## Material Boundary

| X | Y |
|---|---|
| 200 | 427 |
| 317 | 427 |
| 320 | 427 |
| 326 | 427 |
| 920 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 284 | 441 |
| 326 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 425 |
| 323 | 425 |
| 326 | 425 |
| 920 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 421 |
| 445.811 | 421 |
| 920 | 421 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 412 |
| 201.595 | 412 |
| 382.159 | 412 |
| 920 | 412 |

## Material Boundary

| X | Y |
|---|---|
| 269 | 443 |
| 269 | 444 |
| 269 | 446 |

## Material Boundary

| X | Y |
|---|---|
| 326 | 424 |
| 326 | 425 |
| 326 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 269 | 443 |
| 317 | 427 |
| 323 | 425 |
| 326 | 424 |
| 920 | 424 |

## Material Boundary

| X | Y |
|---|---|
| 269 | 444 |
| 320 | 427 |
| 326 | 425 |

### Material Boundary

| X | Y |
|---|---|
| 0 | 377 |
| 200 | 377 |
| 254.474 | 392 |
| 269 | 396 |
| 276.072 | 397 |
| 311.435 | 402 |
| 346.797 | 407 |
| 382.159 | 412 |
| 445.811 | 421 |

### Material Boundary

| X | Y |
|---|---|
| 0 | 407 |
| 201.595 | 407 |

### Material Boundary

| X | Y |
|---|---|
| 201.595 | 407 |
| 346.797 | 407 |

### Material Boundary

| X | Y |
|---|---|
| 0 | 402 |
| 201.595 | 402 |

### Material Boundary

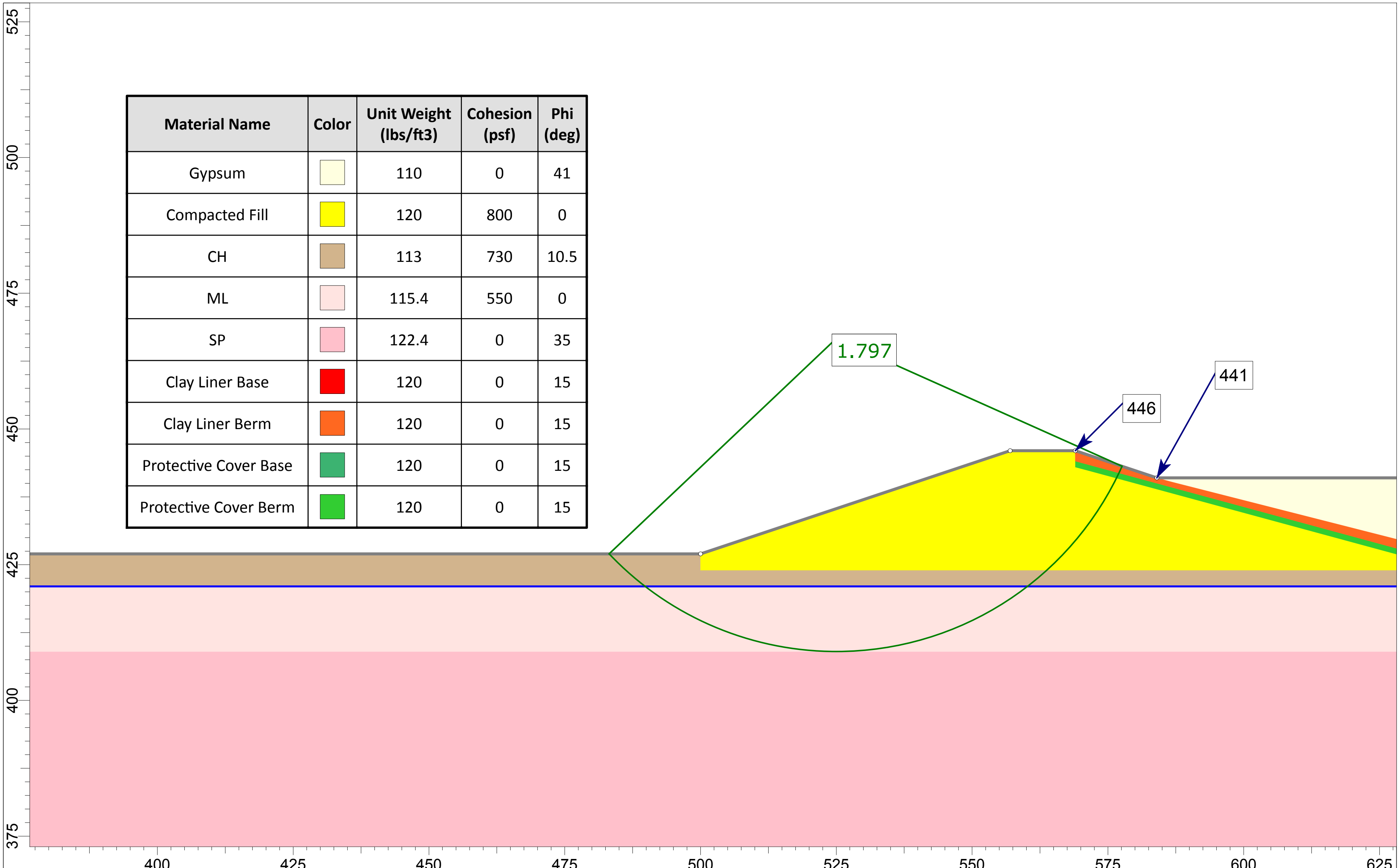
| X | Y |
|---|---|
| 201.595 | 402 |
| 311.435 | 402 |

### Material Boundary

| X | Y |
|---|---|
| 0 | 397 |
| 201.595 | 397 |

### Material Boundary

| X | Y |
|---|---|
| 201.595 | 397 |
| 276.072 | 397 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Gypsum | | 110 | 0 | 41 |
| Compacted Fill | | 120 | 800 | 0 |
| CH | | 113 | 730 | 10.5 |
| ML | | 115.4 | 550 | 0 |
| SP | | 122.4 | 0 | 35 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |

Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELL 2, SOUTH BERM (SECTION E-E)
SHORT-TERM, INITIAL FILLING

REITZ & JENS, INC.

Figure 8-20

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | rand |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

## Materials

| Property | Gypsum | Compacted Fill | CH | ML | SP | Clay Liner Base | Clay Liner Berm | Protective Cover Base |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 110 | 120 | 113 | 115.4 | 122.4 | 120 | 120 | 120 |
| Cohesion [psf] | 0 | 800 | 730 | 550 | 0 | 0 | 0 | 0 |
| Friction Angle [°] | 41 | 0 | 10.5 | 0 | 35 | 15 | 15 | 15 |
| Water Surface | None | None | Piezometric Line 2 | Piezometric Line 2 | Piezometric Line 2 | None | None | None |
| Hu Value | | | 1 | 1 | 1 | | | |
| Ru Value | 0 | 0 | | | | 0 | 0 | 0 |

| Property | Protective Cover Berm |
|---|---|
| Color | |
| Strength Type | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 |
| Cohesion [psf] | 0 |
| Friction Angle [°] | 15 |
| Water Surface | None |
| Ru Value | 0 |

## Entity Information

## Piezoline

| X | Y |
|---|---|
| 0 | 421 |
| 1370 | 421 |

## External Boundary

| X | Y |
|---|---|
| 584 | 441 |
| 569 | 446 |
| 557 | 446 |
| 500 | 427 |
| 0 | 427 |
| 0 | 421 |
| 0 | 409 |
| 0 | 327 |
| 1370 | 327 |
| 1370 | 409 |
| 1370 | 421 |
| 1370 | 424 |
| 1370 | 425 |
| 1370 | 427 |
| 1370 | 441 |

## Material Boundary

| X | Y |
|---|---|
| 584 | 441 |
| 639 | 427 |
| 1370 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 500 | 427 |
| 500 | 424 |
| 639 | 424 |
| 1370 | 424 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 421 |
| 1370 | 421 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 409 |
| 1370 | 409 |

## Material Boundary

| X | Y |
|---|---|
| 569 | 443 |
| 569 | 444 |
| 569 | 446 |

## Material Boundary

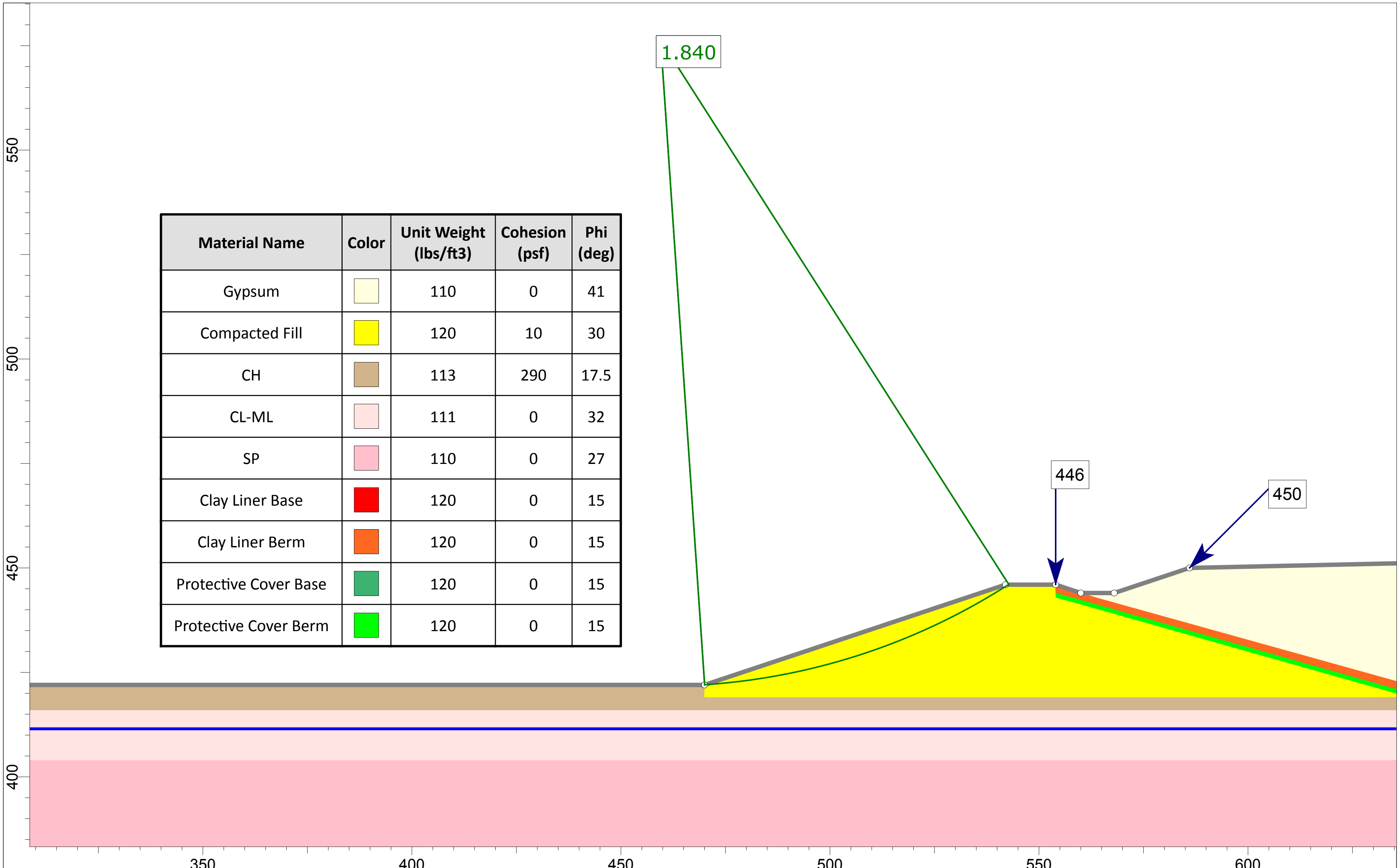
| X | Y |
|---|---|
| 569 | 443 |
| 639 | 424 |
| 639 | 425 |
| 639 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 569 | 444 |
| 639 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 639 | 425 |
| 1370 | 425 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Gypsum | | 110 | 0 | 41 |
| Compacted Fill | | 120 | 10 | 30 |
| CH | | 113 | 290 | 17.5 |
| CL-ML | | 111 | 0 | 32 |
| SP | | 110 | 0 | 27 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |

Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELL 2, SOUTH BERM (SECTION E-E)
LONG-TERM, CLOSED CELL

REITZ & JENS, INC.

Figure 8-21

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Bishop simplified |
| GLE/Morgenstern-Price with interslice force function (Half Sine) |
| Janbu simplified |
| Janbu corrected |
| Ordinary/Fellenius |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | rand |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

## Materials

| Property | Gypsum | Compacted Fill | CH | CL-ML | SP | Clay Liner Base | Clay Liner Berm | Protective Cover Base |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 110 | 120 | 113 | 111 | 110 | 120 | 120 | 120 |
| Cohesion [psf] | 0 | 10 | 290 | 0 | 0 | 0 | 0 | 0 |
| Friction Angle [°] | 41 | 30 | 17.5 | 32 | 27 | 15 | 15 | 15 |
| Water Surface | Piezometric Line 2 | None | None | None | None | None | None | None |
| Hu Value | 1 | | | | | | | |
| Ru Value | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Property | Protective Cover Berm |
|---|---|
| Color | |
| Strength Type | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 |
| Cohesion [psf] | 0 |
| Friction Angle [°] | 15 |
| Water Surface | None |
| Ru Value | 0 |

# *Entity Information*

## Piezoline

| X | Y |
|---|---|
| 0 | 411.5 |
| 1370 | 411.5 |

## External Boundary

| X | Y |
|---|---|
| 1076 | 456 |
| 676 | 452 |
| 586 | 450 |
| 568 | 444 |
| 560 | 444 |
| 554 | 446 |
| 542 | 446 |
| 470 | 422 |
| 0 | 422 |
| 0 | 416 |
| 0 | 404 |
| 0 | 322 |
| 1370 | 322 |
| 1370 | 404 |
| 1370 | 416 |
| 1370 | 419 |
| 1370 | 420 |
| 1370 | 422 |
| 1370 | 456 |

## Material Boundary

| X | Y |
|---|---|
| 560 | 444 |
| 639 | 422 |
| 1370 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 470 | 422 |
| 470 | 419 |
| 639 | 419 |
| 1370 | 419 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 416 |
| 1370 | 416 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 404 |
| 1370 | 404 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 443 |
| 554 | 444 |
| 554 | 446 |

## Material Boundary

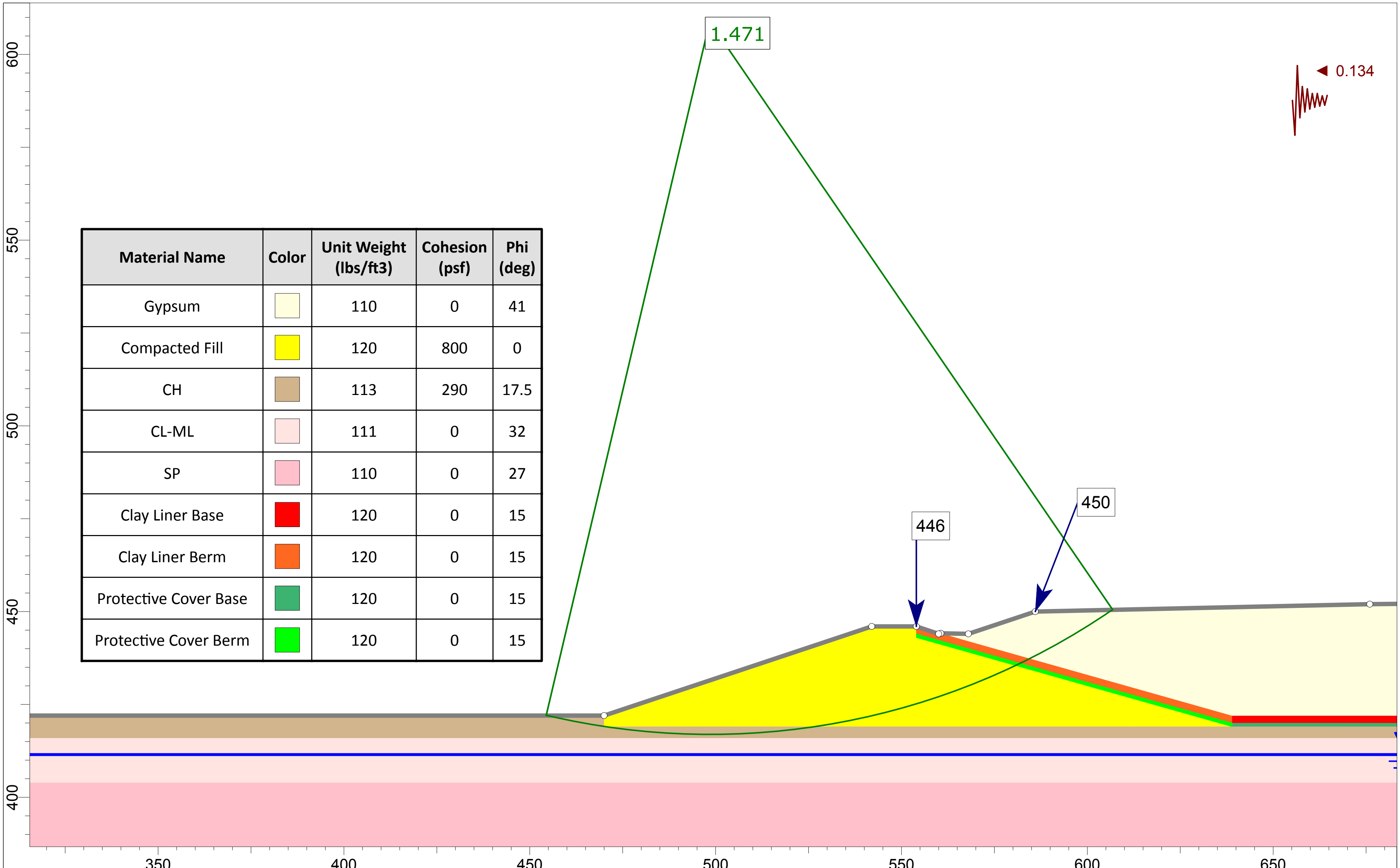
| X | Y |
|---|---|
| 554 | 443 |
| 639 | 419 |
| 639 | 420 |
| 639 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 444 |
| 639 | 420 |

## Material Boundary

| X | Y |
|---|---|
| 639 | 420 |
| 1370 | 420 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Gypsum | | 110 | 0 | 41 |
| Compacted Fill | | 120 | 800 | 0 |
| CH | | 113 | 290 | 17.5 |
| CL-ML | | 111 | 0 | 32 |
| SP | | 110 | 0 | 27 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |

Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELL 2, SOUTH BERM (SECTION E-E)
SEISMIC, CLOSED CELL

REITZ & JENS, INC.

Figure 8-22

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | rand |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

Seismic Load Coefficient (Horizontal): 0.134

## Materials

| Property | Gypsum | Compacted Fill | CH | CL-ML | SP | Clay Liner Base | Clay Liner Berm | Protective Cover Base |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 110 | 120 | 113 | 111 | 110 | 120 | 120 | 120 |
| Cohesion [psf] | 0 | 800 | 290 | 0 | 0 | 0 | 0 | 0 |
| Friction Angle [°] | 41 | 0 | 17.5 | 32 | 27 | 15 | 15 | 15 |
| Water Surface | Piezometric Line 2 | None | None | None | None | None | None | None |
| Hu Value | 1 | | | | | | | |
| Ru Value | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Property | Protective Cover Berm |
|---|---|
| Color | |
| Strength Type | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 |
| Cohesion [psf] | 0 |
| Friction Angle [°] | 15 |
| Water Surface | None |
| Ru Value | 0 |

## Entity Information

## Piezoline

| X | Y |
|---|---|
| 0 | 411.5 |
| 1370 | 411.5 |

## External Boundary

| X | Y |
|---|---|
| 568 | 444 |
| 560.58 | 444.142 |
| 560 | 444 |
| 554 | 446 |
| 542 | 446 |
| 470 | 422 |
| 0 | 422 |
| 0 | 416 |
| 0 | 404 |
| 0 | 322 |
| 1370 | 322 |
| 1370 | 404 |
| 1370 | 416 |
| 1370 | 419 |
| 1370 | 420 |
| 1370 | 422 |
| 1370 | 456 |
| 1076 | 456 |
| 676 | 452 |
| 586 | 450 |

## Material Boundary

| X | Y |
|---|---|
| 560.58 | 444.142 |
| 639 | 422 |
| 1370 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 470 | 422 |
| 470 | 419 |
| 639 | 419 |
| 1370 | 419 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 416 |
| 1370 | 416 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 404 |
| 1370 | 404 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 443 |
| 554 | 444 |
| 554 | 446 |

## Material Boundary

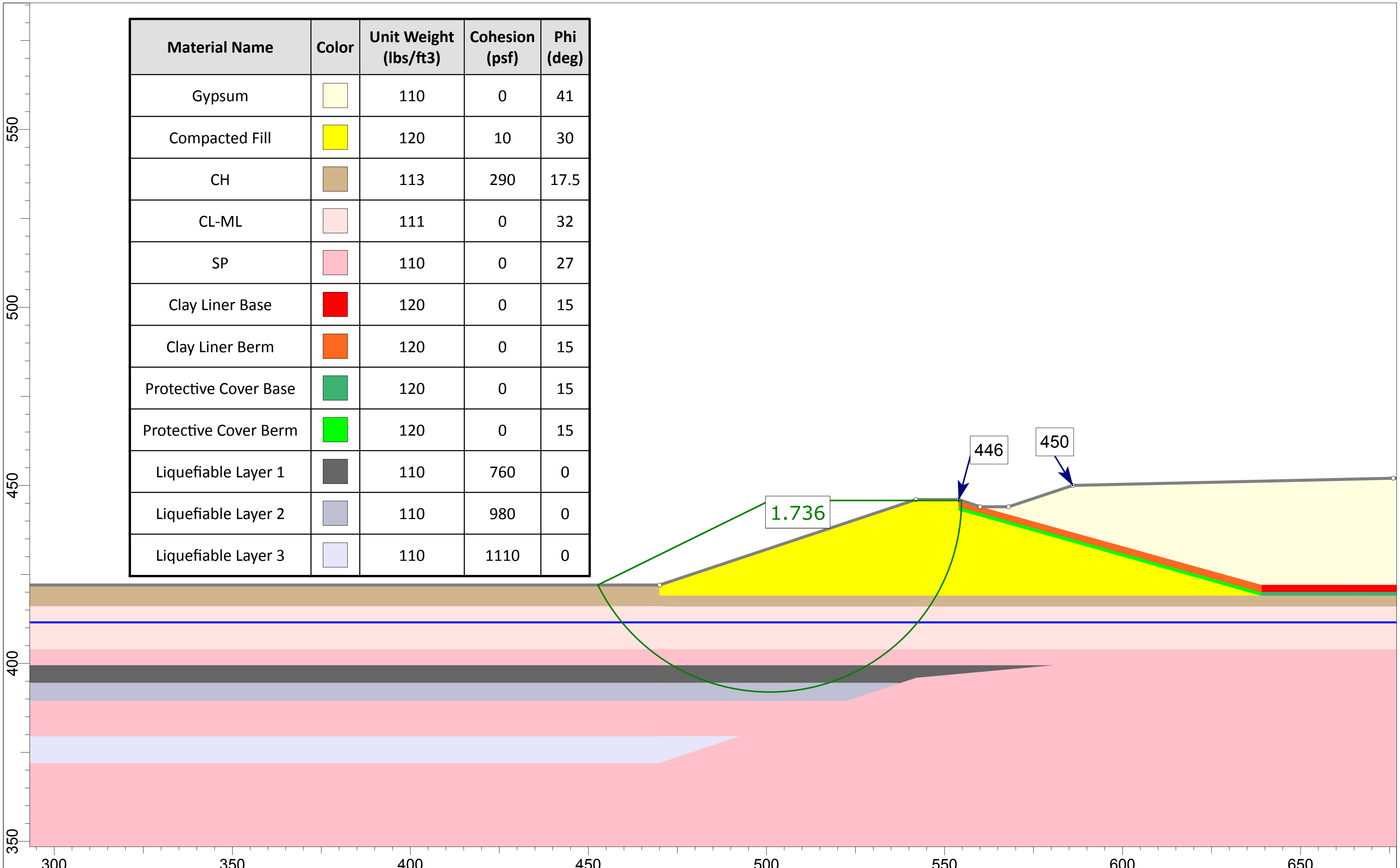
| X | Y |
|---|---|
| 554 | 443 |
| 639 | 419 |
| 639 | 420 |
| 639 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 444 |
| 639 | 420 |

## Material Boundary

| X | Y |
|---|---|
| 639 | 420 |
| 1370 | 420 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Gypsum | | 110 | 0 | 41 |
| Compacted Fill | | 120 | 10 | 30 |
| CH | | 113 | 290 | 17.5 |
| CL-ML | | 111 | 0 | 32 |
| SP | | 110 | 0 | 27 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |
| Liquefiable Layer 1 | | 110 | 760 | 0 |
| Liquefiable Layer 2 | | 110 | 980 | 0 |
| Liquefiable Layer 3 | | 110 | 1110 | 0 |

Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELL 2, SOUTH BERM (SECTION E-E)
WITH LIQUEFACTION, CLOSED CELL

REITZ & JENS, INC.

Figure 8-23

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Bishop simplified |
| GLE/Morgenstern-Price with interslice force function (Half Sine) |
| Janbu simplified |
| Janbu corrected |
| Ordinary/Fellenius |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: rand

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

Advanced seismic analysis: No
Staged pseudostatic analysis: No

## Materials

| Property | Gypsum | Compacted Fill | CH | CL-ML | SP | Clay Liner Base | Clay Liner Berm | Protective Cover Base |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 110 | 120 | 113 | 111 | 110 | 120 | 120 | 120 |
| Cohesion [psf] | 0 | 10 | 290 | 0 | 0 | 0 | 0 | 0 |
| Friction Angle [°] | 41 | 30 | 17.5 | 32 | 27 | 15 | 15 | 15 |
| Water Surface | Piezometric Line 2 | None | None | None | None | None | None | None |
| Hu Value | 1 | | | | | | | |
| Ru Value | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Property | Protective Cover Berm | Liquefiable Layer 1 | Liquefiable Layer 2 | Liquefiable Layer 3 |
|---|---|---|---|---|
| Color | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 | 110 | 110 | 110 |
| Cohesion [psf] | 0 | 760 | 980 | 1110 |
| Friction Angle [°] | 15 | 0 | 0 | 0 |
| Water Surface | None | None | None | None |
| Ru Value | 0 | 0 | 0 | 0 |

# Entity Information

## Piezoline

| X | Y |
|---|---|
| 0 | 411.5 |
| 1370 | 411.5 |

## External Boundary

| X | Y |
|---|---|
| 1076 | 456 |
| 676 | 452 |
| 586 | 450 |
| 568 | 444 |
| 560 | 444 |
| 554 | 446 |
| 542 | 446 |
| 470 | 422 |
| 0 | 422 |
| 0 | 416 |
| 0 | 404 |
| 0 | 399.5 |
| 0 | 394.5 |
| 0 | 389.5 |
| 0 | 379.5 |
| 0 | 372 |
| 0 | 322 |
| 1370 | 322 |
| 1370 | 404 |
| 1370 | 416 |
| 1370 | 419 |
| 1370 | 420 |
| 1370 | 422 |
| 1370 | 456 |

## Material Boundary

| X | Y |
|---|---|
| 560 | 444 |
| 639 | 422 |
| 1370 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 470 | 422 |
| 470 | 419 |
| 639 | 419 |
| 1370 | 419 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 416 |
| 470 | 416 |
| 1370 | 416 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 404 |
| 470 | 404 |
| 896.201 | 404 |
| 1370 | 404 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 443 |
| 554 | 444 |
| 554 | 446 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 443 |
| 639 | 419 |
| 639 | 420 |
| 639 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 444 |
| 639 | 420 |

## Material Boundary

| X | Y |
|---|---|
| 639 | 420 |
| 1370 | 420 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 372 |
| 470 | 372 |
| 492.5 | 379.5 |
| 522.5 | 389.5 |
| 537.5 | 394.5 |
| 542 | 396 |
| 580.5 | 399.5 |

| | |
|---|---|
| 586 | 400 |
| 896.201 | 403.754 |
| 896.201 | 404 |

## Material Boundary

| X | Y |
|---|---|
| 470 | 379.5 |
| 492.5 | 379.5 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 389.5 |
| 470 | 389.5 |

## Material Boundary

| X | Y |
|---|---|
| 470 | 389.5 |
| 522.5 | 389.5 |

## Material Boundary

| X | Y |
|---|---|
| 470 | 394.5 |
| 537.5 | 394.5 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 394.5 |
| 470 | 394.5 |

## Material Boundary

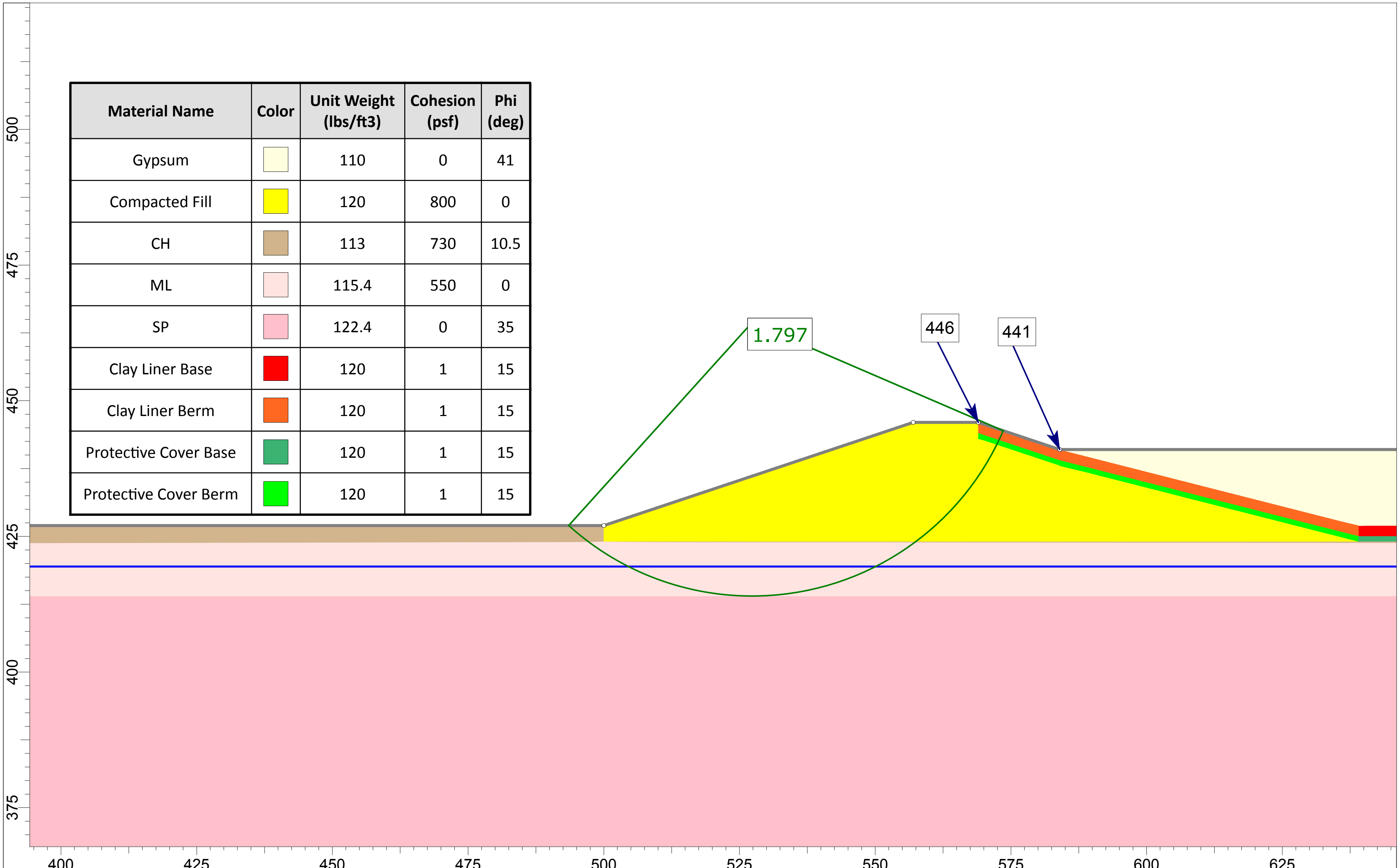
| X | Y |
|---|---|
| 0 | 399.5 |
| 470 | 399.5 |

## Material Boundary

| X | Y |
|---|---|
| 470 | 399.5 |
| 580.5 | 399.5 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 379.5 |
| 470 | 379.5 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Gypsum | | 110 | 0 | 41 |
| Compacted Fill | | 120 | 800 | 0 |
| CH | | 113 | 730 | 10.5 |
| ML | | 115.4 | 550 | 0 |
| SP | | 122.4 | 0 | 35 |
| Clay Liner Base | | 120 | 1 | 15 |
| Clay Liner Berm | | 120 | 1 | 15 |
| Protective Cover Base | | 120 | 1 | 15 |
| Protective Cover Berm | | 120 | 1 | 15 |

Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELL 1, SOUTHWEST BERM (SECTION F-F)
SHORT-TERM, INITIAL FILLING

REITZ & JENS, INC.

Figure 8-24

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | rand |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

## Materials

| Property | Gypsum | Compacted Fill | CH | ML | SP | Clay Liner Base | Clay Liner Berm | Protective Cover Base |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 110 | 120 | 113 | 115.4 | 122.4 | 120 | 120 | 120 |
| Cohesion [psf] | 0 | 800 | 730 | 550 | 0 | 1 | 1 | 1 |
| Friction Angle [°] | 41 | 0 | 10.5 | 0 | 35 | 15 | 15 | 15 |
| Water Surface | Piezometric Line 2 | None | None | None | None | None | None | None |
| Hu Value | 1 | | | | | | | |
| Ru Value | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Property | Protective Cover Berm |
|---|---|
| Color | |
| Strength Type | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 |
| Cohesion [psf] | 1 |
| Friction Angle [°] | 15 |
| Water Surface | None |
| Ru Value | 0 |

## Entity Information

## Piezoline

| X | Y |
|---|---|
| -0.52591 | 419.43 |
| 1370.3 | 419.43 |

## External Boundary

| X | Y |
|---|---|
| 584 | 441 |
| 569 | 446 |
| 557 | 446 |
| 500 | 427 |
| 0 | 427 |
| 0 | 423 |
| 0 | 414 |
| 0 | 327 |
| 1370 | 327 |
| 1370 | 414 |
| 1370 | 423 |
| 1370 | 424 |
| 1370 | 425 |
| 1370 | 427 |
| 1370 | 441 |

## Material Boundary

| X | Y |
|---|---|
| 584 | 441 |
| 639 | 427 |
| 1370 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 500 | 427 |
| 500 | 424 |
| 639 | 424 |
| 1370 | 424 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 423 |
| 500 | 424 |
| 1370 | 423 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 414 |
| 1370 | 414 |

## Material Boundary

| X | Y |
|---|---|
| 569 | 443 |
| 569 | 444 |
| 569 | 446 |

## Material Boundary

| X | Y |
|---|---|
| 584 | 438 |
| 584 | 439 |
| 584 | 441 |

## Material Boundary

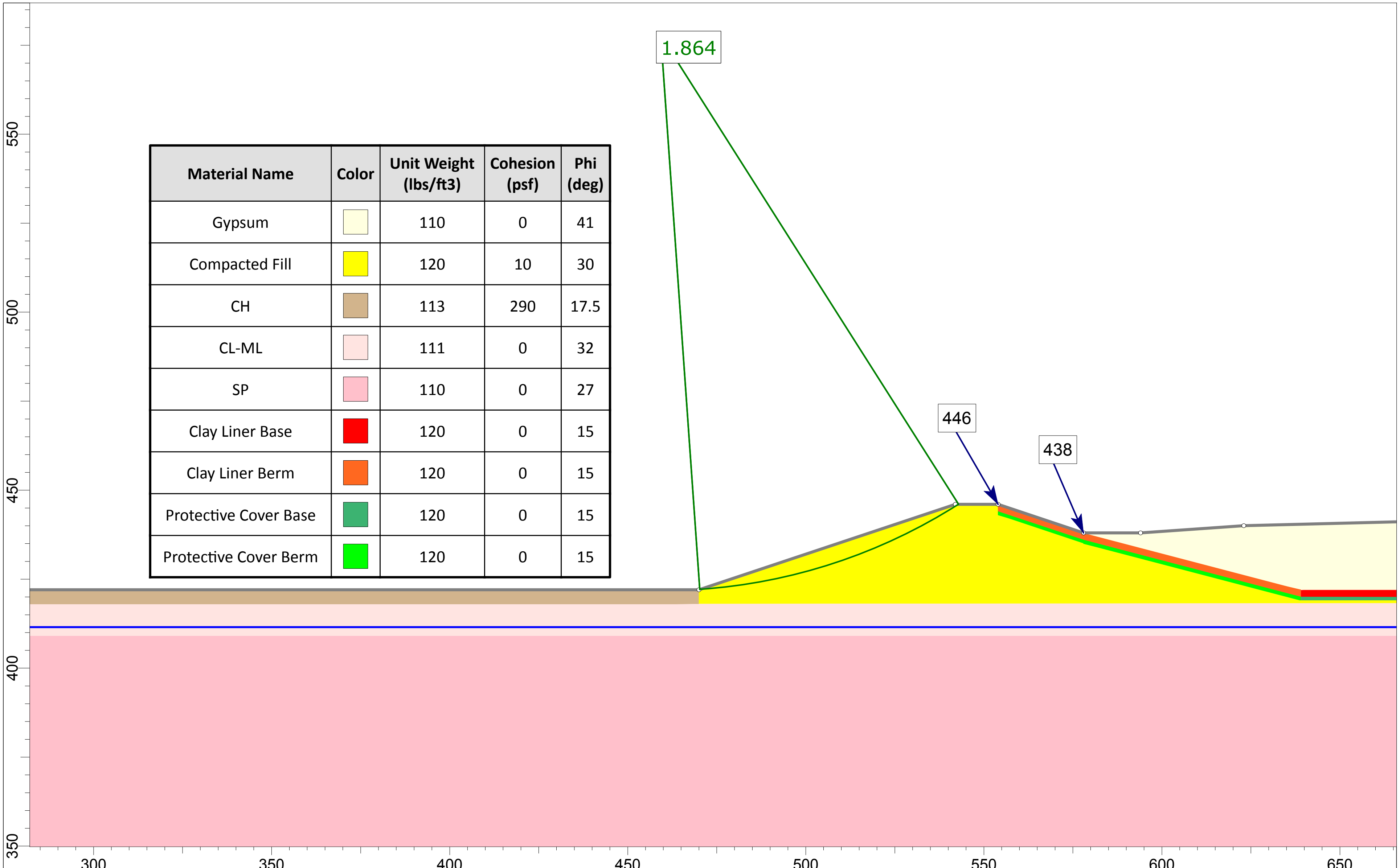
| X | Y |
|---|---|
| 569 | 444 |
| 584 | 439 |
| 639 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 569 | 443 |
| 584 | 438 |
| 639 | 424 |
| 639 | 425 |
| 639 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 639 | 425 |
| 1370 | 425 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Gypsum | | 110 | 0 | 41 |
| Compacted Fill | | 120 | 10 | 30 |
| CH | | 113 | 290 | 17.5 |
| CL-ML | | 111 | 0 | 32 |
| SP | | 110 | 0 | 27 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |

Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELL 1, SOUTHWEST BERM (SECTION F-F)
LONG-TERM, CLOSED CELL

REITZ & JENS, INC.

Figure 8-25

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | rand |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

## Materials

| Property | Gypsum | Compacted Fill | CH | CL-ML | SP | Clay Liner Base | Clay Liner Berm | Protective Cover Base |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 110 | 120 | 113 | 111 | 110 | 120 | 120 | 120 |
| Cohesion [psf] | 0 | 10 | 290 | 0 | 0 | 0 | 0 | 0 |
| Friction Angle [°] | 41 | 30 | 17.5 | 32 | 27 | 15 | 15 | 15 |
| Water Surface | Piezometric Line 2 | None | None | None | None | None | None | None |
| Hu Value | 1 | | | | | | | |
| Ru Value | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Property | Protective Cover Berm |
|---|---|
| Color | |
| Strength Type | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 |
| Cohesion [psf] | 0 |
| Friction Angle [°] | 15 |
| Water Surface | None |
| Ru Value | 0 |

## Entity Information

## Piezoline

| X | Y |
|---|---|
| 0 | 411.5 |
| 1370 | 411.5 |

## External Boundary

| X | Y |
|---|---|
| 623 | 440 |
| 594 | 438 |
| 578 | 438 |
| 554 | 446 |
| 542 | 446 |
| 470 | 422 |
| 0 | 422 |
| 0 | 418 |
| 0 | 409 |
| 0 | 322 |
| 1370 | 322 |
| 1370 | 409 |
| 1370 | 418 |
| 1370 | 419 |
| 1370 | 420 |
| 1370 | 422 |
| 1370 | 456 |
| 1255 | 456 |

## Material Boundary

| X | Y |
|---|---|
| 578 | 438 |
| 639 | 422 |
| 1370 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 470 | 422 |
| 470 | 418 |
| 1370 | 419 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 418 |
| 470 | 418 |
| 1370 | 418 |

## Material Boundary

| X | Y |
|---|---|

| | |
|---|---|
| 0 | 409 |
| 1370 | 409 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 443 |
| 554 | 444 |
| 554 | 446 |

## Material Boundary

| X | Y |
|---|---|
| 578 | 435 |
| 578 | 436 |
| 578 | 438 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 444 |
| 578 | 436 |
| 639 | 420 |

## Material Boundary

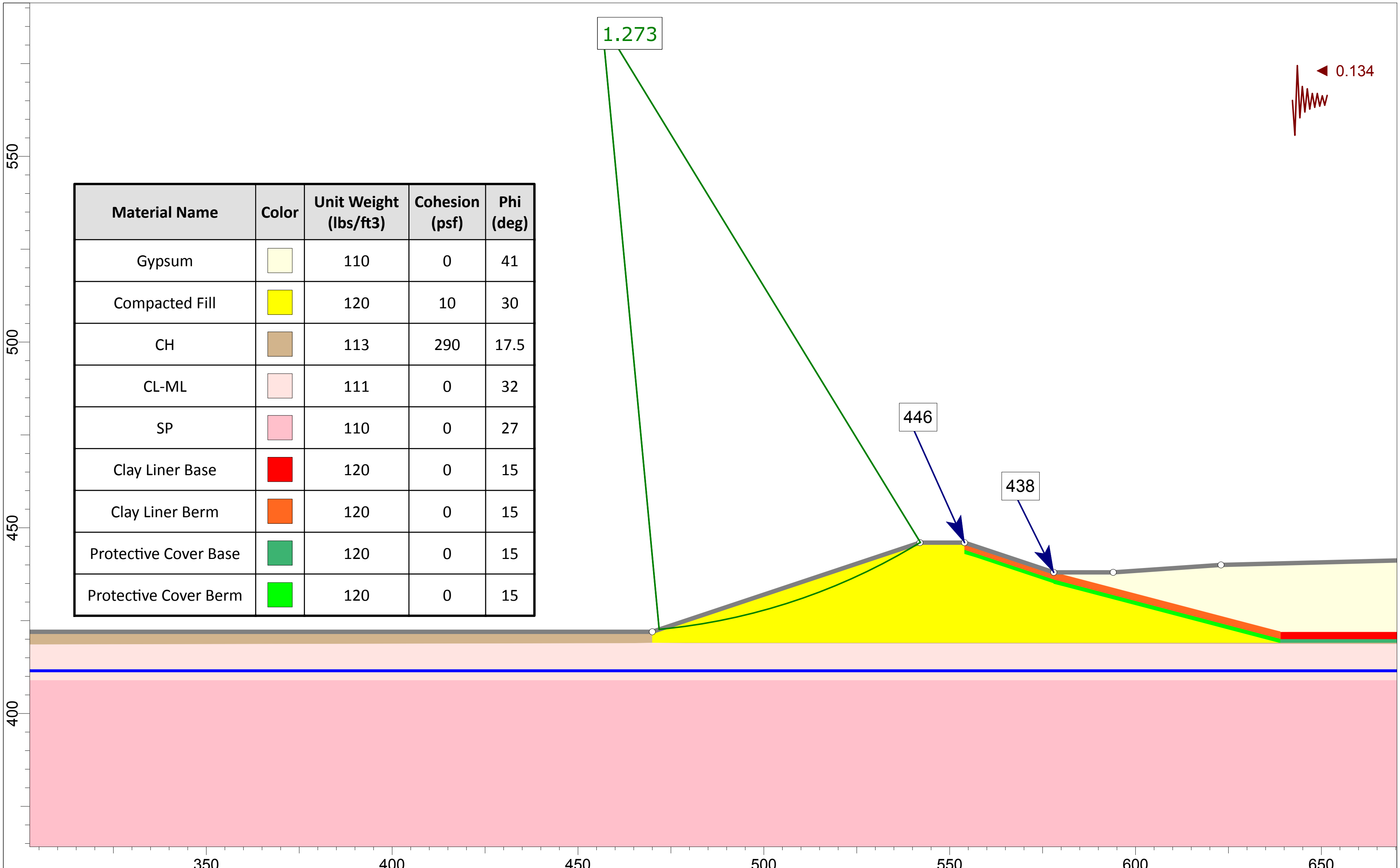
| X | Y |
|---|---|
| 554 | 443 |
| 578 | 435 |
| 639 | 419 |
| 639 | 420 |
| 639 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 639 | 419 |
| 1370 | 419 |

## Material Boundary

| X | Y |
|---|---|
| 639 | 420 |
| 1370 | 420 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Gypsum | | 110 | 0 | 41 |
| Compacted Fill | | 120 | 10 | 30 |
| CH | | 113 | 290 | 17.5 |
| CL-ML | | 111 | 0 | 32 |
| SP | | 110 | 0 | 27 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |

Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELL 1, SOUTHWEST BERM (SECTION F-F)
SEISMIC, CLOSED CELL

REITZ & JENS, INC.

Figure 8-26

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

| | |
|---|---|
| Slices Type: | Vertical |

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | rand |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

Seismic Load Coefficient (Horizontal): 0.134

## Materials

| Property | Gypsum | Compacted Fill | CH | CL-ML | SP | Clay Liner Base | Clay Liner Berm | Protective Cover Base |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 110 | 120 | 113 | 111 | 110 | 120 | 120 | 120 |
| Cohesion [psf] | 0 | 10 | 290 | 0 | 0 | 0 | 0 | 0 |
| Friction Angle [°] | 41 | 30 | 17.5 | 32 | 27 | 15 | 15 | 15 |
| Water Surface | Piezometric Line 2 | None | None | None | None | None | None | None |
| Hu Value | 1 | | | | | | | |
| Ru Value | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Property | Protective Cover Berm |
|---|---|
| Color | |
| Strength Type | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 |
| Cohesion [psf] | 0 |
| Friction Angle [°] | 15 |
| Water Surface | None |
| Ru Value | 0 |

## Entity Information

## Piezoline

| X | Y |
|---|---|
| 0 | 411.5 |
| 1370 | 411.5 |

## External Boundary

| X | Y |
|---|---|
| 594 | 438 |
| 578 | 438 |
| 554 | 446 |
| 542 | 446 |
| 470 | 422 |
| 0 | 422 |
| 0 | 418 |
| 0 | 409 |
| 0 | 322 |
| 1370 | 322 |
| 1370 | 409 |
| 1370 | 418 |
| 1370 | 419 |
| 1370 | 420 |
| 1370 | 422 |
| 1370 | 456 |
| 1255 | 456 |
| 623 | 440 |

## Material Boundary

| X | Y |
|---|---|
| 578 | 438 |
| 639 | 422 |
| 1370 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 470 | 422 |
| 470 | 419 |
| 639 | 419 |
| 1370 | 419 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 418 |
| 470 | 419 |
| 1370 | 418 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 409 |
| 1370 | 409 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 443 |
| 554 | 444 |
| 554 | 446 |

## Material Boundary

| X | Y |
|---|---|
| 578 | 435 |
| 578 | 436 |
| 578 | 438 |

## Material Boundary

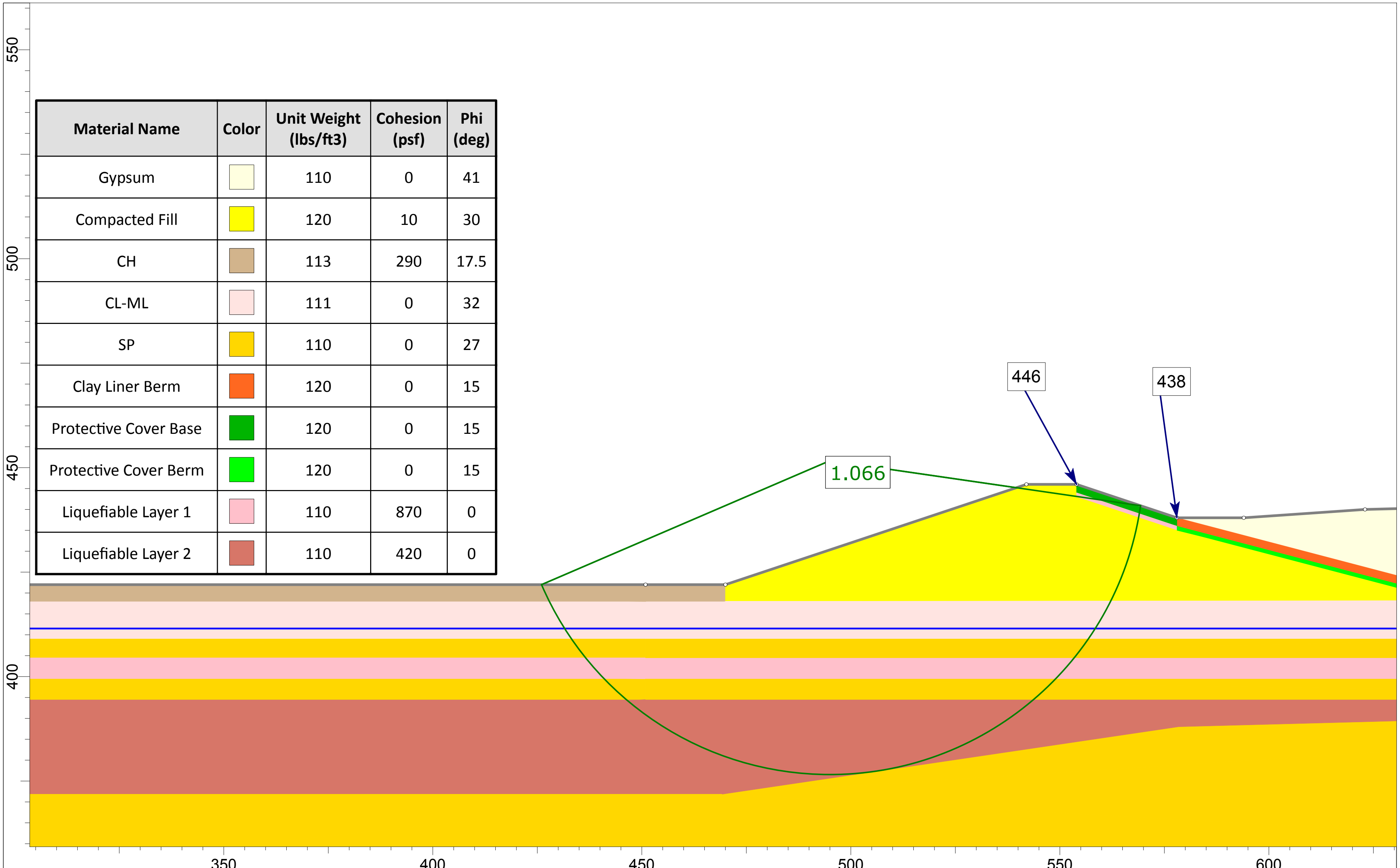
| X | Y |
|---|---|
| 639 | 419 |
| 639 | 420 |
| 639 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 443 |
| 578 | 435 |
| 639 | 419 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 444 |
| 578 | 436 |
| 639 | 420 |
| 1370 | 420 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Gypsum | | 110 | 0 | 41 |
| Compacted Fill | | 120 | 10 | 30 |
| CH | | 113 | 290 | 17.5 |
| CL-ML | | 111 | 0 | 32 |
| SP | | 110 | 0 | 27 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |
| Liquefiable Layer 1 | | 110 | 870 | 0 |
| Liquefiable Layer 2 | | 110 | 420 | 0 |

Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELL 1, SOUTHWEST BERM (SECTION F-F)
WITH LIQUEFACTION, CLOSED CELL

REITZ & JENS, INC.

Figure 8-27

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Bishop simplified |
| GLE/Morgenstern-Price with interslice force function (Half Sine) |
| Janbu simplified |
| Janbu corrected |
| Ordinary/Fellenius |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: rand

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

Advanced seismic analysis: No
Staged pseudostatic analysis: No

## Materials

| Property | Gypsum | Compacted Fill | CH | CL-ML | SP | Clay Liner Base | Clay Liner Berm | Protective Cover Base |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 110 | 120 | 113 | 111 | 110 | 120 | 120 | 120 |
| Cohesion [psf] | 0 | 10 | 290 | 0 | 0 | 0 | 0 | 0 |
| Friction Angle [°] | 41 | 30 | 17.5 | 32 | 27 | 15 | 15 | 15 |
| Water Surface | Piezometric Line 2 | None | None | None | None | None | None | None |
| Hu Value | 1 | | | | | | | |
| Ru Value | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Property | Protective Cover Berm | Liquefiable Layer 1 | Liquefiable Layer 2 |
|---|---|---|---|
| Color | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 | 110 | 110 |
| Cohesion [psf] | 0 | 870 | 420 |
| Friction Angle [°] | 15 | 0 | 0 |
| Water Surface | None | None | None |
| Ru Value | 0 | 0 | 0 |

# Entity Information

## Piezoline

| X | Y |
|---|---|
| 0 | 411.5 |
| 1370 | 411.5 |

## External Boundary

| X | Y |
|---|---|
| 594 | 438 |
| 578 | 438 |
| 554 | 446 |
| 542 | 446 |
| 470 | 422 |
| 450.91 | 422 |
| 0 | 422 |
| 0 | 418 |
| 0 | 409 |
| 0 | 404.5 |
| 0 | 404 |
| 0 | 399.5 |
| 0 | 394.5 |
| 0 | 371.888 |
| 0 | 322 |
| 1370 | 322 |
| 1370 | 405.96 |
| 1370 | 409 |
| 1370 | 418 |
| 1370 | 419 |
| 1370 | 420 |
| 1370 | 422 |
| 1370 | 456 |
| 1255 | 456 |
| 623 | 440 |

## Material Boundary

| X | Y |
|---|---|
| 578 | 438 |
| 639 | 422 |
| 1370 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 470 | 422 |
| 470 | 418 |
| 1370 | 419 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 418 |
| 450.91 | 418 |
| 470 | 418 |
| 1370 | 418 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 409 |
| 450.91 | 409 |
| 666 | 409 |
| 1370 | 409 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 443 |
| 554 | 444 |
| 554 | 446 |

## Material Boundary

| X | Y |
|---|---|
| 578 | 435 |
| 578 | 436 |
| 578 | 438 |

## Material Boundary

| X | Y |
|---|---|
| 639 | 419 |
| 639 | 420 |
| 639 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 443 |
| 578 | 435 |
| 639 | 419 |
| 1370 | 419 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 444 |
| 578 | 436 |
| 639 | 420 |
| 1370 | 420 |

## Material Boundary

| X | Y |
| --- | --- |
| 0 | 371.888 |
| 469.254 | 371.841 |
| 578.433 | 388 |
| 823.387 | 394.5 |
| 1011.82 | 399.5 |
| 1200.25 | 404.5 |
| 1255.26 | 405.96 |
| 1370 | 405.96 |

## Material Boundary

| X | Y |
| --- | --- |
| 0 | 394.5 |
| 450.91 | 394.5 |

## Material Boundary

| X | Y |
| --- | --- |
| 450.91 | 394.5 |
| 823.387 | 394.5 |

## Material Boundary

| X | Y |
| --- | --- |
| 0 | 399.5 |
| 450.91 | 399.5 |

## Material Boundary

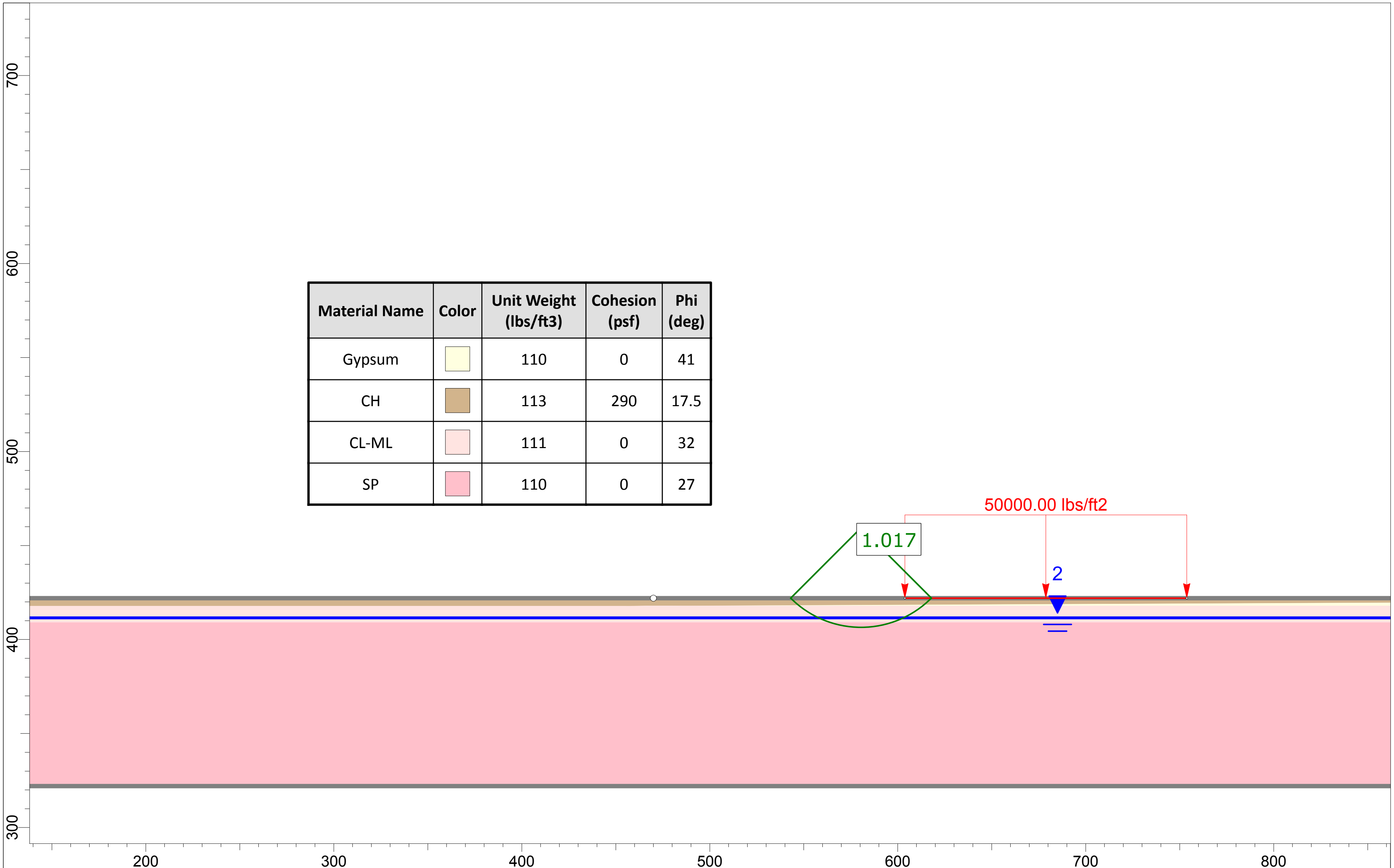
| X | Y |
| --- | --- |
| 450.91 | 399.5 |
| 1011.82 | 399.5 |

## Material Boundary

| X | Y |
| --- | --- |
| 0 | 404.5 |
| 450.91 | 404.5 |

## Material Boundary

| X | Y |
| --- | --- |
| 450.91 | 404.5 |
| 1200.25 | 404.5 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Gypsum | | 110 | 0 | 41 |
| CH | | 113 | 290 | 17.5 |
| CL-ML | | 111 | 0 | 32 |
| SP | | 110 | 0 | 27 |

Ameren Missouri Sioux Energy Center UWL
BEARING CAPACITY ANALYSIS - NATURAL SUBGRADE (SECTION F-F)

REITZ & JENS, INC.

Figure 8-28

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

| | |
|---|---|
| Slices Type: | Vertical |

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | rand |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

## Loading

1 Distributed Load present

| Distributed Load 1 | |
|---|---|
| Distribution: | Constant |
| Magnitude [psf]: | 50000 |
| Orientation: | Vertical |

## Materials

| Property | Gypsum | CH | CL-ML | SP |
|---|---|---|---|---|
| Color | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 110 | 113 | 111 | 110 |
| Cohesion [psf] | 0 | 290 | 0 | 0 |
| Friction Angle [°] | 41 | 17.5 | 32 | 27 |
| Water Surface | Piezometric Line 2 | None | None | None |
| Hu Value | 1 | | | |
| Ru Value | | 0 | 0 | 0 |

## Entity Information

### Piezoline

| X | Y |
|---|---|
| 0 | 411.5 |

| | |
|---|---|
| 1370 | 411.5 |

## Distributed Load

| X | Y |
|---|---|
| 603.777 | 422 |
| 753.777 | 422 |

## External Boundary

| X | Y |
|---|---|
| 470 | 422 |
| 0 | 422 |
| 0 | 418 |
| 0 | 409 |
| 0 | 322 |
| 1370 | 322 |
| 1370 | 409 |
| 1370 | 418 |
| 1370 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 470 | 422 |
| 470 | 418 |
| 1370 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 418 |
| 470 | 418 |
| 1370 | 418 |

## Material Boundary

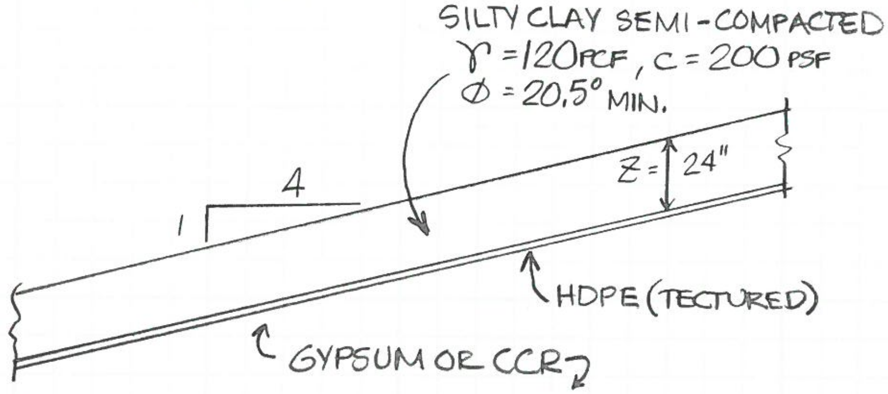
| X | Y |
|---|---|
| 0 | 409 |
| 1370 | 409 |

REITZ & JENS, INC.
CONSULTING ENGINEERS

PROJECT: AMEREN SIOUX EC UWL REDESIGN
SUBJECT: STABILITY OF FINAL COVER

DATE: 1/8/2020 BY: J. FOUSE Proj. Number: 2019012439 SHEET: 1 OF:

## STABILITY OF FINAL COVER




ASSUME NO SEEPAGE THROUGH HDPE MEMBRANE.

FOR "INFINITE SLOPE", $F = \frac{C}{\gamma z} \cdot \frac{1}{\sin\beta\cos\beta} + \frac{\tan\phi'}{\tan\beta}$

$\beta = \tan^{-1}\left(\frac{1}{4}\right) = 14.0°$

$F = \frac{200 \text{ PSF}}{(120 \text{ PCF})(2')} \cdot \frac{1}{\sin(14°)\cos(14°)} + \frac{\tan(20.5°)}{\tan(14°)} = 5.0$

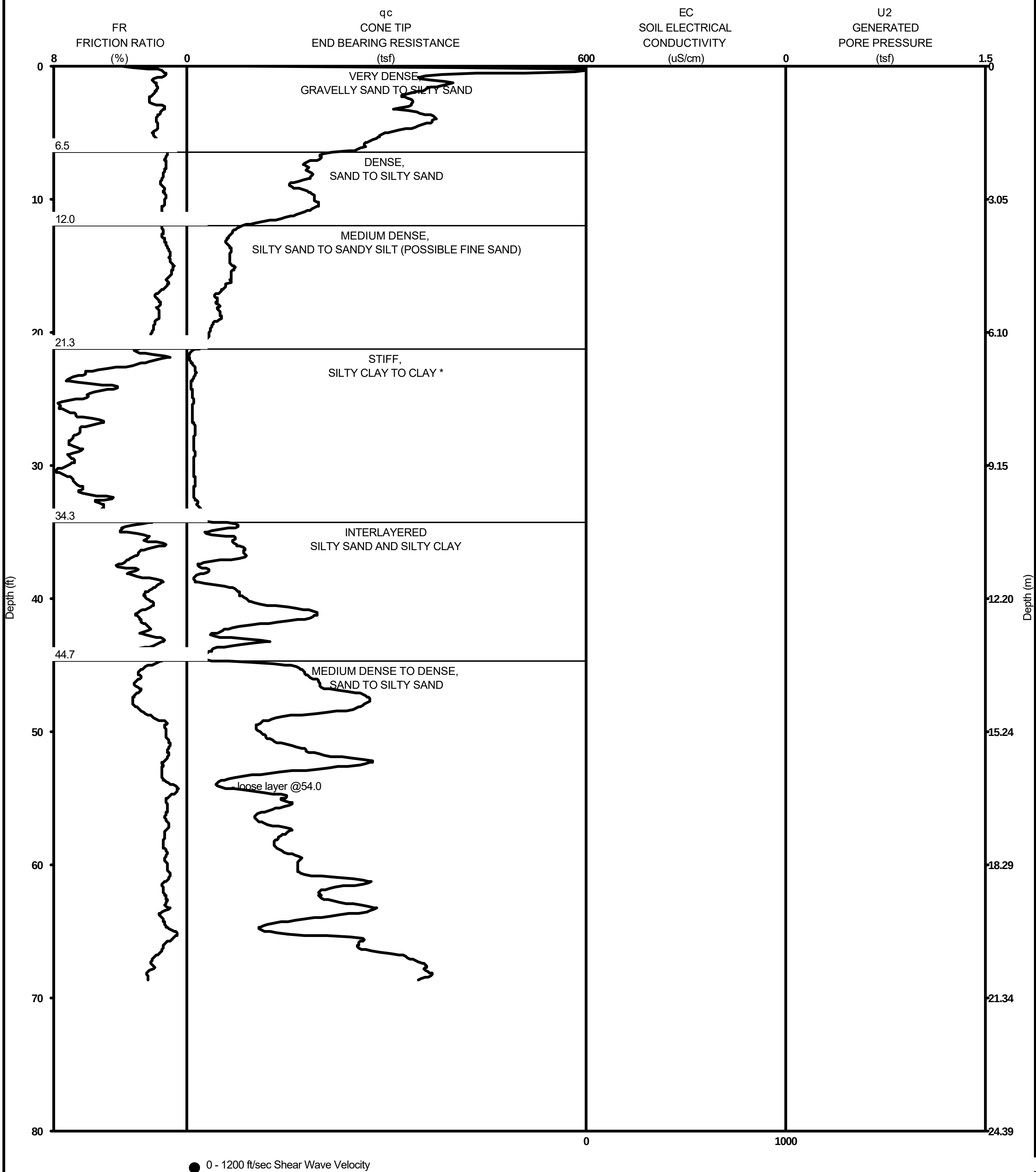
FOR $C = 0$, $F = \frac{\tan(20.5°)}{\tan(14°)} = 1.5$

SO, MINIMUM Ø FOR SOIL COVER IS 20.5°

## Appendix 9

# RESULTS OF CONE PENETROMETER TESTS (CPT) AT SIOUX ENERGY CENTER

# PRELIMINARY CPTU-EC LOG WITH LITHOLOGIC EVALUATION CP-T01

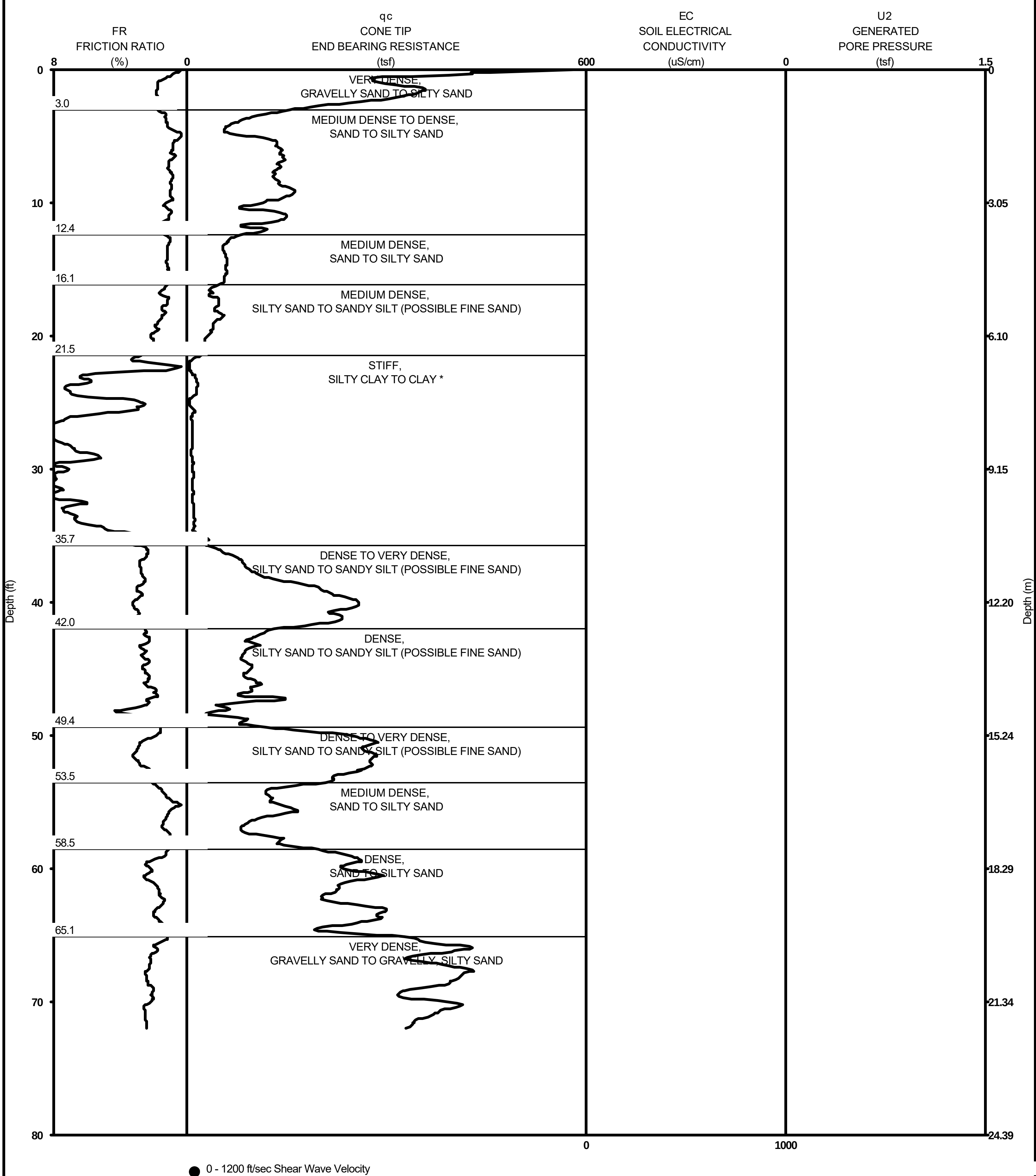



PROJECT NAME:Ameren Sioux WFGD
PROJECT NUMBER:06-110-170

**STRATIGRAPHICS**

R1DATE: 7-04-2006 TIME:07:59:11.40
SOUNDING NUMBER:CPT-01

# PRELIMINARY CPTU-EC LOG WITH LITHOLOGIC EVALUATION CP-T02

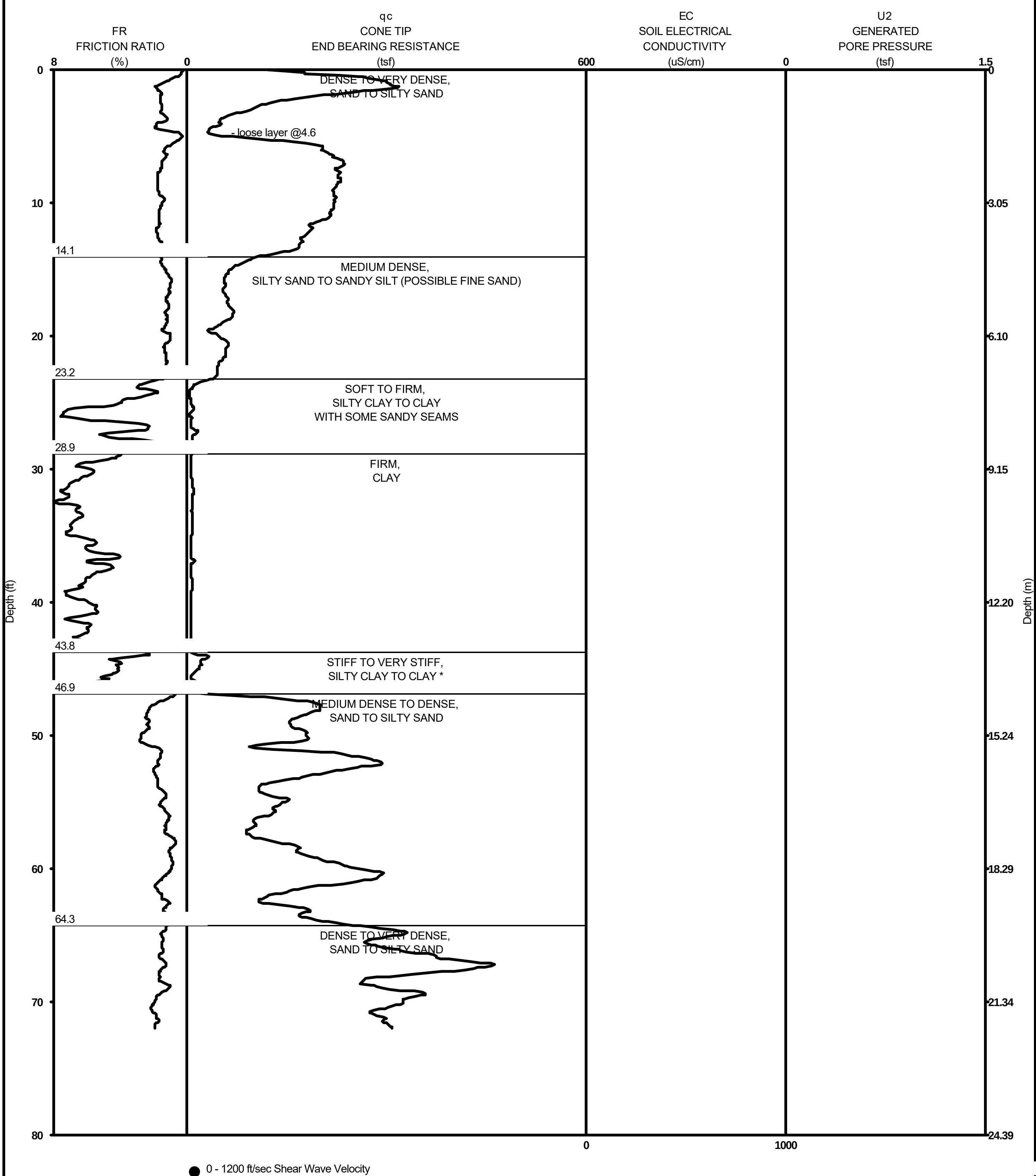



PROJECT NAME:Ameren Sioux WFGD
PROJECT NUMBER:06-110-170

**_STRATIGRAPHICS_**

R1DATE: 7-04-2006 TIME:17:25:21.56
SOUNDING NUMBER:CPT-02

# PRELIMINARY CPTU-EC LOG WITH LITHOLOGIC EVALUATION CP-T03

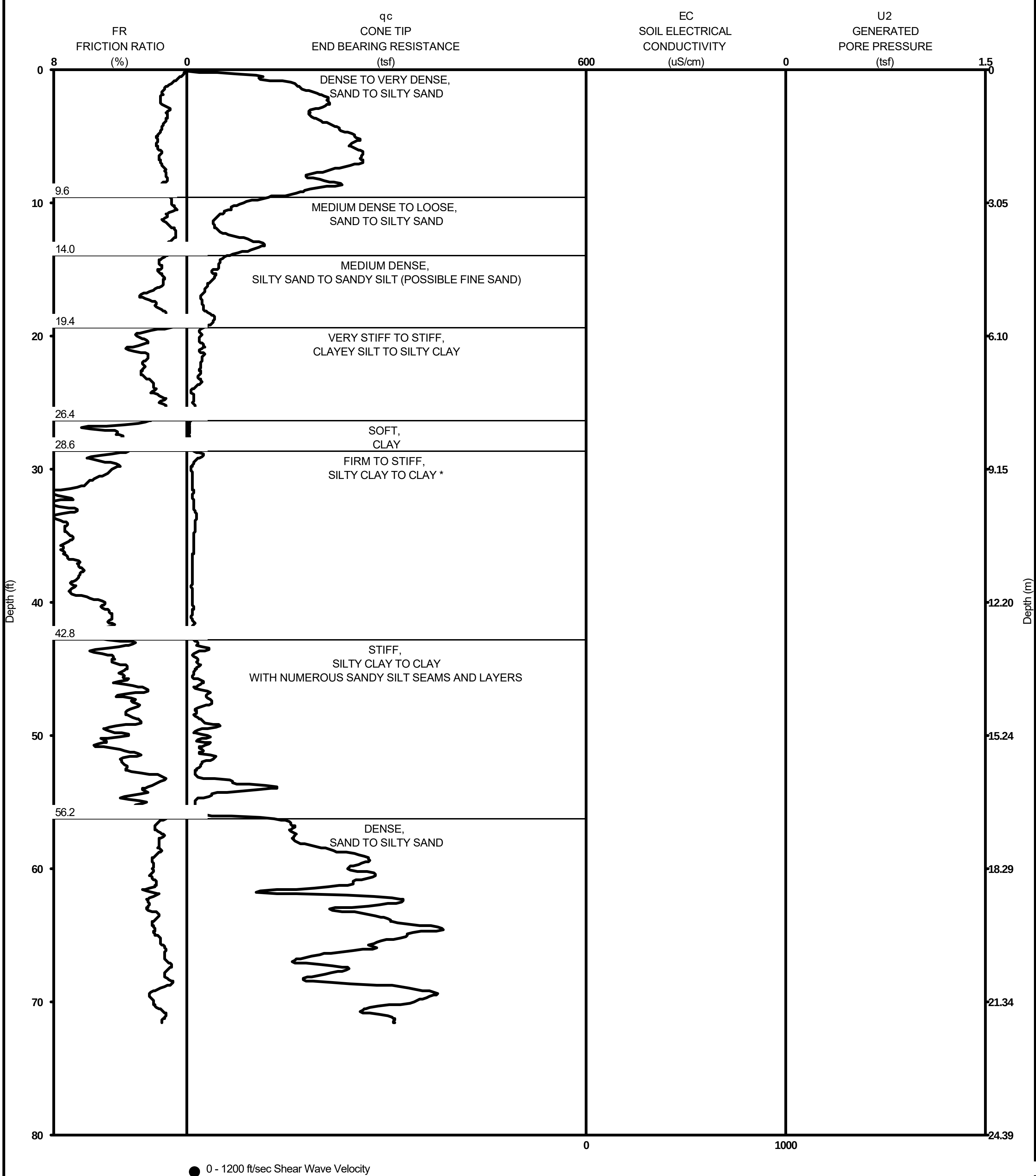



PROJECT NAME:Ameren Sioux WFGD
PROJECT NUMBER:06-110-170

**STRATIGRAPHICS**

R1DATE: 7-04-2006 TIME:09:20:07.64
SOUNDING NUMBER:CPT-03

# PRELIMINARY CPTU-EC LOG WITH LITHOLOGIC EVALUATION CP-T04

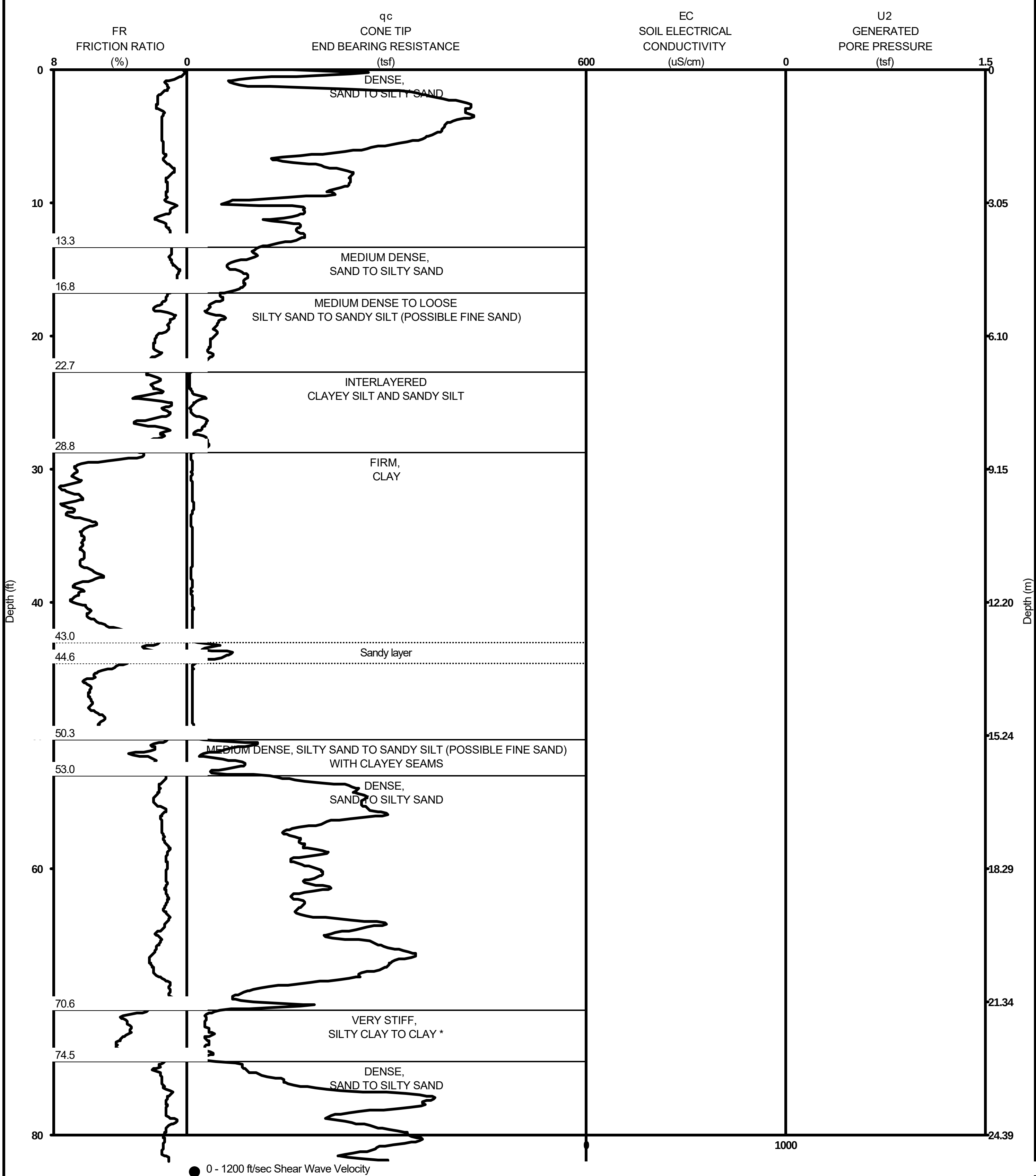



PROJECT NAME:Ameren Sioux WFGD
PROJECT NUMBER:06-110-170

**STRATIGRAPHICS**

R1DATE: 7-04-2006 TIME:13:43:16.14
SOUNDING NUMBER:CPT-04

# PRELIMINARY CPTU-EC LOG WITH LITHOLOGIC EVALUATION CP-T05

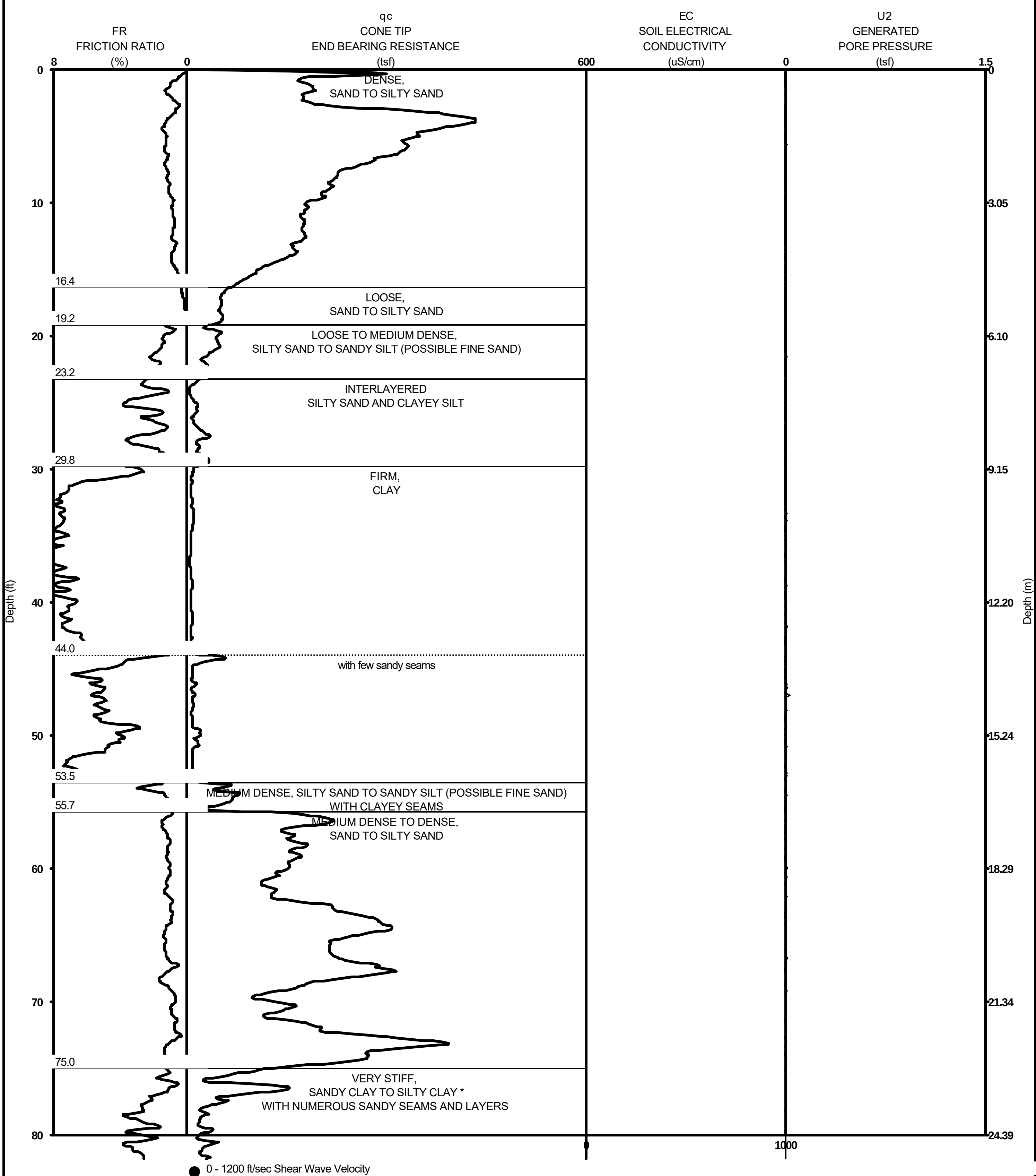



PROJECT NAME:Ameren Sioux WFGD
PROJECT NUMBER:06-110-170

***STRATIGRAPHICS***

R1DATE: 7-03-2006 TIME:14:29:28.28
SOUNDING NUMBER:CPT-05

# PRELIMINARY CPTU-EC LOG WITH LITHOLOGIC EVALUATION CP-T06

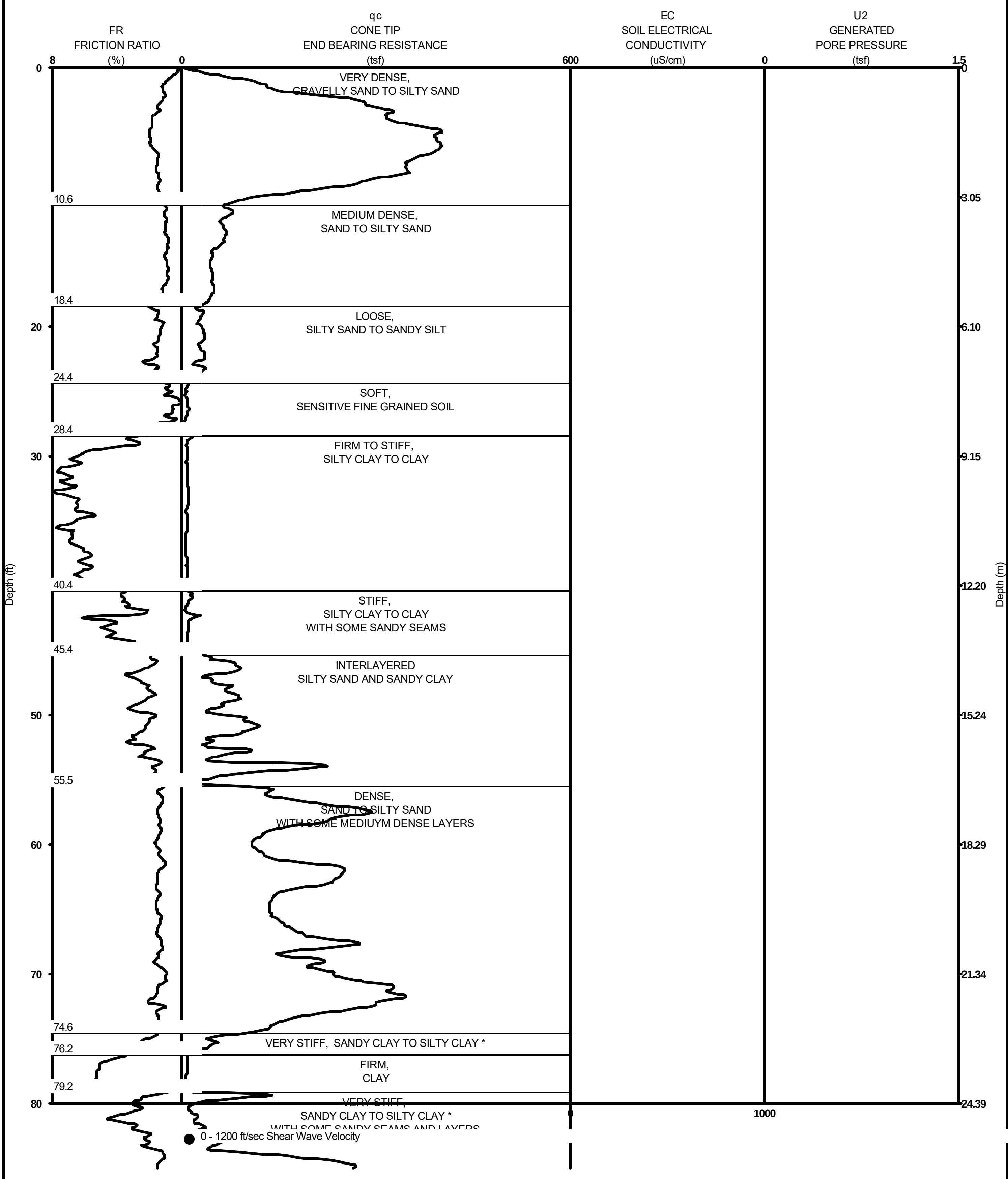



PROJECT NAME:Ameren Sioux WFGD
PROJECT NUMBER:06-110-170

**STRATIGRAPHICS**

R1DATE: 7-03-2006 TIME:11:45:18.00
SOUNDING NUMBER:CPT-06

# PRELIMINARY CPTU-EC LOG WITH LITHOLOGIC EVALUATION CP-T07

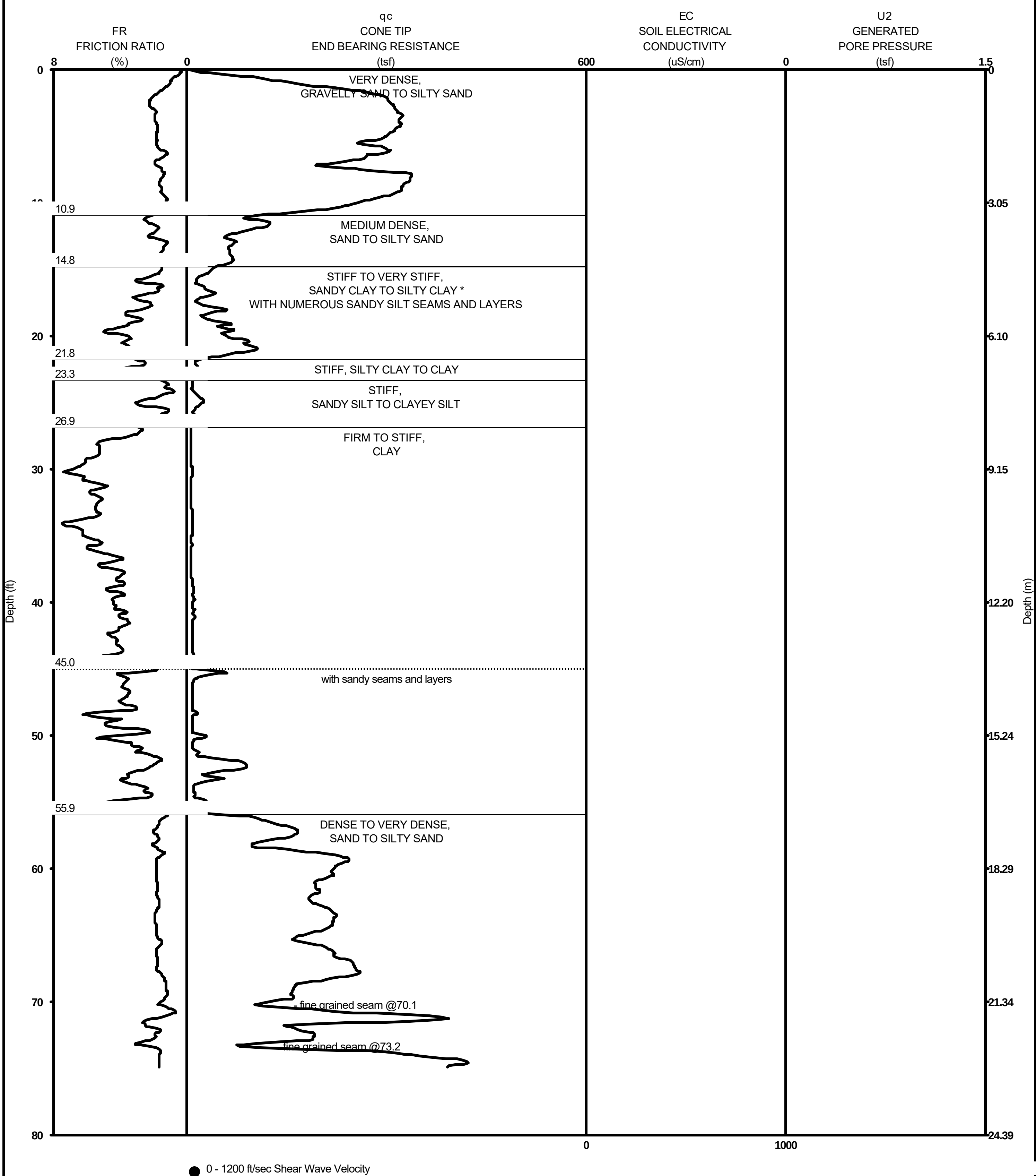



PROJECT NAME:Ameren Sioux WFGD
PROJECT NUMBER:06-110-170

***STRATIGRAPHICS***

R1DATE: 7-04-2006 TIME:10:06:39.78
SOUNDING NUMBER:CPT-07

# PRELIMINARY CPTU-EC LOG WITH LITHOLOGIC EVALUATION CP-T08

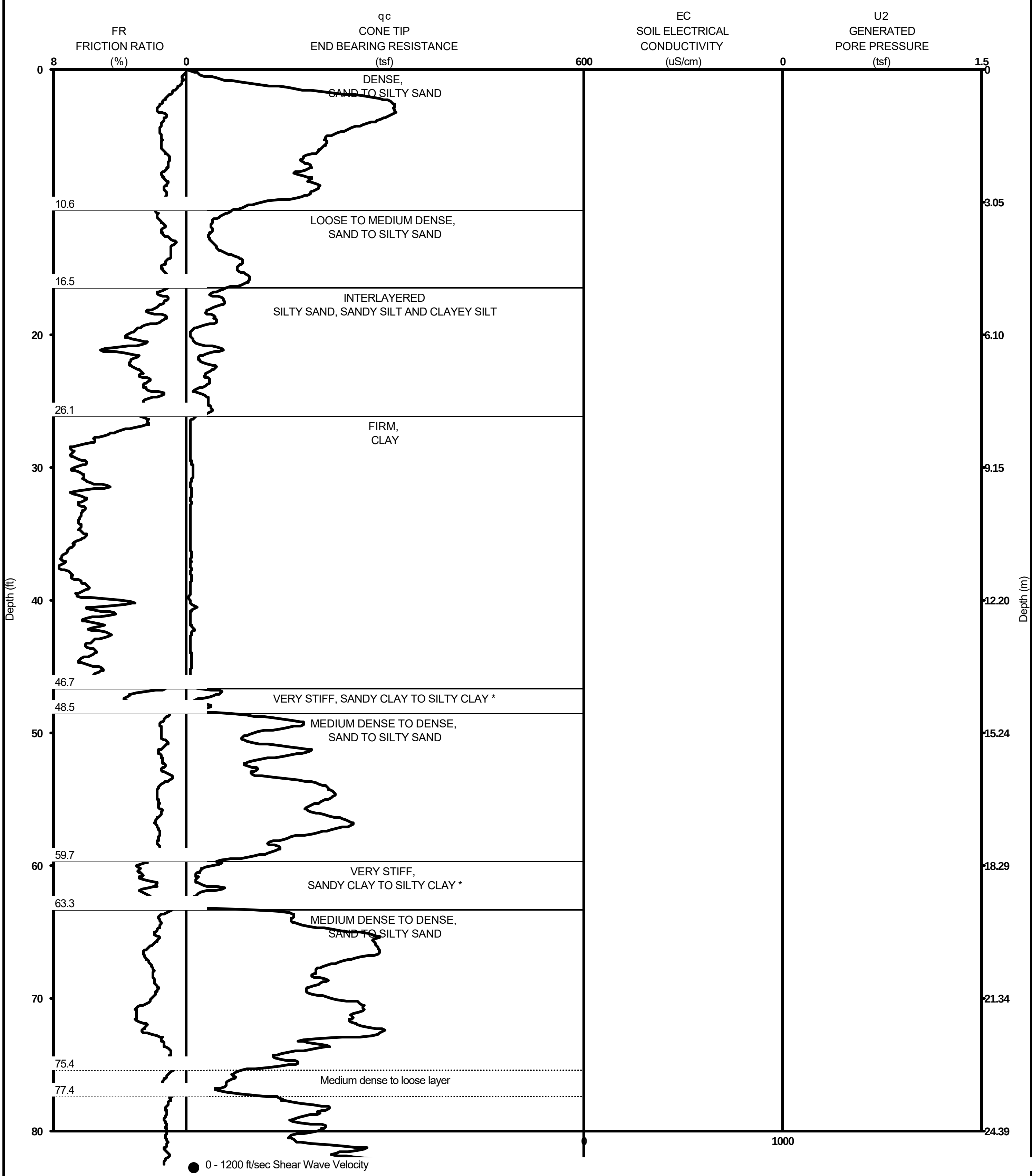



PROJECT NAME:Ameren Sioux WFGD
PROJECT NUMBER:06-110-170

***STRATIGRAPHICS***

R1DATE: 7-04-2006 TIME:11:19:41.35
SOUNDING NUMBER:CPT-08

# PRELIMINARY CPTU-EC LOG WITH LITHOLOGIC EVALUATION CP-T09

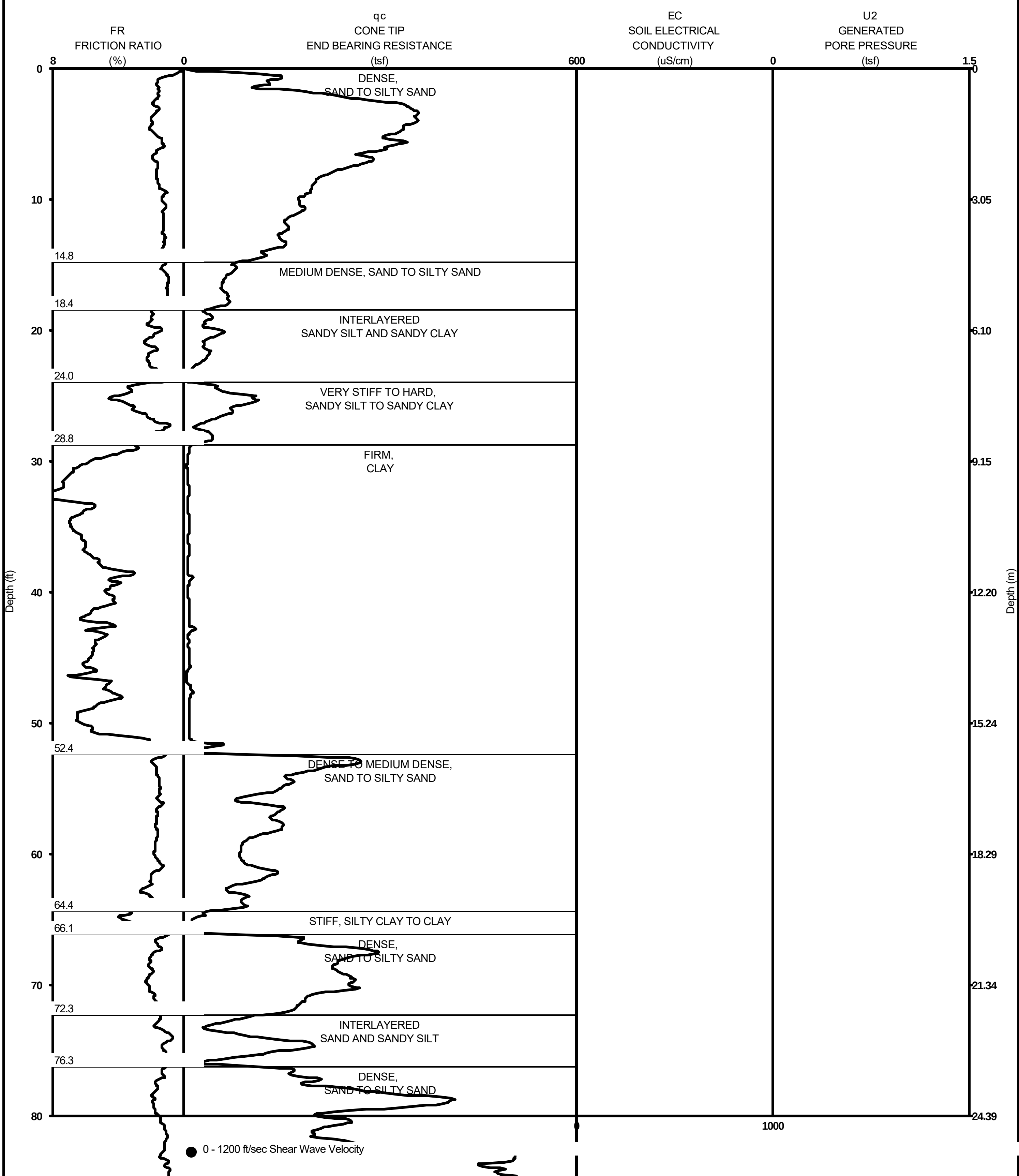



PROJECT NAME:Ameren Sioux WFGD
PROJECT NUMBER:06-110-170

***STRATIGRAPHICS***

R1DATE: 7-03-2006 TIME:16:45:45.92
SOUNDING NUMBER:CPT-09

# PRELIMINARY CPTU-EC LOG WITH LITHOLOGIC EVALUATION CP-T10

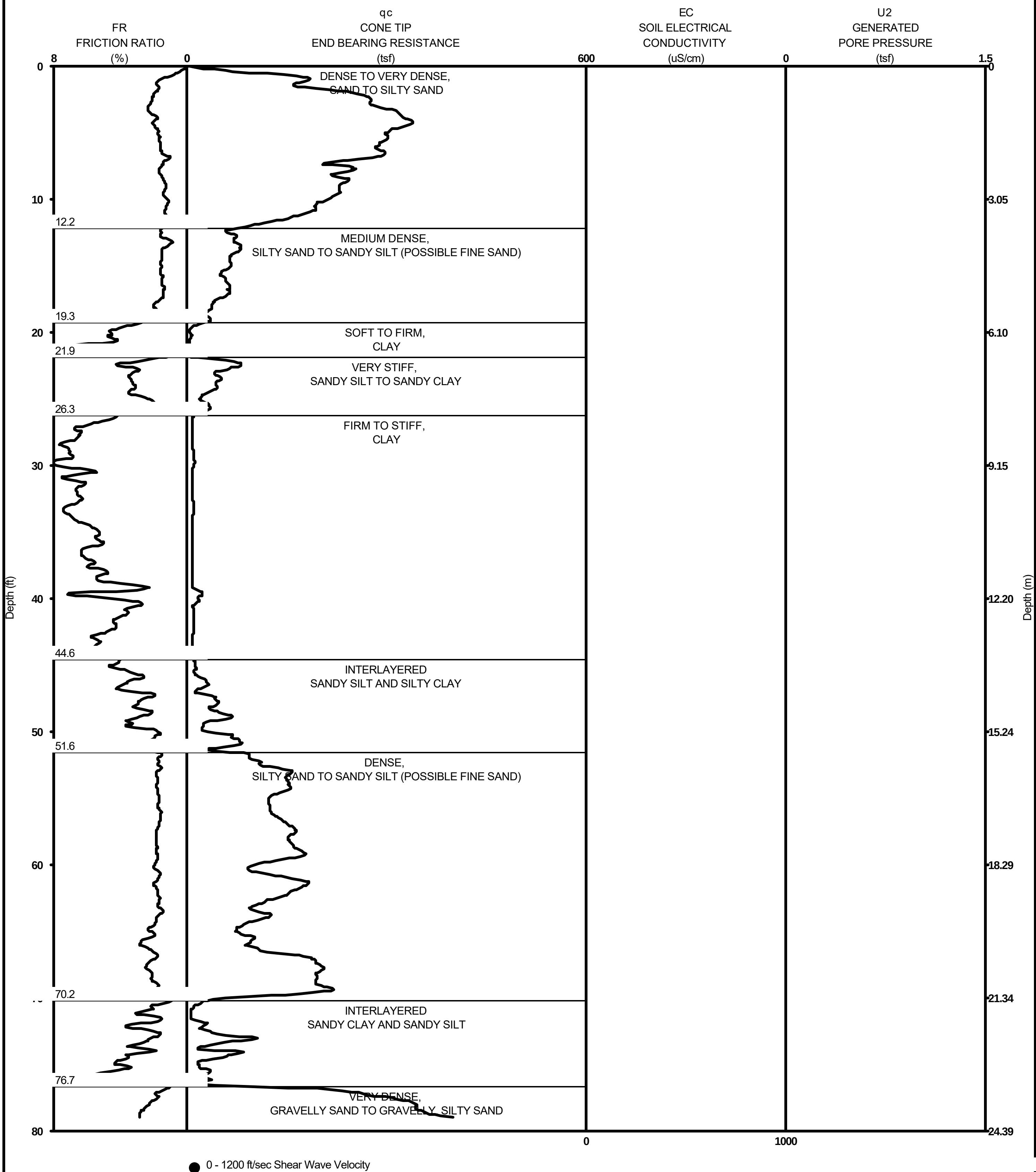



PROJECT NAME:Ameren Sioux WFGD
PROJECT NUMBER:06-110-170

***STRATIGRAPHICS***

R1DATE: 7-03-2006 TIME:15:39:36.35
SOUNDING NUMBER:CPT-10

# PRELIMINARY CPTU-EC LOG WITH LITHOLOGIC EVALUATION CP-T11




PROJECT NAME:Ameren Sioux WFGD
PROJECT NUMBER:06-110-170

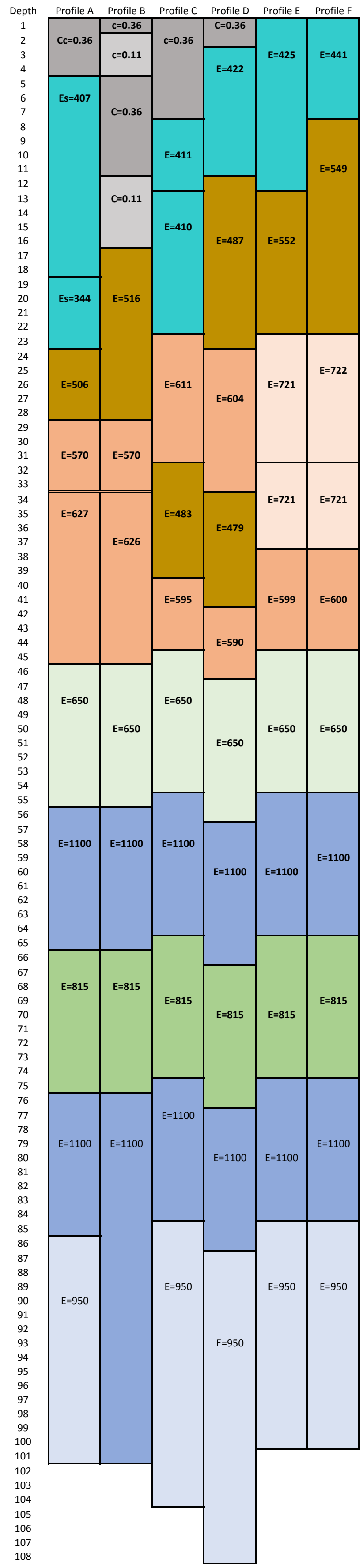
**_STRATIGRAPHICS_**

R1DATE: 7-04-2006 TIME:15:53:12.37
SOUNDING NUMBER:CPT-11

**Appendix 10**

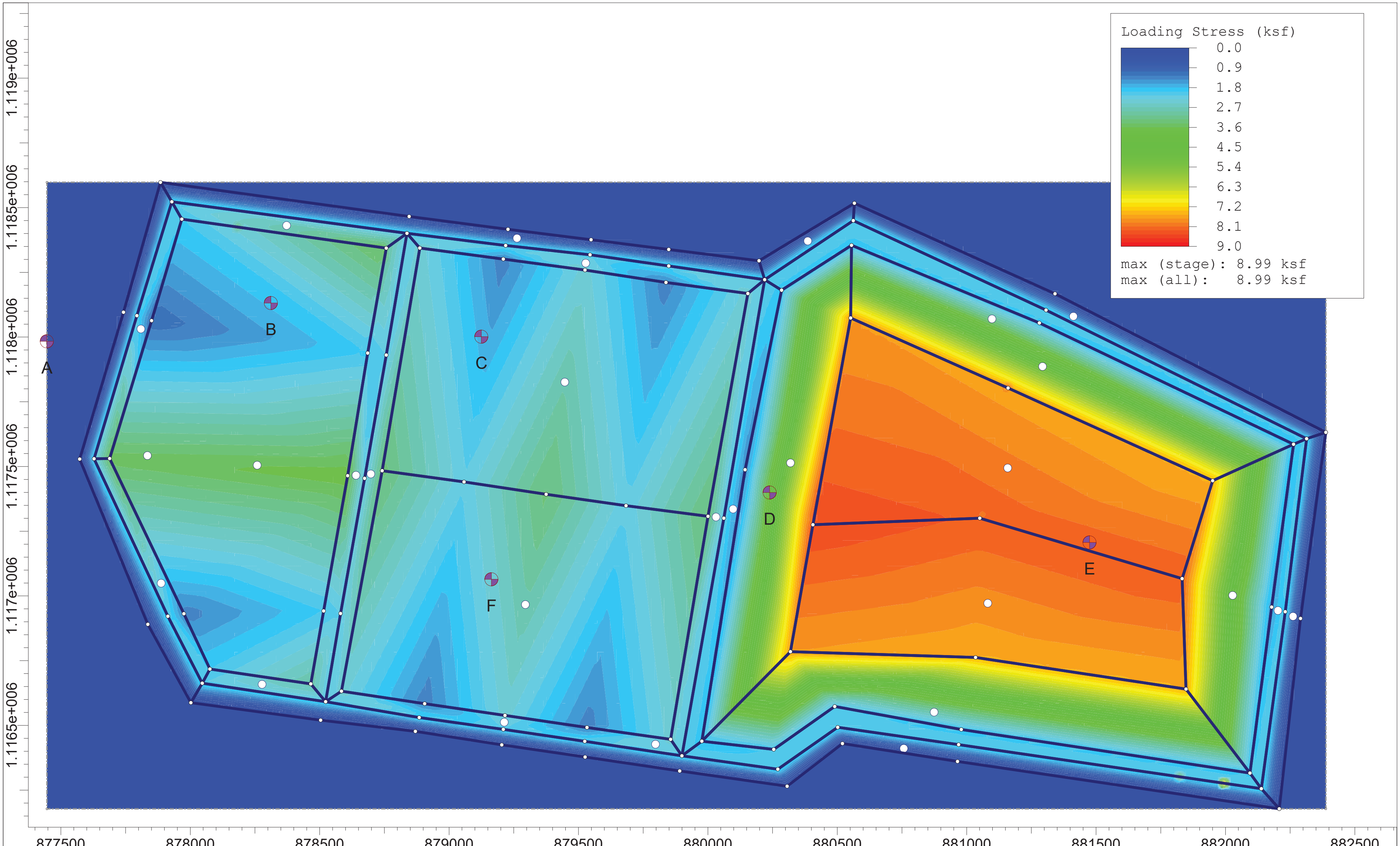
## RESULTS OF SETTLEMENT ANALYSES

# Ameren Missouri Sioux Energy Center UWL
# SUMMARY OF SOIL PROPERTIES FOR SETTLEMENT ANALYSES



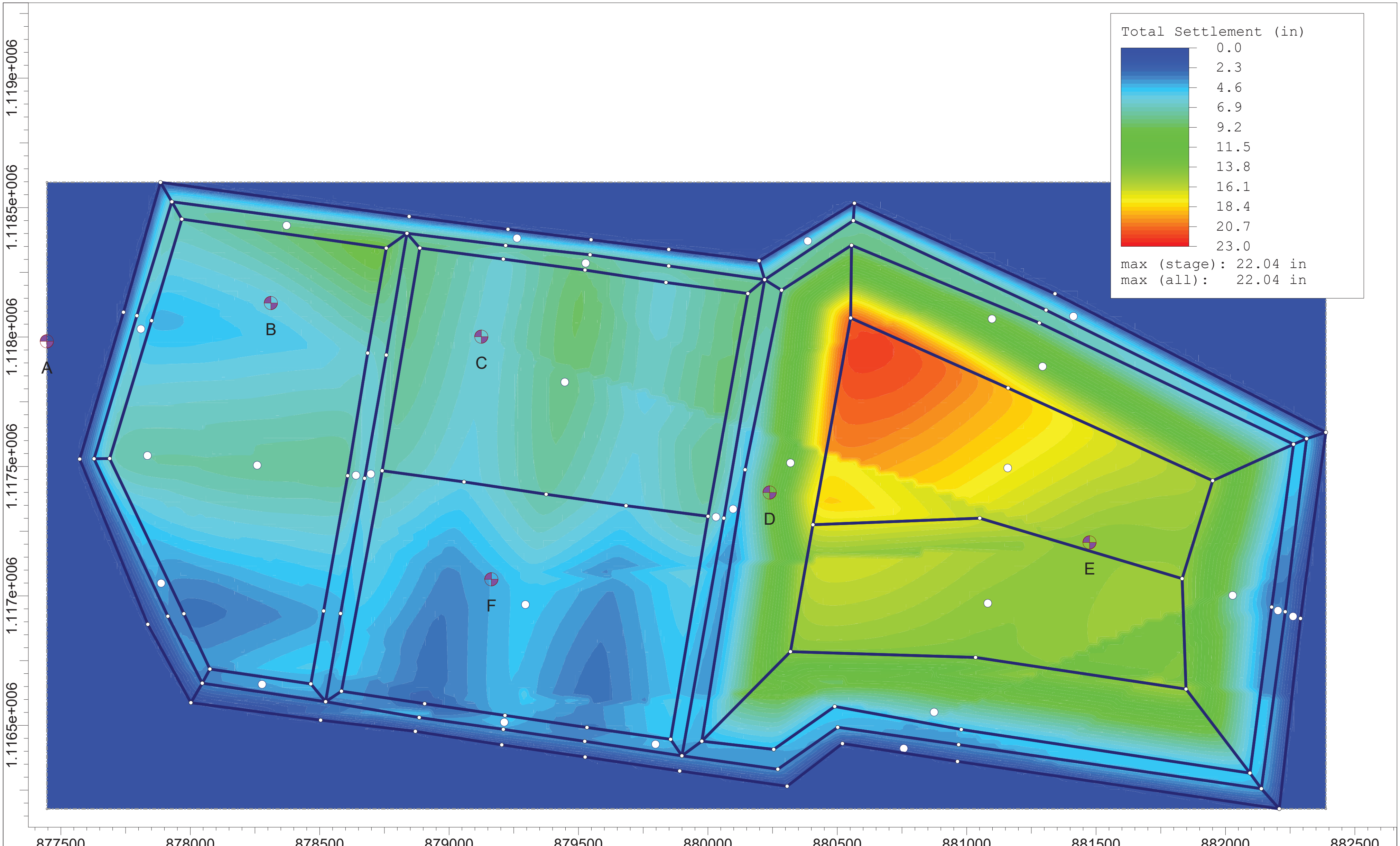

| | g (pcf) | g ' (pcf) | eo | ES (ksf) | CC | CR | Pc (psf) |
|---|---|---|---|---|---|---|---|
| CH | 113 | 50.6 | 1.125 | 0 | 0.36 | 0.07 | 5100 |
| CL-ML | 111 | 48.6 | 1.182 | 0 | 0.11 | 0.01 | 4260 |
| ML | 111 | 48.6 | | 400 | 0 | 0 | 0 |
| SP-SM | 110 | 47.6 | | 500 | 0 | 0 | 0 |
| SP1 | 110 | 47.6 | | 600 | 0 | 0 | 0 |
| SP2 | 110 | 47.6 | | 650 | 0 | 0 | 0 |
| SP3 | 110 | 47.6 | | 721 | 0 | 0 | 0 |
| SP4 | 110 | 47.6 | | 815 | 0 | 0 | 0 |
| SP5 | 110 | 47.6 | | 950 | 0 | 0 | 0 |
| SP6 | 110 | 47.6 | | 1100 | 0 | 0 | 0 |

| | x | y |
|---|---|---|
| Profile A | 877446 | 1117983 |
| Profile B | 878312 | 1118131 |
| Profile C | 879125 | 1118001 |
| Profile D | 880239 | 1117399 |
| Profile E | 881475 | 1117206 |
| Profile F | 879164 | 1117064 |




SETTLE3D 3.020

| | | | |
|---|---|---|---|
| *Project* | Ameren Missouri Sioux Energy Center Utility Waste Landfill | | |
| *Analysis Description* | Total Loading Stress | | |
| *Drawn By* | C. Cook | *Company* | Ameren Missouri |
| *Date* | 12/9/2019, 1:13:39 PM | *File Name* | Sioux UWL Settlement.s3z |




| | | | |
|---|---|---|---|
| Project | Ameren Missouri Sioux Energy Center Utility Waste Landfill | | |
| Analysis Description | Total Settlement | | |
| Drawn By | C. Cook | Company | Ameren Missouri |
| Date | 12/9/2019, 1:13:39 PM | File Name | Sioux UWL Settlement.s3z |

SETTLE3D 3.020

# Settle3D Analysis Information
# Sioux UWL

## Project Settings

| | |
|---|---|
| Document Name | Sioux UWL Settlement.s3z |
| Project Title | Sioux UWL |
| Analysis | Total Settlement |
| Author | C. Cook |
| Company | Ameren Services |
| Date Created | 12/9/2019, 1:13:39 PM |
| Stress Computation Method | Boussinesq |
| Use average properties to calculate layered stresses | |
| Improve consolidation accuracy | |
| Ignore negative effective stresses in settlement calculations | |

## Stage Settings

| Stage # | Name |
|---|---|
| 1 | Stage 1 |

## Results

Time taken to compute: 0 seconds

### Stage: Stage 1

| Data Type | Minimum | Maximum |
|---|---|---|
| Total Settlement [in] | 0 | 22.0367 |
| Consolidation Settlement [in] | 0 | 6.9319 |
| Immediate Settlement [in] | 0 | 16.5623 |
| Loading Stress [ksf] | 0 | 8.98723 |
| Effective Stress [ksf] | 0 | 14.1519 |
| Total Stress [ksf] | 0 | 21.4426 |
| Total Strain | 0 | 0.241847 |
| Pore Water Pressure [ksf] | 0 | 7.3008 |
| Degree of Consolidation [%] | 0 | 100 |
| Pre-consolidation Stress [ksf] | 0.00562808 | 14.1408 |
| Over-consolidation Ratio | 1 | 9.87743e+006 |
| Void Ratio | 0 | 1.182 |
| Hydroconsolidation Settlement [in] | 0 | 0 |
| Undrained Shear Strength | 0 | 1.45341 |

## Loads

### 1. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 1.30936e+006 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

**Coordinates and Load**

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 878515 | 1.11694e+006 | 1.98 |
| 878608 | 1.11746e+006 | 3.74 |
| 878686 | 1.11794e+006 | 1.98 |
| 878757 | 1.11834e+006 | 3.52 |
| 877967 | 1.11846e+006 | 1.98 |
| 877851 | 1.11806e+006 | 1.1 |
| 877688 | 1.11753e+006 | 3.52 |
| 877975 | 1.11693e+006 | 1.32 |
| 878076 | 1.11672e+006 | 1.98 |
| 878466 | 1.11666e+006 | 2.86 |

## 2. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 1.11592e+006 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

**Coordinates and Load**

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 878742 | 1.11748e+006 | 3.3 |
| 879058 | 1.11744e+006 | 2.2 |
| 879375 | 1.11739e+006 | 3.3 |
| 879684 | 1.11735e+006 | 2.2 |
| 880000 | 1.11731e+006 | 3.3 |
| 880155 | 1.11817e+006 | 2.42 |
| 879838 | 1.11821e+006 | 1.32 |
| 879525 | 1.11826e+006 | 2.42 |
| 879209 | 1.1183e+006 | 1.32 |
| 878887 | 1.11834e+006 | 2.42 |

## 3. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 1.11097e+006 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

**Coordinates and Load**

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 879684 | 1.11735e+006 | 2.2 |
| 879375 | 1.11739e+006 | 3.3 |
| 879058 | 1.11744e+006 | 2.2 |
| 878742 | 1.11748e+006 | 3.3 |
| 878584 | 1.11663e+006 | 2.42 |
| 878905 | 1.11658e+006 | 1.32 |
| 879216 | 1.11654e+006 | 2.42 |
| 879533 | 1.11649e+006 | 1.32 |
| 879856 | 1.11645e+006 | 2.42 |
| 880000 | 1.11731e+006 | 3.3 |

## 4. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 734334 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 880319 | 1.11678e+006 | 7.74 |
| 881034 | 1.11676e+006 | 7.568 |
| 881848 | 1.11664e+006 | 7.568 |
| 881833 | 1.11707e+006 | 8.256 |
| 881051 | 1.1173e+006 | 8.256 |
| 880406 | 1.11728e+006 | 8.428 |

## 5. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 803038 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 881950 | 1.11745e+006 | 7.568 |
| 881160 | 1.1178e+006 | 7.654 |
| 880552 | 1.11807e+006 | 7.74 |
| 880406 | 1.11728e+006 | 8.428 |
| 881051 | 1.1173e+006 | 8.256 |
| 881833 | 1.11707e+006 | 8.256 |

## 6. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 458740 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 882263 | 1.11759e+006 | 1.72 |
| 881281 | 1.11805e+006 | 1.892 |
| 880555 | 1.11835e+006 | 1.892 |
| 880552 | 1.11807e+006 | 7.74 |
| 881160 | 1.1178e+006 | 7.654 |
| 881950 | 1.11745e+006 | 7.568 |

## 7. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 329946 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

**Coordinates and Load**

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 882095 | 1.11632e+006 | 1.892 |
| 882178 | 1.11696e+006 | 1.548 |
| 882263 | 1.11759e+006 | 1.72 |
| 881950 | 1.11745e+006 | 7.568 |
| 881833 | 1.11707e+006 | 8.256 |
| 881848 | 1.11664e+006 | 7.568 |

## 8. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 513704 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

**Coordinates and Load**

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 881848 | 1.11664e+006 | 7.568 |
| 881034 | 1.11676e+006 | 7.568 |
| 880319 | 1.11678e+006 | 7.74 |
| 879977 | 1.11644e+006 | 1.806 |
| 880255 | 1.11641e+006 | 1.978 |
| 880490 | 1.11657e+006 | 1.987 |
| 880979 | 1.11648e+006 | 1.892 |
| 882095 | 1.11632e+006 | 1.892 |

## 9. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 481941 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

**Coordinates and Load**

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 880319 | 1.11678e+006 | 7.74 |
| 880406 | 1.11728e+006 | 8.428 |
| 880552 | 1.11807e+006 | 7.74 |
| 880555 | 1.11835e+006 | 1.892 |
| 880285 | 1.11818e+006 | 1.892 |
| 880144 | 1.11749e+006 | 1.376 |
| 879977 | 1.11644e+006 | 1.806 |

## 10. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 25905.6 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 878076 | 1.11672e+006 | 1.98 |
| 878046 | 1.11666e+006 | 2.16 |
| 878523 | 1.11659e+006 | 2.16 |
| 878466 | 1.11666e+006 | 2.86 |

## 11. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 120910 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 878581 | 1.11693e+006 | 2.16 |
| 878674 | 1.11745e+006 | 2.16 |
| 878757 | 1.11793e+006 | 2.16 |
| 878837 | 1.1184e+006 | 2.16 |
| 878757 | 1.11834e+006 | 3 |
| 878686 | 1.11794e+006 | 1.98 |
| 878608 | 1.11746e+006 | 3.74 |
| 878515 | 1.11694e+006 | 1.98 |
| 878466 | 1.11666e+006 | 2.86 |
| 878523 | 1.11659e+006 | 2.16 |

## 12. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 105431 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 878523 | 1.11659e+006 | 2.16 |
| 878584 | 1.11663e+006 | 2.43 |
| 878742 | 1.11748e+006 | 3.3 |
| 878887 | 1.11834e+006 | 2.42 |
| 878837 | 1.1184e+006 | 2.16 |
| 878757 | 1.11793e+006 | 2.16 |
| 878674 | 1.11745e+006 | 2.16 |
| 878581 | 1.11693e+006 | 2.16 |

## 13. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 78466.8 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 878837 | 1.1184e+006 | 2.16 |
| 878887 | 1.11834e+006 | 2.42 |
| 879209 | 1.1183e+006 | 1.32 |
| 879525 | 1.11826e+006 | 2.42 |
| 879838 | 1.11821e+006 | 1.32 |
| 880155 | 1.11817e+006 | 2.42 |
| 880220 | 1.11822e+006 | 2.16 |
| 879849 | 1.11827e+006 | 2.16 |
| 879545 | 1.11832e+006 | 2.16 |
| 879219 | 1.11835e+006 | 2.16 |

## 14. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 104549 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 880220 | 1.11822e+006 | 2.16 |
| 880155 | 1.11817e+006 | 2.42 |
| 880000 | 1.11731e+006 | 3.3 |
| 879856 | 1.11645e+006 | 2.42 |
| 879900 | 1.11638e+006 | 2.16 |
| 880062 | 1.1173e+006 | 2.16 |

## 15. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 72824.6 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 878885 | 1.11653e+006 | 2.16 |
| 879210 | 1.11648e+006 | 2.16 |
| 879524 | 1.11644e+006 | 2.16 |
| 879900 | 1.11638e+006 | 2.16 |
| 879856 | 1.11645e+006 | 2.42 |
| 879533 | 1.11649e+006 | 1.32 |
| 879216 | 1.11654e+006 | 2.42 |
| 878905 | 1.11658e+006 | 1.32 |
| 878584 | 1.11663e+006 | 2.42 |
| 878523 | 1.11659e+006 | 2.16 |

## 16. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 55332.9 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 878837 | 1.1184e+006 | 2.16 |
| 877929 | 1.11852e+006 | 2.16 |
| 877967 | 1.11846e+006 | 1.98 |
| 878757 | 1.11834e+006 | 3.52 |

## 17. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 58655.3 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 877929 | 1.11852e+006 | 2.16 |
| 877794 | 1.11808e+006 | 2.16 |
| 877628 | 1.11753e+006 | 2.16 |
| 877688 | 1.11753e+006 | 3.52 |
| 877851 | 1.11806e+006 | 1.1 |
| 877967 | 1.11846e+006 | 1.98 |

## 18. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 52912 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 877628 | 1.11753e+006 | 2.16 |
| 877913 | 1.11692e+006 | 2.16 |
| 878046 | 1.11666e+006 | 2.16 |
| 878076 | 1.11672e+006 | 1.98 |
| 877975 | 1.11693e+006 | 1.32 |
| 877688 | 1.11753e+006 | 3.52 |

## 19. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 107034 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 879977 | 1.11644e+006 | 1.86 |
| 880144 | 1.11749e+006 | 1.376 |
| 880285 | 1.11818e+006 | 1.892 |
| 880220 | 1.11822e+006 | 2.16 |
| 880062 | 1.1173e+006 | 2.16 |
| 879900 | 1.11638e+006 | 2.16 |

## 20. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 141551 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 879900 | 1.11638e+006 | 2.16 |
| 880270 | 1.11633e+006 | 2.16 |
| 880502 | 1.11649e+006 | 2.16 |
| 880969 | 1.11643e+006 | 2.16 |
| 882139 | 1.11626e+006 | 2.16 |
| 882095 | 1.11632e+006 | 1.892 |
| 880979 | 1.11648e+006 | 1.892 |
| 880490 | 1.11657e+006 | 1.987 |
| 880255 | 1.11641e+006 | 1.978 |
| 879977 | 1.11644e+006 | 1.806 |

## 21. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 68800.3 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 882231 | 1.11694e+006 | 2.16 |
| 882314 | 1.11761e+006 | 2.16 |
| 882263 | 1.11759e+006 | 1.72 |
| 882178 | 1.11696e+006 | 1.548 |
| 882095 | 1.11632e+006 | 1.892 |
| 882139 | 1.11626e+006 | 2.16 |

## 22. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 138996 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 881307 | 1.1181e+006 | 2.16 |
| 880562 | 1.11845e+006 | 2.16 |
| 880220 | 1.11822e+006 | 2.16 |
| 880285 | 1.11818e+006 | 1.892 |
| 880555 | 1.11835e+006 | 1.892 |
| 881281 | 1.11805e+006 | 1.892 |
| 882263 | 1.11759e+006 | 1.72 |
| 882314 | 1.11761e+006 | 2.16 |

## 23. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 150341 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 880220 | 1.11822e+006 | 2.16 |
| 880198 | 1.11829e+006 | 0 |
| 879849 | 1.11834e+006 | 0 |
| 879549 | 1.11838e+006 | 0 |
| 879228 | 1.11842e+006 | 0 |
| 878846 | 1.11847e+006 | 0 |
| 877885 | 1.1186e+006 | 0 |
| 877929 | 1.11852e+006 | 2.16 |
| 878837 | 1.1184e+006 | 2.16 |
| 879219 | 1.11835e+006 | 2.16 |
| 879545 | 1.11832e+006 | 2.16 |
| 879849 | 1.11827e+006 | 2.16 |

## 24. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 130672 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 877885 | 1.1186e+006 | 0 |
| 877742 | 1.1181e+006 | 0 |
| 877573 | 1.11753e+006 | 0 |
| 877836 | 1.11689e+006 | 0 |
| 878002 | 1.11659e+006 | 0 |
| 878046 | 1.11666e+006 | 2.16 |
| 877913 | 1.11692e+006 | 2.16 |
| 877628 | 1.11753e+006 | 2.16 |
| 877794 | 1.11808e+006 | 2.16 |
| 877929 | 1.11852e+006 | 2.16 |

## 25. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 273720 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 878002 | 1.11659e+006 | 0 |
| 878504 | 1.11652e+006 | 0 |
| 878870 | 1.11648e+006 | 0 |
| 879203 | 1.11642e+006 | 0 |
| 879526 | 1.11638e+006 | 0 |
| 879891 | 1.11632e+006 | 0 |
| 880306 | 1.11626e+006 | 0 |
| 880520 | 1.11643e+006 | 0 |
| 880964 | 1.11636e+006 | 0 |
| 882208 | 1.11618e+006 | 0 |
| 882139 | 1.11626e+006 | 2.16 |
| 880969 | 1.11643e+006 | 2.16 |
| 880502 | 1.11649e+006 | 2.16 |
| 880270 | 1.11633e+006 | 2.16 |
| 879900 | 1.11638e+006 | 2.16 |
| 879524 | 1.11644e+006 | 2.16 |
| 879210 | 1.11648e+006 | 2.16 |
| 878885 | 1.11653e+006 | 2.16 |
| 878523 | 1.11659e+006 | 2.16 |
| 878046 | 1.11666e+006 | 2.16 |

## 26. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 96270.2 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 882290 | 1.11691e+006 | 0 |
| 882388 | 1.11763e+006 | 0 |
| 882314 | 1.11761e+006 | 2.16 |
| 882231 | 1.11694e+006 | 2.16 |
| 882139 | 1.11626e+006 | 2.16 |
| 882208 | 1.11618e+006 | 0 |

## 27. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 26866.1 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 880198 | 1.11829e+006 | 0 |
| 880220 | 1.11822e+006 | 2.16 |
| 880562 | 1.11845e+006 | 2.16 |
| 880566 | 1.11852e+006 | 0 |

### 28. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 129286 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

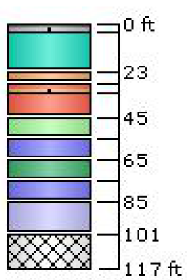
**Coordinates and Load**

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 880566 | 1.11852e+006 | 0 |
| 880562 | 1.11845e+006 | 2.16 |
| 881307 | 1.1181e+006 | 2.16 |
| 882314 | 1.11761e+006 | 2.16 |
| 882388 | 1.11763e+006 | 0 |
| 881341 | 1.11817e+006 | 0 |

## *Soil Layers*

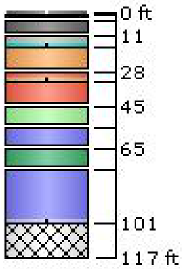
### A: (877446, 1.11798e+006)

| Layer # | Type | Thickness [ft] | Depth [ft] |
|---|---|---|---|
| 1 | CH | 4 | 0 |
| 2 | CL-ML | 0 | 4 |
| 3 | CH | 0 | 4 |
| 4 | CL-ML | 0 | 4 |
| 5 | ML | 19 | 4 |
| 6 | SP-SM | 5 | 23 |
| 7 | SP1 | 5 | 28 |
| 8 | SP3 | 0 | 33 |
| 9 | SP-SM | 0 | 33 |
| 10 | SP1 | 12 | 33 |
| 11 | SP2 | 10 | 45 |
| 12 | SP6 | 10 | 55 |
| 13 | SP4 | 10 | 65 |
| 14 | SP6 | 10 | 75 |
| 15 | SP5 | 16 | 85 |



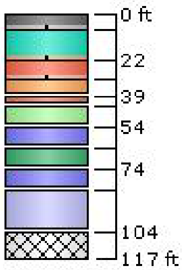

### B: (878312, 1.11813e+006)

| Layer # | Type | Thickness [ft] | Depth [ft] |
|---|---|---|---|
| 1 | CH | 1 | 0 |
| 2 | CL-ML | 3 | 1 |
| 3 | CH | 7 | 4 |
| 4 | CL-ML | 5 | 11 |
| 5 | ML | 0 | 16 |
| 6 | SP-SM | 12 | 16 |
| 7 | SP1 | 5 | 28 |
| 8 | SP3 | 0 | 33 |
| 9 | SP-SM | 0 | 33 |
| 10 | SP1 | 12 | 33 |
| 11 | SP2 | 10 | 45 |
| 12 | SP6 | 10 | 55 |
| 13 | SP4 | 10 | 65 |
| 14 | SP6 | 26 | 75 |
| 15 | SP5 | 0 | 101 |



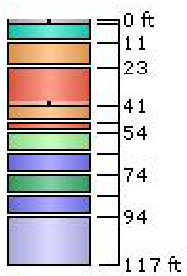

## C: (879125, 1.118e+006)

| Layer # | Type | Thickness [ft] | Depth [ft] |
|---|---|---|---|
| 1 | CH | 7 | 0 |
| 2 | CL-ML | 0 | 7 |
| 3 | CH | 0 | 7 |
| 4 | CL-ML | 0 | 7 |
| 5 | ML | 15 | 7 |
| 6 | SP-SM | 0 | 22 |
| 7 | SP1 | 9 | 22 |
| 8 | SP3 | 0 | 31 |
| 9 | SP-SM | 8 | 31 |
| 10 | SP1 | 5 | 39 |
| 11 | SP2 | 10 | 44 |
| 12 | SP6 | 10 | 54 |
| 13 | SP4 | 10 | 64 |
| 14 | SP6 | 10 | 74 |
| 15 | SP5 | 20 | 84 |



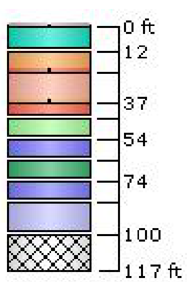

## D: (880239, 1.1174e+006)

| Layer # | Type | Thickness [ft] | Depth [ft] |
|---|---|---|---|
| 1 | CH | 2 | 0 |
| 2 | CL-ML | 0 | 2 |
| 3 | CH | 0 | 2 |
| 4 | CL-ML | 0 | 2 |
| 5 | ML | 9 | 2 |
| 6 | SP-SM | 12 | 11 |
| 7 | SP1 | 18 | 23 |
| 8 | SP3 | 0 | 41 |
| 9 | SP-SM | 8 | 41 |
| 10 | SP1 | 5 | 49 |
| 11 | SP2 | 10 | 54 |
| 12 | SP6 | 10 | 64 |
| 13 | SP4 | 10 | 74 |
| 14 | SP6 | 10 | 84 |
| 15 | SP5 | 23 | 94 |



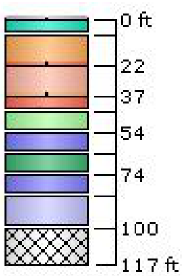

## E: (881475, 1.11721e+006)

| Layer # | Type | Thickness [ft] | Depth [ft] |
|---|---|---|---|
| 1 | CH | 0 | 0 |
| 2 | CL-ML | 0 | 0 |
| 3 | CH | 0 | 0 |
| 4 | CL-ML | 0 | 0 |
| 5 | ML | 12 | 0 |
| 6 | SP-SM | 10 | 12 |
| 7 | SP1 | 0 | 22 |
| 8 | SP3 | 15 | 22 |
| 9 | SP-SM | 0 | 37 |
| 10 | SP1 | 7 | 37 |
| 11 | SP2 | 10 | 44 |
| 12 | SP6 | 10 | 54 |
| 13 | SP4 | 10 | 64 |
| 14 | SP6 | 10 | 74 |
| 15 | SP5 | 16 | 84 |




## F: (879164, 1.11706e+006)

| Layer # | Type | Thickness [ft] | Depth [ft] |
|---|---|---|---|
| 1 | CH | 0 | 0 |
| 2 | CL-ML | 0 | 0 |
| 3 | CH | 0 | 0 |
| 4 | CL-ML | 0 | 0 |
| 5 | ML | 7 | 0 |
| 6 | SP-SM | 15 | 7 |
| 7 | SP1 | 0 | 22 |
| 8 | SP3 | 15 | 22 |
| 9 | SP-SM | 0 | 37 |
| 10 | SP1 | 7 | 37 |
| 11 | SP2 | 10 | 44 |
| 12 | SP6 | 10 | 54 |
| 13 | SP4 | 10 | 64 |
| 14 | SP6 | 10 | 74 |
| 15 | SP5 | 16 | 84 |




## Soil Properties

| Property | CH | CL-ML | ML | SP-SM | SP1 | SP2 | SP3 | SP4 | SP5 | SP6 |
|---|---|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | | | |
| Unit Weight [kips/ft$^3$] | 0.113 | 0.111 | 0.111 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 |
| Saturated Unit Weight [kips/ft$^3$] | 0.115 | 0.115 | 0.115 | 0.115 | 0.115 | 0.115 | 0.115 | 0.115 | 0.115 | 0.115 |
| Immediate Settlement | Disabled | Disabled | Enabled | Enabled | Enabled | Enabled | Enabled | Enabled | Enabled | Enabled |
| Es [ksf] | | | 400 | 500 | 600 | 650 | 721 | 815 | 950 | 1100 |
| Esur [ksf] | | | 400 | 500 | 600 | 650 | 721 | 815 | 950 | 1100 |
| Primary Consolidation | Enabled | Enabled | Disabled | Disabled | Disabled | Disabled | Disabled | Disabled | Disabled | Disabled |
| Material Type | Non-Linear | Non-Linear | | | | | | | | |
| Cc | 0.36 | 0.11 | | | | | | | | |
| Cr | 0.07 | 0.01 | | | | | | | | |
| e0 | 1.125 | 1.182 | | | | | | | | |
| Pc [ksf] | 5.1 | 4.26 | | | | | | | | |
| OCR | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Undrained Su A [kips/ft2] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Undrained Su S | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Undrained Su m | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| Piezo Line ID | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

## Groundwater

| | |
|---|---|
| Groundwater method | Piezometric Lines |
| Water Unit Weight | 0.0624 kips/ft$^3$ |

## Piezometric Line Entities

| ID | Depth (ft) |
|---|---|
| 1 | 0 ft |

# *Field Point Grid*

Number of points 19998
Expansion Factor 1

### Grid Coordinates

| X [ft] | Y [ft] |
|---|---|
| 884311 | 1.12052e+006 |
| 884311 | 1.11426e+006 |
| 875523 | 1.11426e+006 |
| 875523 | 1.12052e+006 |

**Appendix 11**

# DESIGN OF RIPRAP FOR PERIMETER BERM

12/26/06

## Sioux UWL Breach @ Blow hole.

(1)

RAPID PONDING to elev 430.1

MAX $\Delta h_2O$ = 435 (RR O.T.)

$\Delta h$ = 4.9'

MAX Flow = $CLH^{3/2}$ = $2.6 \times 160 \times 4.9^{3/2}$ = 4512 cfs.

---

Section

A-A

S = .0014

440 - 0

430 - 30

431 - 135 W-405'

430 - 250

430 - 435

433 - 448

435 - 470

from South Opening Spreadsheet.
D = 3.7' ± for all flow thru south opening.
V = 2.8 fps.

---

Breach WAVE - (Impact Velocity.)

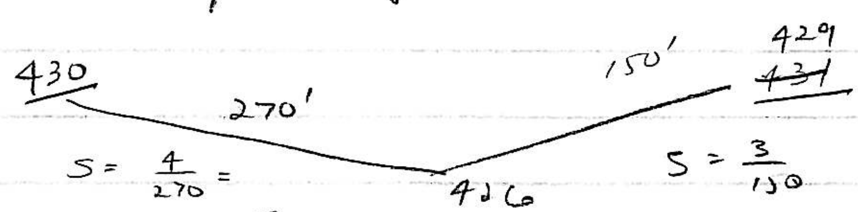
MAX DIFF = 4.9' (from above)

say 3' @ face of embankment.

for $V^2/2g$ = 3' V = $\sqrt{3 \times 64}$ = 13.8 fps impact. NOT LIKELY

---

initial flow path.




S = 4/270 =

S = 3/150

Z = 67.5

Z = 50

depth = 3.87' ± V = 5.2 fps impact.
for Q = 4512 cfs.

check needed as a submerged weir. (see pg 2)

12/27/06

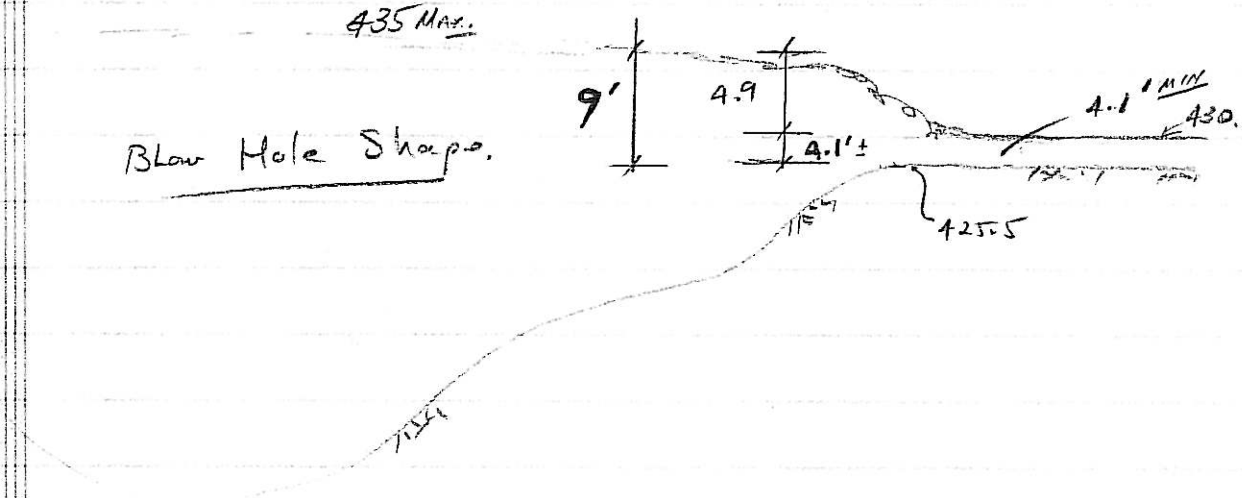
Sioux UWL Breach @ Blow hole (2)

For a Broad crested weir
max flow value occurs @ critical depth.

$Q = 3.087\ L H^{3/2}$ (KING & Brater 5-24)

$= 3.087 \times 160 \times 4.9^{3/2} = 5357$ cfs.

AS A SUBMERGED WEIR.




$H_1 = 9.0 \quad H_2 = 4.1$

$Q_1 = 2.8 \times 160 \times 9^{3/2} = 12096$ cfs.

from Fig 5-5

$\left(\frac{H_2}{H_1}\right)^n = \left(\frac{4.1}{9.0}\right)^{3/2} = 0.307 \quad \therefore \frac{Q}{Q_1} = 0.86$

$Q = 0.86 \times 12096 = 10\,402$ cfs

for $Q = 10402$ $d = H_2 = 5.3'\pm$ (from impact flow spreadsheet).

if $H_1 = 9$ and $H_2 = 5.3$

$\left(\frac{H_2}{H_1}\right)^n = \left(\frac{5.3}{9}\right)^{1.5} = 0.45 \quad \frac{Q}{Q_1} = 0.79 \quad Q = .79 \times 12096 = 9555.$

$d = 5.1'$

use $d = 5.2'$ $Q = 9961$ $v = 6.53$ fps.

South Exit Channel. $d = 6.0'$ elev = 436 to hi.

Q is slightly lower.

use V max e side channel = 3.8 fps.

Sioux UWL 12/27

Blowhole Breach. (3)

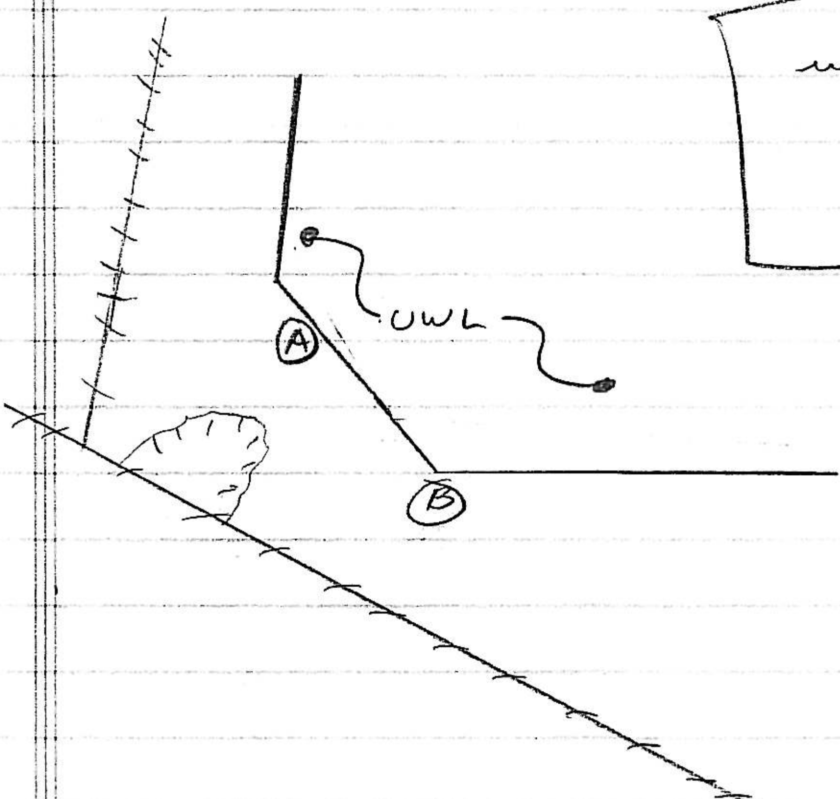
Conclusions. :

1) Ignore NARROW Openin @ N end

2) MAX Breach Flow for 160' Wide Breach (a repeat of 1993) is
$\approx$ 9800 cfs.

Impact Velocity on levee face
$\approx$ 6.5 fps. (A)

Parallel Flow @ South Constriction.
Q = 9800 cfs. (B) v $\approx$ 3.9 fps say 4 fps.




use MIN 15" Thick
9" to 4" over
2" Minus bedding

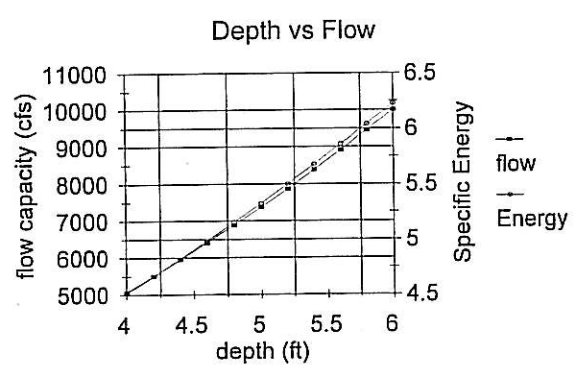
Channel Computation computed on 12/27/06

by **DSE**

oject **Sioux UWL Breach flows**
**all flow to south**

| | | | |
|---|---|---|---|
| Channel Slope | 0.0014 | Right Sideslope | 2 |
| roughness factor | 0.045 | Left Sideslope | 3 |
| bottom width | 405 | | |
| Design Flow (cfs) | 9555.00 | Required A*R^(2/3) | 7733.2202 |

| Depth | Top Width | Area | Wetted Perimeter | Hydraulic Radius | A*R^(2/3) | Velocity (fps) | Velocity Head | Capacity Manning Flow (cfs) | Specific Energy (D+Vel Hd |
|---|---|---|---|---|---|---|---|---|---|
| 4.00 | 425.00 | 1660.000 | 426.5934 | 3.89129 | 4106.80489 | 5.76 | 0.51 | 5074.28 | 4.514469 |
| 4.20 | 426.00 | 1745.100 | 427.6731 | 4.08045 | 4456.14459 | 5.48 | 0.47 | 5505.92 | 4.665516 |
| 4.40 | 427.00 | 1830.400 | 428.7527 | 4.26913 | 4816.94942 | 5.22 | 0.42 | 5951.72 | 4.823139 |
| 4.60 | 428.00 | 1915.900 | 429.8324 | 4.45732 | 5189.05933 | 4.99 | 0.39 | 6411.49 | 4.986216 |
| 4.80 | 429.00 | 2001.600 | 430.9121 | 4.64503 | 5572.32436 | 4.77 | 0.35 | 6885.04 | 5.153851 |
| 5.00 | 430.00 | 2087.500 | 431.9917 | 4.83227 | 5966.60361 | 4.58 | 0.33 | 7372.21 | 5.325329 |
| 5.20 | 431.00 | 2173.600 | 433.0714 | 5.01903 | 6371.76439 | 4.40 | 0.30 | 7872.81 | 5.500066 |
| 5.40 | 432.00 | 2259.900 | 434.1511 | 5.20533 | 6787.68150 | 4.23 | 0.28 | 8386.71 | 5.677586 |
| 5.60 | 433.00 | 2346.400 | 435.2307 | 5.39116 | 7214.23655 | 4.07 | 0.26 | 8913.75 | 5.857497 |
| 5.80 | 434.00 | 2433.100 | 436.3104 | 5.57653 | 7651.31740 | 3.93 | 0.24 | 9453.80 | 6.039472 |
| 6.00 | 435.00 | 2520.000 | 437.3901 | 5.76145 | 8098.81763 | 3.79 | 0.22 | 10006.72 | 6.223241 |



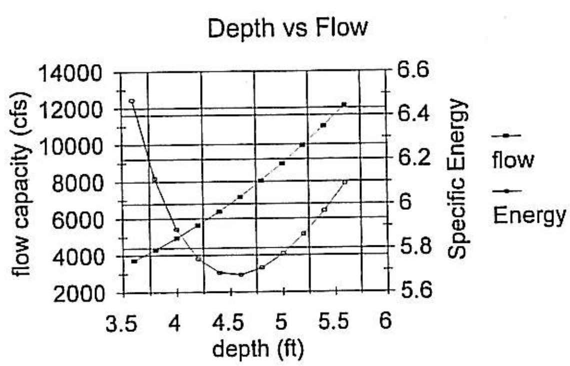
Channel Computation computed on 12/27/06

by **DSE**

oject **Sioux UWL Breach flows**
**impact flow channel**

| | | | | |
|---|---|---|---|---|
| Channel Slope | 0.01 | Right Sideslope | 50 | |
| roughness factor | 0.045 | Left Sideslope | 67.5 | |
| bottom width | 1 | | | |
| Design Flow (cfs) | 10402.00 | Required A*R^(2/3) | | 3150.0000 |

| Depth | Top Width | Area | Wetted Perimeter | Hydraulic Radius | A*R^(2/3) | Velocity (fps) | Velocity Head | Capacity Manning Flow (cfs) | Specific Energy (D+Vel Hd |
|---|---|---|---|---|---|---|---|---|---|
| 3.60 | 424.00 | 765.000 | 424.0627 | 1.80398 | 1133.65881 | 13.60 | 2.87 | 3743.59 | 6.470946 |
| 3.80 | 447.50 | 852.150 | 447.5661 | 1.90396 | 1309.04707 | 12.21 | 2.31 | 4322.76 | 6.113746 |
| 4.00 | 471.00 | 944.000 | 471.0696 | 2.00395 | 1500.47901 | 11.02 | 1.89 | 4954.92 | 5.885401 |
| 4.20 | 494.50 | 1040.550 | 494.5731 | 2.10394 | 1708.51157 | 10.00 | 1.55 | 5641.88 | 5.751751 |
| 4.40 | 518.00 | 1141.800 | 518.0766 | 2.20392 | 1933.69254 | 9.11 | 1.29 | 6385.48 | 5.688747 |
| 4.60 | 541.50 | 1247.750 | 541.5801 | 2.30391 | 2176.56103 | 8.34 | 1.08 | 7187.49 | 5.679177 |
| 4.80 | 565.00 | 1358.400 | 565.0835 | 2.40389 | 2437.64811 | 7.66 | 0.91 | 8049.66 | 5.710526 |
| 5.00 | 588.50 | 1473.750 | 588.5870 | 2.50388 | 2717.47717 | 7.06 | 0.77 | 8973.71 | 5.773571 |
| 5.20 | 612.00 | 1593.800 | 612.0905 | 2.60386 | 3016.56443 | 6.53 | 0.66 | 9961.37 | 5.861424 |
| 5.40 | 635.50 | 1718.550 | 635.5940 | 2.70385 | 3335.41925 | 6.05 | 0.57 | 11014.30 | 5.968884 |
| 5.60 | 659.00 | 1848.000 | 659.0975 | 2.80383 | 3674.54452 | 5.63 | 0.49 | 12134.16 | 6.091976 |



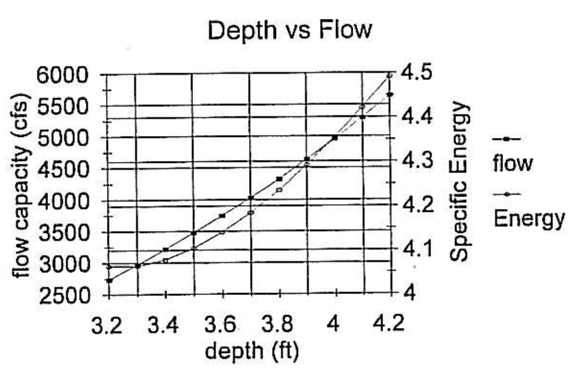
Channel Computation computed on 12/26/06

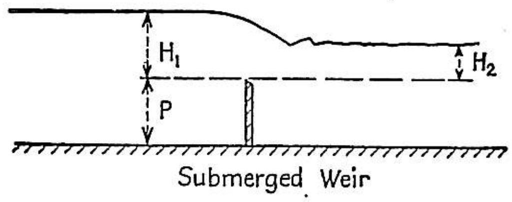
by **DSE**

oject **Sioux UWL Breach flows**
**impact flow channel**

| | | | |
|---|---|---|---|
| Channel Slope | 0.01 | Right Sideslope | 50 |
| roughness factor | 0.045 | Left Sideslope | 67.5 |
| bottom width | 1 | | |
| Design Flow (cfs) | 4512.00 | Required A*R^(2/3) | 1366.3526 |

| Depth | Top Width | Area | Wetted Perimeter | Hydraulic Radius | A*R^(2/3) | Velocity (fps) | Velocity Head | Capacity Manning Flow (cfs) | Specific Energy (D+Vel Hd |
|---|---|---|---|---|---|---|---|---|---|
| 3.20 | 377.00 | 604.800 | 377.0557 | 1.60401 | 828.73554 | 7.46 | 0.86 | 2736.67 | 4.064229 |
| 3.30 | 388.75 | 643.088 | 388.8074 | 1.65400 | 899.41557 | 7.02 | 0.76 | 2970.07 | 4.064385 |
| 3.40 | 400.50 | 682.550 | 400.5592 | 1.70399 | 973.74743 | 6.61 | 0.68 | 3215.53 | 4.078552 |
| 3.50 | 412.25 | 723.188 | 412.3109 | 1.75399 | 1051.80434 | 6.24 | 0.60 | 3473.29 | 4.104436 |
| 3.60 | 424.00 | 765.000 | 424.0627 | 1.80398 | 1133.65881 | 5.90 | 0.54 | 3743.59 | 4.140169 |
| 3.70 | 435.75 | 807.988 | 435.8144 | 1.85397 | 1219.38267 | 5.58 | 0.48 | 4026.67 | 4.18422 |
| 3.80 | 447.50 | 852.150 | 447.5661 | 1.90396 | 1309.04707 | 5.29 | 0.44 | 4322.76 | 4.235332 |
| 3.90 | 459.25 | 897.488 | 459.3179 | 1.95396 | 1402.72255 | 5.03 | 0.39 | 4632.10 | 4.29246 |
| 4.00 | 471.00 | 944.000 | 471.0696 | 2.00395 | 1500.47901 | 4.78 | 0.35 | 4954.92 | 4.354739 |
| 4.10 | 482.75 | 991.687 | 482.8214 | 2.05394 | 1602.38577 | 4.55 | 0.32 | 5291.43 | 4.421442 |
| 4.20 | 494.50 | 1040.550 | 494.5731 | 2.10394 | 1708.51157 | 4.34 | 0.29 | 5641.88 | 4.491962 |




H1
H2
P
Submerged Weir

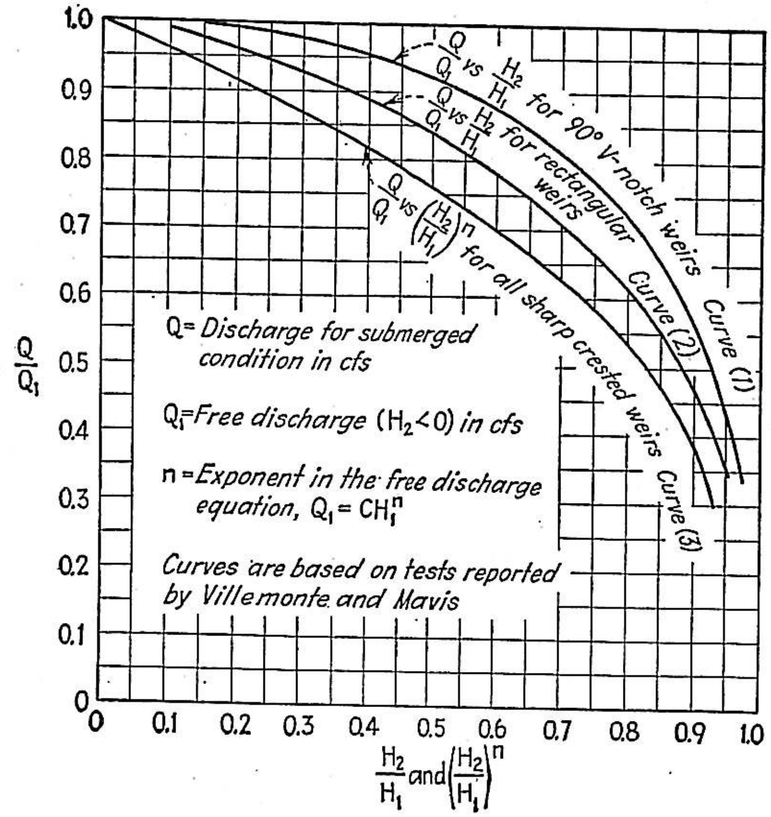

Q/Q1 vs H2/H1 for 90° V-notch weirs Curve (1)
Q/Q1 vs H2/H1 for rectangular weirs Curve (2)
Q/Q1 vs (H2/H1)^n for all sharp crested weirs Curve (3)
Q= Discharge for submerged condition in cfs
Q1=Free discharge (H2<0) in cfs
n =Exponent in the free discharge equation, Q1 = CH1^n
Curves are based on tests reported by Villemonte and Mavis
Q/Q1
H2/H1 and (H2/H1)^n
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0

Fig. 5-5

12/27/06

WEST Consultants, Inc.
2111 Palomar Airport Rd.
Suite 180
Carlsbad, CA 92009-1419

Riprap 2.0

PROGRAM OUTPUT
ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ

ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ USCOE Method ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ

Input Parameters:
ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
Run Name: SIOUX2 Description: BREACH FAILURE

| | |
|---|---|
| Velocity | Average |
| Channel Type | Trapezoidal |
| Straight Channel | Yes |
| Bend Angle, ø | N/A |
| Average Channel Velocity, ft/sec | 6.50 |
| Bottom Width, ft | N/A |
| Minimum Centerline Bend Radius, ft | N/A |
| Water Surface Width, ft | N/A |
| Unit Weight of Stone, lbs/cu ft | 155.00 |
| Riprap Layer Thickness | 1.50 |
| Local Flow Depth, ft | 6.00 |
| Cotangent of Sideslope | 3.00 |
| Safety Factor | 2.00 |

Output Results:
ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ

| | |
|---|---|
| Computed Local Depth Average Velocity, ft/sec | 6.50 |
| Local Velocity / Avg. Channel Velocity | 1.00 |
| Correction for Layer Thickness | 0.88 |
| Side Slope Correction Factor | 1.01 |
| Correction for Secondary Currents | 1.00 |

*** Using Gradation from COE ETL 1110-2-120 ***

| | | |
|---|---|---|
| Computed D30, ft | 0.30 | |
| Specific Weight, pcf | 155.00 | |
| Layer Thickness, ft | 1.125 | (Increased by 50%) |
| Selected Minimum D30, ft | 0.37 | |
| Selected Minimum D90, ft | 0.53 | |

| Percent Lighter by Weight | Stone Weight, lbs Minimum | Maximum |
|---|---|---|
| W100 | 14 | 34 |
| W50 | 7 | 10 |
| W15 | 2 | 5 |

ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ USBR Method ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ

Input Parameters:
ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
Run Name: SIOUX2 Description: BREACH FAILURE

Average Channel Velocity, ft/sec 6.50

Output Results:
ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
Computed D50, ft 0.58

*** Using Gradation from COE ETL 1110-2-120 ***

| | |
|---|---|
| Computed D30, ft | 0.47 |
| Specific Weight, pcf | 155.00 |
| Layer Thickness, ft | 1.00 |
| Selected Minimum D30, ft | 0.49 |
| Selected Minimum D90, ft | 0.71 |

| Percent Lighter by Weight | Stone Weight, lbs Minimum | Maximum |
|---|---|---|
| W100 | 32 | 81 |
| W50 | 16 | 24 |
| W15 | 5 | 12 |

ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ USGS Method ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ

Input Parameters:
ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
Run Name: SIOUX2 Description: BREACH FAILURE

Average Channel Velocity, ft/sec 6.50

Output Results:
ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
Computed D50, ft 0.96

*** Using Gradation from COE ETL 1110-2-120 ***

| | |
|---|---|
| Computed D30, ft | 0.79 |
| Specific Weight, pcf | 155.00 |
| Layer Thickness, ft | 1.75 |
| Selected Minimum D30, ft | 0.85 |
| Selected Minimum D90, ft | 1.23 |

| Percent Lighter by Weight | Stone Weight, lbs Minimum | Maximum |
|---|---|---|
| W100 | 174 | 435 |
| W50 | 87 | 129 |
| W15 | 27 | 64 |

ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ Isbash Method ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ

Input Parameters:
ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
Run Name: SIOUX2 Description: BREACH FAILURE

| | |
|---|---|
| Average Channel Velocity, ft/sec | 6.50 |
| Unit Weight of Stone, lbs/cu ft | 155.00 |
| Turbulence Level | Low |

Output Results:
ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
Computed D50, ft 0.31

*** Using Gradation from COE ETL 1110-2-120 ***

| | |
|---|---|
| Computed D30, ft | 0.25 |
| Specific Weight, pcf | 155.00 |
| Layer Thickness, ft | 0.75 |
| Selected Minimum D30, ft | 0.37 |
| Selected Minimum D90, ft | 0.53 |

use 9" to 4"

| Percent Lighter by Weight | Stone Weight, lbs Minimum | Stone Weight, lbs Maximum |
|---|---|---|
| W100 | 14 | 34 |
| W50 | 7 | 10 |
| W15 | 2 | 5 |

MIN 15" Thick on 2" min bedding.