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Duke Power
Belews Creek Steam Station
Stokes County, N.C.

Flue Gas Desulfurization (FGD) Residue
Landfill Permit Application
Site Suitability Information

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Contents

GEOLOGIC AND HYDROLOGIC SITING REPORT
FGD SCRUBBER RESIDUE DISPOSAL SITE
BELEWS CREEK STEAM STATION
3195 PINE HALL ROAD
BELEWS CREEK, NORTH CAROLINA
S&ME Project 1054-04-955

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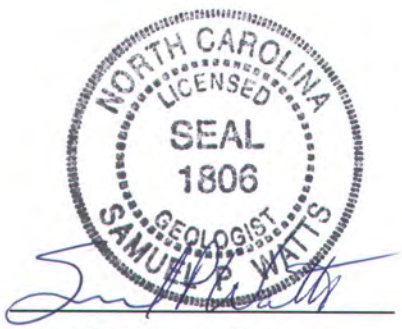

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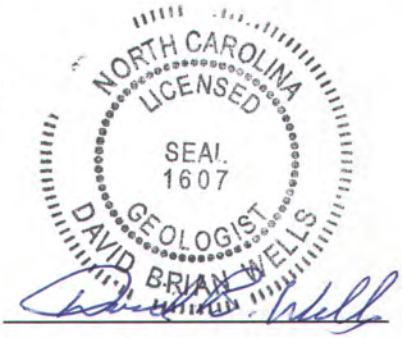

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1.0 INTRODUCTION

1.1 BACKGROUND

In response to the Clean Air Act of 1990 and its subsequent amendments mandating the reduction of sulfur dioxide (SO_2) emissions from power plants, Duke Power is evaluating the installation of a flue gas desulfurization (FGD) scrubber system at its Belews Creek Steam Station (BCSS) located in Belews Creek, North Carolina. FGD systems involve the introduction of lime (limestone) into the exhaust system of coal-fired boilers. The reaction of the lime with the SO_2 gas results in a calcium sulfite or calcium sulfate output residue commonly known as FGD sludge. The specific process being considered for the BCSS is a "wet" process. Once dried, the FGD sludge may be used for beneficial purposes (e.g., production of wallboard, structural fill, etc.) or may be landfilled.

In support of the overall FGD system planning, Duke Energy requested that S&ME conduct a geologic and hydrologic siting study for a potential FGD scrubber residue disposal site (i.e., landfill). This document represents the compilation of the activities and findings from the requested study.

1.2 GEOLOGIC AND HYDROLOGIC SITING STUDY CRITERIA AND PURPOSE

The geologic and hydrologic siting study was performed in general accordance with Duke Energy's *Description of Scope of Work* dated September 6 and 30, 2002 *and BCSS Scrubber Landfill – Additional Scope of Work for S&ME* dated July 29, 2004 and our approved proposals 02548A dated October 1, 2002 and P3459-04V dated August 17, 2004. The activities of the *Description of Scope of Work,* and thus the study, were guided by the requirements of the North Carolina Administrative Code (NCAC) T15A .0504(1)(c), *Application Requirements for Sanitary Landfills*. The purpose of the study was to establish and evaluate the subsurface geologic and hydrologic conditions in an area of the site proposed for use as the FGD scrubber residue landfill.

2.0 SITE INFORMATION

2.1 OVERALL FACILITY LOCATION

Duke Power's Belews Creek Steam Station (BCSS) is located east of N.C. State Road SR 1908 (Pine Hall Road), north of N.C. Highway 65, and west N.C. State Road SR 2042, at 3915 Pine Hall Road in Belews Creek, Stokes County, North Carolina. Figure 1 shows the site area as portrayed on the Belews Lake, North Carolina USGS 7.5-minute quadrangle with the proposed landfill construction area superimposed onto the drawing. As evident from this map, noteworthy facility features include Belews Lake to the northeast and southwest of the power facility, Belews Creek southeast of the power facility, and wetlands and the current fly ash landfill northwest of the facility.

2.2 PROJECT SITE AND CONDITIONS

Within the facility itself, Duke Power selected a 21.3 acre tract as Phase 1 of the proposed landfill. Phases 2 and 3 may be developed adjacent to Phase 1 area sometime in the future. This report presents the siting evaluation for Phase 1 of the proposed landfill. This area, represented on Figure 2, is located approximately 1.1 miles southeast of the intersection of Pine Hall Road and the main entrance to the Duke Power BCSS. The site is bordered to the south and east by a dirt road (Egypt Road), to the north by an open field and overhead power lines, and to the west by Craig Road. The northern portion of the site is currently being used as a construction storage yard for the construction of the FGD scrubber system at the facility. Otherwise, the site remains undeveloped and unoccupied.

A surface water drainage ditch was identified adjacent to the site along Craig Road. Two abandoned water supply wells and a well house were identified along the southern side of the site. The abandoned water supply wells are believed to have been installed in the mid-1970's to service a construction camp utilized during construction of the BCSS. The abandoned wells have not been surveyed, but are located northwest of the monitor well BC-14. No well completion information is available for these wells. During the initial phase of the siting study, two operating

potable wells were identified adjacent to the proposed landfill along Craig road. These wells were 405 and 900 feet deep and provided the potable water for the BCSS. In March 2003, BCSS was connected to a municipal water line from the City of Winston-Salem and the potable wells were abandoned. Well construction and well abandonment records for these two potable wells are included in Appendix I.

Topographically, the subject site area is located on the west face of a ridge with the highest elevation near 860 feet above mean sea level (ft-msl) in the eastern edge of the site and the lowest elevation near 760 ft-msl in the southwest corner and along the northern edge of the site. Surface cover varies from undeveloped, unoccupied woodlands in the southern portion of the site to a gravel covered stockyard used for construction storage purposes in the northern portion of the site.

2.3 REGIONAL GEOLOGY AND HYDROLOGY

The BCSS plant is located in the Piedmont Geologic Province, specifically within the Milton Belt. Metamorphic rock is mapped in this region as strongly foliated gneiss and schist, commonly with distinct compositional layering and having felsic composition; quartzite, calc-silicate gneiss, and marble are minor units (Carpenter, 1982). The majority of the rocks in the Milton Belt are metamorphosed to the sillimanite and kyanite grade of amphibolite metamorphism (Butler and Secor, 1991). Typically, the crystalline bedrock is overlain by variable thicknesses of a highly weathered soil/rock mixture termed partially weathered rock (PWR) (exhibiting standard penetration resistance values in excess of 100 blows per foot) or saprolite (exhibiting standard penetration resistance values less than 100 blows per foot), both of which retain varying structural remnants of the weathered parent bedrock. In other zones, the weathering of strata has resulted in a soil that exhibits no remnant parent structure that is referred to as residuum. In general, the degree of weathering with depth decreases gradually downward and lithological and textural changes from residuum to saprolite to partially weathered rock to bedrock is observed.

The hydrogeology of the Piedmont region differs from sedimentary aquifer systems (LeGrand, 1988). The residual soil, saprolitic soils and PWR typically have high porosity with low to moderate permeability. The ability of the residual soil and saprolite to transmit groundwater is based on the grain size distribution of the sediments, and the remnant structures present in the saprolite. The residuum, saprolite, and PWR are generally leaky (semi-permeable) beds that may store and recharge water to the underlying bedrock aquifer. Groundwater occurs within the residuum, saprolite, and PWR between the clay, silt, and sand grains. Groundwater also occurs within the bedrock, but along secondary fractures, joints, and planes of weakness in the rock, and flows primarily through these zones in the rock. Fracture zones and foliation trends that may occur in the bedrock and/or that are retained in the saprolite/PWR typically exhibit higher hydraulic conductivity than the surrounding materials and will also influence groundwater flow. Fracturing of the bedrock typically decreases with depth with resulting reductions in groundwater volume and transmission.

The movement of groundwater through the saprolite layer and the transitional zone from PWR to fractured nonporous bedrock is strongly influenced by topography which generally controls the location of recharge and discharge zones. Groundwater within the Piedmont generally moves from topographically high areas (recharge areas) to topographically low areas (discharge areas).

Groundwater levels in the Piedmont region continually fluctuate in response to seasonal changes in precipitation, evaporation, recharge, and discharge. Water levels typically decline beginning in April and May due to increasing evaporation and plant transpiration. The decline continues until November or December, when much of the vegetation has become dormant, and precipitation again results in effective recharge to groundwater. In a year with typical rainfall (45-inches for the BCSS region [USDA, 1995]), the recharge to the groundwater reservoir (i.e, saprolite/PWR) is approximately equal to the discharge from the reservoir so that the water table at the end of the year is approximately the same level as at the beginning of the year (USDA, 1995). Minor changes in groundwater levels may occur locally from time to time as a result of unusually high and/or long-lasting rainfall events or drought conditions and in certain areas where the topography has been altered due to excavations and backfilling near the facility.

3.0 SITING STUDY ACTIVITIES AND FINDINGS

The siting study activities comprised the following three major components:

1. Field exploration and testing including soil test borings, soil sample collection, groundwater monitoring well installations, water level measurements, and field testing of in-situ hydraulic conductivity;

2. Laboratory testing of selected soil specimens for classification and engineering properties; and,

3. Compilation of this Geologic/Hydrogeologic Siting Report.

The following sections discuss the implementation of and findings from these siting study activities.

3.1 FIELD EXPLORATION AND TESTING

3.1.1 Soil Test Borings and Rock Coring

To evaluate subsurface characteristics in the proposed FGD scrubber residue disposal site, Duke Energy established, and S&ME concurred with, 23 initial drilling locations designated BC-1 through BC-23. Several additional borings were subsequently added at other locations. Duke Energy surveyors located the proposed drilling locations in the field. The drilling locations were generally distributed throughout the proposed Phase 1 landfill footprint and outside the landfill boundary ranging from 30 to 300 feet from the landfill limit (considering that some of the subsequently installed monitoring wells along this boundary could remain for operational monitoring wells). The criteria established for the drilling was to conduct soil test borings to refusal using hollow-stem auger and split-spoon sampling techniques, then extend the borings by rock coring techniques to the termination depth. The initial indication of the depth to groundwater was also noted and used to indicate the depth for constructing the groundwater monitoring wells.

As stated above, S&ME drilled the original 23 soil test borings/rock corings and five borings at four additional locations designated BC-3A, BC-12A, BC-12B, BC-14A, and BC-23A using CME-45, CME-550, and Mobile B-57 drilling rigs and hollow-stem auger/split-spoon sampling techniques in two phases. The first phase of drilling took place between November 6 and November 27, 2002 and the second phase of drilling took place between August 30 and September 24, 2004. Borings BC-1 through BC-14 were completed during the first phase of drilling. Borings BC-15 through BC-23A were completed during the second phase of drilling. Location BC-3A was added for the purpose of evaluating the relatively deep groundwater condition observed in nearby well BC-3 located near the highest portion of the site northeast of the proposed landfill footprint. A permanent monitor well was constructed in the boring at BC-3A to allow further evaluation of groundwater conditions at this location. Borings BC-12A, BC-12B, BC-14A and BC-23 were drilled to evaluate groundwater conditions at the saprolite, PWR, bedrock contact. No monitor wells were constructed in these borings. Following evaluation of groundwater conditions at these locations, the borings were abandoned. The locations of the actual borings, as established by surveying and/or field measurements after subsequent monitoring well installations, are shown on Figure 2.

Refusal to hollow-stem auger advancement occurred at all boring locations between depths of 10.5 and 89.6 feet below ground surface (bgs). At refusal, monitor wells were constructed at borings BC-2, BC-5, BC-11, BC-18, and BC-19. Rock coring was performed at the remaining borings to determine depth to groundwater, or, if water had already been encountered above bedrock, to collect rock samples. At these remaining wells, NQ2 (approximately 2.98-inch outside diameter) or HQ (approximately 3.76-inch outside diameter) size core barrels were used to extend the well depths into rock in 10-foot maximum intervals. Upon completion of a core run, the coring tools were removed from the borehole and the rock sample was recovered from the core barrel. Water used to cool/flush the diamond bit during the coring process was either bailed or pumped from the corehole and the water level was monitored. If a sufficient water column (e.g., 5-feet) returned into the corehole, the coring was terminated for subsequent groundwater monitor well construction. If a sufficient water column did not return into the corehole for groundwater monitoring well construction, the coring process was continued until

the above condition was met. (discussed below in Section 3.1.3). The list of monitor wells and their construction details is summarized in Table 1.

Boring logs presenting detailed descriptions of the subsurface information from each boring are included in Appendix II. Photographs documenting the rock core samples are included in Appendix III. To further characterize the findings of the subsurface information, lithologic cross-sections were constructed crossing the site at multiple vectors (Figure 3). Lithologic cross-sections depicting the site conditions were prepared and presented on Figures 4, 5, 6, 7, 8, 9, 10, and 11. The cross-sections are generalized representations of the overall conditions and typically do not include the subtleties of each particular boring, or the actual subsurface conditions that exist between boring locations. They are beneficial in presenting an overall understanding of subsurface conditions. A brief discussion of the generalized subsurface materials is provided below.

Fill: Fill is defined as areas in which the natural soils have been altered by earth moving operations or areas where non-native soils have been emplaced. Fill material was encountered in seven borings (BC-2, BC-9, BC-11, BC-12, BC-18, BC-20, and BC-21) from the ground surface to depths ranging from 0.4 to 10.5 feet bgs.

Residuum: Residuum consists of highly weathered, unconsolidated material that retains none to very little of the physical characteristics of the parent bedrock. Residuum was encountered in 24 of the 28 borings (excluding BC-1, BC-8, BC-9, and BC-18) from the ground surface, or base of the fill, to depths of 3 to 10.5 feet bgs. The residuum is generally comprised of silt with variable amounts of clay and sand.

Saprolite: Saprolite is the product of weathered bedrock and usually retains some to much of the observable structure of the parent bedrock. The saprolitic soils encountered were generally comprised sandy silt and silty sand, transitioning to larger size sand grains and even gravel size particles with depth. Saprolitic soils were encountered at depths ranging from the ground surface to 23.5 feet bgs, and ranged in thickness from only a few feet to approximately 55 feet.

Partially Weathered Rock (PWR): PWR is defined as a transitional material ranging between very dense soil and soft weathered rock, exhibiting a standard penetration resistance ("N" value) in excess of 100 blows per foot. The PWR at the BCSS was sampled as silty fine to coarse sand with varying gravel content, and varied in thickness from only a few feet to approximately 29 feet.

Bedrock: Bedrock is the consolidated parent material of soil in the Piedmont Geologic Province, exhibiting little to no weathering. As noted, bedrock was encountered at depths ranging from 10.5 to 89.6 feet bgs. Bedrock core samples generally classify as quartzofeldspathic gneiss. Most rock cores were described as quartz biotite gneiss with amounts of other index minerals such as garnet and muscovite varying from sample to sample. Horizontal to high-angle fractures are present throughout the core samples. However, the degree of fracturing decreases dramatically with depth. Recovery for the core samples ranged from 33 percent (%) to 100% with rock quality designation (RQD) ranging from 0% to 100%. The majority of bedrock weathering, both physical and chemical, occurs within the top 10 feet of the rock. Chemical weathering was evident in some shallow fractures in the form of browned biotite, alteration of biotite to chlorite (chloritization), yellowed quartz grains, and blackened garnets.

Groundwater: Monitor wells were installed in 24 of the 28 borings (excluding BC-12A, BC-12B, BC-14A, and BC-23) to allow further evaluation of groundwater conditions at these locations. Monitor well construction details are presented on the boring logs included in Appendix II and on the Well Construction Records (form GW-1 Rev. 01/2001) included in Appendix IV. The lithology is shown on the lithologic logs and is also summarized on Table 1.

Groundwater was encountered in the unconsolidated saprolite/PWR at locations BC-2, BC-11, BC-15, BC-18, BC-19, BC-20, BC-21, and BC-22 at approximately 17, 41, 26, 22, 39, 11, 8, and 2 feet bgs, respectively. Groundwater was encountered near the interface of PWR and bedrock in locations BC-8, BC-9, BC-10, BC-12, and BC-14 at approximately 34, 23, 24, 56, and 16 feet bgs, respectively. Groundwater was encountered in the upper consolidated bedrock at locations BC-1, BC-4, BC-6, and BC-7 at approximately 15, 54, 38, and 41 feet bgs, respectively. Groundwater was encountered in the deeper portion of bedrock at locations BC-3A, BC-16, BC-17, and BC-23A at depths of approximately 71, 74, 56, and 92 feet bgs, respectively. Finally, groundwater was not encountered at locations BC-3, BC-5 and BC-13 at their respective termination depths of 48, 46 and 45 feet bgs.

At some locations, groundwater levels rose higher than the elevation (and lithologic unit) at which it was initially encountered. These long-term groundwater elevations, which represent "head potential" or "potentiometric head" at each well, are summarized on Table 2.

3.1.2 Soil Sample Collection

Soil sample collection included split-spoon (disturbed) sample collection every five feet during the soil test borings and bulk (bag) sample collection from the soil cuttings returned to the surface by the augers every ten feet. Undisturbed Shelby tube samples were collected from

seven of the 24 borings advanced. Shelby tube samples were collected from both the residuum and saprolite zones of the lithology. Shelby tube samples were obtained from boreholes in which the blow count "N" values indicated a reasonable likelihood that a sample could be retrieved. Shelby tube samples were obtained from the following boreholes:

Boring ID	Depth of sample (ft-bgs)	Footprint
BC-6	18 – 20	Phase 2
BC–7	14 – 16	Phase 2
BC-10	12 – 14	Phase 1
BC-11	23 – 25	Phase 1
BC-12	27 - 28	Phase 1
BC-17	6 – 8	Phase 1
BC-19	27 – 29	Phase 1

All soil samples were transported to S&ME's soil laboratory for visual classification and selected testing as discussed in Section 3.2.

3.1.3 Groundwater Monitoring Well Installations

As previously mentioned, groundwater monitoring wells were constructed in 24 of the 28 boring/coring locations.

Groundwater monitor wells were constructed of Schedule 40 PVC well casing and screen with flush-jointed threaded connections. Monitor wells BC-16, BC-17, and BC-19 were constructed with one-inch inside diameter (I.D.) PVC and the remaining wells were constructed with two-inch I.D. diameter PVC. The well screens were constructed with a slot size of 0.01 inch and were either 15, 20 or 25 feet in length. Upon placement of the well screen and riser casing into the bore/core hole, S&ME placed a manufactured NO.1 (fine-grained) filter sand in borings with well screen intervals that intersected soil or No. 2 (coarse-grained) filter sand in borings with well screen intervals that intersected bedrock to 2 feet above the screen interval. An annular seal of bentonite chips, ranging from 2 to 6 feet thick, was placed above the sand pack and allowed to hydrate a minimum of four hours. Portland cement grout was tremmied into the borehole

annulus from the top of the bentonite to the ground's surface. A locking above-grade steel protective casing, or bolted manhole cover, set into a concrete pad, was installed at each monitor well. Upon completion of the monitor wells, an identification plate showing the drilling contractor and well construction information specified by Rule 2C was affixed to each well. Completed and signed Well Construction Records (form GW-1 REV. 07/2001) are included in Appendix IV. A summary of the well construction details is provided in Table 1.

Following installation of the groundwater monitoring wells, Duke Energy surveyors returned to the site to survey the actual installed monitoring well locations (relative to N.C. State Plane northing and easting), the top-of-casing (TOC) and of the adjacent ground surface elevation, for record and use in groundwater movement evaluations.

Individual details of each well construction are presented on the Boring Logs included in Appendix II and the Well Completion Records included in Appendix IV. Additionally, the screened interval for the wells is reflected graphically on the Lithologic Cross Sections (Figures 4, 5, 6, 7, 8, 9, 10, and 11).

S&ME personnel developed 21 of the newly-installed monitor wells by using a solid PVC surge block to vigorously surge the water in the monitor well and then removing water within the well by pumping/bailing water. Monitor wells installed at locations BC-3, BC-5 and BC-13 did not contain groundwater and could not be developed.

3.1.4 Water Level Measurements

Water level measurements were obtained from each borehole/monitor well location during monitor well installation, development, and sampling, except from the three dry wells. Stabilized water level measurements were obtained at monitor wells BC-1 through BC-14 seventeen times from November 25, 2002 through October 27, 2004. Stabilized water level measurements were obtained at monitor wells BC-15 through BC-23A on October 6 and 27, 2004. These measurements are summarized in Table 2, showing the well survey information, the water level measurements, and the resulting potentiometric surface elevations computed by

subtracting the water level measurements from the top-of-casing surveyed elevations. The water level measurements collected on October 27, 2004 were used in preparing the potentiometric surface map.

3.1.5 Hydraulic Conductivity Testing

On December 10, 11 and 19, 2002, and on October 7 and 8, 2004, S&ME conducted in-situ hydraulic conductivity tests in 18 groundwater monitoring wells to estimate the hydraulic conductivity in the aquifer material near each well. Prior to performing the tests, the monitor wells were opened and allowed to equilibrate. The water level in each well was measured to the nearest 0.01 foot using a decontaminated water level probe. This reading was used as the initial reading for the tests. Rising head or falling head tests were performed in the wells by installing a pressure transducer equipped with a data recorder into each well. After obtaining an initial water level reading, the static water level within the well was lowered by pumping or bailing for the rising head test until the well was relatively dry. The water level in the well was monitored with the pressure transducer as the water returned to static conditions. The falling head tests were completed in one-inch diameter wells by pouring one liter of water into the well and measuring the decrease in head as the slug of water entered the aquifer. After reaching static condition, the tests were repeated in each well as time permitted. A metal slug approximately 9 feet long and 1 1/4-inch diameter was used to displace the water levels in monitor wells MW-15 and MW-18, in place of liquid slug or a pump, to conduct the tests.

The hydraulic testing data were transferred to a computer where the recovery data were imported into AQTESOLV® for Windows software for graphical evaluation. The reduced slug test data were analyzed using the Bouwer and Rice technique in the AQTESOLV® program. The Bouwer and Rice technique makes a variety of simplifying assumptions in the evaluation of slug test data. These include the assumptions that the aquifer in question is homogeneous, isotropic, and extends infinitely in the horizontal direction (Dawson and Istock, 1991; Bouwer and Rice, 1976 and 1989). Table 3 presents the test point assumptions used and the resulting hydraulic conductivity calculations. Copies of the actual hydraulic conductivity test data and analysis are included in Appendix V.

The hydraulic conductivity data were further evaluated considering the material(s) in which the wells were completed and where the water column primarily exists.

- Monitoring wells, BC-2, BC-5 (dry), BC-11, BC-15, BC-19, BC-20, BC-21 and BC-22 were completed in unconsolidated sediments (residuum) or saprolite with the water table occurring in the unconsolidated material or saprolite.

- Monitor wells BC-1, BC-4, BC-7, BC-8, BC-9, BC-10, BC-12, BC-13 (dry) BC-14 and BC-18 were completed in PWR and/or shallow fractured rock with the water column primarily occurring in the PWR.

- Monitor wells BC-3A, BC-6 (dry), BC-16, BC-17 and BC-23A were completed in deep fractured rock with the water column primarily occurring in the bedrock.

In attempt to obtain a representative hydraulic conductivity value for each medium, the individual values were used to calculate the geometric mean hydraulic conductivity for each medium.

In Table 4, hydraulic conductivities are grouped by water-bearing zone. The measured hydraulic conductivity in the residuum/saprolite ranged from $5.37x10^{-5}$ to $7.28x10^{-3}$ centimeters per second (cm/sec) with a geometric mean of $9.41x10^{-4}$ cm/sec. The measured hydraulic conductivity in the PWR/shallow bedrock ranged from $1.24x10^{-6}$ to $1.22x10^{-3}$ cm/sec with a geometric mean of $1.76x10^{-5}$ cm/sec. The measured hydraulic conductivity in the bedrock ranged from $1.93x10^{-5}$ to $1.64x10^{-4}$ cm/sec with a geometric mean of $5.60x10^{-5}$ cm/sec.

3.2 LABORATORY TESTING

Physical properties testing of soil samples collected from each borehole location was performed. The following tests were performed.

Disturbed (Split-Spoon) Samples

- Grain Size Distribution
- Atterberg Limits
- Specific Gravity

Bulk Samples

- Grain Size Distribution
- Atterberg Limits
- Natural Moisture Content
- Specific Gravity
- Standard Proctor Compaction
- Total Porosity (Remolded)
- Remolded Permeability

Relatively Undisturbed (Shelby Tube) Samples

- Grain Size Distribution
- Atterberg Limits
- Specific Gravity
- Total Porosity
- Permeability

Test samples were obtained from different intervals at each borehole location so that a "representative" number of tests could be performed on the unconsolidated materials encountered at the site. Table 5 summarizes the interval from which split spoon, bulk and Shelby tube samples were collected at each boring.

The bulk samples were collected near the ground surface to evaluate the on-site soils suitability for use in potential landfill liner/covers. Further discussion of the findings from the laboratory testing for each specimen type is continued below.

3.2.1 Disturbed (Split-Spoon) Samples

A summary of the disturbed (split-spoon) samples laboratory data is provided in Table 6, *Summary of Soil Laboratory Data – Split-Spoon Samples.* Actual laboratory test reports are included in Appendix VI.

Thirteen split-spoon sample specimens were selected for laboratory analysis, from intervals summarized in Table 6. In general, these soils classify as silty clayey sands to fine clayey sandy silt, exhibiting a USCS group symbol of SC to ML. The plasticity indices for the soils ranged from 3 to 22.

3.2.2 Bulk Samples

A summary of the bulk samples laboratory data is provided in Table 7, *Summary of Soil Laboratory Data – Bulk Samples*. Actual laboratory test reports are included in Appendix VII.

Twenty bulk sample specimens were selected for laboratory analysis. Ten samples from between the interval of 0 to 10 feet bgs, seven from the interval of 0 to 5 feet bgs, two samples from the interval of 5 to 10 feet bgs, and one from the interval of 10 to 20 feet bgs were tested. Fourteen of these soils classify as either silty clay to clayey silt (USCS group symbol of CH-MH-CL-ML), with varying amounts of clay, silt, and sand. Six of the samples (BC-10, BC-11, BC-13, BC-15, BC-16, and BC-17) classified as silty clayey sand or silty sand (USCS group symbols of SM-SC). However, samples from BC-11 and BC-13 (0'-10') are more silty/clay than sandy; having 56% and 65% by weight passing #200 sieve. Plasticity indices ranged from 3 to 28. Maximum standard Proctor dry densities ranged from 87.8 to 118.7 pounds per cubic foot. Optimum moisture contents ranged from 13% to 32.4% compared to in-place natural moisture contents ranging from approximately 2.7 to 42.1%.

Of the 20 bulk sample specimens selected for physical testing, 15 were selected for remolded permeability testing. The remolded conditions were selected to be near 95 percent of the soils' standard Proctor maximum dry density at near optimum to slightly above optimum moisture content. Based on our experience, these are considered common compaction criteria for landfill liner/cover soils. Total porosity ranged from 34.1% to 51.3% under the remolded conditions. At the simulated criterion and a minimal confining pressure of 2.5 pounds per square inch (psi) to secure the specimen in the sample mold, the soil permeability ranged from 1.67×10^{-7} to 2.40×10^{-5} cm/sec for bulk samples at BC-3, BC-7, BC-10, BC-11, BC-12, and BC-13. Resulting soil

permeability for samples taken from BC-15 through BC-23 utilizing a simulated effective consolidation pressure pf 7.0 psi ranged from 2.03 x 10^{-6} to 3.74 x 10^{-1} cm/sec.

3.2.3 Relatively Undisturbed (Shelby Tube) Samples

A summary of the relatively undisturbed (Shelby Tube) samples laboratory data is provided in Table 8, *Summary of Soil Laboratory Data – Shelby Tube Samples*. Actual laboratory test reports are included in Appendix VIII.

S&ME submitted seven Shelby tube samples for laboratory testing. Of the seven Shelby tube specimens available for permeability testing, BC-10, BC-11, BC-12, BC-17, and BC-19 were collected from borings located in the proposed Phase 1 landfill footprint, while BC-6 and BC-7 were collected from borings located within the conceptual Phase 2 landfill footprint. Five of the soil samples (BC-6, BC-7, BC-10, BC-11, and BC-12) classified as clayey silts (USCS group symbol of MH-ML), with varying amounts of clay, silt and sand. The sample taken at BC-17 classified as a silty sandy clay (CL), and the sample taken at BC-19 classified as a clayey sand (SC). Plasticity indices ranged from 6 to 16. In-place natural moisture contents ranged from approximately 13% to 41% and total porosity ranged from 45.7% to 59.7%.

Six of the undisturbed Shelby tube samples were also tested for permeability. In an effort to simulate the existing (pre-landfill) and potential future (post-landfill) in-situ conditions at these locations, we computed confining pressures using reasonably assumed and/or literature supported unit weights and coefficients of internal friction for both soil and FGD scrubber waste and the corresponding at-rest lateral earth coefficients. These computations are included in Appendix IX for reference and record.

At the conditions simulating existing in-situ conditions (pre-landfilling), the soil permeability ranged from 8.14 x 10^{-6} to 4.26 x 10^{-4} cm/sec. Under the post-landfilling simulated condition, the permeability reduced from as little as 3% at BC-7 (2.33 x 10^{-4} to 2.66 x 10^{-4} cm/sec) to as much as 55% at BC-11 (5.14 x 10^{-5} to 2.29 x 10^{-5} cm/sec).

3.3 GEOLOGIC MAPPING AND FRACTURE TRACE ANALYSIS

3.3.1 Fracture Trace Analysis

On May 16, 2003, S&ME personnel performed geologic mapping and field reconnaissance of the Belews Creek Steam Station project site and surrounding area. Resources used to assist in the mapping process included North Carolina Department of Conservation and Development Bulletin Number 55, *Geology and Groundwater in the Greensboro Area, North Carolina*, by M.J. Mundorff, 1948, the Department of the Interior United States Geological Survey *Geologic Map of the East Half of the Winston-Salem Quadrangle, North Carolina-Virginia*, by G.H. Espenshade and Others, 1975, the North Carolina Department of Natural Resources and Community Development Division of Land Resources Geological Survey Section *Geologic Map of Region G, North Carolina* by P. Albert Carpenter, III, 1982, and geologic mapping of Belews Creek by M. F. Schaeffer, 2001.

The channel cut between West Belews Creek and Belews Creek, utility easements, road cuts, steep slopes, ravines, railroad beds, streambeds, and slopes to Belews Lake were examined for bedrock outcrops that could provide source information suitable for geologic mapping. The mapping was necessary to evaluate structural characteristics of the bedrock below and near the site that may influence surface water and groundwater flow as well as the proposed landfill design. Primary mapping information at outcrop locations focused on bedding plane strike and dip, orientations of joint sets, and orientation of mineral foliations within the bedrock. Bedrock outcrop locations were found and measured in the vicinity of the proposed ash landfill and FGD Landfill sites.

Five outcrop locations were mapped in the vicinity of the FGD landfill and are depicted on Figure 12. Outcrops #1 and #3 are located west of the proposed gypsum and limestone piles and are within the footprint of Phase I of the FGD landfill. Outcrop #4 is located south of the proposed FGD landfill at the northern limit of a finger to Belews Lake. Outcrop #5 is located south of the proposed ash landfill facility and north of Phase 2 and 3 of the proposed FGD

landfill location. Outcrop #2 is within a power easement approximately 2,000 feet south of the proposed limestone pile.

Orientations of geologic structural features were measured on outcrops with a Brunton® Compass. The dip of joints and fractures were observed in Outcrop #1 with angles that were approximately 32 ° from the horizontal. Joints and fractures observed in Outcrop #2 had dip angles of approximately 38 °. Joints and fractures observed at Outcrop #3 were estimated at 45 ° due to the condition of the outcrop surface. Outcrop #4 had joints and fractures with a dip angle of 78 °. Joint faces in Outcrop #5 occurred with angles of 60 ° and 78 °. Mineral foliation plains present in the bedrock were also measured at several outcrops. Foliations generally had moderate dips ranging from 10° to 50°.

Not all of the structural features observed had exposed surfaces that were suitable for collecting measurements. Therefore, the rock core samples from eight borings (BC-1, BC-4, BC-6, BC-7, BC-9, BC-12, BC-13, and BC-14) were reviewed to supplement joint and fracture angle data that occur below the site. The rock core samples had fracture and joint angle dips that ranged from approximately 10° to 85 °.

Appendix II includes photographs of the outcrops documenting source locations of the measured joint faces and foliations as well as rock core samples.

Additional information sources were used to verify the structural geology within the study area that covered approximately a 3.5-mile radius around the subject site. Topographic maps and aerial photography from Stokes County Geographic Information System (GIS) Department and United States Geological Survey (USGS) 7.5 Minute Series Maps for the *Belews Creek Quadrangle* dated 1969, Revised 1994, and the *Belews Lake Quadrangle*, dated 1971, Revised 1994, were used to assist the field reconnaissance that confirmed stream lineaments present in the study area. Stream lineaments are recognized on maps by stretches of relatively straight line topographic features which are often indicative of bedrock structures such as fractures, (joints and faults) and foliations. The stream lineaments are depicted on the Figure 13.

3.3.2 Results

The orientation of structural features mapped were primarily joints and, to a lesser degree, foliations. A total of 46 measurements were made from five different outcrop locations. Thirty-six measurements were made on joint sets and ten measurements were made on foliations. The strikes of the joints and foliations were then plotted on rose diagrams. The rose diagrams graphically represent the percentages of measurement that lie in a 10° azimuth increment. The field measurements for each outcrop are shown on Figure 12.

Individual rose diagrams display joint orientations and representative foliation measurements where present for each outcrop are presented on Figures 14, through 18. A composite rose diagram for all field measurements of joint and foliations for the five outcrops are presented on Figure 19. Three principal sets of joints and foliations are displayed on the composite rose diagram. Two primary sets bear approximately NNW-SSE and E-W. One secondary set bears approximately NNE-SSW.

As shown on Figures 12 and 13, fifty-nine (59) map lineaments were noted within the 3.5 mile radius of the proposed FGD landfill. As previously described for the field mapping, the map lineaments were plotted on a rose diagram (Figure 20). From Figure 20, at least three distinct sets of lineament trends were represented. The primary trend bears NNW-SSE. Two secondary sets bear WNW-ESE and ENE-WSW. A weak forth set may bear NNE-SSW.

The two composite rose diagrams that were constructed allow correlations to be made between field data and map lineaments. It appears that the principal joint set orientations have a strong correlation with the principal lineament trends that bear NNW-SSE and a lesser correlation in the WNW-ESE and ENE-WSW directions. Secondary joint sets correlate with the weak lineament set that bear NNE-SSW. The principal stream lineament and foliation bearings do not correlate. However, a moderate correlation is made between the secondary stream lineament and foliation that is oriented WNW-ESE. Groundwater flow is strongly influenced by topography and surface water drainage features. However, groundwater flow may be indirectly influenced by bedrock

joints and to a lesser extent by foliations based on the correlations of principal stream lineament and structural bedrock measurements made in the area.

It should be noted that one of the mapped fracture lineaments with a trend bearing NNW-SSE passes through the proposed footprint of Phase I of the FGD Scrubber Landfill. Field observations of topography and soil borings support the presence of the mapped lineament identified in this area. Fracture zones are typically less resistant to erosion than unfractured rock and, thus, valley and stream segments tend to follow them, creating topographic lows. These may represent zones of groundwater drainage or groundwater discharge; groundwater springs or seeps may be present in groundwater discharge zones (Fetter, 1994).

The two arms of Belews Lake have coves oriented in the NNW-SSE direction which come into close proximity to each other in the vicinity if the mapped fracture lineament. Borings on a line drawn between the two coves have lithologic sequences that support the evidence of the mapped fracture lineament. These borings tend to have a deeper weathered zone of residuum, saprolite, and partially weathered rock and highly fractured bedrock.

Hydrogeologic data collected to date at the site indicate that groundwater flow within strata is more pronounced near drainage swales in the vicinity of the mapped lineament, suggesting that these surface topographic features reflect relatively more developed subsurface fracture zones that influence the location and occurrence of groundwater movement within these strata. Evidence of the increased flow in this area can be seen on the potentiometric map of the October 27, 2004 water levels (Figure 21) which shows a steeper hydraulic gradient in the vicinity of monitor wells BC-11, BC-12, BC-14A, and BC-15. Features indicative of groundwater discharge (e.g., seeps) were observed in drainage swales or intermittent surface water bodies while conducting the siting study.

4.0 HYDROGEOLOGIC EVALUATION

Given the findings from the siting study activities, we have considered the hydrogeologic aspects of the BCSS site relative to the placement and monitoring of a disposal site landfill.

4.1 LOCATION OF ROCK AND GROUNDWATER

The bedrock and groundwater are of sufficient depth to allow airspace while maintaining a regulatory separation between the landfill base grades and rock and groundwater. Water level measurements and computations were performed to establish the estimated seasonal high groundwater (ESHG) surface for the BCSS site.

4.2 GROUNDWATER OCCURRENCE AND MOVEMENT

4.2.1 Groundwater Occurrence

A review of the lithologic cross sections (Figures 4 through 11) indicates that groundwater at the BCSS site occurs in residuum or saprolite (BC-2, BC-5, BC-11, BC-15, BC-19, BC-20, BC-21, and BC-22), in the partially weathered rock (PWR) in the upper portions of the fractured bedrock within approximately 1 to 15 feet of auger refusal (BC-1, BC-4, BC-7, BC-8, BC-9, BC-10, BC-12, BC-14, and BC-18), and in the deep fractured bedrock greater than approximately 15 feet of auger refusal (BC-3 (dry), BC-3A, BC-6, BC-16, BC-13 (dry), BC-17 and BC-23A).

At BC-3, the boring was advanced 10 feet into the rock, to a total depth of 48 feet bgs, without encountering water. Boring BC-3A was advanced adjacent to BC-3 to further evaluate the absence of groundwater to the depth drilled at BC-3. At BC-3A, the boring was advanced 31 feet into the rock to a total depth of 71.8 feet bgs before groundwater was observed. Immediately after termination of the drilling, evacuation of the borehole, and construction of a monitoring well at BC-3A, approximately 15.3 feet of standing water was measured in the well.

After the well was developed and water levels were allowed to stabilize (24 hrs.), approximately 3.3 feet of standing water was measured in the well. Subsequent groundwater gauging measured 0.5, 0.48 and 0.45 feet of standing water 12, 22 and 121 days later, respectively. The observed decline in static water levels indicates that the initial water measured may have resulted from drilling fluids introduced into fractures during drilling, or could have come from an isolated water bearing fracture with little or no connection other fractures that contained a limited amount of water that was subsequently de-watered. The remaining water measured at about 0.5 foot may not represent the true static water level in the bedrock at this location, but may be the remaining water trapped at the bottom of the well screen.

The boring BC-13 was continued 20 feet past auger refusal to a total depth of 45 feet bgs. Although no water was encountered, a well was installed at this location. A review of static water levels in nearby wells as presented on the lithologic cross-sections indicates that the water table surface may be approximately 60 feet bgs at this location.

The water elevations at BC-3 and BC-13 indicated that the water-bearing zones in the fractured rock may possibly be isolated from the water table in the saprolite and partially weathered rock. In considering construction of the potentiometric map and in evaluating water conditions at the site, it was important to understand whether the water in the bedrock was openly connected to the water table or whether it was confined. By examining the lithologic cross-sections and comparing lithology to water elevations, we have concluded based on available information that the water within the shallow and the deep fractured bedrock is largely connected to the water table forming an unconfined aquifer unit. Therefore, it appears that the saprolite, partially weathered rock and the shallow fractured bedrock largely represent a single water bearing zone.

Groundwater levels and corresponding elevations used in the groundwater flow evaluation are summarized in Table 2, *Summary of Water Level Information*. The groundwater elevations, which represent the "head potential" or "potentiometric head" of an unconfined aquifer at each individual monitoring well, were evaluated by mathematically calculating the individual points of equi-potential between pairs of wells and then drawing the equi-potential lines across and adjacent to the proposed footprint. The resulting potentiometric groundwater surface, a two-

dimensional representation of the unconfined groundwater surface, or groundwater table, beneath the site, is presented as Figure 21, *Groundwater Potentiometric Surface Map October 27, 2004.* Groundwater flow will occur from locations of higher head potential to locations of lower head potential. Accordingly, based on Figure 21, groundwater flow appears to be flowing in a west-northwest direction toward the lake. The equi-potential lines generally mimic the ground surface topography of the site.

The proposed groundwater potentiometric surface appears reasonable within the local regional flow regime. The flow direction under and around the proposed footprint appears to be influenced by the topographic "highs" occurring at site which likely act as surface drainage divides for the area, which are mimicked by hydraulic divides in the groundwater. Groundwater flowing underneath the proposed footprint is also influenced by the Belews Lake located approximately 450 feet west and 850 feet east of the site.

4.2.2 Groundwater Flow Rate

A variation of Darcy's Law can be used to calculate the groundwater flow rate or velocity:

$$V_x = Q/A*n_e = K/n_e * dh/dl$$

Where:

V_x = seepage or average linear velocity of groundwater
K = hydraulic conductivity
n_e = effective porosity
dh/dl = hydraulic gradient (slope of the groundwater surface)

From the summary of hydraulic conductivity data in Table 4, we determined that the geometric mean of the hydraulic conductivity values measured in wells where the water column primarily exists in the residuum/saprolite materials is 9.41×10^{-4} cm/sec. The geometric mean hydraulic conductivity is 1.76×10^{-5} cm/sec in the wells where the water column primarily exists in PWR and shallow fractured bedrock and 5.6×10^{-5} cm/sec in the wells where the water column exists in the deep fractured bedrock.

Total porosity computed from measurements on the relatively undisturbed Shelby tube samples collected from saprolitic soils ranged from 46.6% to 59.7%, with a geometric mean of 53.3%. Although, these samples were collected above the saturated zone, they give an indication of the relative total porosity that may exist in the saprolite at the BCSS site. Literature (Fetter 1994, Freeze and Cherry 1979, and Heath 1982) references ranges of total porosity from 25% to 50% for sand, the primary classification of the saprolitic soils and PWR at the site. Fetter (1994), references "weathered metamorphic rock can have porosities in the range of 30% to 60%". In practice, it is common to consider a reduction in the total porosity to account for the effective porosity – that cross-sectional area of the porous medium that is actually interconnected and readily available for fluid flow. Freeze and Cherry (1979) reference a range of porosity in the consolidated fractured bedrock from 10% to 0.001% while Heath (1982) cites a porosity of 10% for granite. Considering both the measured (computed) and literature values, we have assumed an average effective porosity of 30% for our computations in the saprolite/PWR, 20% in the PWR/shallow bedrock, and 10% in the shallow fractured bedrock.

As flow is radial from the northeast of the BCSS project site, we considered the hydraulic gradients toward the north, northwest, south, and southwest. The hydraulic gradient to the north was measured between BC-19 and BC-22 to be approximately 0.051 feet per foot (ft/ft) in the residuum and saprolite. The hydraulic gradient the north was also measured between BC-23A and BC-22 to be 0.038 feet per foot (ft/ft) in the deep rock and residuum saprolite. The hydraulic gradient to the northwest was measured between BC-10 and BC-20 to be approximately 0.021 ft/ft in the PWR, residuum and saprolite. The hydraulic gradient to the northwest was also measured between BC-9 and BC-20 to be approximately 0.034 ft/ft in the PWR, residuum and saprolite. The hydraulic gradient to the south was measured between BC-16 and BC-12 to be approximately 0.018 ft/ft in the deep rock, shallow fractured rock and PWR. The hydraulic gradient to the southwest was measured between BC-11 and BC-15 to be approximately 0.035 ft/ft in the residuum and saprolite. The overall average hydraulic gradient is 0.045 ft/ft to the north, 0.0275 ft/ft to the northwest, 0.018 ft/ft to the south, and 0.035 ft/ft to the southwest.

Several factors were considered in calculating the groundwater flow velocity at the BCSS site. These include the hydraulic conductivity values, the hydraulic gradient, and the estimated effective porosity of the lithologic unit that the water is flowing through. For instance, groundwater in the vicinity of BC-19 toward BC-22 flows under the greatest hydraulic gradient and begins in partially weathered rock and ends in saprolite /residuum, while flow from BC-16 toward BC-12 has flatter gradient and begins in bedrock and ends in PWR.

After evaluating flow direction, hydraulic gradient, hydraulic conductivity, effective porosity and lithology, individual groundwater flow velocities were calculated for different portions of the site. Groundwater flow velocities were calculated using the hydraulic gradients measured from the October 27, 2004 static water levels and the hydraulic conductivities calculated from the aquifer rising and/or falling head tests.

Based on the above parameters, the calculated groundwater flow in the northern portion of the site, and the hydraulic gradients measured between BC-19 to BC-22 and BC-23A to BC-22, groundwater that flows primarily through the saprolite and residuum lithologic units has calculated flow velocities that range from 122.6 ft/yr to 165.8 feet per year (ft/yr).

The groundwater flow calculated for the fractured bedrock in the northern portion of the site is calculated to be 21.9 ft/yr based on the hydraulic gradient measured between BC-23A and BC-22.

The calculated groundwater flow in the northwestern portion of the site based on the hydraulic gradients measured between BC-10 to BC-20 and BC-9 to BC-20, groundwater that primarily flows through the saprolite and residuum lithologic units has calculated velocities that range from 69.3 ft/yr to 111.3 ft/yr.

The groundwater flow calculated for the partially weathered rock and shallow fractured bedrock in the northwestern portion of the site has calculated velocities that range from 1.9 ft/yr to 3.1 ft/yr based on the hydraulic gradient measured from BC-10 to BC-20 and BC-9 to BC-20.

Based on the above parameters, the calculated groundwater flow in the southern portion of the site in the vicinity of BC-16 to BC-12 that primarily flows through the PWR and shallow fractured bedrock has a calculated velocity of 1.6 ft/yr.

The groundwater flow for the deep bedrock in the southern portion of the site is calculated to be 10.1 ft/yr based on the hydraulic gradient measured between BC-16 and BC-12.

The groundwater flow in the saprolite and residuum in the southwestern portion of the site is calculated to be 113.9 ft/yr based on the hydraulic gradient measured between BC-11 and BC-15.

Table 9, *Groundwater Flow Velocity Calculations*, provides a summary of the values used in these calculations and the results. Care should be taken in the use of these values, as they represent a range of velocities calculated from approximations of widely varying lithologic and groundwater flow conditions. These values are useful in understanding the magnitude and range of groundwater flow rates at the site and the relative rate of groundwater movement in different portions of the site.

While groundwater velocity computations could be made between other well sets for modeling or other more specific purposes, our intent in this evaluation was to develop a generalization for what the range of groundwater velocities could be beneath the proposed BCSS landfill site, rather than for the use for the calculation of critical values.

4.3 ESTIMATED SEASONAL HIGH GROUNDWATER

The depth-to-water at the proposed FGD Scrubber Landfill site has been characterized by 18 rounds of water levels measured taken at monitor wells BC-1 thought BC-14 from November 11, 2003 through October 10, 2004 (Table 2). A review of these data shows that water levels have increased in each of the wells during this period of time. The well with the least increase in static water levels was BC-4 (3.89 feet) and the well with the greatest increase in static water levels was BC-1 (11.89 feet). Although several (BC-2, BC-7, BC-8, BC-9, BC-11, BC-14) wells had their highest measured static water levels on August 25, 2003, this was not the case for a majority of the wells.

In fact, other than the site-wide increase in water levels, there is no comprehensive statement that can be made relative to characterizing the seasonal high water table at the site. For this reason, in addition to the fact that only two groundwater elevation data points have been collected at monitor wells BC-14 through BC-23 at the proposed FGD Scrubber Landfill, it would be more appropriate to predict an estimated seasonal high groundwater (ESHG) surface for the site than to rely on the limited amount depth-to-water measurements currently available.

The (ESHG) elevations at the proposed FGD Scrubber Landfill at Belews Creek were projected by applying statistical analysis of hydrological data from on-site monitor wells installed during the first phase of drilling (BC-1 through BC-14) at the proposed FGD Scrubber Landfill and monitor wells (MW-1 through MW-5) at the neighboring Pine Hall Road ash landfill. The following procedures describe the application of the statistical analyses and extrapolation of the results to develop projected high water at Belews Creek.

S&ME reviewed 15 years of hydrological data from monitor wells MW-1 through MW-5 located at the Pine Hall Road Landfill which had up to 27 data points. The number of data points from monitor wells BC-1 through BC-14 located at the proposed FGD Scrubber Landfill ranged from 12 to 18 rounds of water level measurements over the past two years. The quantity of water level data from these wells was sufficient to perform statistical predictions at the upper 90th, 95th and 99th percent confidence level (%CL). There were insufficient data to perform a similar statistical prediction for monitor wells BC-14 through BC-23 at the proposed FGD Scrubber Landfill as these wells had only two groundwater elevation data points collected from each well. The projected 90%, 95% and 99% CL was calculated for water levels from monitor wells where there were a sufficient quantity of data points using the following formula (Steel and Torrie, 1980; page 65):

$$P\left[\mathrm{Y} \le \overline{\mathrm{Y}}\, t_{\alpha} \sqrt{s^2\left(\frac{n+1}{n}\right)}\right] = 0.90 \text{ or } 0.95 \text{ or } 0.99$$

where;

P = probability that $\mathrm{Y} \le \overline{\mathrm{Y}}\, t_{\alpha} \sqrt{s^2\left(\frac{n+1}{n}\right)}$ is below the 90th, 95th and 99th percentile

Y = projected water level

$\overline{Y}$ = Sample population mean of water levels

t_α = t-statistic at either the 90th, 95th, and 99th percent confidence level with n-1 degrees of freedom.

s^2 = sample population variance of the water levels

n = number of water level measurements in a well.

The application of this equation uses the Students T-distribution which takes into account that the prediction of the next measured water level will be within a certain level at the 95% CL. The equation is based on a sample mean instead of the true population mean, which is unknown. The appropriate variance to the next predicted water level measurement value in any one monitor well is the sum of the variances of the observed sample mean of water levels measured plus a random component.

Time series graphs of the data for the Pine Hall Road monitor wells (MW-1 through MW-5) and the FGD Scrubber Landfill monitor wells (BC-1 through BC-14) are presented graphically in Appendix X. The time series graphs provided a means review of the data sets subjectively so that the appropriate CL for the data set could be selected. The analysis of the graphs determined that an excessive number of measured water levels exceeded the 90% CL water level and the 99% CL water level provided an elevation that appeared too conservative for projecting the ESHG elevations. Thus, the 95% CL level was selected to project the high water elevation. The predicted 95% CL for water levels at both the Pine Hall Road Landfill and the FGD Scrubber Landfill are listed in Table 10.

After calculating the 95% CL on water levels at both landfills and reviewing the time series graphs, S&ME applied a three step process to predict the ESHG elevations at the Scrubber Landfill:

Step 1:

Hydrological data from the Pine Hall Road Landfill were used to approximate ESHG elevations for observation wells BC-1 through BC-23A at the proposed Belews Creek Landfill. ESHG elevations for the monitor wells at the Pine Hall Road Landfill were projected for data from monitor wells

MW-1 through MW-5 using the predictive 95% CL water elevation. A modification factor was calculated by taking the difference between the measured water elevations on October 27, 2004 and the predicted 95% UCL elevation for Pine Hall Landfill wells MW-1 through MW-5. The following are the modification factors calculated for the wells Pine Hall Landfill.

Pine Hall Road Landfill Well	10/27/04 Static Water Level (ft-AMSL)	ESHG Static Water Level (95% CL)	Resulting Modification Factor
MW-1	822.41	826.63	+4.5 feet
MW-2	814.07	816.68	+ 3.0 feet
MW-3	804.92	807.20	+ 2.5 feet
MW-4	753.24	752.92	+ 1 foot
MW-5	761.09	762.53	+ 1.5 feet

Based on our review of the water level data, the topographic position of the wells, and their proximity to drainage features, S&ME used the following wells from the Pine Hall Road site to correspond to the proposed wells at the proposed FGD Scrubber Landfill.

Monitor Wells at the Proposed Scrubber Residue Landfill	Corresponding Wells at the Pine Hall Road Landfill
BC-1	MW-2
BC-2	MW-1
BC-3A	MW-3
BC-4	MW-5
BC-5	MW-1
BC-6	MW-1
BC-7	MW-5
BC-8	MW-5
BC-9	MW-2
BC-10	MW-1
BC-11	MW-5
BC-12	MW-3
BC-14	MW-4
BC-15	MW-4
BC-16	MW-1
BC-17	MW-1
BC-18	MW-2
BC-19	MW-5
BC-20	MW-2
BC-21	MW-2
BC-22	MW-1
BC-23A	MW-1

Step 2:

For wells BC-1 through BC-14 at the Scrubber Landfill, 12 to 18 water level measurements were taken over two years were used to project the 95% CL ESHG at each of these wells. There were insufficient data to perform a similar statistical prediction for monitor wells BC-15 through BC-23A at the proposed FGD Scrubber Landfill because these wells only had two groundwater elevation data points at each well. To approximate the projected high water table elevations for wells BC-15 through BC-23A, a modification factor was calculated by taking the difference between the measured water elevations October 27, 2004 and the predicted 95% CL elevation for wells BC-1 through MW-14. The following are the modification factors calculated for the Scrubber Landfill wells BC- through BC-14.

Scrubber Landfill Well	10/27/04 Static Water Level (ft-AMSL)	ESHG Static Water Level (95% CL)	Resulting Modification Factor
BC-1	746.41	752.51	+ 6.10 feet
BC-2	748.93	751.60	+ 2.67 feet
BC-4	760.67	762.17	+ 1.50 feet
BC-6	762.47	766.97	+ 4.50 feet
BC-7	736.11	738.34	+ 1.93 feet
BC-8	756.66	736.30	+ 2.19 feet
BC-9	757.48	761.54	+ 4.88 feet
BC-10	750.32	761.98	+ 4.50 feet
BC-11	755.02	753.44	+ 3.12 feet
BC-12	743.98	758.66	+ 3.64 feet
BC-14	743.98	748.48	+ 4.50 feet

For wells BC-15 through BC-23A, which only had two measured elevations, the high water elevation was projected by adding the corresponding modification factor to the groundwater elevation measured on October 27, 2004 for wells BC-1 through BC-14.

Monitor Wells BC-1 Through BC-14 at the Proposed Scrubber Residue Landfill	Corresponding Wells BC-15 though BC-23 at the Proposed Scrubber Residue Landfill
BC-8	BC-15
BC-4	BC-16
BC-4	BC-17
BC-9	BC-18
BC-4	BC-19
BC-2	BC-20
BC-2	BC-21
BC-10	BC-22
BC-4	BC-23A

Step 3:

Step 3 was to analyze the results of Steps 1 and 2 in combination with the time series plots (hydrographs) to develop groundwater potentiometric maps.

After several iterations of groundwater potentiometric maps, S&ME selected the ESHG elevations that appeared to best represent the physical and hydrogeological characteristics at Scrubber Landfill site. The ESHG elevation at each well (BC-1 through BC-23A) was developed based on selecting the highest elevation between the ESHG using the modification numbers from the Pine Hall Road Landfill monitor wells and ESHG using the modification factor, and the predicted 95% CL, for wells BC-1 through BC-14 at the Scrubber Landfill. The resulting ESHG elevations for the Scrubber Landfill wells (BC-1 through BC-23A) are summarized on Table 10. Figure 22 presents a potentiometric map of the ESHG that appears to correlate with the ground surface topography, screened lithology, and the potentiometric map of water levels measured on October 27, 2004.

5.0 QUALIFICATIONS OF REPORT

The contents of this report, including the summary, conclusions, and recommendations, are based on the data available to S&ME at the time of this report. This report presents an assessment of the existing conditions at the site at the time of our evaluation and available public information. The interpretations and conclusions provided in this report are based on widely spaced data within a complex hydrogeologic framework. Conditions may exist at the site which were not recognized from the available data.

This report has been prepared for the use of Duke Energy for specific application to this project. The report has been prepared in accordance with generally accepted engineering and hydrogeologic practices for projects of this type. The findings and recommendations contained in this report were based on applicable standards of our profession at the time this report was prepared.

The analysis and findings submitted in this report are based, in part, upon data obtained from subsurface exploration. The nature and extent of variations between boring and sampling locations may not be evident. Analysis and findings of this report are based on interpolation between data points and may not be representative of all subsurface conditions. Regardless of the thoroughness of an assessment, there is always the possibility that conditions between borings are different from those at specific boring locations due to the variability of subsurface conditions.

This report has been prepared for the sole purpose of providing an engineering evaluation of the site that can be used by Duke Energy for preliminary facility design criteria. The party or parties involved in this specific evaluation, as authorized by the addressee, may rely upon the conclusions provided in this report. The use of this report by any third party or parties will be such party's sole risk, and S&ME disclaims liability for any such use or reliance by third parties. No other warranties are implied or expressed.

6.0 REFERENCES

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Tables

Table 1
Monitoring Well Construction Details
Proposed FGD Scrubber Residue Landfill
Duke Power - Belews Creek Steam Station
Belews Creek, Stokes County, North Carolina
S&ME Project No. 1054-04-955

BORING/ WELL ID	GROUND SURFACE ELEVATION (ft-msl)	TOC ELEVATION (ft-msl)	DEPTH TO WATER (ft-bgs)	SOIL TEST BORING DEPTH (to top of rock) (ft-bgs)	ROCK CORING DEPTH (ft-bgs)	TOTAL BORING DEPTH (ft-bgs)	GROUT INTERVAL (ft-bgs)	BENTONITE SEAL INTERVAL (ft-bgs)	SAND PACK INTERVAL (ft-bgs)	SCREENED INTERVAL (ft-bgs)	LITHOLOGIC UNIT SCREENED
BC-1	758.1	760.35	14.29	0 - 10.5	10.5 - 20.0	20.0	0.0 - 2.0	2.0 - 4.0	4.0 - 20.0	4.0 - 19.0	Partially Weathered Rock
BC-2	764.74	766.99	16.97	0 - 43.5	-	43.5	0.0 - 18.0	18.0 - 23.0	23.0 - 42.2	27.28 -42.28	Silty Sand Residuum
BC-3	842.34	844.84	-	0.0 - 38.0	38.0 - 48.0	48.0	0.0 - 27.0	27.0 - 29.0	29.0 - 48.0	30.07 - 45.07	Silty Sand Residuum and Weathered Rock
BC-3A	842.34	844.17	70.92	0.0 - 40.8	40.8 - 71.8	71.8	0.0 - 34.0	34.0 - 40.0	40.0 - 71.8	46.4 - 71.4	Fractured Rock
BC-4	811.99	813.74	54.71	0.0 - 50.0	50.0 - 62.0	62.0	0.0 - 38.5	38.5 - 45.0	45.0 - 62.0	46.44 - 61.44	PWR and Fractured Rock
BC-5	818.13	819.96	-	0.0 - 46.0	-	46.0	0.0 - 25.0	25.0 - 29.0	29.0 - 46.0	30.92- 45.92	Sandy Silt Residuum
BC-6	800.74	802.16	37.79	0.0 - 28.5	28.5 - 38.72	38.7	0.0 - 18.8	18.8 - 23.5	23.5 - 38.72	23.72 - 38.72	Saprolite and Firm Rock
BC-7	775.86	777.8	41.57	0.0 - 36.3	36.3 - 52.38	52.4	0.0 - 31.5	31.5 - 36.0	36.0 - 52.38	37.38 - 52.38	Partially Weathered Rock
BC-8	762.41	764.24	33.98	0.0 - 25.2	25.2 - 43.37	43.4	0.0 - 22.0	22.0 - 25.0	25.0 - 43.37	28.37 - 43.37	Partially Weathered Rock
BC-9	773.54	775.54	21.5	0.0 - 13.8	13.8 - 28.8	28.8	0.0 - 6.5	6.5 - 12.5	12.5 - 28.8	13.8 - 28.8	Partially Weathered Rock
BC-10	781.84	784.07	28.21	0.0 - 38.5	38.5 - 47.5	47.5	0.0 - 26.5	26.5 - 30.5	30.5 - 47.5	31.13 - 46.13	PWR and Weathered Rock
BC-11	785.15	786.85	41.02	0.0 - 67.9	-	67.9	0.0 - 41.0	41.0 - 47.0	47.0 - 67.9	51.45 - 66.45	Saprolite
BC-12	802.91	804.62	56.25	0.0 - 62.8	62.8 - 76.8	76.8	0.0 - 56.5	56.5 - 60.0	60.0 - 76.8	61.09 - 76.09	Partially Weathered Rock
BC-13	812.06	813.56	-	0.0 - 25.0	25.0 - 45.0	45.0	0.0 - 18.8	18.8 - 22.0	22.0 - 45.0	23.3 - 43.3	Partially Weathered Rock
BC-14	757.23	758.86	16.16	0.0 - 21.8	21.8 - 31.4	31.4	0.0 - 12.4	12.4 - 15.4	15.4 - 31.4	16.02 - 31.02	PWR and weathered Rock
BC-15	760.53	762.26	26.14	0.0 - 45.0	48.9 - 61.8	61.8	0.0 - 24.0	24.0 - 26.0	26.0 - 43.4	28.4 - 43.4	Silty Sand Residuum and Weathered Rock
BC-16	833.77	835.65	73.8	0.0 - 68.2	68.3 - 106.4	106.4	0.0 - 90.5	90.5 - 93.0	93.0 - 106.0	96.0 - 106.0	Fractured Rock
BC-17	823.66	825.49	56.0	0.0 - 45.4	49.2-71.1	71.1	0.0 - 47.5	47.5 - 49.0	49.0 - 70.8	60.8 - 70.8	Fractured Rock
BC-18	780.97	783.74	22.4	0.0 - 33.6	-	38.3	0.0 - 22.0	22.0 - 25.5	25.5 - 38.1	27.8 - 38.1	Partially Weathered Rock.
BC-19	813.09	814.81	38.96	0.0 - 53.7	-	57.2	0.0 - 41.0	41.0 - 42.6	42.6 - 56.0	46.0 - 56.0	Saprolite
BC-20	754.58	757.22	11.2	0.0 - 18.6	22.9-34.4	34.4	0.0 - 7.3	7.3 - 9.6	9.6 - 21.6	11.6 - 21.6	Saprolite
BC-21	753.42	756.69	7.7	0.0 - 28.9	34.6-44.6	44.6	0.0 - 1.3	1.3 - 3.0	3.0 - 13.9	3.9 - 13.9	Gravelly Sand Saprolite
BC-22	762.58	764.53	1.5	0.0 - 18.8	21.9 - 31.9	31.9	0.0 - 1.0	1.0 - 2.0	2.0 - 13.0	3.0 - 13.0	Sand Residuum with Rock Fragments
BC-23A	862.562	863.79	81.42	0.0 - 88.6	84.6 - 102.7	102.7	0.0 - 72.1	72.1 - 74.0	74.0 - 101.7	76.7 - 101.7	Fractured Rock and Weathered Rock

Notes:
ft-msl: Feet above mean sea level
ft-bgs: Feet below ground surface
PWR: Partially weathered rock

1) TOC (top of casing) and ground surface elevations from the survey relative to mean sea level, provided by Duke Energy.
2) Water level measurements were taken 24 hours following the well completion.

Table 2
Monitoring Well Groundwater Depths and Elevations
Proposed FGD Scrubber Residue Landfill
Duke Power - Belews Creek Steam Station
Belews Creek, Stokes County, North Carolina
S&ME Project No. 1054-04-955

Well ID	TOC Elevation (ft AMSL)	Screened Interval (ft bgs)	11/25/2002 Static Water (ft AMSL)	12/9/2002 Static Water (ft AMSL)	12/19/2002 Static Water (ft AMSL)	2/2/2003 Static Water (ft AMSL)	2/26/2003 Static Water (ft AMSL)	3/24/2003 Static Water (ft AMSL)	3/28/2003 Static Water (ft AMSL)	4/28/2003 Static Water (ft AMSL)	5/27/2003 Static Water (ft AMSL)
BC-1	760.35	5 - 20	742.83	740.44	743.81	741.09	745.22	752.12	NM	748.75	751.51
BC-2	766.99	27.2 - 42.2	747.42	747.32	747.77	748.39	748.89	749.8	749.74	750.69	750.8
BC-3	844.84	33 - 48	dry	dry	dry	dry	dry	dry	dry	dry	dry
BC-3A	844.17	46.3 - 71.3	774.33	771.44	771.42	771.25	771.28	771.3	771.39	771.28	771.25
BC-4	813.74	47 - 62	757.02	757.22	757.28	756.94	756.96	756.83	756.9	757.11	757.19
BC-5	819.96	31 - 46	dry	dry	dry	771.98	772.03	771.97	dry	772.11	772.04
BC-6	802.16	23.5 - 38.5	767.69	762.92	762.95	762.8	762.79	762.7	762.73	762.82	762.24
BC-7	777.80	37-52	733.41	733.29	734.29	734.71	735.29	736.01	735.93	736.69	736.86
BC-8	764.24	28-43	728.16	728.06	728.43	729.35	729.73	730.97	731.12	733.29	733.48
BC-9	775.54	13.8-28.8	749.52	751.86	752.04	753.3	753.64	755.32	NM	757.94	758.48
BC-10	784.07	32.5-47.5	753.09	753.29	753.63	754.38	754.81	756.07	756.32	758.46	759.05
BC-11	786.85	51.5-66.5	743.66	743.68	744.13	744.73	745.16	745.98	746.17	747.78	748.81
BC-12	804.62	61.8-76.8	749.46	749.72	746.66	746.71	747.1	748.23	748.49	750.79	752.06
BC-13	813.56	25 - 45	dry	dry	dry	dry	dry	dry	dry	dry	dry
BC-14	758.86	16.4-31.4	740.28	739.91	741.07	741.04	742.11	743.07	743.08	744.34	744.59
BC-15	762.26	28.4 - 43.4	-	-	-	-	-	-	-	-	-
BC-16	835.65	96.0 - 106.0	-	-	-	-	-	-	-	-	-
BC-17	825.49	60.8 - 70.8	-	-	-	-	-	-	-	-	-
BC-18	783.74	27.8 - 37.8	-	-	-	-	-	-	-	-	-
BC-19	814.81	46.0 - 56.0	-	-	-	-	-	-	-	-	-
BC-20	757.22	11.6 - 21.6	-	-	-	-	-	-	-	-	-
BC-21	756.69	3.9 - 13.9	-	-	-	-	-	-	-	-	-
BC-22	764.53	3.0 - 13.0	-	-	-	-	-	-	-	-	-
BC-23A	863.79	76.7 - 101.7	-	-	-	-	-	-	-	-	-

Notes:
TOC = top of casing
ft AMSL = feet above mean sea level
ft bTOC = feet below top of casing
- = not measured (well not installed)

1) TOC (top of casing) and ground surface elevations from the survey relative to mean sea level, provided by Duke Energy.

Table 2 (cont'd)
Monitoring Well Groundwater Elevations
Proposed FGD Scrubber Residue Landfill
Duke Power - Belews Creek Steam Station
Belews Creek, Stokes County, North Carolina
S&ME Project No. 1054-04-955

Well ID	TOC Elevation (ft AMSL)	Screened Interval (ft bgs)	6/25/2003 Static Water (ft AMSL)	8/25/2003 Static Water (ft AMSL)	11/21/2003 Static Water (ft AMSL)	2/19/2004 Static Water (ft AMSL)	5/13/2004 Static Water (ft AMSL)	6/22/2004 Static Water (ft AMSL)	7/22/2004 Static Water (ft AMSL)	10/6/2004 Static Water (ft AMSL)	10/27/2004 Static Water (ft AMSL)
BC-1	760.35	5 - 20	749.2	748.19	744.05	747.05	746.43	745.53	745.08	749.43	746.41
BC-2	766.99	27.2 - 42.2	751.45	751.45	749.93	749.9	749.57	749.24	748.96	748.95	748.93
BC-3	844.84	33 - 48	dry	NM	dry	dry	dry	dru	dry	dry	dry
BC-3A	844.17	46.3 - 71.3	771.19	771.17	771.23	771.32	771.14	771.1	771.18	771.18	771.08
BC-4	813.74	47 - 62	757.32	NM	759	759.86	760.34	760.5	760.62	760.72	760.67
BC-5	819.96	31 - 46	772.02	772.03	772.15	772.25	772.17	772.06	772.03	dry	dry
BC-6	802.16	23.5 - 38.5	762.75	762.78	762.9	762.88	762.77	762.66	762.58	dry	762.47
BC-7	777.80	37-52	736.89	737.3	737.24	737.29	737.09	736.77	736.46	736.53	736.41
BC-8	764.24	28-43	733.97	734.41	732.96	733.83	734.4	733.78	733.53	734.02	734.11
BC-9	775.54	13.8-28.8	760.15	760.38	757.74	757.52	757.79	757.37	757.02	756.93	756.66
BC-10	784.07	32.5-47.5	760.13	760.52	759.11	758.68	758.59	758.19	757.91	757.42	757.48
BC-11	786.85	51.5-66.5	749.84	751.27	751.17	750.92	751.07	751.01	750.81	750.29	750.32
BC-12	804.62	61.8-76.8	753.1	754.7	756.07	756.26	756.26	756.13	755.75	754.92	755.02
BC-13	813.56	25 - 45	dry	NM	dry	dry	dry	dru	dry	dry	dry
BC-14	758.86	16.4-31.4	744.66	744.67	744.54	744.56	744.58	744.34	744.15	744.1	743.98
BC-15	762.26	28.4 - 43.4	-	-	-	-	-	-	-	736.55	736.4
BC-16	835.65	96.0 - 106.0	-	-	-	-	-	-	-	762.36	762.47
BC-17	825.49	60.8 - 70.8	-	-	-	-	-	-	-	766.58	766.95
BC-18	783.74	27.8 - 37.8	-	-	-	-	-	-	-	757.68	757.63
BC-19	814.81	46.0 - 56.0	-	-	-	-	-	-	-	775.46	775.81
BC-20	757.22	11.6 - 21.6	-	-	-	-	-	-	-	744.43	743.23
BC-21	756.69	3.9 - 13.9	-	-	-	-	-	-	-	746.16	746.07
BC-22	764.53	3.0 - 13.0	-	-	-	-	-	-	-	761.56	761.19
BC-23A	863.79	76.7 - 101.7	-	-	-	-	-	-	-	782.36	782.43

Notes:
TOC = top of casing
ft AMSL = feet above mean sea level
ft bTOC = feet below top of casing
- = not measured (well not installed)

1) TOC (top of casing) and ground surface elevations from the survey relative to mean sea leve

Table 3
Aquifer Test Assumptions / Hydraulic Conductivity Values
Proposed FGD Scrubber Residue Landfill
Duke Power - Belews Creek Steam Station
Belews Creek, Stokes County, North Carolina
S&ME Project 1054-04-955

Boring ID		BC-2	BC-4	BC-7	BC-8	BC-9	BC-10	BC-11	BC-12	BC-14
TOC Elevation	(ft AMSL)	766.99	813.74	777.8	764.24	755.54	784.07	786.85	804.62	758.86
Total Depth	(ft bgs)	44.53	63.19	54.32	45.2	28.69	48.35	68.15	77.8	32.65
Screened Interval	(ft bgs)	27.2 - 42.2	47 - 62	37-52	28-43	13.8-28.8	32.5-47.5	51.5-66.5	61.8-76.8	16.4-31.4
Screen Length	(ft)	15	15	15	15	15	15	15	15	15
Casing In Rock?	Y/N	N*	N	Y	Y	N	Y*	N*	N*	N
Auger Refusal	(ft bgs)	43	50	36	25.2	13.8	38.5	67.9	62.8	21.8
Depth to Water (12/19/02)	(ft bTOC)	19.22	56.46	43.51	35.81	23.5	30.44	42.72	57.96	17.79
Depth to:										
Top of Screen	(ft bTOC)	29.53	48.19	39.32	30.2	13.69	33.35	53.15	62.8	17.65
Bottom of Screen	(ft bTOC)	44.53	63.19	54.32	45.2	28.69	48.35	68.15	77.8	32.65
Bottom of Boring	(ft bTOC)	45.75	63.75	54.32	45.2	30.8	49.73	69.6	78.51	46.4
r, Well Casing Radius	(ft)	0.0833	0.0833	0.0833	0.0833	0.0833	0.0833	0.0833	0.0833	0.0833
R, Borehole Radius	(ft)	0.3125	0.3125	0.3125	0.3125	0.3125	0.3125	0.3125	0.3125	0.3125
R, Core Hole Radius	(ft)	-	0.125	0.125	0.125	0.125	0.125	-	0.125	0.125
Description of Borehole R/ Core Hole Radius Depths		43.5' of 0.312' 0	50.0' of 0.312' 12.0' of 0.125'	36.3' of 0.312' 16.0' of 0.125'	25.2' of 0.312' 18.2' of 0.125'	13.8' of 0.312' 15.0' of 0.125'	38.5' of 0.312' 9.0' of 0.125'	67.9' of 0.312' 0	62.8' of 0.312' 14.0' of 0.125'	21.8' of 0.312' 9.6' of 0.125'
Aquifer Test Imput Values										
b										
Ft of Standing Water	(ft)	25.31	6.73	10.81	9.39	5.19	17.91	25.43	19.84	14.86
D										
Aquifer Thickness	(ft)	100	100	100	100	100	100	100	100	100
K										
Hydraulic Conductivity (Test #1)	(cm/sec)	9.95E-05	1.24E-06	3.64E-06	6.49E-06	2.47E-06	4.87E-06	6.64E-05	6.85E-05	3.15E-05
Hydraulic Conductivity (Test #2)	(cm/sec)	3.53E-05	--	3.47E-05	6.85E-06	--	5.20E-05	4.35E-05	6.75E-05	2.88E-05
Hydraulic Conductivity (Test #3)	(cm/sec)	--	--	--	--	--	1.61E-05	--	--	--
**Avg. Hydraulic Conductivity	(cm/sec)	5.93E-05	1.24E-06	1.12E-05	6.67E-06	2.47E-06	1.60E-05	5.37E-05	6.80E-05	3.02E-05

Notes:
* = The water level is above the screened interval.
** = Average calculated as the geometric mean.

Table 3 (cont'd)
Aquifer Test Assumptions / Hydraulic Conductivity Values
Proposed FGD Scrubber Residue Landfill
Duke Power - Belews Creek Steam Station
Belews Creek, Stokes County, North Carolina
S&ME Project 1054-04-955

Boring ID		BC-15	BC-16	BC-17	BC-18	BC-19	BC-20	BC-21	BC-22	BC-23A
TOC Elevation	(ft AMSL)	762.26	835.65	825.49	783.74	814.81	757.22	756.69	764.53	863.79
Total Depth	(ft bgs)	43.4	106	70.8	37.8	56	21.6	13.9	13	101.7
Screened Interval	(ft bgs)	28.4 - 43.4	96.0 - 106.0	60.8 - 70.8	27.8 - 37.8	46.0 - 56.0	11.6 - 21.6	3.9 - 13.9	3.0 - 13.0	76.7 - 101.7
Screen Length	(ft)	15	10	10	10	10	10	10	10	25
Casing In Rock?	Y/N	N	Y	Y*	N*	N*	N	N	N*	Y
Auger Refusal	(ft bgs)	48.9	68.3	49.2	-	-	22.9	34.6	21.9	84.6
Depth to Water (10/6/04)	(ft bTOC)	25.69	73.28	58.74	25.98	38.97	12.67	10.42	3	81.39
Depth to:										
Top of Screen	(ft bTOC)	29.68	98.21	60.55	30.8	49.96	14.58	7.14	5.09	94.85
Bottom of Screen	(ft bTOC)	44.68	108.21	70.55	40.8	59.96	24.58	17.14	15.09	104.85
Bottom of Boring	(ft bTOC)	44.68	108.21	70.55	40.8	59.96	24.58	17.14	15.09	104.85
r, Well Casing Radius	(ft)	0.0833	0.04167	0.04167	0.0833	0.04167	0.0833	0.0833	0.0833	0.0833
R, Borehole Radius	(ft)	0.3542	0.3542	0.3542	0.3542	0.3542	0.3542	0.3542	0.3542	0.3542
R, Core Hole Radius	(ft)		0.1572	0.125						0.1042
Description of Borehole r/ Core Hole Radius Depths		43.4' of 0.177'	68.2' of 0.177' 38.1' of 0.104'	49.2' of 0.177' 21.9' of 0.0782'	37.8' of 0.177'	56.0' of 0.177'	21.6' of 0.177'	13.9' of 0.177'	13.0' of 0.177'	84.6.' of 0.104' 18.1' of 0.1042'
Aquifer Test Imput Values										
b										
Ft of Standing Water	(ft)	18.99	34.93	11.81	14.82	20.99	11.91	6.72	12.09	23.46
D										
Aquifer Thickness	(ft)	100	100	100	100	100	100	100	100	100
K										
Hydraulic Conductivity (Test #1)	(cm/sec)	2.25E-03	1.87E-04	2.57E-05	2.92E-04	1.21E-03	7.28E-03	3.55E-03	1.23E-02	4.37E-05
Hydraulic Conductivity (Test #2)	(cm/sec)	--	1.43E-04	1.45E-05	1.16E-02	--	--	--	1.85E-03	7.05E-05
Hydraulic Conductivity (Test #3)	(cm/sec)	--	--	--	5.29E-04	--	--	--	1.09E-03	--
**Avg. Hydraulic Conductivity	(cm/sec)	2.25E-03	1.64E-04	1.93E-05	1.22E-03	1.21E-03	7.28E-03	3.55E-03	2.92E-03	5.55E-05

Notes:
* = The water level is above the screened interval.
** = Average calculated as the geometric mean.

Table 4
Hydraulic Conductivity Values Grouped by Lithologic Unit
Proposed FGD Scrubber Residue Landfill
Duke Energy - Belews Creek Steam Station
Belews Creek, Stokes County, North Carolina
S&ME Project 1054-04-955

Well ID	Lithologic Unit	Monitor Well* Avgerage Hydraulic Conductivity (cm/sec)	Lithologic Unit* Avgerage Hydraulic Conductivity (cm/sec)
BC-21	Residuum, Saprolite	3.55E-03	9.41E-04
BC-22		2.92E-03	
BC-2		5.93E-05	
BC-19		1.21E-03	
BC-11		5.37E-05	
BC-15		2.25E-03	
BC-20		7.28E-03	
BC-4	Partially Weathered Rock, Bedrock	1.24E-06	1.76E-05
BC-7		1.12E-05	
BC-8		6.67E-06	
BC-9		2.47E-06	
BC-10		1.60E-05	
BC-12		6.80E-05	
BC-14		3.02E-05	
BC-18		1.22E-03	
BC-16	Deep Rock	1.64E-04	5.60E-05
BC-17		1.93E-05	
BC-23A		5.55E-05	

Notes:
* Average calculated as the geometric mean.
cm/sec = centimeters per second

Table 5
Summary of Soil Sampling Intervals
Proposed FGD Scrubber Residue Landfill
Duke Energy - Belews Creek Steam Station
Belews Creek, Stokes County, North Carolina
S&ME Project 1054-04-955

BORING ID	BC-1						BC-2						BC-3						BC-3A					
	Split Spoon		Bulk		Undisturbed		Split Spoon		Bulk		Undisturbed		Split Spoon		Bulk		Undisturbed		Split Spoon		Bulk		Undisturbed	
Sample Depth (ft bgs)	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth
	SS-1	0	S-1	0-10			SS-1	0-1.5	S-1	0-10*			SS-1	0.5-3.5	S-1	0-10*			SS-1	53.8-54.0				
	SS-2	3.5*					SS-2	3.5	S-2	10-20			SS-2	3.5-5.0	S-2	10-20								
	SS-3	8.5					SS-3	8.5	S-3	20-30			SS-3	8.5-10	S-3	20-30								
							SS-4	13.5	S-4	30-40			SS-4	13.5-15.0	S-4	30-40								
							SS-5	18.5					SS-5	18.5-19.4*										
							SS-6	23.5					SS-6	23.5-25										
							SS-7	28.5					SS-7	28.5-30										
							SS-8	33.5					SS-8	32.5-33										
							SS-9	38.5																

BORING ID	BC-4						BC-5						BC-6						BC-7					
	Split Spoon		Bulk		Undisturbed		Split Spoon		Bulk		Undisturbed		Split Spoon		Bulk		Undisturbed		Split Spoon		Bulk		Undisturbed	
Sample Depth (ft bgs)	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth
	SS-1	1-2.5	S-1	0-10	ST-1	5-6.9	SS-1	1.5	S-1	1-10	ST-1	3-4.3	SS-1	0.5-2	S-1	0-10*	ST-1	3-5	SS-1	1-2.5	S-1	1-10*	ST-1	4-6
	SS-2	3.5-5	S-2	10-20			SS-2	3.5	S-2	10-20			SS-2	3.5-5	S-2	10-20	ST-2	18-20*	SS-2	3.5-5	S-2	10-20	ST-2	14-16*
	SS-3	6-7.5	S-3	20-30			SS-3	5.5-7	S-3	20-30			SS-3	8.5-10	S-3	20-28.5			SS-3	8.5-10	S-3	20-30		
	SS-4	8.5-10	S-4	30-40			SS-4	8.5-10	S-4	30-40			SS-4	13.5-15					SS-4	13.5-15				
	SS-5	13.5-15	S-5	40-50			SS-5	13.5	S-5	40-46			SS-5	18.5-20					SS-5	18.5-20				
	SS-6	18.5-20					SS-6	18.5					SS-6	23.5-25					SS-6	23.5-25				
	SS-7	23.5-25					SS-7	20.5											SS-7	28.5-28.9				
	SS-8	33.5-34					SS-8	28.5											SS-8	33.5-35				
	SS-9	38.5-38.7					SS-9	33.5																
	SS-10	43.5-43.6					SS-10	38.5																
	SS-11	48.5-49					SS-11	43.5																

BORING ID	BC-8						BC-9						BC-10						BC-11					
	Split Spoon		Bulk		Undisturbed		Split Spoon		Bulk		Undisturbed		Split Spoon		Bulk		Undisturbed		Split Spoon		Bulk		Undisturbed	
Sample Depth (ft bgs)	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth
	SS-1	3.5-5	S-1	0-10*			SS-1	0	S-1	0-10*			SS-1	1-1.5	S-1	1-10*	ST-1	12-14*	SS-1	0-1.5	S-1	5-10*	ST-1	1-2.9
	SS-2	8.5-10	S-2	10-20			SS-2	3.5					SS-2	3.5-5	S-2	10-20			SS-2	3.5-5	S-2	10-20	ST-2	23-25*
	SS-3	13.5-15	S-3	20-25			SS-3	8.5					SS-3	6-7.5	S-3	20-30			SS-3	8.5-10	S-3	20-30		
													SS-4	8.5-10	S-4	30-38.5			SS-4	13.5-15	S-4	30-40		
													SS-5	13.5-15					SS-5	18.5-20	S-5	40-50		
													SS-6	18.5-20					SS-6	23.5-25	S-6	50-60		
													SS-7	23.5-25*					SS-7	28.5-28.9	S-7	60-67.9		
													SS-8	28.5-28.9					SS-8	33.5-35*				
													SS-9	33.5-33.85					SS-9	38.5-38.8				
																			SS-10	43.5-43.9				
																			SS-11	48.5-49				
																			SS-12	53.5-53.9				
																			SS-13	58.5-59				
																			SS-14	63.5-63.8				
																			SS-15	67.9-67.9				

Notes: ft bgs = feet below ground surface

* Indicates sample selected for laboratory analysis

Table 5 (cont'd)
Summary of Soil Sampling Intervals
Proposed FGD Scrubber Residue Landfill
Duke Energy - Belews Creek Steam Station
Belews Creek, Stokes County, North Carolina
S&ME Project 1054-04-955

BORING ID	BC-12						BC-13						BC-14						BC-15					
	Split Spoon		Bulk		Undisturbed		Split Spoon		Bulk		Undisturbed		Split Spoon		Bulk		Undisturbed		Split Spoon		Bulk		Undisturbed	
Sample Depth (ft bgs)	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth
	SS-1	1-1.5	S-1	1-5*	ST-1	3-5	SS-1	0.5-2	S-1	0-10*	ST-1	5-6.9	SS-1	0-2.5	S-1	5-10*	ST-1	5-7	SS-1	3.5-5	S-1	0-5*		
	SS-2	3.5-5	S-2	5-10	ST-2	27-28.7*	SS-2	3.5-5	S-2	10-20*	ST-2	15-17	SS-2	3.5-5	S-2	10-15			SS-2	8.5-10				
	SS-3	6-7.5	S-3	15-25			SS-3	8.5-10	S-3	20-25			SS-3	6-7.5					SS-3	13.5-15				
	SS-4	8.5-10	S-4	25-35			SS-4	13.5-15					SS-4	8.5-10					SS-4	18.5-20*				
	SS-5	13.5-15	S-5	35-45			SS-5	18.5-19.4					SS-5	13.5-15					SS-5	23.5-25				
	SS-6	18.5-20*	S-6	45-55			SS-6	23.5					SS-6	18.5-19					SS-6	28.5-30				
	SS-7	23.5-25																	SS-7	33.5-35				
	SS-8	28.5-30																	SS-8	38.5-40				
	SS-9	33.5-35																	SS-9	43.5-45				
	SS-10	38.5-39																						
	SS-11	43.5-44																						
	SS-12	48.5-50																						
	SS-13	53.5-55																						
	SS-14	58.5-60																						

BORING ID	BC-16						BC-17						BC-18						BC-19					
	Split Spoon		Bulk		Undisturbed		Split Spoon		Bulk		Undisturbed		Split Spoon		Bulk		Undisturbed		Split Spoon		Bulk		Undisturbed	
Sample Depth (ft bgs)	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth
	SS-1	3.5-5	S-1	1-5*			SS-1	3.9-5.4	S-1	0-6*	ST-1	5.9-8.4*	SS-1	3.5-5					SS-1	3.5-5	S-1	2-7*	ST-1	27-29*
	SS-2	8.5-10					SS-2	8.9-10.4					SS-2	8.5-10					SS-2	8.5-10				
	SS-3	13.5-15*					SS-3	13.9-15.4*					SS-3	13.5-13.9					SS-3	13.5-15				
	SS-4	18.5-20					SS-4	18.9-20.4					SS-4	18.5-18.8*					SS-4	18.5-20*				
	SS-5	23.5-24.8					SS-5	23.9-25.4					SS-5	23.5-24.3					SS-5	23.5-25				
	SS-6	28.5-30					SS-6	28.9-30.4					SS-6	28.5-28.3					SS-6	28.5-30				
	SS-7	33.5-35					SS-7	33.9-35.4					SS-7	33.5-33.6					SS-7	33.5-34.5				
	SS-8	38.5-40					SS-8	38.9-40.4											SS-8	38.5-39.8				
	SS-9	43.5-45					SS-9	43.9-45.4											SS-9	43.5-44				
	SS-10	48.5-49																	SS-10	48.5-48.9				
	SS-11	53.5-54.2																	SS-11	53.5-53.7				
	SS-12	58.5-60																						
	SS-13	63.5-64																						
	SS-14	68.5-68.2																						

BORING ID	BC-20						BC-21						BC-22						BC-23					
	Split Spoon		Bulk		Undisturbed		Split Spoon		Bulk		Undisturbed		Split Spoon		Bulk		Undisturbed		Split Spoon		Bulk		Undisturbed	
Sample Depth (ft bgs)	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth	Sample ID	Depth
	SS-1	3.5-5	S-1	1-6*			SS-1	3.7-5.2*	S-1	0-5*			SS-1	3.5-4.8	S-1	0-5*			SS-1	3.5-4.5	S-1	1-6*		
	SS-2	8.5-9.0*					SS-2	8.7-10.2					SS-2	8.5-8.7					SS-2	8.5-9.5				
	SS-3	13.5-15					SS-3	13.7-14.3					SS-3	13.5-14					SS-3	13.5-15				
	SS-4	18.5-18.6					SS-4	18.7-18.9					SS-4	18.5-18.8					SS-4	18.5-19.9				
							SS-5	23.7-24.0											SS-5	23.5-25				
							SS-6	28.7-28.9											SS-6	28.5-30				
																			SS-7	33.5-35				
																			SS-8	38.5-39.4				
																			SS-9	43.5-45				
																			SS-10	48.5-49.4				
																			SS-11	53.5-54.4				
																			SS-12	58.5-60				
																			SS-13	63.5-64.9*				
																			SS-14	68.5-69				
																			SS-15	73.5-73.8				
																			SS-16	78.5-78.9				
																			SS-17	83.5-83.8				
																			SS-18	88.5-88.6				

Notes: ft bgs = feet below ground surface
* Indicates sample selected for laboratory analysis

Table 7
Summary of Soil Laboratory Data - Bulk Samples
Proposed FGD Scrubber Residue Landfill
Duke Power - Belews Creek Steam Station
Belews Creek, Stokes County, North Carolina
S&ME Project No. 1054-04-955

Boring No.	Sample ID	Sample Depth (ft-bgs)	USCS Classification		Lithologic Unit	Natural Moisture Content (%)	Standard Proctor		Clay %	Silt %	% Finer No. 200	Sand %	Gravel %	Atteberg Limits			Specific Gravity (unitless)	Porosity (%)		K (cm/sec)
			Symbol	Soil Description			Maximum Dry Density (pcf)	Optimum Moisture Content (%)						LL	PL	PI		Initial Sample Conditions	Final Sample Conditions	
BC-2	S-1	0 - 10	ML	Tan/brn fine sandy clayey SILT	Residuum	7.5	107	16.4	--	--	--	--	--	31	25	6	2.677	--	--	--
BC-3	S-1	0 - 10	CL	Brn. fine sandy silty CLAY	Saprolite	5.8	103.3	18.2	14.9	42.7	57.6	42.4	0.0	37	20	17	2.761	42.8	46.2	2.40E-05
BC-6	S-1	0 - 10	CH	Red silty sandy CLAY	Saprolite	27.6	96.3	23.4	--	--	--	--	--	54	36	18	2.692	--	--	--
BC-7	S-1	0 - 10	ML	Tan/brn sandy clayey SILT	Saprolite	24.3	98.2	22.3	27.0	43.2	70.2	28.8	1.0	44	31	11	2.726	45.4	46.3	3.42E-06
BC-8	S-1	0 - 10	ML	Tan/brn sandy clayey SILT	Saprolite	13.5	100.9	19.6	--	--	--	--	--	45	38	7	2.784	--	--	--
BC-9	S-1	0 - 10	ML	Tan sandy clayey SILT	Saprolite	6.6	110.8	13	--	--	--	--	--	25	21	4	2.691	--	--	--
BC-10	S-1	0 - 10	SM	Yellow clayey silty SAND	Saprolite	9.3	109.1	14.9	7.9	31.6	39.5	57.5	3.0	24	21	3	2.652	39.6	37.1	9.06E-05
BC-11	S-1	0 - 10	SC	Tan/brn silty clayey SAND	Fill/Residuum	27.6	108.4	17.6	--	--	56.6	41.4	2.0	47	26	21	2.716	39.2	40.4	1.67E-07
BC-12	S-1	5 - 10	ML	Brown fine sandy clayey SILT	Saprolite	14.5	105	18.1	--	--	60.5	39.1	0.4	36	29	6	2.668	40.2	40.2	5.61E-06
BC-13	S-1	0 - 10	SC	Tan/brn silty clayey SAND	Saprolite	11.1	98.8	22.4	--	--	65.5	33.9	0.6	38	28	10	2.672	43.9	45.0	4.18E-06
	S-2	10 - 20	ML	Brown fine sandy clayey SILT	Saprolite	18.0	103.0	19.1	--	--	60.8	39.2	0.0	34	27	7	2.705	41.8	41.8	8.65E-06
BC-14	S-1	5 - 10	CL	Tan/brown fine sandy silty CLAY	Saprolite	27.6	108.3	17.6	--	--	--	--	--	40	23	17	2.839	--	--	--
BC-15	S-1	0 - 5	SM	Tan sily SAND	Residuum	26.8	101.2	20.8	13.8	21.9	35.7	63.6	0.7	27	22	5	2.635	41.8	41.8	7.61E-06
BC-16	S-1	1 - 5	SM	Tan brown silty SAND	Residuum	42.1	114.2	14.8	15.6	34.1	49.7	50.3	0.0	30	22	8	2.708	36.9	36.9	2.30E-05
BC-17	S-1	0 - 6	MH	Red brown sandy clayey SILT	Residuum	21.3	104.2	19.5	36.0	48.2	84.2	15.8	0.0	55	31	24	2.654	40.6	40.6	1.82E-05
BC-19	S-1	0 - 10	MH	Orange Brown Sandy SILT	Residuum	37.1	87.8	32.4	53.0	30.8	83.8	15.2	1.0	72	44	28	2.735	51.3	51.3	1.79E-05
BC-20	S-1	0 - 5	CL	Tan brown CLAY	Residuum	10.5	114.6	15.3	12.2	38.1	50.3	47.3	2.4	36	22	14	2.799	37.3	37.3	2.03E-06
BC-21	S-1	0 - 5	CL-ML	Tan brown sandy clayey SILT	Residuum	21.4	112.5	14.2	14.0	36.6	50.6	48.4	1.0	26	20	6	2.654	36.2	36.2	3.95E-06
BC-22	S-1	0 - 5	ML	Tan brown sandy clayey SILT	Residuum	15.4	110.0	14.6	24.0	32.9	56.9	39.8	3.3	35	23	12	2.659	37.5	37.4	3.74E-01
BC-23	S-1	1 - 6	SC-SM	Tan orange silty clayey SAND gravel	Residuum	2.7	118.7	12.2	4.3	20.6	24.9	60.1	15.0	22	16	6	2.708	34.3	34.1	4.39E-05

Notes:
LL: Liquid Limit
PL: Plastic Limit
PI: Plastic Index

CL: Low Plasticity Clays
CH: High Plasticity Clays
ML: Low Plasticity Silts
SC: Clayey Sands

pcf: Pounds Per Cubic Foot
ft-bgs: Feet Below Ground Surface
K: Hydraulic Conductivity
cm/sec: Centimeters Per Second

%: Percentage of water by volume in the sample
% Finer No. 200: Sum of the Clay % and Silt % by total volume in the sample

Table 8
Summary of Soil Laboratory Data - Shelby Tube Samples
Proposed FGD Scrubber Residue Landfill
Duke Power - Belews Creek Steam Station
Belews Creek, Stokes County, North Carolina
S&ME Project No. 1054-04-955

Boring No.	Sample ID	Sample Depth (ft-bgs)	USCS Classification		Lithologic Unit	Natural Moisture Content (%)	Clay %	Silt %	% Finer No. 200	Sand %	Gravel %	Atteberg Limits			Specific Gravity (unitless)	Confining Pressure (psi)	Porosity (%)		K (cm/sec)
			Symbol	Soil Description								LL	PL	PI			Initial Sample Conditions	Final Sample Conditions	
BC-6	ST-2	18 - 20	ML	Tan/brn sandy clayey SILT	Saprolite	23.5	21.9	49.9	71.8	28.1	0.1	44	32	12	2.752	7.1	52.0	46.0	5.22E-05
																24.8	52.0	41.8	3.29E-05
BC-7	ST-2	14 - 16	ML	Tan sandy clayey SILT	Saprolite	13.2	17.3	47.4	64.7	34.4	0.9	38	29	9	2.652	6.0	52.5	42.2	2.33E-04
																13.0	52.5	40.8	2.26E-04
BC-10	ST-1	12 - 14	MH	Yellow/tan-brn sandy clayey SILT	Saprolite	41.2	12.0	67.9	79.9	20.1	0.0	59	45	14	2.797	3.7	56.9	56.0	8.14E-06
																11.9	56.9	54.6	6.42E-06
BC-11	ST-2	23 - 25	ML	Tan/brn sandy clayey SILT	Saprolite	17.8	10.2	46.0	56.2	43.8	0.0	44	37	7	2.745	8.0	46.6	35.3	5.14E-05
																27.9	46.6	29.6	2.29E-05
BC-12	ST-2	27 - 28	ML	Tan sandy clayey SILT	Saprolite	19.0	6.0	56.3	62.3	37.6	0.1	32	26	6	2.654	9.0	59.7	58.0	4.26E-04
																29.0	59.7	53.9	3.29E-04
BC-17	ST-1	5.9 - 8.4	CL	Orange silty sandy CLAY	Residuum	25.3	23.5	53.5	77.0	23.0	0.0	41	25	16	2.658	--	--	--	--
																--	--	--	--
BC-19	ST-1	27 - 29	SC	Brown clayey SAND	Residuum	20.2	7.2	34.9	42.1	57.8	0.1	31	22	9	2.665	7.0	45.8	45.7	1.23E-04
																--	--	--	--

Notes:
ML: Low Plasticity Silts
MH: High Plasticity Silts
ft-bgs: Feet Below Ground Surface
-- insufficient sample for laboratory analysis

LL: Liquid Limit
PL: Plastic Limit
PI: Plastic Index

%: Percentage of water by volume in the sample
% Finer No. 200: Sum of the Clay % and Silt % by total volume in the sample
K: Hydraulic Conductivity
cm/sec: Centimeters Per Second

Table 9
Groundwater Velocity Calculations
Proposed FGD Scrubber Residue Landfill
Duke Energy - Belews Creek Steam Station
Belews Creek, Stokes County, North Carolina
S&ME Project 1054-04-955

Location	Lithologic Unit	Hydraulic Gradient	Hydraulic Conductivity (cm/sec)	Effective Porosity (%)	Groundwater Flow Velocity (ft/yr)
Northwest BC-10 to BC-20	Partialy Weathered Rock, Shallow Fractured bedrock	0.021	1.76E-05	20	1.9
	Residuum, Saprolite	0.021	9.41E-04	30	69.3
Northwest BC-9 to BC-20	Partialy Weathered Rock, Shallow Fractured bedrock	0.034	1.76E-05	20	3.1
	Residuum, Saprolite	0.034	9.41E-04	30	111.3
Southwest BC-11 to BC-15	Residuum, Saprolite	0.035	9.41E-04	30	113.9
South BC-16 to BC 12	Deep Rock	0.018	5.60E-05	10	10.1
	Partialy Weathered Rock, Shallow Fractured bedrock	0.018	1.76E-05	20	1.6
North BC-19 to BC 22	Residuum, Saprolite	0.051	9.41E-04	30	165.8
North BC-23A to BC-22	Deep Rock	0.038	5.60E-05	10	21.9
	Residuum, Saprolite	0.038	9.41E-04	30	122.6

Notes:
cm/sec = centimeters per second
ft/yr = feet per uear

Table 10
Estimated Seasonal High Groundwater Elevations
Belews Creek Scrubber Residue Landfill
Duke Energy - Belews Creek Steam Station
Belews Creek, Stokes County, North Carolina
S&ME Project No. 1054-04-955

Monitor Well	Ground Surface	Groundwater Elevation (10/27/2004)	Estimated Seasonal High Groundwater Elevation (Predicted 95% CL)
BC-1	758.10	746.41	752.51
BC-2	764.74	748.93	751.60
BC-4	811.99	760.67	762.17
BC-6	800.74	762.47	766.97
BC-7	775.86	736.41	738.34
BC-8	762.41	734.11	736.30
BC-9	775.54	756.66	761.54
BC-10	781.84	757.48	761.98
BC-11	785.15	750.32	753.44
BC-12	802.91	755.02	758.66
BC-14	757.23	743.98	748.48
BC-15	760.53	736.40	740.90
BC-16	833.77	762.47	766.97
BC-17	823.66	766.95	769.45
BC-18	780.97	757.63	762.63
BC-19	813.09	775.81	780.31
BC-20	754.58	743.23	746.23
BC-21	753.42	746.07	749.07
BC-22	762.58	761.19	765.19
BC-23A	862.56	782.43	784.93

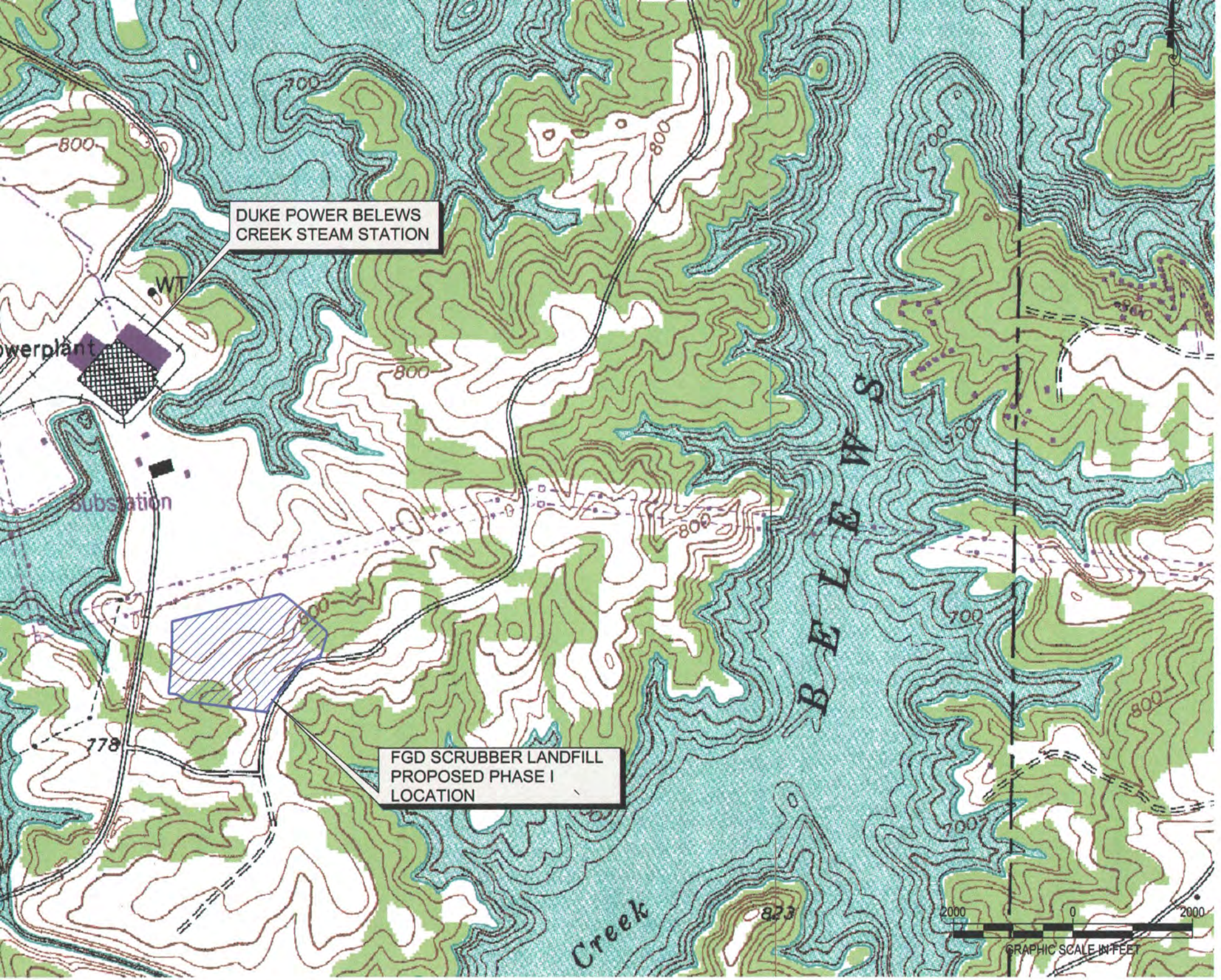
Notes:
Monitor wells BC-3A, BC-5, and BC-13 were dry on 10/27/04.

Table 6
Summary of Soil Laboratory Data - Split-Spoon Samples
Proposed FGD Scrubber Residue Landfill
Duke Power - Belews Creek Steam Station
Belews Creek, Stokes County, North Carolina
S&ME Project No. 1054-04-955

Boring No.	Sample ID	Sample Depth (ft-bgs)	USCS Classification		Lithologic Unit	Clay %	Silt %	% Finer No. 200	Sand %	Gravel %	Atteberg Limits			Specific Gravity (unitless)
			Symbol	Soil Description							LL	PL	PI	
BC-1	SS-2	3.5 - 5.0	SC	Tan fine silty clayey SAND	Saprolite	4.5	25.0	29.5	70.5	0.0	37	--	--	2.701
BC-3	SS-5	18.5 - 19.4	ML	Tan fine clayey sandy SILT	Saprolite	9.7	49.5	59.2	40.8	0.0	36	30	6	2.801
BC-10	SS-7	23.5 - 25.0	ML	Tan fine clayey sandy SILT	PWR	6.4	50.4	56.8	42.5	0.7	35	28	7	2.666
BC-11	SS-8	33.5 - 35.0	ML	Brown fine clayey sandy SILT	Saprolite	7.8	44.4	52.2	47.8	0.0	32	29	3	--
BC-12	SS-6	18.5 - 20.0	ML	Tan fine sandy clayey SILT	Saprolite	12.5	53.8	66.3	33.7	0.0	45	36	9	2.757
BC-15	SS-4	18.5 - 20.0	ML	Tan-brown sandy SILT	Saprolite	5.8	44.4	50.2	49.8	0.0	38	27	11	2.68
BC-16	SS-3	13.5 - 15.0	SC	Purple and tan clayey SAND with gravel	Residuum	7.5	38.1	45.6	44.7	9.7	36	24	12	2.677
BC-17	SS-3	13.9 - 15.4	ML	Brown sandy SILT	Residuum	7.0	53.8	60.8	38.0	1.2	36	27	9	2.719
BC-18	SS-4	18.5 - 18.8	SM	Brown clayey SAND	PWR	4.7	26.0	30.7	63.1	6.2	32	23	9	2.759
BC-19	SS-4	18.5 - 20	ML	Tan sandy SILT	Residuum	8.8	46.9	55.7	44.3	0.0	38	29	9	2.67
BC-20	SS-2	8.5 - 9.0	SM	Tan silty SAND	Residuum	3.5	41.6	45.1	54.0	0.9	36	25	11	2.715
BC-21	SS-1	3.7 - 5.2	SM	Tan silty clayey SAND	Residuum	6.5	37.8	44.3	55.7	0.0	29	22	7	2.655
BC-23	SS-13	63.5 - 65	SC	Tan-brown clayey SAND	PWR	4.8	42.5	47.3	52.3	0.4	45	23	22	2.702

LEGEND:
LL: Liquid Limit
PL: Plastic Limit
PI: Plastic Index
ft-bgs: Feet Below Ground Surface
ML: Low Plasticity Silts
SC: Clayey Sands
%: Percentage of water by volume in the sample
% Finer No. 200: Sum of the Clay % and Silt % by total volume in the sample
PWR: Partially Weathered Rock

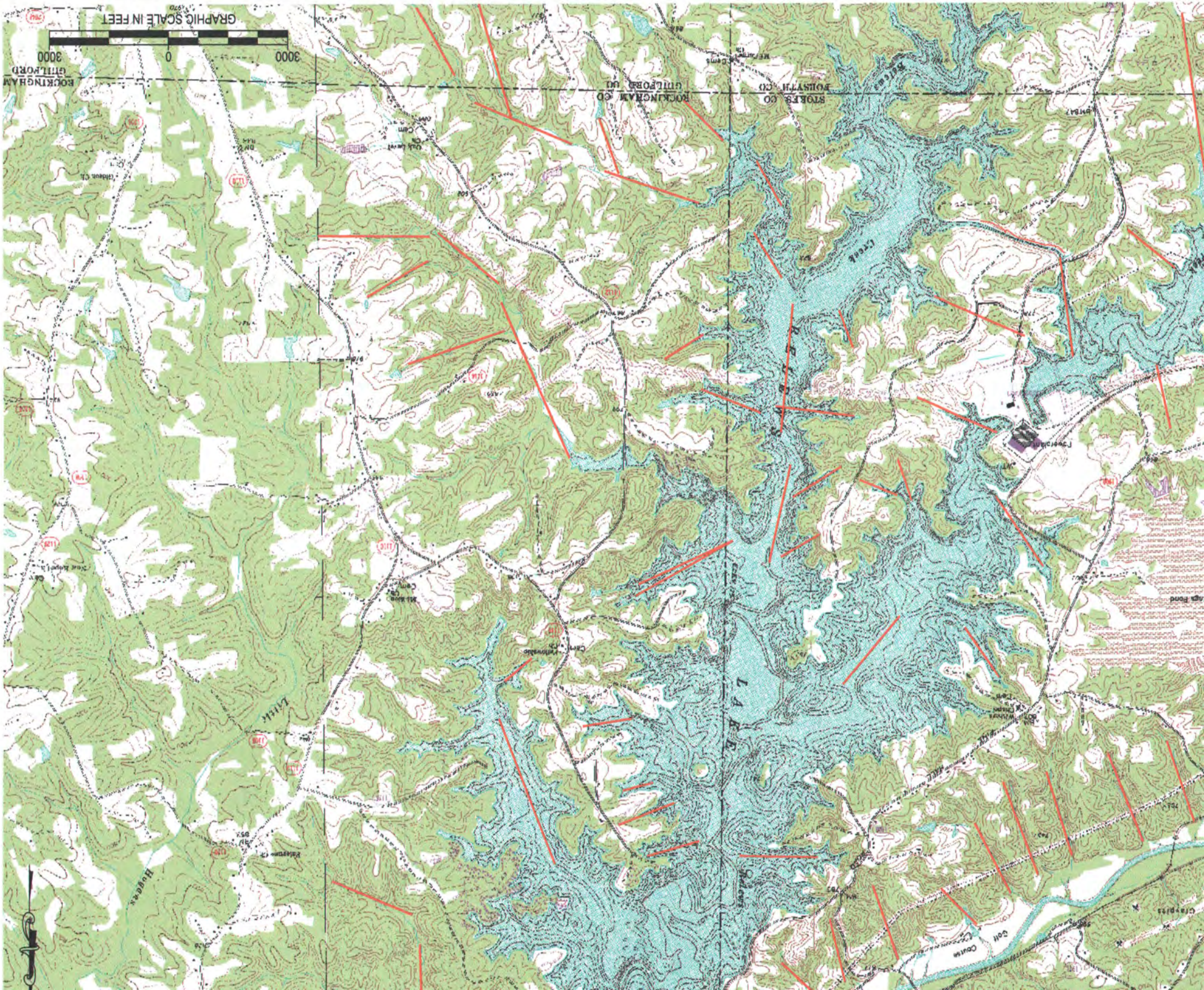
Figures

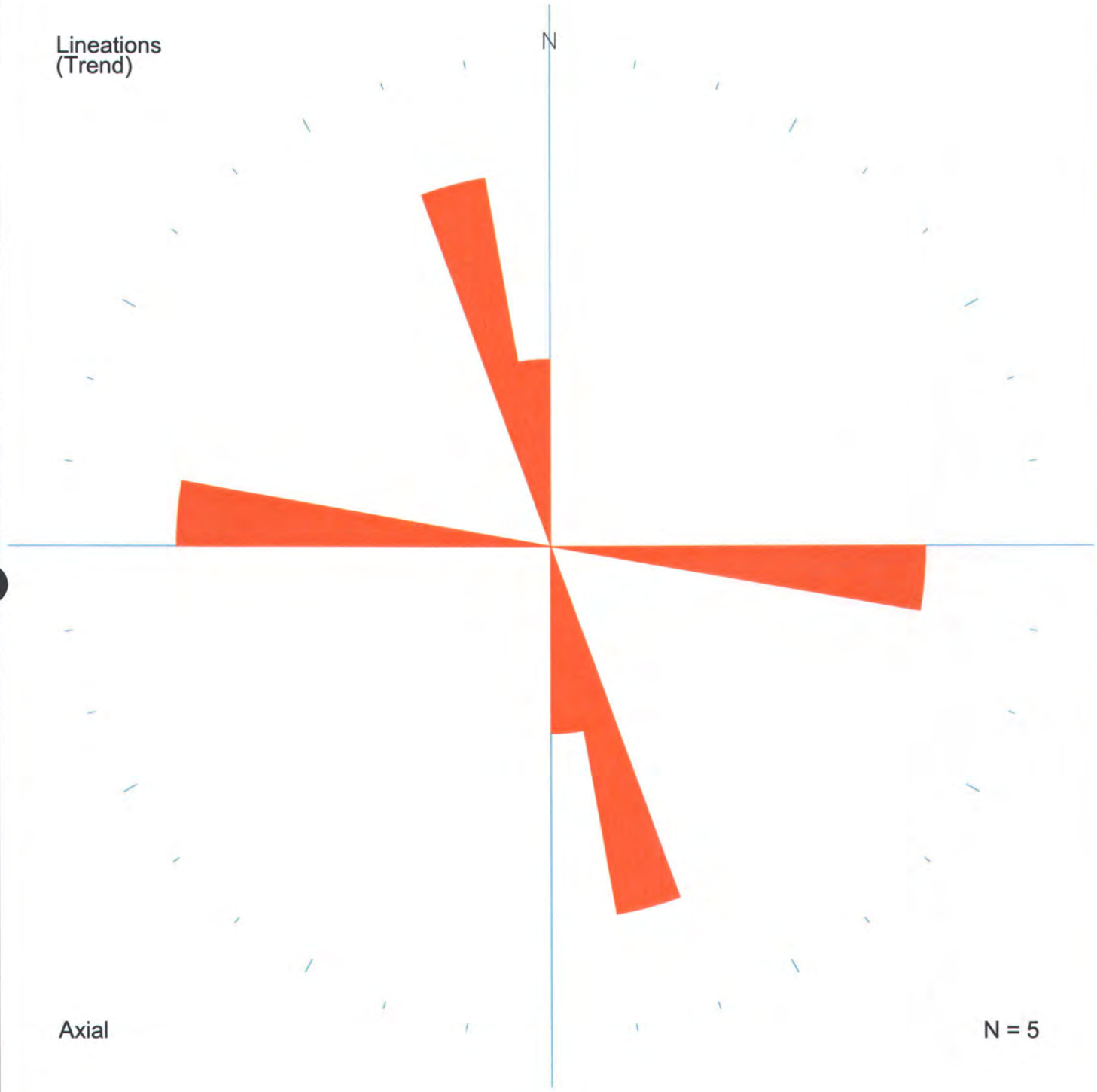


VICINITY MAP

FIGURE NO.

- Drawings (2 thru 12) and (21 thru 22) Under Seperate Cover


GRAPHIC SCALE IN FEET
3000
0
3000
ROCKINGHAM
GUILFORD
ROCKINGHAM CO
GUILFORD CO
STOKES CO
FORSYTH CO
LAKE
Golf Course



SCALE:	NTS
DATE:	FEBRUARY 2005
DRAWN BY:	JCJ
PROJECT NO:	1054-04-955

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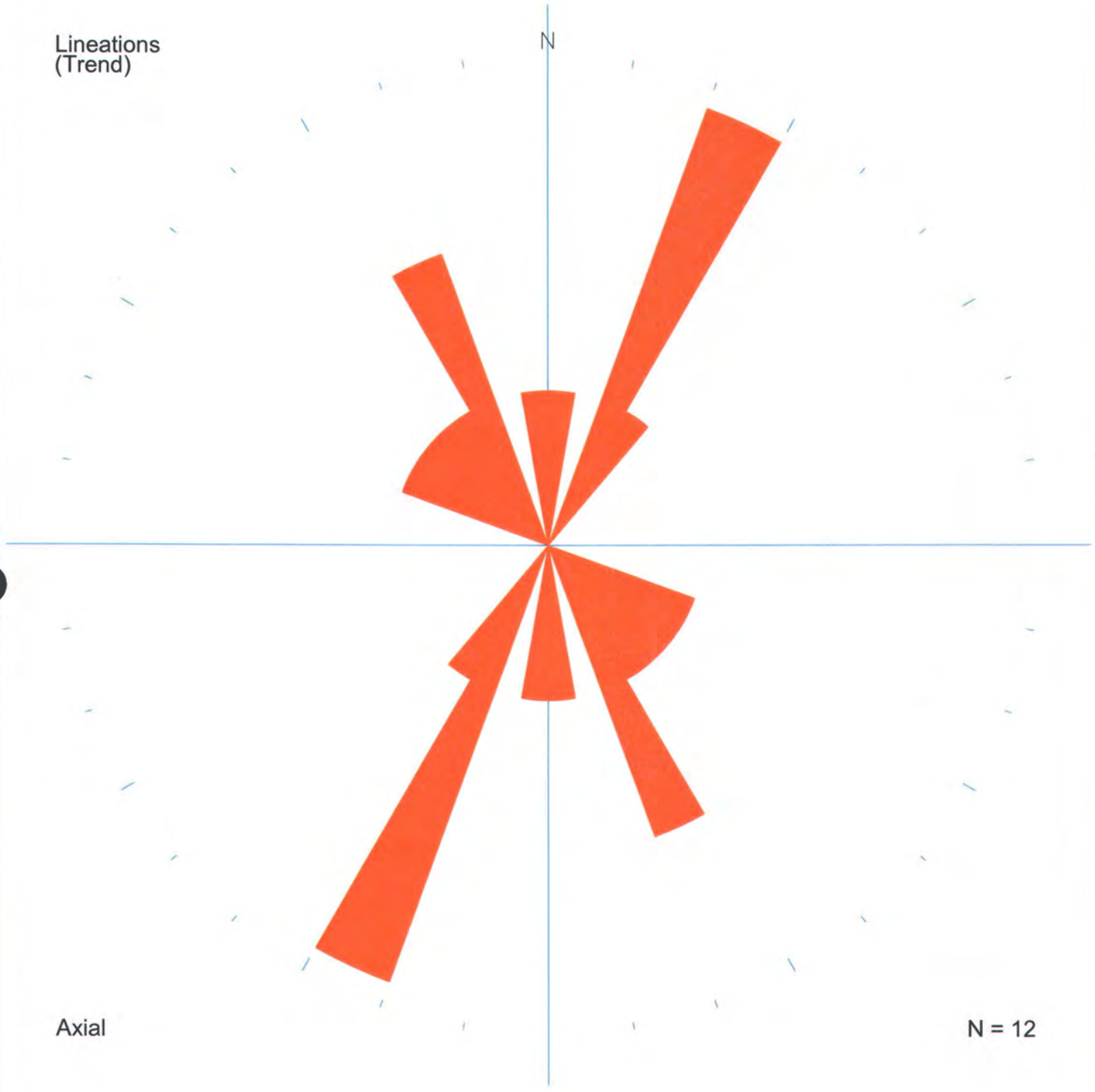
WWW.SMEINC.COM

OUTCROP #1

JOINT/FOLIATION ORIENTATIONS
DUKE BELEWS CREEK STEAM STATION
FGD SCRUBBER RESIDUE DISPOSAL SITE
BELEWS CREEK, NORTH CAROLINA

FIGURE NO.
14

Lineations
(Trend)



Axial

N = 12

SCALE:	NTS
DATE:	FEBRUARY 2005
DRAWN BY:	JCJ
PROJECT NO:	1054-04-955

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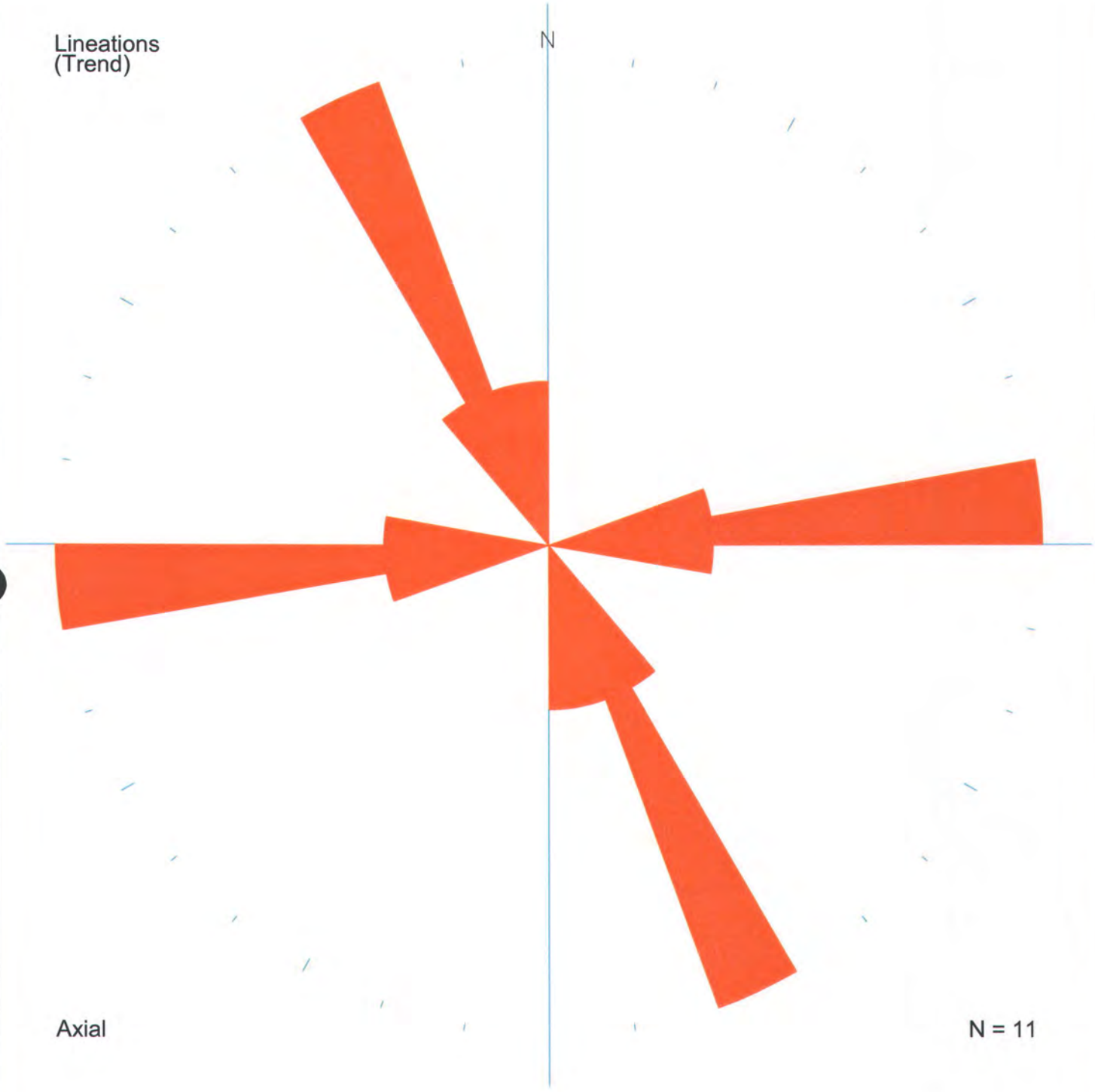
ENGINEERING TESTING
WWW.SMEINC.COM

OUTCROP #2

JOINT/FOLIATION ORIENTATIONS
DUKE BELEWS CREEK STEAM STATION
FGD SCRUBBER RESIDUE DISPOSAL SITE
BELEWS CREEK, NORTH CAROLINA

FIGURE NO.
15



SCALE:	NTS
DATE:	FEBRUARY 2005
DRAWN BY:	JCJ
PROJECT NO:	1054-04-955

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ENGINEERING TESTING
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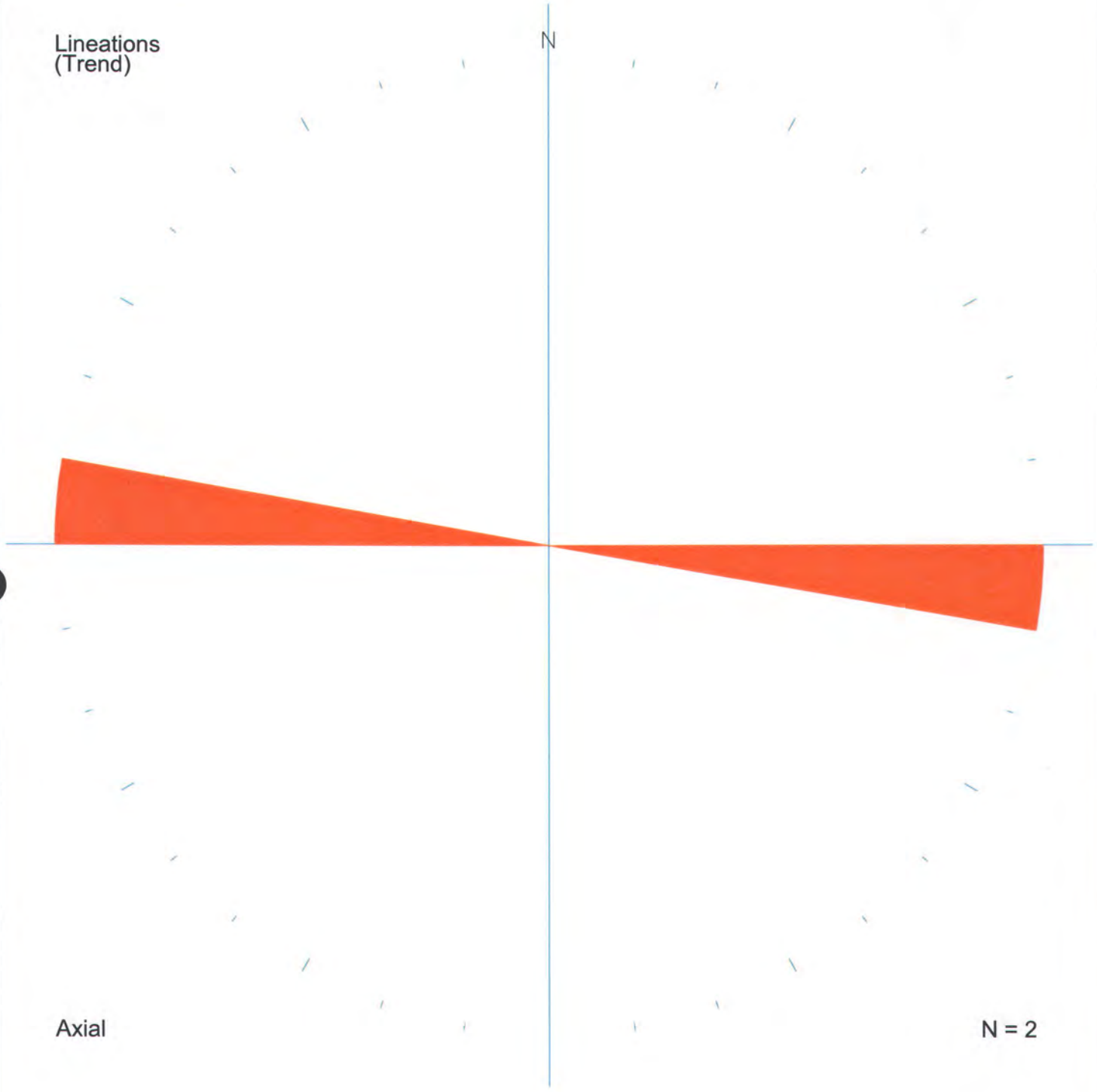
OUTCROP #3

JOINT/FOLIATION ORIENTATIONS
DUKE BELEWS CREEK STEAM STATION
FGD SCRUBBER RESIDUE DISPOSAL SITE
BELEWS CREEK, NORTH CAROLINA

FIGURE NO.
16



SCALE:	NTS
DATE:	FEBRUARY 2005
DRAWN BY:	JCJ
PROJECT NO:	1054-04-955

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OUTCROP #4

JOINT/FOLIATION ORIENTATIONS
DUKE BELEWS CREEK STEAM STATION
FGD SCRUBBER RESIDUE DISPOSAL SITE
BELEWS CREEK, NORTH CAROLINA

FIGURE NO.
17

Lineations
(Trend)

Axial

N = 2

SCALE:	NTS
DATE:	FEBRUARY 2005
DRAWN BY:	JCJ
PROJECT NO:	1054-04-955

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OUTCROP #5

JOINT/FOLIATION ORIENTATIONS
DUKE BELEWS CREEK STEAM STATION
FGD SCRUBBER RESIDUE DISPOSAL SITE
BELEWS CREEK, NORTH CAROLINA

FIGURE NO.
18

Lineations
(Trend)

Weighted Histogram

Axial

N = 32

SCALE:	NTS
DATE:	FEBRUARY 2005
DRAWN BY:	JCJ
PROJECT NO:	1054-04-955

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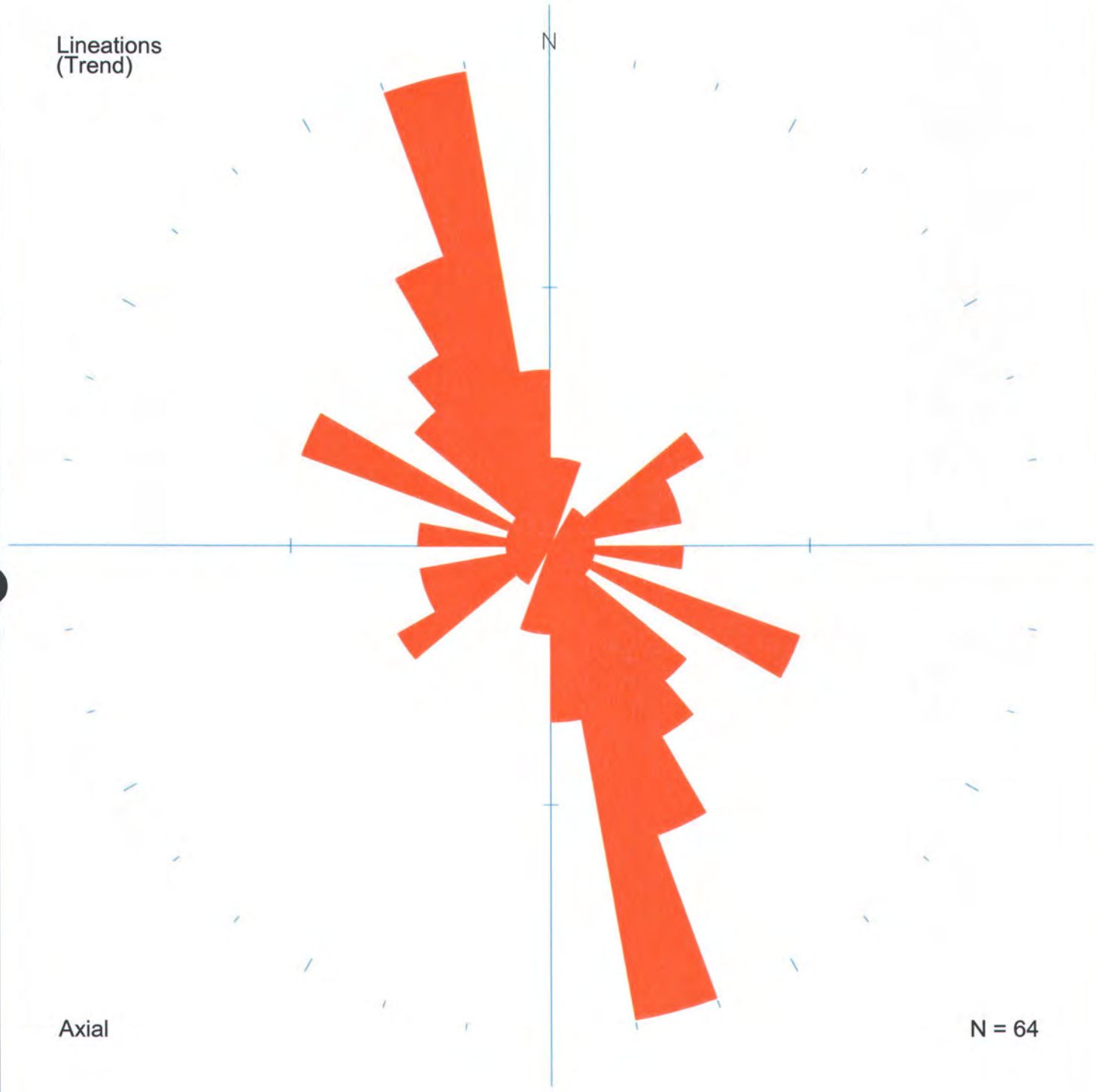
WWW.SMEINC.COM

COMPOSITE DIAGRAM

JOINT/FOLIATION ORIENTATIONS
DUKE BELEWS CREEK STEAM STATION
FGD SCRUBBER RESIDUE DISPOSAL SITE
BELEWS CREEK, NORTH CAROLINA

FIGURE NO.
19



SCALE:	NTS
DATE:	FEBRUARY 2005
DRAWN BY:	JCJ
PROJECT NO:	1054-04-955

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COMPOSITE DIAGRAM

MAP LINEAMENT ORIENTATIONS
DUKE BELEWS CREEK STEAM STATION
FGD SCRUBBER RESIDUE DISPOSAL SITE
BELEWS CREEK, NORTH CAROLINA

FIGURE NO.
20

APPENDIX I

POTABLE WELLS – WELL CONSTRUCTION AND ABANDONMENT RECORDS

P.O. BOX 27687 – RALEIGH, N.C. 27611, PHONE (919)733-3221

Quad. No.	Serial No.
Lat.	Long.
Minor Basin	
Basin Code	
Header Ent.	GW-1 Ent.

WELL CONSTRUCTION RECORD

410140

DRILLING CONTRACTOR McCall Bros. Inc.

DRILLER REGISTRATION NUMBER

STATE WELL CONSTRUCTION PERMIT NUMBER:

1. WELL LOCATION: (Show sketch of the location below)
   Nearest Town: Walnut Cove N.C. County: Stokes

   (Road, Community, or Subdivision and Lot No.)
2. OWNER Duke Power Co
   ADDRESS Belews Creek Steam Station (Street or Route No.)
   City or Town State Zip Code
3. DATE DRILLED 9-4-92 USE OF WELL Plant
4. TOTAL DEPTH 900 CUTTINGS COLLECTED ☑ Yes ☐ No
5. DOES WELL REPLACE EXISTING WELL? ☐ Yes ☑ No
6. STATIC WATER LEVEL: 40 FT. ☐ above ☑ below TOP OF CASING. TOP OF CASING IS 1 FT. ABOVE LAND SURFACE.
7. YIELD (gpm): 30 METHOD OF TEST Blow
8. WATER ZONES (depth): 30 gpm at 495
9. CHLORINATION: Type HTH Amount 2 lb.
10. CASING:

Depth From	To	Diameter	Wall Thickness or Weight/Ft.	Material
0	47 Ft.	12	.188	blk steel
0	103 Ft.	8	.322	galv.
	Ft.			

11. GROUT:

Depth From	To	Material	Method
0	103 Ft.	Cement	pumped in
	Ft.		

12. SCREEN:

Depth From	To	Diameter	Slot Size	Material
	Ft.	in.	in.	
	Ft.	in.	in.	
	Ft.	in.	in.	

13. GRAVEL PACK:

Depth From	To	Size	Material
	Ft.		
	Ft.		

14. REMARKS:

DRILLING LOG

Depth From	To	Formation Description
0	2	topsoil
2	6	red clay
6	39	brown clay
39	47	saprolite
47	69	soft rock
69	103	hard granite
103	228	" " + slate
228	335	biotite schist
335	505	granite, gray/green
505	900	biotite schist

If additional space is needed use back of form.

LOCATION SKETCH

(Show direction and distance from at least two State Roads or other map reference points)

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

[signature] 9-4-92

SIGNATURE OF CONTRACTOR OR AGENT DATE

near Laydown yd

CAROLINA DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT
DIVISION OF ENVIRONMENTAL MANAGEMENT - GROUNDWATER SECTION
P.O. BOX 27687 - RALEIGH,N.C. 27611, PHONE (919)733-3221

WELL #2

WELL CONSTRUCTION RECORD

FOR OFFICE USE ONLY	
Quad. No.	Serial No.
Lat.	Long. Pc
Minor Basin	
Basin Code	
Header Ent.	GW-1 Ent.

DRILLING CONTRACTOR Venable Bros. Well Const., Inc.

DRILLER REGISTRATION NUMBER 487

STATE WELL CONSTRUCTION PERMIT NUMBER:

1. WELL LOCATION: (Show sketch of the location below)
Nearest Town: Walnut Cove, County: Stokes
(Road, Community, or Subdivision and Lot No.)

2. OWNER Duke Power Co.
ADDRESS Pine Hall Rd. (Street or Route No.)
Walnut Cove NC 27052
City or Town State Zip Code

3. DATE DRILLED 1/21-1/22/99 USE OF WELL Commercial

4. TOTAL DEPTH 405 CUTTINGS COLLECTED ☐ Yes ☒ No

5. DOES WELL REPLACE EXISTING WELL? ☒ Yes ☐ No

6. STATIC WATER LEVEL: 20 FT. ☐ above ☒ below TOP OF CASING,
TOP OF CASING IS 1 FT. ABOVE LAND SURFACE.

7. YIELD (gpm): 35 METHOD OF TEST Sold

8. WATER ZONES (depth): 90ft to 91ft. = 5GPM

9. CHLORINATION: Type Chlorox Amount 2 gal

10. CASING:

	Depth From	To	Ft.	Diameter	Wall Thickness or Weight/Ft.	Material
	0	60'		6 5/8	sch. 188	galv
From		To	Ft.			
From		To	Ft.			

11. GROUT:

	Depth From	To	Ft.	Material	Method
	0	60		cement/water	pumped
From		To	Ft.		

12. SCREEN:

	Depth From	To	Ft.	Diameter	Slot Size	Material
From		To	Ft.	in.	in.	
From		To	Ft.	in.	in.	
From		To	Ft.	in.	in.	

13. GRAVEL PACK:

	Depth From	To	Ft.	Size	Material
From		To	Ft.		
From		To	Ft.		

14. REMARKS:

DRILLING LOG	
Depth From - To	Formation Description
0 - 4	dirt
4 - 30	hard sand rock
30 - 65	blue granite
65 - 90	hard sand rock
90 - 405	blue granite

If additional space is needed use back of form.

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Chris King 1-22-99

DWR

I-36-771-4631

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section - 1636 Mail Service Center - Raleigh, NC 27699-1639 - Phone No. (919) 733-3221

WELL ABANDONMENT RECORD

WELL CONTRACTOR Mike Venable

WELL CONTRACTOR CERTIFICATION # 2029

1. WELL USE (Check Applicable Box): Residential ☐ Municipal ☐ Industrial ☑ Agricultural ☐ Monitoring ☐ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use: _____

2. WELL LOCATION: (Show a sketch of the location on back of form.)
Nearest Town: Belews Creek County Forsyth
(Road Name and Number, Community, Subdivision, Lot No.) Quadrangle No.

3. OWNER: Duke Power

4. ADDRESS: Belews Creek NC

5. TOPOGRAPHY: ☐ draw, ☐ slope, ☐ hilltop, ☐ valley, ☑ flat (circle one)

6. TOTAL DEPTH: 905' DIAMETER 8"

7. CASING REMOVED:

feet	diameter

8. DISINFECTION: 15 oz
(Amount of 70% hypochlorite used:)

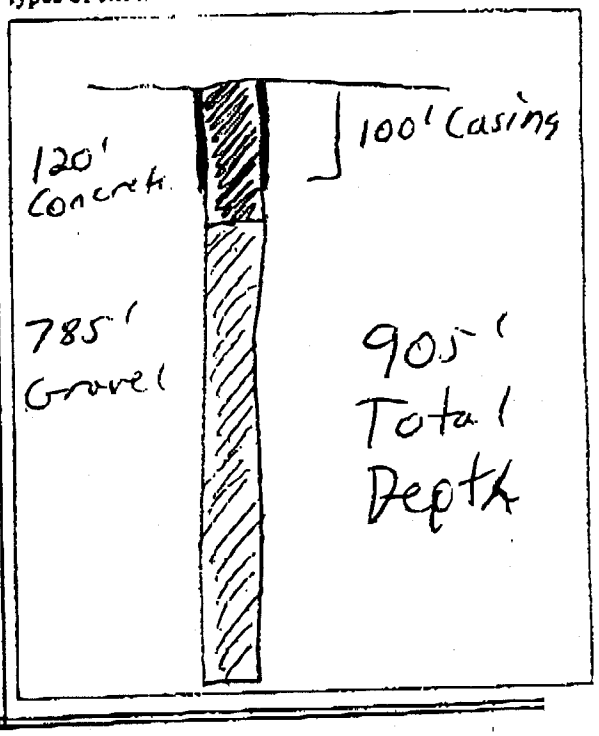
9. SEALING MATERIAL:

Neat Cement	Sand Cement
bags of cement	bags of cement
gallons of water	gallons of water

Other
Type material Concrete / Gravel
Amount 120' / 785

10. EXPLAIN METHOD EMPLACEMENT OF MATERIAL.
Concrete + Gravel from Truck

WELL DIAGRAM: Draw a detailed sketch of the well showing total depth, depth and diameter of screens remaining in the well, gravel interval, intervals of casing perforations, and depths and types of fill materials used.



11. DATE WELL ABANDONED 5-3-04

I do hereby certify that this well was abandoned in accordance with 15A NCAC 2C, well construction standards, and that a copy of the record has been provided to the well owner.

Signature of person abandoning the well Mike Venable Date 5-3-04

WELL LOCATION: Draw a location sketch on the reverse of this sheet, showing the direction and distance of the well to at least two (2) nearby reference points such as roads, intersections and streams. Identify roads with State Highway road identification numbers.

Submit original to the Division of Water Quality, Groundwater Section, one copy to the owner within 30 days from completion of abandonment.

GW-30 Revised 12/99

DW

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section - 1636 Mail Service Center - Raleigh, NC 27699-1639 - Phone No. (919) 733-3221

WELL ABANDONMENT RECORD

WELL CONTRACTOR Mike Venable
WELL CONTRACTOR CERTIFICATION # 2079

1. WELL USE (Check Applicable Box): Residential ☐ Municipal ☐ Industrial ☐ Agricultural ☐ Monitoring ☐ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use: _____

2. WELL LOCATION: (Show a sketch of the location on back of form.)
Nearest Town: Belews Creek County Stokes
(Road Name and Number, Community, Subdivision, Lot No.) Quadrangle No.

3. OWNER: Duke Power

4. ADDRESS: _____

5. TOPOGRAPHY: ☐ draw, ☐ slope, ☐ hilltop, ☐ valley, ☑ flat (circle one)

6. TOTAL DEPTH: 405' DIAMETER 6"

7. CASING REMOVED:

feet	diameter

8. DISINFECTION: 100c
(Amount of 70% hypochlorite used:)

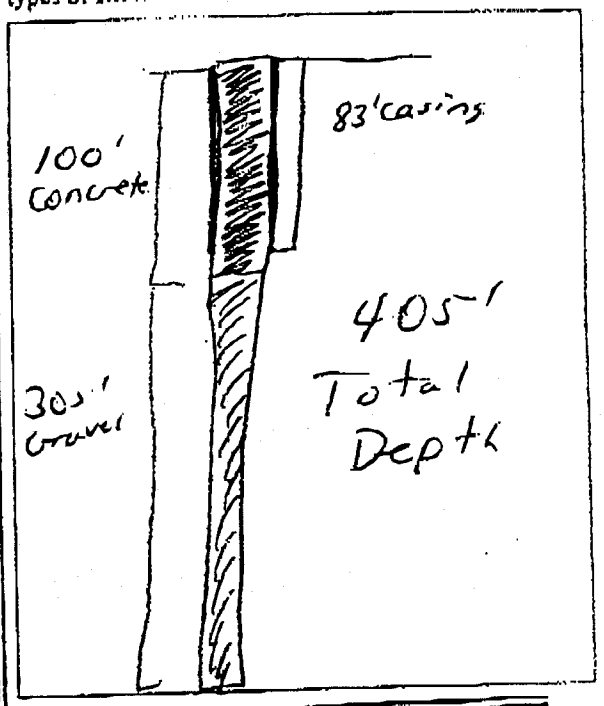
9. SEALING MATERIAL:

Neat Cement	Sand Cement
bags of cement	bags of cement
gallons of water	gallons of water

Other
Type material Concrete / Pea Gravel
Amount 2yds / 310'

10. EXPLAIN METHOD EMPLACEMENT OF MATERIAL.
Gravel + Concrete from Truck

WELL DIAGRAM: Draw a detailed sketch of the well showing total depth, depth and diameter of screens remaining in the well, gravel interval, intervals of casing perforations, and depths and types of fill materials used.



11. DATE WELL ABANDONED 4-20-04

I do hereby certify that this well was abandoned in accordance with 15A NCAC 2C, well construction standards, and that a copy of the record has been provided to the well owner.

Signature of person abandoning the well Mike Venable Date 4-20-04

WELL LOCATION: Draw a location sketch on the reverse of this sheet, showing the direction and distance of the well to at least two (2) nearby reference points such as roads, intersections and streams. Identify roads with State Highway road identification numbers.

Submit original to the Division of Water Quality, Groundwater Section, one copy to the owner within 30 days from completion of abandonment.

GW-30 Revised 12/99

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section - 1636 Mail Service Center - Raleigh, NC 27699-1639 - Phone No. (919) 733-3221

WELL ABANDONMENT RECORD

WELL CONTRACTOR Mike Venable
WELL CONTRACTOR CERTIFICATION # 2079

1. WELL USE (Check Applicable Box): Residential ☐ Municipal ☐ Industrial ☐ Agricultural ☐ Monitoring ☐ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use: _____

2. WELL LOCATION: (Show a sketch of the location on back of form.)
Nearest Town: Belews Creek County Forsyth
Pinehall Rd
(Road Name and Number, Community, Subdivision, Lot No.) Quadrangle No.

3. OWNER: Duke Power

4. ADDRESS: _____

5. TOPOGRAPHY: draw, slope, hilltop, valley, flat ☐ ☐ ☐ ☐ ☑ (circle one)

6. TOTAL DEPTH: 222 DIAMETER 6"

7. CASING REMOVED:

feet	diameter

8. DISINFECTION: 6 oz.
(Amount of 70% hypochlorite used:)

9. SEALING MATERIAL:

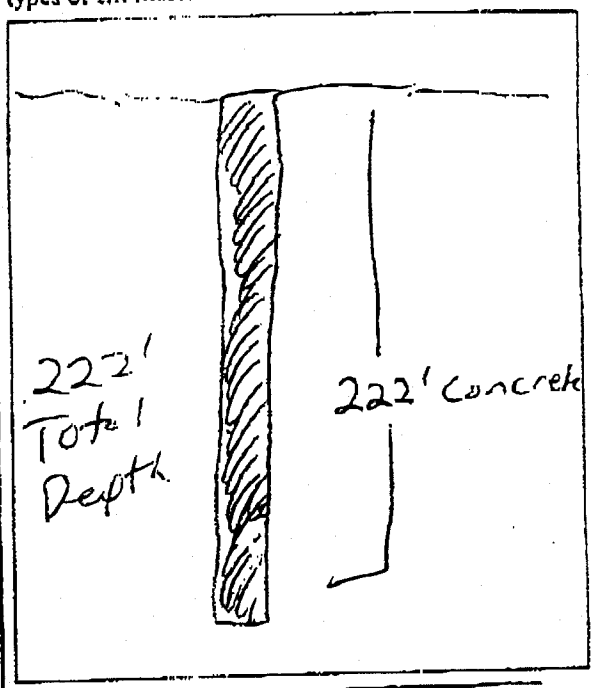
Neat Cement
bags of cement ____
gallons of water ____

Sand Cement
bags of cement ____
gallons of water ____

Other
Type material Concrete
Amount 222'

10. EXPLAIN METHOD EMPLACEMENT OF MATERIAL.
Concrete from Truck

WELL DIAGRAM: Draw a detailed sketch of the well showing total depth, depth and diameter of screens remaining in the well, gravel interval, intervals of casing perforations, and depths and types of fill materials used.



11. DATE WELL ABANDONED 4-20-04

I do hereby certify that this well was abandoned in accordance with 15A NCAC 2C, well construction standards, and that a copy of the record has been provided to the well owner.

Signature of person abandoning the well Mike Venable Date 4-20-04

WELL LOCATION: Draw a location sketch on the reverse of this sheet, showing the direction and distance of the well to at least two (2) nearby reference points such as roads, intersections and streams. Identify roads with State Highway road identification numbers.

Submit original to the Division of Water Quality, Groundwater Section, one copy to the owner within 30 days from completion of abandonment.

GW-30 Revised 12/99

APPENDIX II

BORING LOGS

BORING LOG BC-1

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**3¼" H.S.A.**
PROJECT NO.:	**1264-02-576**	DRILL RIG:	**Mobile B-57**
LOGGED BY:	**S. Watts**	TOP OF CASING ELEVATION (ft):	**760.35**
DATE DRILLED:	**11/13/2002**	WATER LEVEL TOB (ft bgs):	**17.75**
BORING DEPTH (ft):	**20**	WATER LEVEL 24 HRS (ft bgs):	**14.29**

Sample Information						Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (Feet)
Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)					
	S-1	0.0-10.0	–	5			Moderate yellow brown to dark yellowish orange silty gravelly SAND (SP/SM) w/Mg staining along high angle fractures, weathered granitic and quartz fragments, relict structures visible, crumbly. Auger refusal at 10.5 ft.	Protective Casing Dia: 4.0 in. Type: Stick-Up Interval: 2.25 ft.		755
	SS-1	0-0.5	50/5–							
	SS-2	3.5-5.0	50/4–	4				Riser Casing Dia: 2.0 in. Type: Sch 40 PVC Interval: 0.0 - 4.0 ft.		750
5										
	SS-3	8.5-10.0	50/3–	3				Grout Type: Portland Cement Interval: 0.0 - 2.0 ft.		745
10										
	R-1	11.0 -16.0	–				Tan, black, white micaceous fine to medium highly weathered Quartz GNEISS, highly fractured. REC = 92% RQD = 34% Fractures at 11.3' : 60,10 11.7' : 10 12.2' : 85	Seal Type: Bentonite Chips Interval: 2.0 - 4.0 ft.		
15										
	R-2	16.0 - 20.0	–				Light gray, light brown, black, white micaceous medium to coarse highly weathered Quartz GNEISS, highly fractured, high angle fracture located at 18 ft. REC = 38% RQD = 43% Fractures at 17.1' : 70 18.4' : 70 Boring terminated at 20.0 ft.	Filterpack Type: Filter Sand #2 Interval: 4.0 - 20.0 ft. Screen Dia: 2.0 in. Type: Sch 40 PVC Interval: 4.0 - 19.0 ft.		
20										

NOTES

SS = Split Spoon Sample
ST = Shelby Tube Sample
S = Bulk Sample
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REC = Rock Core Recovery
RQD = Rock Quality Designation

1. ▽ = Water Level At Termination of Boring
2. ▼ = Water Level After 24 Hours

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BORING LOG BC-2

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**3¼" H.S.A.**
PROJECT NO.:	**1264-02-576**	DRILL RIG:	**Mobile B-57**
LOGGED BY:	**S. Watts**	TOP OF CASING ELEVATION (ft):	**766.99**
DATE DRILLED:	**11/20/2002**	WATER LEVEL TOB (ft bgs):	**19.75**
BORING DEPTH (ft):	**43.5**	WATER LEVEL 24 HRS (ft bgs):	**16.97**

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Description & Remarks
	S-1	0.0-10.0	–	18		Crush and run GRAVEL.
	SS-1	0.5-2.0	3-2-1			
	SS-2	3.5-4.5	4-6-11	12		Moderate yellow brown to light brown very fine sandy SILT (ML), A-horizon material, slightly moist.
5						Light brown to orangish brown slightly micaceous very fine sandy SILT (MH/ML), slightly moist.
	SS-3	8.5-10.0	10-15-14	18		Grayish orange to pale yellow orange fine silty SAND (SM) w/relict layering structures, loose and crumbly, slightly moist.
10	S-2	10.0-20.0	–			
	SS-4	13.5-15.0	17-27-21	18		
15						
	SS-5	18.519.5	18-27-24	12		
20	S-3	20.0-30.0	–			
	SS-6	23.5-23.7	50/2–	2		Grayish orange to pale yellow orange silty SAND (SM) (saprolite), crumbly. Very hard layer identified at 36.5 ft.
25						
	SS-7	28.5-28.7	50/2–	2		
30	S-4	30.0-40.0	–			
	SS-8	33.5-33.7	50/2–	2		

Well Construction Details

Protective Casing
Dia: 4.0 in.
Type: Stick-Up
Interval: 2.25 ft.

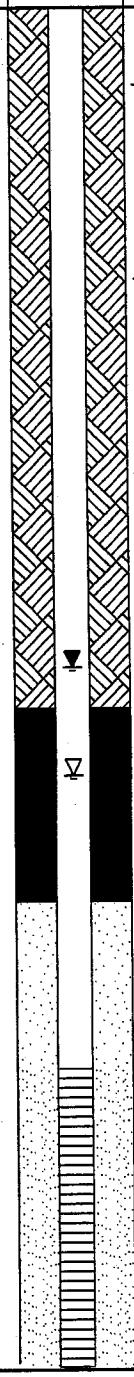
Riser Casing
Dia: 2.0 in.
Type: Sch 40 PVC
Interval: 0.0 - 27.28 ft.

Grout
Type: Portland Cement
Interval: 0.0 - 18.0 ft.

Seal
Type: Bentonite Chips
Interval: 18.0 - 23.0 ft.

Filterpack
Type: Filter Sand #2
Interval: 23.0 - 42.28 ft.

Screen
Dia: 2.0 in.
Type: Sch 40 PVC
Interval: 27.28 - 42.28



NOTES
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BORING LOG BC-2

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**3¼" H.S.A.**
PROJECT NO.:	**1264-02-576**	DRILL RIG:	**Mobile B-57**
LOGGED BY:	**S. Watts**	TOP OF CASING ELEVATION (ft):	**766.99**
DATE DRILLED:	**11/20/2002**	WATER LEVEL TOB (ft bgs):	**19.75**
BORING DEPTH (ft):	**43.5**	WATER LEVEL 24 HRS (ft bgs):	**16.97**

Sample Information						Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)					
							Grayish orange to pale yellow orange silty SAND (SM) (saprolite), crumbly. Very hard layer identified at 36.5 ft. *(continued)*	**Protective Casing** Dia: 4.0 in. Type: Stick-Up Interval: 2.25 ft.		730
	SS-9	38.5-38.6	50/.5–	0.5						
40								**Riser Casing** Dia: 2.0 in. Type: Sch 40 PVC Interval: 0.0 - 27.28 ft.		725
							Auger Refusal - Boring terminated at 43.5 ft.	**Grout** Type: Portland Cement Interval: 0.0 - 18.0 ft.		
								Seal Type: Bentonite Chips Interval: 18.0 - 23.0 ft.		
								Filterpack Type: Filter Sand #2 Interval: 23.0 - 42.28 ft.		
								Screen Dia: 2.0 in. Type: Sch 40 PVC Interval: 27.28 - 42.28		

NOTES

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BORING LOG BC-3

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1264-02-576**	DRILL RIG:	**Mobile B-57**
LOGGED BY:	**S. Watts**	TOP OF CASING ELEVATION (ft):	**844.84**
DATE DRILLED:	**11/12/2002**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**48**	WATER LEVEL 24 HRS (ft bgs):	

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Description & Remarks
	S-1	0.0-10.0	--	12		Reddish brown clayey SILT (ML/MH), slightly plastic, moist.
	SS-1	0.5-3.5	7-6-6			Light red to pink micaceous very fine sandy SILT (MH/SM) w/relict structures visible (saprolite).
	SS-2	3.5-5.0	9-14-15	12		
5						
	SS-3	8.5-10.0	11-12-13	10		Light red to pink micaceous very fine sandy SILT (MH/SM) w/layering visible (saprolite).
10	S-2	10.0-20.0	--			
	SS-4	13.5-15.0	14-16-20	8		Light red to pink very fine silty SAND (MH/SM) w/Mg staining along relict fractures and quartz and biotite crystals (saprolite), crumbly, dry.
15						
	SS-5	18.5-19.4	36-28-50/4	12		Moderate red to moderate reddish brown micaceous silty SAND (MH/SM) w/dark brown and pale yellow orange streaks (saprolite), crumbly, dry.
20	S-3	20.0-30.0	--			
	SS-6	23.5-25.0	50/3--	3		
25						
	SS-7	28.5-30.0	16-15-14	18		White silty SAND (MH/SM), mineral rich layer (feldspar/albite).
30	SS-8	30.0-40.0	50/3--	3		Moderate red to light red micaceous silty fine SAND (MH/SM) w/layering and rock fragments (saprolite), crumbly, dry.
	SS-9	33.5-35.0	50/0--	0		

Well Construction Details

Protective Casing
Dia: 4.0 in.
Type: Stick-Up
Interval: 2.50 ft.

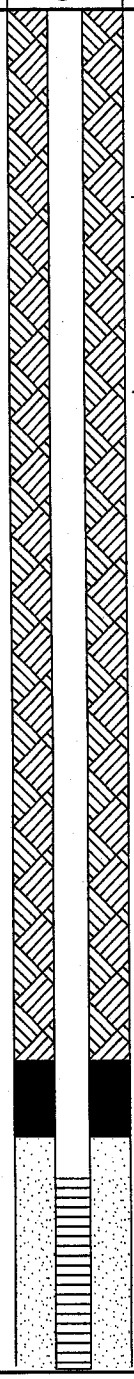
Riser Casing
Dia: 2.0 in.
Type: Sch 40 PVC
Interval: 0.0 - 30.07 ft.

Grout
Type: Portland Cement
Interval: 0.0 - 27.0 ft.

Seal
Type: Bentonite Chips
Interval: 27.0 - 29.0 ft.

Filterpack
Type: Filter Sand #2
Interval: 29.0 - 48.0 ft.

Screen
Dia: 2.0 in.
Type: Sch 40 PVC
Interval: 30.07 - 45.07 ft.



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BORING LOG BC-3

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1264-02-576**	DRILL RIG:	**Mobile B-57**
LOGGED BY:	**S. Watts**	TOP OF CASING ELEVATION (ft):	**844.84**
DATE DRILLED:	**11/12/2002**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**48**	WATER LEVEL 24 HRS (ft bgs):	

Sample Information						Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)					
							Moderate red to light red micaceous silty fine SAND (MH/SM/GM) w/granitic rock fragments and layering. Auger refusal at 38.0 ft. *(continued)*	**Protective Casing** Dia: 4.0 in. Type: Stick-Up Interval: 2.50 ft.		
	R-1	38.0-43.0	--	40	0		Highly weathered and highly fractured interlayered SCHIST and Quartz GRANITE. REC = 40% RQD = 0%	**Riser Casing** Dia: 2.0 in. Type: Sch 40 PVC Interval: 0.0 - 30.07 ft.		805
40										
	R-2	43.0-48.0	--	45	0		Highly weathered and highly fractured interlayered SCHIST and Quartz GRANITE. REC = 45% RQD = 0%	**Grout** Type: Portland Cement Interval: 0.0 - 27.0 ft.		800
45								**Seal** Type: Bentonite Chips Interval: 27.0 - 29.0 ft.		
							Boring terminated at 48.0 ft.	**Filterpack** Type: Filter Sand #2 Interval: 29.0 - 48.0 ft.		
								Screen Dia: 2.0 in. Type: Sch 40 PVC Interval: 30.07 - 45.07 ft.		

NOTES

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BORING LOG BC-3A

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1264-02-576**	DRILL RIG:	**Mobile B-57**
LOGGED BY:	**W. Mize**	TOP OF CASING ELEVATION (ft):	**844.17**
DATE DRILLED:	**11/26/2002**	WATER LEVEL TOB (ft bgs):	**54.17**
BORING DEPTH (ft):	**71.8**	WATER LEVEL 24 HRS (ft bgs):	**70.92**

Sample Information: Depth (feet) | Sample Number | Sample Interval (feet) | Blow Counts per 6 inches | Recovery (inches) | Rock RQD (%) | Symbol

Description & Remarks	Well Construction Details
(LITHOLOGY 0-40.8 FT TAKEN FROM BC-3) Reddish brown clayey SILT (ML/MH), slightly plastic, moist.	Protective Casing Dia: 4.0 in. Type: Stick-Up Interval: 1.83 ft.
Light red to pink micaceous very fine sandy SILT (MH/SM) w/relict structures visible (saprolite).	Riser Casing Dia: 2.0 in. Type: Sch 40 PVC Interval: 0.0 - 46.4 ft.
Light red to pink micaceous very fine sandy SILT (MH/SM) w/layering visible (saprolite).	Grout Type: Portland Cement Interval: 0.0 - 34.0 ft.
Light red to pink very fine silty SAND (MH/SM) w/Mg staining along relict fractures and quartz and biotite crystals (saprolite), crumbly, dry.	Seal Type: Bentonite Chips Interval: 34.0 - 40.0 ft.
Moderate red to moderate reddish brown micaceous silty SAND (MH/SM) w/dark brown and pale yellow orange streaks (saprolite), crumbly, dry.	Filterpack Type: Filter Sand #2 Interval: 40.0 - 71.8 ft.
White silty SAND (MH/SM), mineral rich layer (feldspar/albite).	Screen Dia: 2.0 in. Type: Sch 40 PVC Interval: 46.4 - 71.4 ft.
Moderate red to light red micaceous silty fine SAND (MH/SM) w/layering and rock fragments (saprolite), crumbly, dry.	

Well Construction Graphic

Elevation (feet): 840, 835, 830, 825, 820, 815, 810

NOTES

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BORING LOG BC-3A

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1264-02-576**	DRILL RIG:	**Mobile B-57**
LOGGED BY:	**W. Mize**	TOP OF CASING ELEVATION (ft):	**844.17**
DATE DRILLED:	**11/26/2002**	WATER LEVEL TOB (ft bgs):	**54.17**
BORING DEPTH (ft):	**71.8**	WATER LEVEL 24 HRS (ft bgs):	**70.92**

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Description & Remarks
40	R-1	40.8-46.3	–	48	26	Moderate red to light red micaceous silty fine SAND (MH/SM/GM) w/granitic rock fragments and layering. Auger refusal at 40.8 ft. *(continued)* Light gray, white, and medium brown micaceous medium to coarse Quartz GNEISS w/mud and rock fragments, high angle fractures. -Roller Cone from 51.3 - 53.8 ft-bgs -Split Spoon from 53.8 - 54.0 ft-bgs
45	R-2	46.3-51.3	–	39	0	
50	RC-1	51.3-53.8	–			
55	SS-1 R-3	53.8-54.0 54.0-61.3	– –	54	60	Gray and white micaceous moderately fractured medium to coarse Quartz GNEISS. REC = 63% RQD = 60%
60	R-5	61.3-71.3	–	78	56	Dark brown, dark gray, and white micaceous very fractured medium to coarse Quartz GNEISS w/high angle at 63.8 ft.
65						

Well Construction Details

Protective Casing
Dia: 4.0 in.
Type: Stick-Up
Interval: 1.83 ft.

Riser Casing
Dia: 2.0 in.
Type: Sch 40 PVC
Interval: 0.0 - 46.4 ft.

Grout
Type: Portland Cement
Interval: 0.0 - 34.0 ft.

Seal
Type: Bentonite Chips
Interval: 34.0 - 40.0 ft.

Filterpack
Type: Filter Sand #2
Interval: 40.0 - 71.8 ft.

Screen
Dia: 2.0 in.
Type: Sch 40 PVC
Interval: 46.4 - 71.4 ft.

Well Construction Graphic

Elevation (feet): 805, 800, 795, 790, 785, 780, 775

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BORING LOG BC-3A

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1264-02-576**	DRILL RIG:	**Mobile B-57**
LOGGED BY:	**W. Mize**	TOP OF CASING ELEVATION (ft):	**844.17**
DATE DRILLED:	**11/26/2002**	WATER LEVEL TOB (ft bgs):	**54.17**
BORING DEPTH (ft):	**71.8**	WATER LEVEL 24 HRS (ft bgs):	**70.92**

Sample Information						Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)					
	R-4	61.3-71.3	–	78	56		Dark brown, dark gray, and white micaceous very fractured medium to coarse Quartz GNEISS w/high angle at 63.8 ft. Boring terminated at 71.8 ft.	**Protective Casing** Dia: 4.0 in. Type: Stick-Up Interval: 1.83 ft. **Riser Casing** Dia: 2.0 in. Type: Sch 40 PVC Interval: 0.0 - 46.4 ft. **Grout** Type: Portland Cement Interval: 0.0 - 34.0 ft. **Seal** Type: Bentonite Chips Interval: 34.0 - 40.0 ft. **Filterpack** Type: Filter Sand #2 Interval: 40.0 - 71.8 ft. **Screen** Dia: 2.0 in. Type: Sch 40 PVC Interval: 46.4 - 71.4 ft.		770

NOTES

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BORING LOG BC-4

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1264-02-576**	DRILL RIG:	**CME-45**
LOGGED BY:	**J. Drummond**	TOP OF CASING ELEVATION (ft):	**813.74**
DATE DRILLED:	**11/15/2002**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**62**	WATER LEVEL 24 HRS (ft bgs):	**54.71**

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
	S-1	0.0-10.0	–				Orange brown micaceous SILT and fine to coarse SAND, slightly moist.	Protective Casing Dia: 4.0 in. Type: Stick-Up Interval: 1.75 ft.		810
	SS-1	1.0-2.5	6-6-7	18						
	SS-2	3.5-5.0	4-7-8	18			Orange brown to light yellowish brown very micaceous SILT and fine to coarse SAND, dry, crumbly.			
5								Riser Casing Dia: 2.0 in. Type: Sch 40 PVC Interval: 0.0 - 46.44 ft.		805
	SS-3	6.0-7.5	4-6-7	18			Orange brown micaceous SILT and fine to coarse SAND w/rock fragments, trace wood fibers, dry, crumbly.			
	SS-4	8.5-10.0	10-11-12	18			Orange brown and light yellowish brown micaceous SILT and coarse SAND w/rock fragments (saprolite), dry, crumbly.			
10	S-2	10.0-20.0	–				Light orange brown and light yellowish brown micaceous SILT and fine to coarse SAND w/rock fragments (saprolite), dry, crumbly.	Grout Type: Portland Cement Interval: 0.0 - 38.5 ft.		800
	SS-5	13.5-15.0	5-9-10	18				Seal Type: Bentonite Chips Interval: 38.5 - 45.0 ft.		
15							Light to medium orange brown micaceous SILT and fine to coarse SAND w/rock fragments (saprolite), dry, crumbly.	Filterpack Type: Filter Sand #2 Interval: 45.0 - 62.0 ft.		795
	SS-6	18.5-18.5	50/.1–	0				Screen Dia: 2.0 in. Type: Sch 40 PVC Interval: 46.44 - 61.44 ft.		
20	S-3	20.0-30.0	–							790
	SS-7	23.5-25.0	14-15-12	18						
25							Light yellowish brown micaceous SILT and fine to coarse SAND (gneissic saprolite), dry, crumbly.			785
	SS-8	28.5-30.0	32-35-35	18						
30	S-4	30.0-40.0	–				Medium gray, light orange, and light yellowish brown micaceous SILT and fine to coarse SAND w/rock fragments (gneissic saprolite), dry, crumbly.			780
	SS-9	33.5-34.0	50/6–	6						

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BORING LOG BC-4

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1264-02-576**	DRILL RIG:	**CME-45**
LOGGED BY:	**J. Drummond**	TOP OF CASING ELEVATION (ft):	**813.74**
DATE DRILLED:	**11/15/2002**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**62**	WATER LEVEL 24 HRS (ft bgs):	**54.71**

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Description & Remarks
	SS-10	38.8-38.8	50/0.2--	0.2		Light yellowish brown and light to medium gray micaceous HARD WEATHERED ROCK samples as SILT and fine to coarse SAND w/rock fragments, dry, crumbly. Auger refusal at 50.0 ft.
40	S-5	40.0-50.0	--			
	SS-11	43.5-43.5	50/1--	1		
45						
	SS-12	48.5-49.0	50/6--	6		
50	R-1	50.0-54.5	--	54	44	Medium gray, black, and white layered medium to coarse grained quartz-feldspar GNEISS, very weathered, highly fractured with large fracture at 40 (degrees) 53 ft., blockage and quartzite at 58 ft. REC = 38% RQD = 44% Fracture at 58.5' : 56
55						
60						Boring terminated at 62.0 ft. in weathered GNEISS.

Well Construction Details

Protective Casing
Dia: 4.0 in.
Type: Stick-Up
Interval: 1.75 ft.

Riser Casing
Dia: 2.0 in.
Type: Sch 40 PVC
Interval: 0.0 - 46.44 ft.

Grout
Type: Portland Cement
Interval: 0.0 - 38.5 ft.

Seal
Type: Bentonite Chips
Interval: 38.5 - 45.0 ft.

Filterpack
Type: Filter Sand #2
Interval: 45.0 - 62.0 ft.

Screen
Dia: 2.0 in.
Type: Sch 40 PVC
Interval: 46.44 - 61.44 ft.

Well Construction Graphic

Elevation (feet): 775, 770, 765, 760, 755

NOTES
SS = Split Spoon Sample
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BORING LOG BC-5

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1264-02-576**	DRILL RIG:	**CME-45**
LOGGED BY:	**J. Drummond**	TOP OF CASING ELEVATION (ft):	**819.96**
DATE DRILLED:	**11/19/2002**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**46**	WATER LEVEL 24 HRS (ft bgs):	

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Description & Remarks
-	S-1	1.0-10.0	--			White and light yellowish brown micaceous SILT and coarse SAND w/rock fragments (saprolite), dry.
-	SS-1	1.5-3.0	4-28-45	18		
-	ST-1	3.0-4.3	--			Dark brown micaceous SOFT WEATHERED ROCK samples as SILT and fine to coarse SAND, dry.
-	SS-2	3.5-5.0	32-40-46	18		
5 —	SS-3	5.5-7.0	8-9-8	18		White, light yellowish brown, dark brown, and medium gray micaceous SILT and fine to coarse SAND, dry.
-	SS-4	8.5-10.0	8-7-10	18		Light yellowish brown and white micaceous SILT and coarse SAND, dry, crumbly.
10 —	S-2	10.0-20.0	--			
-	SS-5	13.5-15.0	6-7-9	18		
15 —						Light brown, medium brown, orange brown, black, and white micaceous SILT and fine to coarse SAND, slightly moist.
-	SS-6	18.5-18.9	11-12-12	5		
20 —	S-3	20.0-30.0	--			
-	SS-7	20.5-21.0	6-8-15	5		
25 —						
-	SS-8	28.5-29.0	8-11-12	5		Medium to dark brown and orange brown micaceous SILT and fine to coarse SAND, slightly moist.
30 —	S-4	30.0-40.0	--			
-	SS-9	33.5-34.0	7-9-12	5		

Well Construction Details

Protective Casing
Dia: 4.0 in.
Type: Stick-Up
Interval: 1.83 ft.

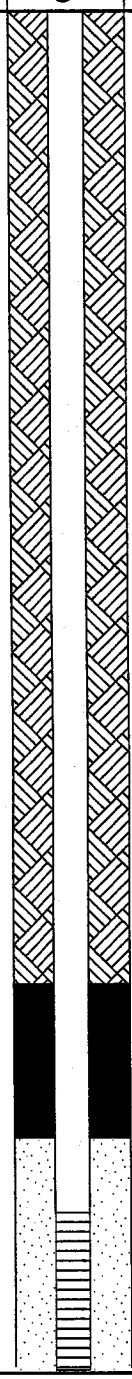
Riser Casing
Dia: 2.0 in.
Type: Sch 40 PVC
Interval: 0.0 - 30.92 ft.

Grout
Type: Portland Cement
Interval: 0.0 - 25.0 ft.

Seal
Type: Bentonite Chips
Interval: 25.0 - 29.0 ft.

Filterpack
Type: Filter Sand #2
Interval: 29.0 - 46.0 ft.

Screen
Dia: 2.0 in.
Type: Sch 40 PVC
Interval: 30.92 - 45.92 ft.



Elevation (feet): 815, 810, 805, 800, 795, 790

NOTES
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BORING LOG BC-5

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1264-02-576**	DRILL RIG:	**CME-45**
LOGGED BY:	**J. Drummond**	TOP OF CASING ELEVATION (ft):	**819.96**
DATE DRILLED:	**11/19/2002**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**46**	WATER LEVEL 24 HRS (ft bgs):	

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
							Light yellowish brown, medium gray, and white micaceous SILT and fine to coarse SAND w/quartzite rock fragments, slightly moist.	Protective Casing Dia: 4.0 in. Type: Stick-Up Interval: 1.83 ft.		
	SS-10	38.5-39.0	21-15-16	5			Medium brown, medium gray, orange brown, and white micaceous SILT and fine to coarse SAND, slightly moist.			780
40	S-5	40.0-50.0	–					Riser Casing Dia: 2.0 in. Type: Sch 40 PVC Interval: 0.0 - 30.92 ft.		
	SS-11	43.5-44.0	12-28-30	5						775
45								Grout Type: Portland Cement Interval: 0.0 - 25.0 ft.		
							Auger Refusal - Boring terminated at 46.0 ft.	Seal Type: Bentonite Chips Interval: 25.0 - 29.0 ft.		
								Filterpack Type: Filter Sand #2 Interval: 29.0 - 46.0 ft.		
								Screen Dia: 2.0 in. Type: Sch 40 PVC Interval: 30.92 - 45.92 ft.		

NOTES

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BORING LOG BC-6

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1264-02-576**	DRILL RIG:	**Mobile B-57**
LOGGED BY:	**S. Watts**	TOP OF CASING ELEVATION (ft):	**802.16**
DATE DRILLED:	**11/7/2002**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**38.72**	WATER LEVEL 24 HRS (ft bgs):	**37.79**

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Description & Remarks	Well Construction Details	Elevation (feet)
						Moderate reddish brown SILT (MH), slightly plastic, slightly moist.	Protective Casing Dia: 4.0 in. Type: Stick-Up Interval: 1.42 ft.	800
	SS-1	0.5-2.0	3-3-5	12				
	ST-1	3.0-5.0	--					
	SS-2	3.5-5.0	3-4-6	10		Moderate reddish brown slightly micaceous very fine sandy SILT (MH) w/pale yellowish orange streaks, slightly moist.		
5							Riser Casing Dia: 2.0 in. Type: Sch 40 PVC Interval: 0.0 - 23.72 ft.	795
	SS-3	8.5-10.0	9-11-12	15		Dark yellowish orange to grayish orange slightly micaceous very fine sandy SILT (MH).		
10	S-1	0.0-10.0	--				Grout Type: Portland Cement Interval: 0.0 - 18.8 ft.	790
	SS-4	13.5-15.0	8-12-13	16		Light brown to pale yellowish orange micaceous very fine silty SAND (SM), relict layer structures visible (saprolite), dusky brown to pinkish gray streaks, few quartz crystals.	Seal Type: Bentonite Chips Interval: 18.8 - 23.5 ft.	
15							Filterpack Type: Filter Sand #2 Interval: 23.5 - 38.72 ft.	785
	ST-2	18.0-20.0	--					
	SS-5	18.5-20.0	5-3-5	7		Dusky yellow green quartzite (SOFT WEATHERED ROCK).	Screen Dia: 2.0 in. Type: Sch 40 PVC Interval: 23.72 - 38.72 ft.	
20	S-2	10.0-20.0	--			Light brown to pale yellowish orange micaceous very fine silty SAND (SM).		780
	SS-6	23.5-25.0	7-10-14	9		Light brown to moderate reddish brown very fine sandy SILT (MH/SM).		
25						Slightly moist along a layer of SOFT WEATHERED ROCK (about 1 inch thick). Light brown to moderate reddish brown very fine sandy SILT (MH/SM). Auger refusal at 28.5 feet on rock.		775
	S-3	20.0-28.5	--					
	R-1	28.5-33.5	--	54	53	Medium gray to light gray granitic and augen GNEISS. REC = 90% RQD = 53% Fracture at 32.0' : 41		
30								770
	R-2	33.5-38.5	--	60.5	97			

NOTES

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BORING LOG BC-6

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1264-02-576**	DRILL RIG:	**Mobile B-57**
LOGGED BY:	**S. Watts**	TOP OF CASING ELEVATION (ft):	**802.16**
DATE DRILLED:	**11/7/2002**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**38.72**	WATER LEVEL 24 HRS (ft bgs):	**37.79**

Sample Information						Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)					
							Medium gray to light gray granitic and augen GNEISS. REC = 100% RQD = 97% Fractures at 37.0' : 40 38.5' : 40 *(continued)*	**Protective Casing** Dia: 4.0 in. Type: Stick-Up Interval: 1.42 ft.		765
							Boring terminated at 38.72 ft.	**Riser Casing** Dia: 2.0 in. Type: Sch 40 PVC Interval: 0.0 - 23.72 ft. **Grout** Type: Portland Cement Interval: 0.0 - 18.8 ft. **Seal** Type: Bentonite Chips Interval: 18.8 - 23.5 ft. **Filterpack** Type: Filter Sand #2 Interval: 23.5 - 38.72 ft. **Screen** Dia: 2.0 in. Type: Sch 40 PVC Interval: 23.72 - 38.72 ft.		

NOTES

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BORING LOG BC-7

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1264-02-576**	DRILL RIG:	**Mobile B-57**
LOGGED BY:	**S. Watts**	TOP OF CASING ELEVATION (ft):	**777.80**
DATE DRILLED:	**11/21/2002**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**52.38**	WATER LEVEL 24 HRS (ft bgs):	**41.57**

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Description & Remarks	Well Construction Details	Elevation (feet)
-	S-1	1.0-10.0	--			Light red to orange red clayey SILT w/few small gravel (ML/CL), medium plastic, slightly moist.	Protective Casing Dia: 4.0 in. Type: Stick-Up Interval: 1.94 ft.	775
-	SS-1	1.0-2.5	5-8-10	16				
-	SS-2	3.5-5.0	6-6-7	14				
-	ST-1	4.0-6.0	--			Light brown to dark yellowish orange SILT (ML).		
5							Riser Casing Dia: 2.0 in. Type: Sch 40 PVC Interval: 0.0 - 37.38 ft.	770
-	SS-3	8.5-10.0	6-7-8	16		Pale yellow orange slightly micaceous fine sandy SILT (ML) w/few biotite/muscovite crystals.		
10	S-2	10.0-20.0	--				Grout Type: Portland Cement Interval: 0.0 - 31.5 ft.	765
-	SS-4	13.5-15.0	6-8-11	15		Grayish orange to pale yellowish orange slightly micaceous fine sandy SILT w/few weathered rock fragments (SM/SP), (hard layer encountered at 16.5 ft.).	Seal Type: Bentonite Chips Interval: 31.5 - 36.0 ft.	
-	ST-2	14.0-16.0	--					
15							Filterpack Type: Filter Sand #2 Interval: 36.0 - 52.38 ft.	760
-	SS-5	18.5-20.0	11-24-45	15		Light olive brown to moderate yellow brown fine sandy SILT w/layering visible (SM), soft, loose.		
20	S-3	20.0-30.0	--			Gray orange to pale yellowish orange silty SAND w/weathered rock fragments (SM/SP), hard and crumbly.	Screen Dia: 2.0 in. Type: Sch 40 PVC Interval: 37.38 - 52.38 ft.	755
-	SS-6	23.5-25.0	21-34-23	16		Grayish orange slightly micaceous sandy SILT w/white streaks (SM), soft and loose.		
25								750
-	SS-7	28.5-28.9	50/3--	3		Grayish orange to pale yellow orange micaceous sandy SILT w/light to medium gray streaks (SM).		
30						Gray to yellow orange sandy SILT (SM).		745
-	SS-8	33.5-35.0	50/1.5--	3		Grayish to yellow orange sandy SILT w/weathered rock fragments (SM/SP).		

NOTES

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BORING LOG BC-7

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1264-02-576**	DRILL RIG:	**Mobile B-57**
LOGGED BY:	**S. Watts**	TOP OF CASING ELEVATION (ft):	**777.80**
DATE DRILLED:	**11/21/2002**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**52.38**	WATER LEVEL 24 HRS (ft bgs):	**41.57**

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
							Auger refusal at 36.3 ft. on rock.	Protective Casing Dia: 4.0 in. Type: Stick-Up Interval: 1.94 ft.		740
	R-1	36.3-46.3	--	108			Light gray, white, light brown, black micaceous medium to coarse weathered Quartz GNEISS, moderately fractured, sandy silt layer encountered at 41.7 ft. REC = 90% RQD = 49% Fractures at 37.27' : 50 38.97' : 30 39.95' : 25 42.85' : 70	Riser Casing Dia: 2.0 in. Type: Sch 40 PVC Interval: 0.0 - 37.38 ft.		735
40								Grout Type: Portland Cement Interval: 0.0 - 31.5 ft.		
45	R-2	46.3-52.3	--	62			Light gray, white, black, micaceous medium to coarse weathered Quartz GNEISS, slightly to moderately fractured, low angle fractures,biotite enriched layer from 50 - 52 ft. REC = 87% RQD = 81%	Seal Type: Bentonite Chips Interval: 31.5 - 36.0 ft.		730
50							Boring terminated at 52.3 ft.	Filterpack Type: Filter Sand #2 Interval: 36.0 - 52.38 ft.		
								Screen Dia: 2.0 in. Type: Sch 40 PVC Interval: 37.38 - 52.38 ft.		

NOTES

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BORING LOG BC-8

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1264-02-576**	DRILL RIG:	**Mobile B-57**
LOGGED BY:	**S. Watts**	TOP OF CASING ELEVATION (ft):	**764.24**
DATE DRILLED:	**11/26/2002**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**43.37**	WATER LEVEL 24 HRS (ft bgs):	**33.98**

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Description & Remarks
	S-1	0.0-10.0	--			Moderate reddish brown slightly micaceous fine SILT w/biotite and hornblende (ML/SM), layering visible, slightly moist.
	SS-1	3.5-5.0	4-9-11	14		
5						
	SS-2	8.5-10.0	6-7-10	12		
10	S-2	10.0-20.0	--			Moderate yellow brown to dark yellowish orange slightly micaceous very fine sandy SILT (SM) w/Mg staining along high angle fractures in soil, layering visible, slightly moist. Auger refusal at 25.2 ft.
	SS-3	13.5-15.0	5-6-7	8		
15						
	SS-4	18.5-20.0	50/.5--	0		
20	S-3	20.0-25.0	--			
25	R-1	25.2-29.7	--	3	0	Light to medium gray micaceous highly weathered Quartz GNEISS, highly fractured. REC = 65% RQD = 0%
30	R-2	29.7-37.5	--	2.1	0	Light to medium gray micaceous coarse weathered Quartz GNEISS, highly fractured, sandy silt fillings within fractures. REC = 42% RQD = 0%

Well Construction Details

Protective Casing
Dia: 4.0 in.
Type: Stick-Up
Interval: 1.83 ft.

Riser Casing
Dia: 2.0 in.
Type: Sch 40 PVC
Interval: 0.0 - 28.37 ft.

Grout
Type: Portland Cement
Interval: 0.0 - 22.0 ft.

Seal
Type: Bentonite Chips
Interval: 22.0 - 25.0 ft.

Filterpack
Type: Filter Sand #2
Interval: 25.0 - 43.37 ft.

Screen
Dia: 2.0 in.
Type: Sch 40 PVC
Interval: 28.37 - 43.37 ft.

Well Construction Graphic

Elevation (feet): 760, 755, 750, 745, 740, 735, 730

NOTES
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BORING LOG BC-8

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1264-02-576**	DRILL RIG:	**Mobile B-57**
LOGGED BY:	**S. Watts**	TOP OF CASING ELEVATION (ft):	**764.24**
DATE DRILLED:	**11/26/2002**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**43.37**	WATER LEVEL 24 HRS (ft bgs):	**33.98**

Sample Information						Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)					
40	R-3	37.5-43.5	--	1.8	0		Light to medium gray, medium brown micaceous coarse weathered Quartz GNEISS, highly fractured, layers of saprolite. REC = 33% RQD = 0% Boring terminated at 43.37 ft.	**Protective Casing** Dia: 4.0 in. Type: Stick-Up Interval: 1.83 ft. **Riser Casing** Dia: 2.0 in. Type: Sch 40 PVC Interval: 0.0 - 28.37 ft. **Grout** Type: Portland Cement Interval: 0.0 - 22.0 ft. **Seal** Type: Bentonite Chips Interval: 22.0 - 25.0 ft. **Filterpack** Type: Filter Sand #2 Interval: 25.0 - 43.37 ft. **Screen** Dia: 2.0 in. Type: Sch 40 PVC Interval: 28.37 - 43.37 ft.		725

NOTES

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BORING LOG BC-9

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1264-02-576**	DRILL RIG:	**Mobile B-57**
LOGGED BY:	**S. Watts**	TOP OF CASING ELEVATION (ft):	**775.54**
DATE DRILLED:	**11/21/2002**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**28.8**	WATER LEVEL 24 HRS (ft bgs):	**21.5**

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Description & Remarks
	S-1	0.0-10.0	–			Crush and run GRAVEL (geotextile fabric).
	SS-1	0.0-0.4	50/5--	2		Moderate yellow brown to dark yellowish orange silty gravelly SAND (SP/SM) w/Mg staining along high angle fractures and weathered granite and quartz fragments, relict structures visible, crumbly. Auger refusal at 13.8 ft.
	SS-2	3.5-5.0	50/5--	2		
5						
	SS-3	8.5-10.0	50/5--	2		
10						
	SS-4	13.5-13.8	50/.5--	0	0	
	R-1	13.8-18.8	--	34		Medium gray, tan, white, black micaceous weathered Quartz GNEISS, highly fractured, sandy silt fillings located within fractures. REC = 57% RQD = 0%
15						
	R-2	18.8-23.8	--	53	0	Gray green, medium brown, white, tan micaceous weathered Quartz GNEISS, highly fractured, saprolite located at 19.5 ft. REC = 88% RQD = 0%
20						
	R-3	23.8-28.8	--	49	32	Light to medium gray, dark red, black, white, tan micaceous weathered Quartz GNEISS, moderately fractured, highly fractured from 26.8 - 28.8 ft. REC = 82% RQD = 22% Fracture at 26.50' : 80
25						
						Boring terminated at 28.8 ft.

Well Construction Details

Protective Casing
Dia: 4.0 in.
Type: Flush
Interval:

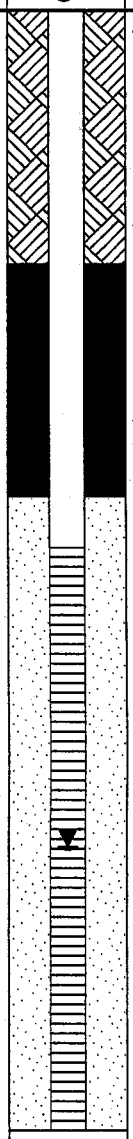
Riser Casing
Dia: 2.0 in.
Type: Sch 40 PVC
Interval: 0.0 - 13.8 ft.

Grout
Type: Portland Cement
Interval: 0.0 - 6.5 ft.

Seal
Type: Bentonite Chips
Interval: 6.5 - 12.5 ft.

Filterpack
Type: Filter Sand #2
Interval: 12.5 - 28.8 ft.

Screen
Dia: 2.0 in.
Type: Sch 40 PVC
Interval: 13.8 - 28.8 ft.



NOTES
SS = Split Spoon Sample
ST = Shelby Tube Sample
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BORING LOG BC-10

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1264-02-576**	DRILL RIG:	**Mobile B-57**
LOGGED BY:	**J. Zschiedrich**	TOP OF CASING ELEVATION (ft):	**784.07**
DATE DRILLED:	**11/20/2002**	WATER LEVEL TOB (ft bgs):	**33.77**
BORING DEPTH (ft):	**47.5**	WATER LEVEL 24 HRS (ft bgs):	**28.21**

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Description & Remarks
	S-1	1.0-10.0	--	12		Crush and run gravel
	SS-1	1.0-2.5	5-7-10			Tan to light brown sandy SILT w/some Mg staining with thin visible layers, slightly moist.
	SS-2	3.5-5.0	11-16-24	10		
5	SS-3	6.0-7.5	15-20-23	11		Tan to light brown sandy SILT w/some quartzite and some Mg staining with thin visible layers, slightly moist.
	SS-4	8.5-10.0	16-23-36	9		Dark brown to orange silty fine SAND w/some quartz fragments and Mg/Fe staining and layers, moist.
10	S-2	10.0-20.0	--			
	ST-1	12.0-14.0	--			
	SS-5	13.5-15.0	6-7-11	13		Dark brown to orange micaceous SILT (mica semischist), moderately soft.
15						
	SS-6	18.5-20.0	44-41-37	8		Light brown fine SAND w/quartz and mica fragments, dry.
20	S-3	20.0-30.0	--			
	SS-7	23.5-25.0	40-34-16	14		Partially weathered ROCK (Quartzite) w/some silty Sand, dry.
25						Red and brown micaceous silty SAND, slightly moist.
	SS-8	28.5-28.9	50/4.4--	2		Reddish brown and gray Partially Weathered ROCK (Mica Schist), moist. Auger refusal at 38.5 ft.
30	S-4	30.0-38.5	--			
	SS-9	33.5-33.9	50/.35--	0		

Well Construction Details

Protective Casing
Dia: 4.0 in.
Type: Stick-Up
Interval: 2.23 ft.

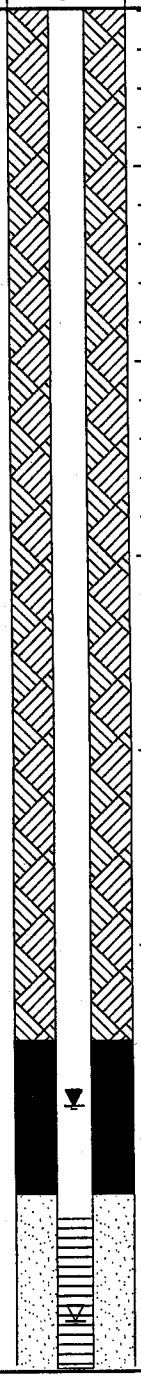
Riser Casing
Dia: 2.0 in.
Type: Sch 40 PVC
Interval: 0.0 - 31.12 ft.

Grout
Type: Portland Cement
Interval: 0.0 - 26.5 ft.

Seal
Type: Bentonite Chips
Interval: 26.5 - 30.5 ft.

Filterpack
Type: Filter Sand #2
Interval: 30.5 - 47.5 ft.

Screen
Dia: 2.0 in.
Type: Sch 40 PVC
Interval: 31.12 - 46.12 ft.



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BORING LOG BC-10

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1264-02-576**	DRILL RIG:	**Mobile B-57**
LOGGED BY:	**J. Zschiedrich**	TOP OF CASING ELEVATION (ft):	**784.07**
DATE DRILLED:	**11/20/2002**	WATER LEVEL TOB (ft bgs):	**33.77**
BORING DEPTH (ft):	**47.5**	WATER LEVEL 24 HRS (ft bgs):	**28.21**

Sample Information						Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)					
							Reddish brown and gray Partially Weathered ROCK (Mica Schist), moist. Auger refusal at 38.5 ft. *(continued)*	**Protective Casing** Dia: 4.0 in. Type: Stick-Up Interval: 2.23 ft.		745
	R-1	38.5-47.5	--	60	31		Light to dark gray, light brown weathered Mica SCHIST, moderately fractured. REC = 86% RQD = 31% Fractures at 38.83' : 28 39.15' : 28 39.4' : 20 39.44' : 25 39.65' : 20, 40 40.1' : 76 40.4' : 40, 25 41.0' : 70 41.1' : 20 42.0' : 25 42.4' : 24 43.0' : 20 43.5' : 55 43.9' : 20 44.8' : 72, 20 ,65 46.45' : 30 47.0' : 45 Boring terminated at 47.5 ft.	**Riser Casing** Dia: 2.0 in. Type: Sch 40 PVC Interval: 0.0 - 31.12 ft. **Grout** Type: Portland Cement Interval: 0.0 - 26.5 ft. **Seal** Type: Bentonite Chips Interval: 26.5 - 30.5 ft. **Filterpack** Type: Filter Sand #2 Interval: 30.5 - 47.5 ft. **Screen** Dia: 2.0 in. Type: Sch 40 PVC Interval: 31.12 - 46.12 ft.		740

NOTES

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BORING LOG BC-11

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1264-02-576**	DRILL RIG:	**Mobile B-57**
LOGGED BY:	**J. Zschiedrich**	TOP OF CASING ELEVATION (ft):	**786.85**
DATE DRILLED:	**11/21/2002**	WATER LEVEL TOB (ft bgs):	**53.3**
BORING DEPTH (ft):	**67.9**	WATER LEVEL 24 HRS (ft bgs):	**41.02**

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
	S-1	0.0-10.0	--	15			Moderate reddish brown clayey SILT w/organic material and few small Gravel (disturbed or fill material) (CL), slightly plastic, slightly moist, large root encountered at 4.5 ft.	Protective Casing Dia: 4.0 in. Type: Stick-Up Interval: 1.70 ft.		785
	SS-1	0.0-1.5	6-7-9							
	ST-1	1.0-2.9	--							
	SS-2	3.5-5.0	8-12-15	12				Riser Casing Dia: 2.0 in. Type: Sch 40 PVC Interval: 0.0 - 51.45 ft.		780
5										
	SS-3	8.5-10.0	8-10-13	16				Grout Type: Portland Cement Interval: 0.0 - 41.0 ft.		
10	S-2	10.0-20.0	--							775
	SS-4	13.5-15.0	23-13-11	14			Dark yellow orange slightly micaceous very fine sandy SILT (SM), dry.	Seal Type: Bentonite Chips Interval: 41.0 - 47.0 ft.		
15							Partially weathered ROCK (Mica Schist).			770
							Light brown to reddish orange very fine silty SAND (saprolite) (SM/SP), crumbly, dry.	Filterpack Type: Filter Sand #2 Interval: 47.0 - 67.9 ft.		
	SS-5	18.5-20.0	15-50/3-	8			Moderate pink orange micaceous silty SAND (saprolite) (SM) w/white streaks, relict structures visible, high angle paleo fractures w/Mg staining, dry.	Screen Dia: 2.0 in. Type: Sch 40 PVC Interval: 51.45 - 66.45 ft.		
20	S-3	20.0-30.0	--							765
	ST-2	23.0-25.0	--							
	SS-6	23.5-25.0	9-10-11	17			Dark yellow orange silty SAND (SM), relict structures visible, layering and high angle fractures w/Mg staining (saprolite).			
25										760
	SS-7	28.5-28.9	50/4--	4						
30	S-4	30.0-40.0	--							755
	SS-8	33.5-35.0	19-23-25	18			Tan-yellow SILT (saprolite), relict structure layering, dry.			

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BORING LOG BC-11

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1264-02-576**	DRILL RIG:	**Mobile B-57**
LOGGED BY:	**J. Zschiedrich**	TOP OF CASING ELEVATION (ft):	**786.85**
DATE DRILLED:	**11/21/2002**	WATER LEVEL TOB (ft bgs):	**53.3**
BORING DEPTH (ft):	**67.9**	WATER LEVEL 24 HRS (ft bgs):	**41.02**

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Description & Remarks
						Tan-yellow SILT (saprolite), relict structure layering, dry. *(continued)*
	SS-9	38.5-38.8	50/3–	3		Partially weathered ROCK (Mica Schist), black relict layering, dry.
40	S-5	40.0-50.0	–			
	SS-10	43.5-43.9	50/4–	4		Partially weathered ROCK (Mica Schist) w/white streaks, black relict layering, dry.
45						
	SS-11	48.5-49.0	50/5–	5		
50	S-6	50.0-60.0	–			
	SS-12	53.5-53.9	50/4–	4		Partially weathered ROCK (Mica Schist), black relict layering, dry.
55						
	SS-13	58.5-59.0	50/5–	5		Partially weathered ROCK (Mica Schist) w/angular quartzite fragments (1 inch diameter), black relict layering, wet.
60	S-7	60.0-67.9	–			
	SS-14	63.5-63.8	50/3–	3		
65						
	SS-15	67.9	50/0–	0		Auger Refusal - Boring terminated at 67.9 ft.

Well Construction Details

Protective Casing
Dia: 4.0 in.
Type: Stick-Up
Interval: 1.70 ft.

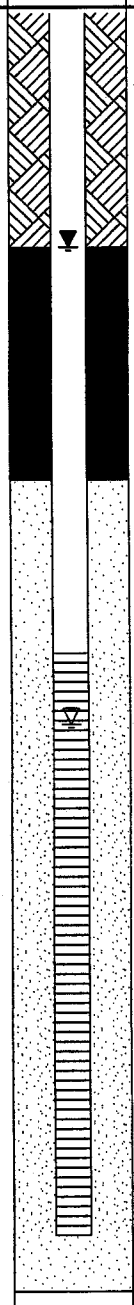
Riser Casing
Dia: 2.0 in.
Type: Sch 40 PVC
Interval: 0.0 - 51.45 ft.

Grout
Type: Portland Cement
Interval: 0.0 - 41.0 ft.

Seal
Type: Bentonite Chips
Interval: 41.0 - 47.0 ft.

Filterpack
Type: Filter Sand #2
Interval: 47.0 - 67.9 ft.

Screen
Dia: 2.0 in.
Type: Sch 40 PVC
Interval: 51.45 - 66.45 ft.



Elevation (feet): 750, 745, 740, 735, 730, 725, 720

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BORING LOG BC-12

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1264-02-576**	DRILL RIG:	**CME-45**
LOGGED BY:	**J. Drummond**	TOP OF CASING ELEVATION (ft):	**804.62**
DATE DRILLED:	**11/13/2002**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**76.8**	WATER LEVEL 24 HRS (ft bgs):	**56.25**

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Description & Remarks
-	S-1	0.0-5.0	--			Orange brown micaceous SILT, trace fine Sand, slightly moist.
-	SS-1	1.0-2.5	3-2-3	6		
-	ST-1	3.0-5.0	--			Orange brown to light brown very micaceous SILT and fine to coarse SAND, slightly moist.
-	SS-2	3.5-5.0	4-7-10	18		
5	S-2	5.0-15.0	--			Orange and white micaceous SILT and fine SAND (saprolite), dry, crumbly.
-	SS-3	6.0-7.5	4-5-7	18		
-	SS-4	8.5-10.0	4-5-11	18		
10						
-	SS-5	13.5-15.0	12-15-16	18		
15	S-3	15.0-25.0	--			
-	SS-6	18.5-20.0	8-9-11	18		
20						Light brown micaceous SILT and fine to coarse SAND w/quartzite rock fragments (saprolite), dry, crumbly.
-	SS-7	23.5-25.0	25-18-15	18		
25	S-4	25.0-35.0	--			Light brown, white, and light yellowish brown micaceous SILT and fine to coarse SAND (saprolite), dry, crumbly.
-	ST-2	27.0-28.7	--			
-	SS-8	28.5-30.0	10-11-12	18		
30						Orange brown and light yellowish brown micaceous SILT and fine to coarse SAND (saprolite), dry, crumbly.
-	SS-9	33.5-35.0	12-15-16	18		

Well Construction Details

Protective Casing
Dia: 4.0 in.
Type: Stick-Up
Interval: 1.71 ft.

Riser Casing
Dia: 2.0 in.
Type: Sch 40 PVC
Interval: 0.0 - 61.09 ft.

Grout
Type: Portland Cement
Interval: 0.0 - 56.5 ft.

Seal
Type: Bentonite Chips
Interval: 56.5 - 60.0 ft.

Filterpack
Type: Filter Sand #2
Interval: 60.0 - 76.8 ft.

Screen
Dia: 2.0 in.
Type: Sch 40 PVC
Interval: 61.09 - 76.09 ft.

Well Construction Graphic

Elevation (feet): 800, 795, 790, 785, 780, 775, 770

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BORING LOG BC-12

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1264-02-576**	DRILL RIG:	**CME-45**
LOGGED BY:	**J. Drummond**	TOP OF CASING ELEVATION (ft):	**804.62**
DATE DRILLED:	**11/13/2002**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**76.8**	WATER LEVEL 24 HRS (ft bgs):	**56.25**

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
	S-5	35.0-45.0	--				Light brown and orange brown micaceous HARD WEATHERED ROCK samples as SILT and fine to coarse SAND w/quartzite rock fragments (gneissic saprolite), dry.	Protective Casing Dia: 4.0 in. Type: Stick-Up Interval: 1.71 ft.		765
	SS-10	38.5-40.0	50/6--	18				Riser Casing Dia: 2.0 in. Type: Sch 40 PVC Interval: 0.0 - 61.09 ft.		
40										760
	SS-11	43.5-44.0	38-50/.45-	6				Grout Type: Portland Cement Interval: 0.0 - 56.5 ft.		
45	S-6	45.0-55.0	--				Light brown, light yellowish brown, and white micaceous HARD WEATHERED ROCK samples as SILT and fine to coarse SAND w/quartzite rock fragments (gneissic saprolite), dry. Fractures at 50.7' : 40 51.6' : 40	Seal Type: Bentonite Chips Interval: 56.5 - 60.0 ft.		755
	SS-12	48.5-50.0	50/.45--	0				Filterpack Type: Filter Sand #2 Interval: 60.0 - 76.8 ft.		
50										750
	SS-13	53.5-55.0	50/.35--	0				Screen Dia: 2.0 in. Type: Sch 40 PVC Interval: 61.09 - 76.09 ft.		
55							Light brown and green gray micaceous HARD WEATHERED ROCK samples as SILT and fine to coarse SAND (gneissic saprolite), dry. Auger refusal at 62.8 ft. Fracture at 55.6' : 60			745
	SS-14	58.5-60.0	50/.45--	0						
60										740
	R-1	62.8-71.8	--	102	55		Medium gray, dark green gray, and white layered medium to coarse grained quartz-feldspar GNEISS, very weathered, moderately fractured, fine sand and clay fracture filling. REC = 94% RQD = 55% Fractures at 63.5' : 71 71.3' : 80			
65										735

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BORING LOG BC-12

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1264-02-576**	DRILL RIG:	**CME-45**
LOGGED BY:	**J. Drummond**	TOP OF CASING ELEVATION (ft):	**804.62**
DATE DRILLED:	**11/13/2002**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**76.8**	WATER LEVEL 24 HRS (ft bgs):	**56.25**

Sample Information						Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)					
75	R-2	71.8-76.8	–	60	52		Medium gray, black, and white layered medium to coarse grained quartz-feldspar GNEISS, very weathered, moderately fractured, fine sand seam. REC = 100% RQD = 52% Boring terminated at 76.8 ft. in weathered GNEISS.	**Protective Casing** Dia: 4.0 in. Type: Stick-Up Interval: 1.71 ft. **Riser Casing** Dia: 2.0 in. Type: Sch 40 PVC Interval: 0.0 - 61.09 ft. **Grout** Type: Portland Cement Interval: 0.0 - 56.5 ft. **Seal** Type: Bentonite Chips Interval: 56.5 - 60.0 ft. **Filterpack** Type: Filter Sand #2 Interval: 60.0 - 76.8 ft. **Screen** Dia: 2.0 in. Type: Sch 40 PVC Interval: 61.09 - 76.09 ft.		730

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BORING LOG BC-12A

PROJECT: **Duke Power-Belews Creek**
LOCATION: **Belews Creek, NC**
PROJECT NO.: **1264-02-576**
LOGGED BY: **J. Drummond**
DATE DRILLED: **11/22/2002**
BORING DEPTH (ft): **48**

DRILLING CONTRACTOR: **S&ME, Inc.**
DRILLING METHOD: **4¼" H.S.A.**
DRILL RIG: **CME-45**
TOP OF CASING ELEVATION (ft):
WATER LEVEL TOB (ft bgs):
WATER LEVEL 24 HRS (ft bgs):

Sample Information						Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)					
							(LITHOLOGY TAKEN FROM BC-12) Orange brown micaceous SILT, trace fine Sand, slightly moist.	Protective Casing Dia: N/A Type: N/A Interval: N/A		
							Orange brown to light brown very micaceous SILT and fine to coarse SAND, slightly moist.			
5							Orange and white micaceous SILT and fine SAND (saprolite), dry, crumbly.	Riser Casing Dia: N/A Type: N/A Interval: N/A		
								Grout Type: Portland Interval: 0.0 - 48.0 ft.		
10								Seal Type: N/A Interval: N/A		
15								Filterpack Type: N/A Interval: N/A		
20							Light brown micaceous SILT and fine to coarse SAND w/quartzite rock fragments (saprolite), dry, crumbly.	Screen Dia: N/A Type: N/A Interval: N/A		
25							Light brown, white, and light yellowish brown micaceous SILT and fine to coarse SAND (saprolite), dry, crumbly.			
30							Orange brown and light yellowish brown micaceous SILT and fine to coarse SAND (saprolite), dry, crumbly.			

NOTES
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BORING LOG BC-12A

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1264-02-576**	DRILL RIG:	**CME-45**
LOGGED BY:	**J. Drummond**	TOP OF CASING ELEVATION (ft):	
DATE DRILLED:	**11/22/2002**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**48**	WATER LEVEL 24 HRS (ft bgs):	

Sample Information						Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)					
40							Light brown and orange brown micaceous HARD WEATHERED ROCK samples as SILT and fine to coarse SAND w/quartzite rock fragments (gneissic saprolite), dry.	**Protective Casing** Dia: N/A Type: N/A Interval: N/A **Riser Casing** Dia: N/A Type: N/A Interval: N/A **Grout** Type: Portland Interval: 0.0 - 48.0 ft. **Seal** Type: N/A Interval: N/A **Filterpack** Type: N/A Interval: N/A **Screen** Dia: N/A Type: N/A Interval: N/A		
45							Light brown, light yellowish brown, and white micaceous HARD WEATHERED ROCK samples as SILT and fine to coarse SAND w/quartzite rock fragments (gneissic saprolite), dry.			
							Auger refusal at 48.0 ft. Boring terminated at 48.0 ft.			

NOTES

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BORING LOG BC-12B

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1264-02-576**	DRILL RIG:	**CME-45**
LOGGED BY:	**J. Drummond**	TOP OF CASING ELEVATION (ft):	
DATE DRILLED:	**11/22/2002**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**52.2**	WATER LEVEL 24 HRS (ft bgs):	

Sample Information						Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)					
							(LITHOLOGY TAKEN FROM BC-12) Orange brown micaceous SILT, trace fine Sand, slightly moist.	Protective Casing Dia: N/A Type: N/A Interval: N/A		
							Orange brown to light brown very micaceous SILT and fine to coarse SAND, slightly moist.			
5							Orange and white micaceous SILT and fine SAND (saprolite), dry, crumbly.	Riser Casing Dia: N/A Type: N/A Interval: N/A		
								Grout Type: Portland Interval: 0.0 - 52.2 ft.		
10								Seal Type: N/A Interval: N/A		
15								Filterpack Type: N/A Interval: N/A		
20							Light brown micaceous SILT and fine to coarse SAND w/quartzite rock fragments (saprolite), dry, crumbly.	Screen Dia: N/A Type: N/A Interval: N/A		
25							Light brown, white, and light yellowish brown micaceous SILT and fine to coarse SAND (saprolite), dry, crumbly.			
30							Orange brown and light yellowish brown micaceous SILT and fine to coarse SAND (saprolite), dry, crumbly.			

NOTES

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BORING LOG BC-12B

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1264-02-576**	DRILL RIG:	**CME-45**
LOGGED BY:	**J. Drummond**	TOP OF CASING ELEVATION (ft):	
DATE DRILLED:	**11/22/2002**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**52.2**	WATER LEVEL 24 HRS (ft bgs):	

Sample Information						Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)					
40							Light brown and orange brown micaceous HARD WEATHERED ROCK samples as SILT and fine to coarse SAND w/quartzite rock fragments (gneissic saprolite), dry.	**Protective Casing** Dia: N/A Type: N/A Interval: N/A **Riser Casing** Dia: N/A Type: N/A Interval: N/A **Grout** Type: Portland Interval: 0.0 - 52.2 ft. **Seal** Type: N/A Interval: N/A **Filterpack** Type: N/A Interval: N/A **Screen** Dia: N/A Type: N/A Interval: N/A		
45							Light brown, light yellowish brown, and white micaceous HARD WEATHERED ROCK samples as SILT and fine to coarse SAND w/quartzite rock fragments (gneissic saprolite), dry.			
50							Auger refusal at 52.2 ft. Boring terminated at 52.2 ft.			

NOTES

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BORING LOG BC-13

PROJECT: **Duke Power-Belews Creek**
LOCATION: **Belews Creek, NC**
PROJECT NO.: **1264-02-576**
LOGGED BY: **S. Watts**
DATE DRILLED: **11/5/2002**
BORING DEPTH (ft): **45**

DRILLING CONTRACTOR: **S&ME, Inc.**
DRILLING METHOD: **4¼" H.S.A.**
DRILL RIG: **Mobile B-57**
TOP OF CASING ELEVATION (ft): **813.56**
WATER LEVEL TOB (ft bgs):
WATER LEVEL 24 HRS (ft bgs):

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Description & Remarks	Well Construction Details
	S-1	0.0-10.0	–				
-	SS-1	0.5-2.0	3-4-5	15		Moderate reddish brown clayey SILT, slightly plastic, slightly moist (ML/MH).	Protective Casing Dia: 4.0 in. Type: Stick-Up Interval: 1.50 ft.
	SS-2	3.5-5.0	5-6-8	12			
5	ST-1	5.0-8.0	–				Riser Casing Dia: 2.0 in. Type: Sch 40 PVC Interval: 0.0 - 23.3 ft.
	SS-3	8.5-10.0	5-4-3	12		Moderate reddish brown micaceous SILT w/layering (MH), crumbly, dry (saprolite).	
10	S-2	10.0-20.0	–				Grout Type: Portland Cement Interval: 0.0 - 18.0 ft.
	SS-4	13.5-15.0	3-3-3	10		Dark yellowish orange to light brown fine sandy SILT w/relict structures (MH/SM), crumbly, dry (saprolite). Auger refusal at 25.0 ft.	Seal Type: Bentonite Chips Interval: 18.0 - 22.0 ft.
15	ST-2	15.0-18.0	–				Filterpack Type: Filter Sand #2 Interval: 25.0 - 45.0 ft.
	SS-5	18.5-19.4	14-50/4.5-	10			
20	S-3	20.0-25.0	–				Screen Dia: 2.0 in. Type: Sch 40 PVC Interval: 23.3 - 43.3 ft.
	SS-6	23.5-25.0	50/2–	2			
25	R-1	25.0-30.0	–	25	0	Highly weathered GNEISS and SCHIST layered w/sandy silt and saprolite. -A layer of lt. gray calc-silicate GNEISS encountered at 25.0'. -A layer of lt. brown to gray mica schist encountered at 25.7'. REC = 42% RQD = 0% Fractures : Low angle partings at 10 26.65' : 69 29.60' : 60	
30	R-2	30.0-35.0	--	24	0	Brown foliated mica SCHIST, low angle fractures along bedding and high angle fractures w/Mg staining. -Moderate brown sandy SILT, stiff (saprolite) at 30.0'. -Lt. gray calc-silicate layer encountered	

Well Construction Graphic

Elevation (feet): 810, 805, 800, 795, 790, 785, 780

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BORING LOG BC-13

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1264-02-576**	DRILL RIG:	**Mobile B-57**
LOGGED BY:	**S. Watts**	TOP OF CASING ELEVATION (ft):	**813.56**
DATE DRILLED:	**11/5/2002**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**45**	WATER LEVEL 24 HRS (ft bgs):	

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
	R-3	35.0-40.0	–	24	0		at 30.5'. REC = 40% RQD = 0% Fractures at 30.40' : 40 Weathered SCHIST and biotite GNEISS. REC = 40% RQD = 0% Fractures at 36.1' : 72 39.5' : 65	**Protective Casing** Dia: 4.0 in. Type: Stick-Up Interval: 1.50 ft. **Riser Casing** Dia: 2.0 in. Type: Sch 40 PVC Interval: 0.0 - 23.3 ft. **Grout** Type: Portland Cement Interval: 0.0 - 18.0 ft. **Seal** Type: Bentonite Chips Interval: 18.0 - 22.0 ft. **Filterpack** Type: Filter Sand #2 Interval: 25.0 - 45.0 ft. **Screen** Dia: 2.0 in. Type: Sch 40 PVC Interval: 23.3 - 43.3 ft.		775
40	R-4	40.0-45.0	–	41.5	16		Weathered augen GNEISS and SCHIST. REC = 69% RQD = 16%			770
45							Boring terminated at 45.0 ft.			

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BORING LOG BC-14

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1264-02-576**	DRILL RIG:	**CME-45**
LOGGED BY:	**J. Drummond**	TOP OF CASING ELEVATION (ft):	**758.86**
DATE DRILLED:	**11/11/2002**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**31.4**	WATER LEVEL 24 HRS (ft bgs):	**16.16**

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Description & Remarks
	SS-1	0.0-2.5	4-2-3	30		Orange brown micaceous SILT and fine SAND, slightly moist.
	SS-2	3.5-5.0	3-4-6	18		Orange brown mottled black micaceous SILT and fine to coarse SAND, slightly moist.
5	S-1	5.0-10.0	–			
	ST-1	5.0-7.0	–			Orange brown and light orange micaceous SILT, trace fine to coarse Sand, slightly moist.
	SS-3	6.0-7.5	5-7-13	18		
	SS-4	8.5-10.0	11-18-23	18		Light orange micaceous SOFT WEATHERED ROCK samples as SILT and fine to coarse SAND w/quartzite rock fragments (gneissic saprolite), dry, crumbly.
10	S-2	10.0-15.0	–			
	SS-5	13.5-13.5	50/.25–	0.25		Light orange micaceous HARD WEATHERED ROCK samples as SILT and fine to coarse SAND w/quartzite rock fragments (gneissic saprolite), dry, crumbly. Auger refusal at 21.8 ft.
15						
	SS-6	18.5-19.0	50/6–	6		
20						
	R-1	21.8-31.4	–	113	57	Medium gray, green gray, black, and white layered medium to coarse grained quartz-feldspar GNEISS, very weathered, highly fractured from 21.8 - 25.0 ft. REC = 94% RQD = 57% Fractures at 25.15' : 30 26.22' : 26 28.33' : 75
25						
30						Boring terminated at 31.4 ft. in weathered GNEISS.

Well Construction Details

Protective Casing
Dia: 4.0 in.
Type: Stick-Up
Interval: 1.63 ft.

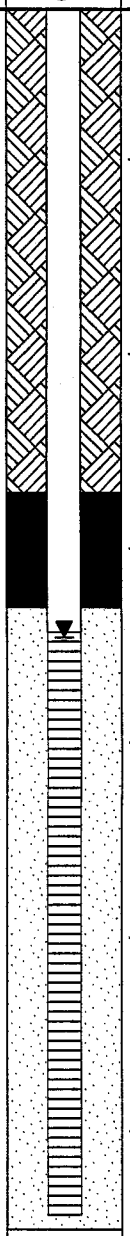
Riser Casing
Dia: 2.0 in.
Type: Sch 40 PVC
Interval: 0.0 - 16.02 ft.

Grout
Type: Portland Cement
Interval: 0.0 - 12.4 ft.

Seal
Type: Bentonite Chips
Interval: 12.4 - 15.4 ft.

Filterpack
Type: Filter Sand #2
Interval: 15.4 -31.4 ft.

Screen
Dia: 2.0 in.
Type: Sch 40 PVC
Interval: 16.02 - 31.02 ft



Elevation (feet): 755, 750, 745, 740, 735, 730

NOTES
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BORING LOG BC-14A

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1264-02-576**	DRILL RIG:	**CME-45**
LOGGED BY:	**J. Drummond**	TOP OF CASING ELEVATION (ft):	
DATE DRILLED:	**11/22/2002**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**20.5**	WATER LEVEL 24 HRS (ft bgs):	**18.9**

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
							(LITHOLOGY TAKEN FROM BC-14) Orange brown micaceous SILT and fine SAND, slightly moist.	Protective Casing Dia: N/A Type: N/A Interval: N/A		
							Orange brown mottled black micaceous SILT and fine to coarse SAND, slightly moist.			
5							Orange brown and light orange micaceous SILT, trace fine to coarse Sand, slightly moist.	Riser Casing Dia: N/A Type: N/A Interval: N/A		
							Light orange micaceous SOFT WEATHERED ROCK samples as SILT and fine to coarse SAND w/quartzite rock fragments (gneissic saprolite), dry, crumbly.			
10							Light orange micaceous HARD WEATHERED ROCK samples as SILT and fine to coarse SAND w/quartzite rock fragments (gneissic saprolite), dry, crumbly. .	Grout Type: Portland Interval: 0.0 - 20.5 ft. Seal Type: N/A Interval: N/A Filterpack Type: N/A Interval: N/A		
15										
20							Auger refusal at 20.5 ft. Boring terminated at 20.5 ft.	Screen Dia: N/A Type: N/A Interval: N/A		

NOTES

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BORING LOG BC-15

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1054-04-955**	DRILL RIG:	**CME-550X**
LOGGED BY:	**L. Ennis**	TOP OF CASING ELEVATION (ft):	**762.26**
DATE DRILLED:	**9/22/2004**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**61.8**	WATER LEVEL 24 HRS (ft bgs):	**26.14**

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Description & Remarks
						TOPSOIL Tan silty SAND, damp
	S-1	0-5	–			
	SS-1	3.5-5	3-3-5	11		
5						
	SS-2	8.5-10	3-3-3	12		
						Light brown sandy SILT, micaceous, damp
10						
	SS-3	23.5-25	3-3-7	13		
						Light brown sandy Silt with alternating lenses of weathered k-feldspar, SAPROLITE, damp
15						
	SS-4	13.5-15	4-4-5	12		
						Tan brown sandy SILT with alternating leness of weathered k-feldspar, SAPROLITE, damp
20						
	SS-5	43.5-45	4-3-4	16		
						Orange brown silty Sand SAPROLITE, with black oxidized interlayers, moist, layers not easily visible
25						
	SS-6	28.5-30	7-8-11	13		
						Light brown silty sand SAPROLITE with black and orange oxidation layers, micaceous, K-feldspar visible in sections, moist
30						
	SS-7	33.5-35	5-10-11	13		

Well Construction Details

Protective Casing
Dia:
Type: N/A
Interval:

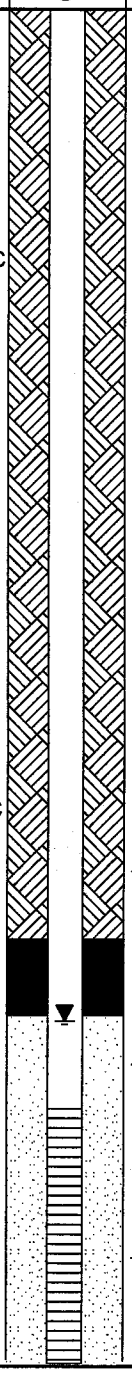
Riser Casing
Dia: 2.0 in.
Type: Schedule 40 PVC
Interval: 0.0 - 28.4

Grout
Type: Portland Cement
Interval: 0.0 - 24.0

Seal
Type: Bentonite
Interval: 24.0 - 26.0

Filterpack
Type: Sand
Interval: 26.0 - 43.4

Screen
Dia: 2"
Type: Schedule 40 PVC
Interval: 28.4 - 43.4



Elevation (feet): 760, 755, 750, 745, 740, 735, 730

NOTES

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BORING LOG BC-15

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1054-04-955**	DRILL RIG:	**CME-550X**
LOGGED BY:	**L. Ennis**	TOP OF CASING ELEVATION (ft):	**762.26**
DATE DRILLED:	**9/22/2004**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**61.8**	WATER LEVEL 24 HRS (ft bgs):	**26.14**

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Description & Remarks	Well Construction Details
						Light brown silty sand SAPROLITE with black and orange oxidation layers, micaceous, K-feldspar visible in sections, moist *(continued)*	**Protective Casing** Dia: Type: N/A Interval:
	SS-8	38.5-40	17-23-40	13		Olive gray silty Sand SAPROLITE with very visible micaceous layers, wet	
40						Orange light brown silty Sand SAPROLITE, layering visible, wet	**Riser Casing** Dia: 2.0 in. Type: Schedule 40 PVC Interval: 0.0 - 28.4
	SS-9	18.5-20	35-19-18	12		White tan and orange tan layered silty Sand SAPROLITE, wet	**Grout** Type: Portland Cement Interval: 0.0 - 24.0
45						Orange brown silty Sand SAPROLITE, micaceous, Wet	**Seal** Type: Bentonite Interval: 24.0 - 26.0
	R-1	48.9-51.8	--	25	43	Medium gray Quartz Gneiss	
50							**Filterpack** Type: Sand Interval: 26.0 - 43.4
	R-2	51.8-56.8	--	60	22		
55							**Screen** Dia: 2" Type: Schedule 40 PVC Interval: 28.4 - 43.4
	R-3	56.8-61.8	--	58	50	Gray mica SCHIST	
60						Boring Terminated at 61.8 fts	

Well Construction Graphic

Elevation (feet): 725, 720, 715, 710, 705

NOTES

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BORING LOG BC-16

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1054-04-955**	DRILL RIG:	**CME-550X**
LOGGED BY:	**L. Ennis/A. Smith**	TOP OF CASING ELEVATION (ft):	**835.65**
DATE DRILLED:	**9/9/2004**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**106.4**	WATER LEVEL 24 HRS (ft bgs):	**73.8**

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
							TOPSOIL	Protective Casing		
							Pink/tan brown silty SAND, dry	Dia:		
								Type: N/A		
	S-1	1-5	–					Interval:		
	SS-1	3.5-5	12-16-10							830
5								Riser Casing		
								Dia: 1.0 in.		
								Type: Schedule 40 PVC		
								Interval: 0 - 96.0		
	SS-2	8.5-10	10-16-29				Orange and pink fine sandy SILT, with clay layers, dry to moist with some rock fragments			825
10								Grout		
								Type: Portland Cement		
								Interval: 0.0 - 90.5		
								Seal		
	SS-3	13.5-15	13-12-18					Type: Bentonite		
							Purple and tan clayey SAND with gravel, moist	Interval: 90.5 - 93.0		820
15								Filterpack		
								Type: Sand		
								Interval: 93.0 - 106.0		
	SS-4	18.5-20	8-13-17	1.5			Red pink and yellow brown sandy SILT, micaceous, dry			815
20								Screen		
								Dia: 1"		
								Type: Schedule 40 PVC		
								Interval: 96.0 - 106		
	SS-5	23.5-24.8	22-40-50/3"	1.1			Pink brown micaceous very fine sandy Silt SAPROLITE, layering visible, dry			810
25										
	SS-6	28.5-30	45-22-23	1.5						805
30										
	SS-7	33.5-35	21-35-50	1.2			Light tan/pink Silt SAPROLITE with rock fragments, dry			

NOTES

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BORING LOG BC-16

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1054-04-955**	DRILL RIG:	**CME-550X**
LOGGED BY:	**L. Ennis/A. Smith**	TOP OF CASING ELEVATION (ft):	**835.65**
DATE DRILLED:	**9/9/2004**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**106.4**	WATER LEVEL 24 HRS (ft bgs):	**73.8**

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
							Light tan/pink Silt SAPROLITE with rock fragments, dry *(continued)*	Protective Casing Dia: Type: N/A Interval:		
	SS-8	38.5-40	13-12-15	1.5			Yellow orange tan silty SAND, with some clay	Riser Casing Dia: 1.0 in. Type: Schedule 40 PVC Interval: 0 - 96.0		795
40										
	SS-9	43.5-45	23-12-25	1.5			Gray weathered QUARTZITE, PWR Yellow orange tan very fine sandy SILT, dry	Grout Type: Portland Cement Interval: 0.0 - 90.5		790
45										
	SS-10	48.5-49	50--	0.5			Tan silty medium sand PWR, with quartz rock fragments, dry	Seal Type: Bentonite Interval: 90.5 - 93.0		785
50								Filterpack Type: Sand Interval: 93.0 - 106.0		
	SS-11	53.5-54.2	21-50/2"-	0.5			Tan silty sand PWR, visible layering, with weathered garnets, micaceous, damp	Screen Dia: 1" Type: Schedule 40 PVC Interval: 96.0 - 106		780
55										
	SS-12	58.5-60	7-15-39	1.5			White very fine sandy SILT, dry			775
60							Yellowish light brown silty sand PWR, visible layering, micaceous, dry			
	SS-13	63.5-64	50--	0.5						770
65										
	R-1	68.3-71.4	--	52	13		Medium gray Quartz Biotite GNEISS			

NOTES

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BORING LOG BC-16

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1054-04-955**	DRILL RIG:	**CME-550X**
LOGGED BY:	**L. Ennis/A. Smith**	TOP OF CASING ELEVATION (ft):	**835.65**
DATE DRILLED:	**9/9/2004**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**106.4**	WATER LEVEL 24 HRS (ft bgs):	**73.8**

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
							Medium gray Quartz Biotite GNEISS *(continued)*	Protective Casing Dia: Type: N/A Interval:		765
	R-2	71.4-76.4	--	60	41		Medium to dark gray Quartz Biotite GNEISS			
75								Riser Casing Dia: 1.0 in. Type: Schedule 40 PVC Interval: 0 - 96.0		760
	R-3	76.4-81.4	--	60	23					
80								Grout Type: Portland Cement Interval: 0.0 - 90.5		755
	R-4	81.4-86.4	--	60	52					
85								Seal Type: Bentonite Interval: 90.5 - 93.0		750
	R-5	86.4-91.4	--	60	27		Medium gray highly fractured Biotite GNEISS	Filterpack Type: Sand Interval: 93.0 - 106.0		
90								Screen Dia: 1" Type: Schedule 40 PVC Interval: 96.0 - 106		745
	R-6	91.4-96.4	--	60	0					740
95										
	R-7	96.4-101.4	--	60	70		Gray GNEISS and Mica SCHIST alternating layers			735
100										
	R-8	101.4-106.4	--	57	21					

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BORING LOG BC-16

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1054-04-955**	DRILL RIG:	**CME-550X**
LOGGED BY:	**L. Ennis/A. Smith**	TOP OF CASING ELEVATION (ft):	**835.65**
DATE DRILLED:	**9/9/2004**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**106.4**	WATER LEVEL 24 HRS (ft bgs):	**73.8**

Sample Information						Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)					
105							Gray GNEISS and Mica SCHIST alternating layers *(continued)*	Protective Casing Dia: Type: N/A Interval:		730
							Boring Terminated at 106.4 ft	Riser Casing Dia: 1.0 in. Type: Schedule 40 PVC Interval: 0 - 96.0		
								Grout Type: Portland Cement Interval: 0.0 - 90.5		
								Seal Type: Bentonite Interval: 90.5 - 93.0		
								Filterpack Type: Sand Interval: 93.0 - 106.0		
								Screen Dia: 1" Type: Schedule 40 PVC Interval: 96.0 - 106		

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BORING LOG BC-17

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1054-04-955**	DRILL RIG:	**Mobile B-57**
LOGGED BY:	**A. Smith**	TOP OF CASING ELEVATION (ft):	**825.49**
DATE DRILLED:	**9/2/2004**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**71.1**	WATER LEVEL 24 HRS (ft bgs):	**56**

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
							TOPSOIL	Protective Casing		
							Tan/yellow to red/brown sandy clayey SILT, Residuum	Dia:		
								Type: N/A		
	S-1	0-6	--					Interval:		
	SS-1	3.9-5.4	5-5-6							820
5								Riser Casing		
								Dia: 1.0 in.		
	ST-1	5.9-8.4	--					Type: Schedule 40 PVC		
								Interval: 0.0 - 60.8		
	SS-2	8.9-10.4	3-4-4							815
							Red orange firm very fine sandy SILT, moist in seams	Grout		
10								Type: Portland Cement		
								Interval: 0.0 - 47.5		
								Seal		
	SS-3	13.9-15.4	4-4-5					Type: Bentonite		810
							Brown sandy SILT	Interval: 47.5 - 49.0		
15								Filterpack		
								Type: Sand		
								Interval: 49.0 - 70.8		
	SS-4	18.9-20.4	4-6-8							805
							Red orange very fine sandy SILT, moist to damp	Screen		
20								Dia: 1"		
								Type: Schedule 40 PVC		
								Interval: 60.8 - 70.8		
	SS-5	23.9-25.4	4-5-6							800
25										
	SS-6	28.9-30.4	7-7-6							795
							Tan orange fine sandy SILT, moist to wet with black veins and sand lenses			
30										
	SS-7	33.9-35.4	11-11-10							

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BORING LOG BC-17

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1054-04-955**	DRILL RIG:	**Mobile B-57**
LOGGED BY:	**A. Smith**	TOP OF CASING ELEVATION (ft):	**825.49**
DATE DRILLED:	**9/2/2004**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**71.1**	WATER LEVEL 24 HRS (ft bgs):	**56**

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Description & Remarks
						White and orange fine sandy SILT, moist with mica and black veins *(continued)*
	SS-8	38.9-40.4	19-20-50/0.4			Quartzite fragments and sand (PWR)
40						Tan orange and Tan white vine sandy SILT
	SS-9	43.9-45.4	10-13-17			
45						
	R-1	49.2-51.0	--	13	0	Gray orange and white, highly fractured Quarts GNEISS
50	R-2	51.0-52.4	--	8	0	Gray/white highly fractured Quartz GNEISS
	R-3	52.4-56.1	--	26	27	Brown to gray highly fractured Quartz GNEISS
55	R-4	56.1-61.1	--	53	32	
60	R-5	61.1-65.0	--	47	64	
65	R-6	65.0-68.7	--	38	46	

Well Construction Details

Protective Casing
Dia:
Type: N/A
Interval:

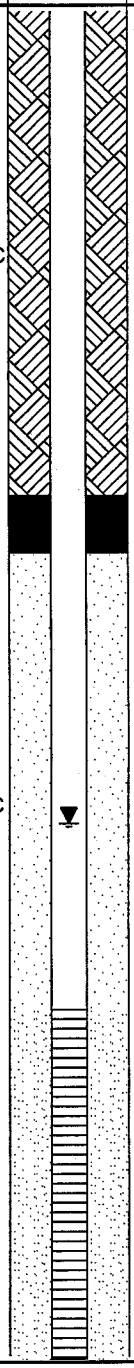
Riser Casing
Dia: 1.0 in.
Type: Schedule 40 PVC
Interval: 0.0 - 60.8

Grout
Type: Portland Cement
Interval: 0.0 - 47.5

Seal
Type: Bentonite
Interval: 47.5 - 49.0

Filterpack
Type: Sand
Interval: 49.0 - 70.8

Screen
Dia: 1"
Type: Schedule 40 PVC
Interval: 60.8 - 70.8



NOTES

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BORING LOG BC-17

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1054-04-955**	DRILL RIG:	**Mobile B-57**
LOGGED BY:	**A. Smith**	TOP OF CASING ELEVATION (ft):	**825.49**
DATE DRILLED:	**9/2/2004**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**71.1**	WATER LEVEL 24 HRS (ft bgs):	**56**

Sample Information						Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)					
–							Gray slightly fractured Mica SCHIST *(continued)*	Protective Casing Dia: Type: N/A Interval: Riser Casing Dia: 1.0 in. Type: Schedule 40 PVC Interval: 0.0 - 60.8 Grout Type: Portland Cement Interval: 0.0 - 47.5 Seal Type: Bentonite Interval: 47.5 - 49.0 Filterpack Type: Sand Interval: 49.0 - 70.8 Screen Dia: 1" Type: Schedule 40 PVC Interval: 60.8 - 70.8		–
–	R-7	68.7-71.1	–	0	0					

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BORING LOG BC-18

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1054-04-955**	DRILL RIG:	**Mobile B-57**
LOGGED BY:	**A. Smith**	TOP OF CASING ELEVATION (ft):	**783.74**
DATE DRILLED:	**8/30/2004**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**38.1**	WATER LEVEL 24 HRS (ft bgs):	**22.4**

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Description & Remarks	Elevation (feet)
						FILL	
						Brown fine sandy SILT, moist	
	SS-1	3.5-5	10-12-15				
5							780
	SS-2	8.5-10	20-30-50/4				
10						Brown clayey Sand PWR, moist, rock fragments at 13.5	775
	SS-3	13.5-13.9	50/4--				
15							770
	SS-4	18.5-18.8	50/3--			Tan brown/brown fine sandy Silt PWR, moist, with rock fragments	
20							765
	SS-5	23.5-24.3	39-50/2-				
25							760
	SS-6	28.5-28.3	50/3--				
30							755
	SS-7	33.5-33.6	50/0.1--				750

Well Construction Details

Protective Casing
Dia:
Type: N/A
Interval:

Riser Casing
Dia: 2.0 in.
Type: Schedule 40 PVC
Interval: 0.0 - 27.8

Grout
Type: Portland Cement
Interval: 0.0 - 22.0

Seal
Type: Bentonite
Interval: 22.0 - 25.5

Filterpack
Type: Sand
Interval: 25.5 - 37.8

Screen
Dia: 2"
Type: Schedule 40 PVC
Interval: 27.8 - 37.8

NOTES
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BORING LOG BC-18

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1054-04-955**	DRILL RIG:	**Mobile B-57**
LOGGED BY:	**A. Smith**	TOP OF CASING ELEVATION (ft):	**783.74**
DATE DRILLED:	**8/30/2004**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**38.1**	WATER LEVEL 24 HRS (ft bgs):	**22.4**

Sample Information						Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)					
							Tan brown/brown fine sandy Silt PWR, moist, with rock fragments *(continued)*	Protective Casing Dia: Type: N/A Interval:		745
							Boring Terminated at 38.3	Riser Casing Dia: 2.0 in. Type: Schedule 40 PVC Interval: 0.0 - 27.8 Grout Type: Portland Cement Interval: 0.0 - 22.0 Seal Type: Bentonite Interval: 22.0 - 25.5 Filterpack Type: Sand Interval: 25.5 - 37.8 Screen Dia: 2" Type: Schedule 40 PVC Interval: 27.8 - 37.8		

NOTES

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BORING LOG BC-19

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1054-04-955**	DRILL RIG:	**CME-550X**
LOGGED BY:	**L. Ennis**	TOP OF CASING ELEVATION (ft):	**814.81**
DATE DRILLED:	**9/21/2004**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**56**	WATER LEVEL 24 HRS (ft bgs):	**52**

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Description & Remarks	Elevation (feet)
						TOPSOIL Orange brown clayey sandy SILT with orange and black oxidation, damp	
	S-1	2-7	--				
	SS-1	3.5-5	12-8-10	1.3			810
5							
	SS-2	8.5-10	4-4-5	1.3		Yellow orange sandy SILT, damp	805
10							
	SS-3	13.5-15	4-4-4	1.3			800
15							
	SS-4	18.5-20	5-5-8	1.5		Tan sandy SILT	795
20							
	SS-5	23.5-25	5-8-12	1.3		Yellow orange brown silty clayey Sand SAPROLITE, micaceous, with some weathered k-feldspar lenses	790
25							
	ST-1	27-29	--				785
	SS-6	33.5-34.5	5-11-15	0.9			
30							
	SS-7	38.5-39.8	10-50-	1			

Well Construction Details

Protective Casing
Dia:
Type: N/A
Interval:

Riser Casing
Dia: 1.0 in.
Type: Schedule 40 PVC
Interval: 0.0 - 46.0

Grout
Type: Portland Cement
Interval: 0.0 - 41.0

Seal
Type: Bentonite
Interval: 41.0 - 42.6

Filterpack
Type: Sand
Interval: 42.6 - 56.0

Screen
Dia: 1"
Type: Schedule 40 PVC
Interval: 46.0 - 56.0

NOTES

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BORING LOG BC-19

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1054-04-955**	DRILL RIG:	**CME-550X**
LOGGED BY:	**L. Ennis**	TOP OF CASING ELEVATION (ft):	**814.81**
DATE DRILLED:	**9/21/2004**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**56**	WATER LEVEL 24 HRS (ft bgs):	**52**

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
							Yellow orange brown silty clayey Sand SAPROLITE, micaceous, with some weathered k-feldspar lenses *(continued)*	Protective Casing Dia: Type: N/A Interval:		
	SS-8	43.5-44	13-31-50/4"	1.25						775
40							Light brown and gray silty sand PWR, highly weathered micaceous rock, layering visible, dry	Riser Casing Dia: 1.0 in. Type: Schedule 40 PVC Interval: 0.0 - 46.0		770
	SS-9	48.5-48.9	50/6"--	4.5				Grout Type: Portland Cement Interval: 0.0 - 41.0		
45										765
	SS-10	53.5-53.7	50/5"--	1				Seal Type: Bentonite Interval: 41.0 - 42.6		
50								Filterpack Type: Sand Interval: 42.6 - 56.0		760
55								Screen Dia: 1" Type: Schedule 40 PVC Interval: 46.0 - 56.0		
							Auger Refusal at 57.2			

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BORING LOG BC-20

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1054-04-955**	DRILL RIG:	**Mobile B-57**
LOGGED BY:	**A. Smith**	TOP OF CASING ELEVATION (ft):	**757.22**
DATE DRILLED:	**8/31/2004**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**34.4**	WATER LEVEL 24 HRS (ft bgs):	**11.2**

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Description & Remarks
						ABC Stone and Fabric
	S-1	1-6	--			Tan/brown fine silty SAND, moist with mica fragments
	SS-1	3.5-5	14-22-19			
5						
	SS-2	8.5-9.0	15-11-15			Orange and brown fine sandy SILT, moist, with some quartz and mica rock fragments
10						
	SS-3	13.5-15	50/0.5--			Gray brown fine sandy Silt PWR moist with mica fragments
15						
	SS-4	18.5-18.6	50/0.1--			Tan silty very fine Sand PWR with trace rock fragments
20						
	R-1	22.9-25.6	--	24	0	Brown tan highly fractured GNEISS with Quartz veins
25	R-2	25.6-30.6	--	26	28	Brown tan medium to highly fractured GNEISS with Quartz veins
30	R-3	30.6-34.4	--	40	0	Brown tan highly fractured GNEISS with Quartz veins

Well Construction Details

Protective Casing
Dia:
Type: N/A
Interval:

Riser Casing
Dia: 2.0 in.
Type: Schedule 40 PVC
Interval: 0 - 11.6

Grout
Type: Portland Cement
Interval: 0.0 - 11.3

Seal
Type: Bentonite
Interval: 7.3 - 9.6

Filterpack
Type: Sand
Interval: 9.6 - 21.6

Screen
Dia: 2"
Type: Schedule 40 PVC
Interval: 11.6 - 21.6

Well Construction Graphic

Elevation (feet): 755, 750, 745, 740, 735, 730, 725

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BORING LOG BC-21

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1054-04-955**	DRILL RIG:	**Mobile B-57**
LOGGED BY:	**A. Smith**	TOP OF CASING ELEVATION (ft):	**756.69**
DATE DRILLED:	**9/1/2004**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**44.6**	WATER LEVEL 24 HRS (ft bgs):	**7.7**

Sample Information						Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)					
							ABC Stone and fabric	Protective Casing Dia: Type: N/A Interval:		755
							Tan orange silty clayey SAND, moist to wet at 6			
	SS-1	3.7-5.2	6-7-6							
5								Riser Casing Dia: 2.0 in. Type: Schedule 40 PVC Interval: 0 - 3.9		750
							Tan orange clayey silty very fine SAND, wet			
	SS-2	8.7-10.2	9-10-12							
10								Grout Type: Portland Cement Interval: 0.0 - 1.3		745
								Seal Type: Bentonite Interval: 1.3 - 3.0		
	SS-3	13.7-14.3	50/0.2--							
15										740
								Filterpack Type: Sand Interval: 3.0 - 13.9		
	SS-4	18.7-18.9	50/0.4--				Tan orange fine silty SAND with trace quartz lenses, wet			
20								Screen Dia: 2" Type: Schedule 40 PVC Interval: 3.9 - 13.9		735
	SS-5	23.7-24	50/0.3--							
25										730
	SS-6	28.7-28.9	50/0.2--							
30										725
		34.6-39.6	--	50	56					

NOTES

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BORING LOG BC-21

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1054-04-955**	DRILL RIG:	**Mobile B-57**
LOGGED BY:	**A. Smith**	TOP OF CASING ELEVATION (ft):	**756.69**
DATE DRILLED:	**9/1/2004**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**44.6**	WATER LEVEL 24 HRS (ft bgs):	**7.7**

Sample Information						Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)					
							Tan-gray and whit moderately fractured quartz GNEISS *(continued)*	Protective Casing Dia: Type: N/A Interval:		720
40		39.6-44.6	--	48	8		Tan-gray and white highly fractured quartz GNEISS	Riser Casing Dia: 2.0 in. Type: Schedule 40 PVC Interval: 0 - 3.9		715
							Boring Terminated at 44.6	Grout Type: Portland Cement Interval: 0.0 - 1.3 Seal Type: Bentonite Interval: 1.3 - 3.0 Filterpack Type: Sand Interval: 3.0 - 13.9 Screen Dia: 2" Type: Schedule 40 PVC Interval: 3.9 - 13.9		

NOTES

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BORING LOG BC-22

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1054-04-955**	DRILL RIG:	**CME-550X**
LOGGED BY:	**L. Ennis**	TOP OF CASING ELEVATION (ft):	**764.53**
DATE DRILLED:	**9/24/2004**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**31.9**	WATER LEVEL 24 HRS (ft bgs):	**1.5**

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Description & Remarks
0						TOPSOIL Orange brown silty SAND, wet
	SS-1	3.5-4.8	8-15-50/4"	15		Tan brown sandy silty CLAY, moist Tan and white SAND with rock fragments and some silt, wet
5						
	SS-2	8.5-8.7	50/2"--	1		
10						
	SS-3	13.5-14	50/6"--	3		Gray silty Sand SAPROLITE with visible layering, orange oxidized layers, olive green layers, wet
15						
	SS-4	18.5-18.8	50/3"--	1		Tan and white Sand SAPROLITE with some silt and rock fragments, wet
20						
	R-1	21.9-26.9	--	55	26	Gray Quartzite
25						
	R-2	26.9-31.9	--	55	45	
30						
						Boring Terminated

Well Construction Details

Protective Casing
Dia:
Type: N/A
Interval:

Riser Casing
Dia: 2.0 in.
Type: Schedule 40 PVC
Interval: 0.0 - 3.0

Grout
Type: Portland Cement
Interval: 0.0 - 1.0

Seal
Type: Bentonite
Interval: 1.0 - 2.0

Filterpack
Type: Sand
Interval: 2.0 - 13.0

Screen
Dia: 2"
Type: Schedule 40 PVC
Interval: 3.0 - 13.0

Well Construction Graphic

Elevation (feet): 760, 755, 750, 745, 740, 735

NOTES

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BORING LOG BC-23

PROJECT: **Duke Power-Belews Creek**
LOCATION: **Belews Creek, NC**
PROJECT NO.: **1054-04-955**
LOGGED BY: **L. Ennis**
DATE DRILLED: **9/2/2004**
BORING DEPTH (ft): **88.6**

DRILLING CONTRACTOR: **S&ME, Inc.**
DRILLING METHOD: **4¼" H.S.A.**
DRILL RIG: **CME-550X**
TOP OF CASING ELEVATION (ft):
WATER LEVEL TOB (ft bgs):
WATER LEVEL 24 HRS (ft bgs):

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
							TOPSOIL Orange/Yellow brown silty SAND, dry	Protective Casing Dia: Type: Interval:		
	S-1	1-6	--							
	SS-1	3.5-4.5	38-50/6-				Light tan/ yellow orange silty clayey SAND with rock fragments, micaceous, moist at 13.5			
5								Riser Casing Dia: Type: Interval:		
	SS-2	8.5-9.5	30-50/6-					Grout Type: Interval:		
10										
	SS-3	13.5-15	7-8-8					Seal Type: Interval:		
							Light red brown sandy silt SAPROLITE, with visible micaceous layering, moist			
15								Filterpack Type: Interval:		
	SS-4	18.5-19.9	28-41-50/5"							
20								Screen Dia: Type: Interval:		
	SS-5	23.5-25	12-15-15							
25										
	SS-6	28.5-30	7-11-11							
30							Pink and light tan/white silt SAPROLITE, with micaceous layering, moist			
	SS-7	33.5-35	11-21-24							

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BORING LOG BC-23

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1054-04-955**	DRILL RIG:	**CME-550X**
LOGGED BY:	**L. Ennis**	TOP OF CASING ELEVATION (ft):	
DATE DRILLED:	**9/2/2004**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**88.6**	WATER LEVEL 24 HRS (ft bgs):	

Sample Information						Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)					
							Medium red brown fine sandy silt SAPROLITE, with micaceous layering, moist *(continued)*	Protective Casing Dia: Type: Interval:		
	SS-8	38.5-39.4	22-50/5"-							
40							Pink/red and gray sandy silt PWR, with micaceous layering, moist	Riser Casing Dia: Type: Interval:		
	SS-9	43.5-45	11-21-26					Grout Type: Interval:		
45										
	SS-10	48.5-49.4	31-50/5"-					Seal Type: Interval:		
50								Filterpack Type: Interval:		
	SS-11	53.5-54.4	32-50/6-				Olive gray micaceous sandy silt SAPROLITE with visible layering, moist	Screen Dia: Type: Interval:		
55										
	SS-12	58.5-60	19-18-27							
60										
	SS-13	63.5-64.9	22-47-50/4.5"				Tan brown micaceous clayey Sand PWR, moist			
65										
	SS-14	68.5-69	50/6–							

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BORING LOG BC-23

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1054-04-955**	DRILL RIG:	**CME-550X**
LOGGED BY:	**L. Ennis**	TOP OF CASING ELEVATION (ft):	
DATE DRILLED:	**9/2/2004**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**88.6**	WATER LEVEL 24 HRS (ft bgs):	

Sample Information						Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)					
							Tan brown micaceous clayey Sand PWR, moist *(continued)*	Protective Casing Dia: Type: Interval:		
	SS-15	73.5-73.8	50/3.5"--							
75							Yellow orange silty sand PWR, no layering, dry	Riser Casing Dia: Type: Interval:		
	SS-16	78.5-78.9	50/4"--					Grout Type: Interval:		
80								Seal Type: Interval:		
	SS-17	83.5-83-8	50/3.5"--					Filterpack Type: Interval:		
85										
	SS-18	88.5-88.6	50/1"--					Screen Dia: Type: Interval:		
							Auger Refusal at 89.6			

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BORING LOG BC-23A

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1054-04-955**	DRILL RIG:	**CME-550X**
LOGGED BY:	**L. Ennis**	TOP OF CASING ELEVATION (ft):	**863.79**
DATE DRILLED:	**9/2/2004**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**102.7**	WATER LEVEL 24 HRS (ft bgs):	**81.42**

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
							(Lithology taken from BC-23) TOPSOIL Orange/Yellow brown silty SAND, dry	Protective Casing Dia: Type: N/A Interval:		860
5							Light tan/ yellow orange silty clayey SAND with rock fragments, micaceous, moist at 13.5	Riser Casing Dia: 2.0 in. Type: Schedule 40 PVC Interval: 0.0 - 76.7		855
10								Grout Type: Portland Cement Interval: 0.0 - 72.1		850
								Seal Type: Bentonite Interval: 72.1 - 74.0		
15							Light red brown sandy silt SAPROLITE, with visible micaceous layering, moist	Filterpack Type: Sand Interval: 74.0 - 101.7		845
20								Screen Dia: 2" Type: Schedule 40 PVC Interval: 76.7 - 101.7		840
25										835
30							Pink and light tan/white silt SAPROLITE, with micaceous layering, moist			830

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BORING LOG BC-23A

PROJECT:	**Duke Power-Belews Creek**	DRILLING CONTRACTOR:	**S&ME, Inc.**
LOCATION:	**Belews Creek, NC**	DRILLING METHOD:	**4¼" H.S.A.**
PROJECT NO.:	**1054-04-955**	DRILL RIG:	**CME-550X**
LOGGED BY:	**L. Ennis**	TOP OF CASING ELEVATION (ft):	**863.79**
DATE DRILLED:	**9/2/2004**	WATER LEVEL TOB (ft bgs):	
BORING DEPTH (ft):	**102.7**	WATER LEVEL 24 HRS (ft bgs):	**81.42**

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
							Medium red brown fine sandy silt SAPROLITE, with micaceous layering, moist *(continued)*	Protective Casing Dia: Type: N/A Interval:		825
40							Pink/red and gray sandy silt PWR, with micaceous layering, moist	Riser Casing Dia: 2.0 in. Type: Schedule 40 PVC Interval: 0.0 - 76.7		820
45								Grout Type: Portland Cement Interval: 0.0 - 72.1		815
50								Seal Type: Bentonite Interval: 72.1 - 74.0		810
55							Olive gray micaceous sandy silt SAPROLITE with visible layering, moist	Filterpack Type: Sand Interval: 74.0 - 101.7		805
60								Screen Dia: 2" Type: Schedule 40 PVC Interval: 76.7 - 101.7		800
65							Tan brown micaceous clayey Sand PWR, moist			795

NOTES

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BORING LOG BC-23A

PROJECT: **Duke Power-Belews Creek**
LOCATION: **Belews Creek, NC**
PROJECT NO.: **1054-04-955**
LOGGED BY: **L. Ennis**
DATE DRILLED: **9/2/2004**
BORING DEPTH (ft): **102.7**

DRILLING CONTRACTOR: **S&ME, Inc.**
DRILLING METHOD: **4¼" H.S.A.**
DRILL RIG: **CME-550X**
TOP OF CASING ELEVATION (ft): **863.79**
WATER LEVEL TOB (ft bgs):
WATER LEVEL 24 HRS (ft bgs): **81.42**

Depth (feet)	Sample Number	Sample Interval (feet)	Blow Counts per 6 inches	Recovery (inches)	Rock RQD (%)	Symbol	Description & Remarks	Well Construction Details	Well Construction Graphic	Elevation (feet)
							Tan brown micaceous clayey Sand PWR, moist *(continued)*	Protective Casing Dia: Type: N/A Interval:		790
75							Yellow orange silty sand PWR, no layering, dry	Riser Casing Dia: 2.0 in. Type: Schedule 40 PVC Interval: 0.0 - 76.7		785
80								Grout Type: Portland Cement Interval: 0.0 - 72.1		780
85	R-1	84.6-87.7	--	46	21		Light gray/white Quartz GNEISS, highly fractured	Seal Type: Bentonite Interval: 72.1 - 74.0		
	R-2	87.7-92.7	--	26	6			Filterpack Type: Sand Interval: 74.0 - 101.7		775
90								Screen Dia: 2" Type: Schedule 40 PVC Interval: 76.7 - 101.7		770
	R-3	92.7-97.7	--	36	13		Gray slightly fractured Quartz GNEISS			
95										765
	R-4	97.7-102.7	--	60	21					
100							Boring Terminated at 102.7			

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APPENDIX III

PHOTOGRAPHS OF ROCK CORES AND ROCK OUTCROPS

Run 1 (11.0 - 16.0')

Recovery: 4.5'
RQD: 34%
Rock Type: Quartz Gneiss

Run 2 (16.0 - 20.0')

Recovery: 1.5'
RQD: 43%
Rock Type: Quartz Gneiss

FGD Scrubber Landfill	Boring:	BC-1
Duke Power - Belews Creek Steam Station	Sample Depth:	11.0 - 20.0
Belews Creek, Stokes County, North Carolina	Box:	1 of 1
S&ME Project No. 1054-04-955		

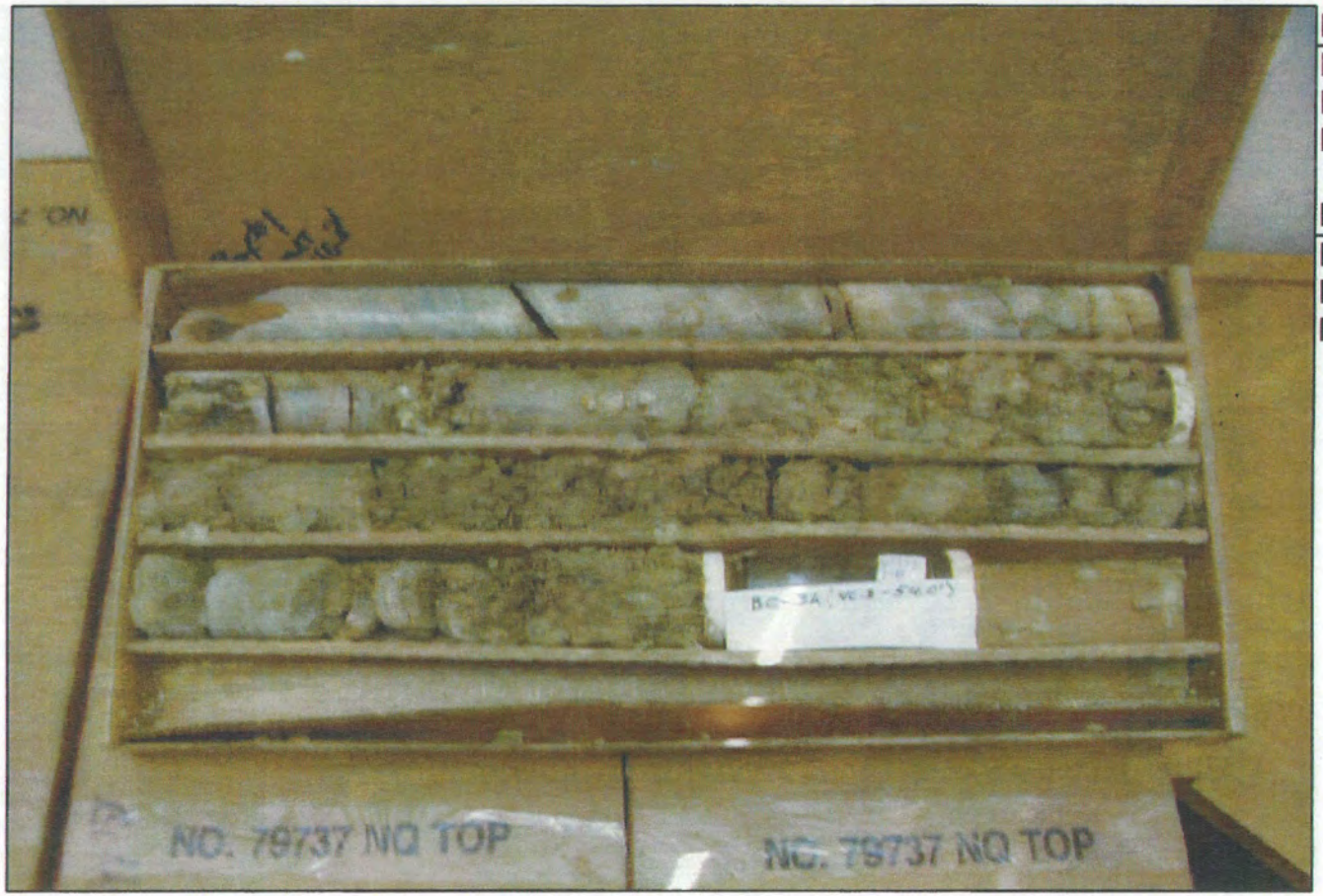
Run 1 (38.0 - 43.0')

Recovery: 2.0'
RQD: 0%
Rock Type: Interlayered Schist and Quartz

Run 2 (43.0 - 48.0')

Recovery: 2.25'
RQD: 0%
Rock Type: Interlayered Schist and Quartz

FGD Scrubber Landfill	Boring:	BC-3
Duke Power - Belews Creek Steam Station	Sample Depth:	38.0 - 48.0'
Belews Creek, Stokes County, North Carolina	Box:	1 of 1
S&ME Project No. 1054-04-955		



Run 1 (40.8 - 46.3')

Recovery: 4.0'
RQD: 26%
Rock Type: Quartz Gneiss

Run 2 (46.3 - 51.3')

Recovery: 3.3'
RQD: 0%
Rock Type: Quartz Gneiss

FGD Scrubber Landfill	Boring:	BC-3A
Duke Power - Belews Creek Steam Station	Sample Depth:	40.8 - 53.8'
Belews Creek, Stokes County, North Carolina	Box:	1 of 3
S&ME Project No. 1054-04-955		

Run 2 (53.8 - 61.3')

Recovery: 4.7'
RQD: 60%
Rock Type: Quartz Gneiss

FGD Scrubber Landfill	Boring:	BC-3A
Duke Power - Belews Creek Steam Station	Sample Depth:	53.8 - 61.3'
Belews Creek, Stokes County, North Carolina	Box:	2 of 3
S&ME Project No. 1054-04-955		

Run 3 (61.3 - 71.3')
Recovery: 6.3'
RQD: 25%
Rock Type: Quartz Gneiss

FGD Scrubber Landfill	Boring:	BC-3A
Duke Power - Belews Creek Steam Station	Sample Depth:	61.3 - 71.3'
Belews Creek, Stokes County, North Carolina	Box:	3 of 3
S&ME Project No. 1054-04-955		

Run 1 (50.0 - 54.5')

Recovery: 1.7'
RQD: 44%
Rock Type: Qrtz-Feldspar Gneiss

FGD Scrubber Landfill	Boring:	BC-4
Duke Power - Belews Creek Steam Station	Sample Depth:	50.0 - 54.5'
Belews Creek, Stokes County, North Carolina	Box:	1 of 1
S&ME Project No. 1054-04-955		

Run 1 (28.5 - 33.5')

Recovery: 4.5'
RQD: 53%
Rock Type: Granitic and Augen Gneiss

Run 2 (33.5 - 38.5')

Recovery: 5.0'
RQD: 97%
Rock Type: Granitic and Augen Gneiss

FGD Scrubber Landfill	Boring:	BC-6
Duke Power - Belews Creek Steam Station	Sample Depth:	28.5 - 38.5'
Belews Creek, Stokes County, North Carolina	Box:	1 of 1
S&ME Project No. 1054-04-955		

Run 1 (36.3 - 46.3')
Recovery: 9.0'
RQD: 49%
Rock Type: Quartz Gneiss

FGD Scrubber Landfill	Boring:	BC-7
Duke Power - Belews Creek Steam Station	Sample Depth:	36.3 - 52.3'
Belews Creek, Stokes County, North Carolina	Box:	1 of 2
S&ME Project No. 1054-04-955		

Run 2 (46.3 - 52.3')

Recovery: 5.22'
RQD: 81%
Rock Type: Quartz Gneiss

FGD Scrubber Landfill	Boring:	BC-7
Duke Power - Belews Creek Steam Station	Sample Depth:	36.3 - 52.3'
Belews Creek, Stokes County, North Carolina	Box:	2 of 2
S&ME Project No. 1054-04-955		

Run 1 (25.2 - 29.7')
Recovery: 2.9'
RQD: 0%
Rock Type: Quartz Gneiss

Run 2 (29.7 - 37.5')
Recovery: 3.25'
RQD: 0%
Rock Type: Quartz Gneiss

Run 3 (37.5 - 43.5')
Recovery: 2.0'
RQD: 0%
Rock Type: Quartz Gneiss

FGD Scrubber Landfill	Boring:	BC-8
Duke Power - Belews Creek Steam Station	Sample Depth:	25.2 - 43.5'
Belews Creek, Stokes County, North Carolina	Box:	1 of 1
S&ME Project No. 1054-04-955		

Run 1 (13.8 - 18.8')
Recovery: 2.85'
RQD: 0%
Rock Type: Quartz Gneiss

Run 2 (18.8 - 23.8')
Recovery: 4.4'
RQD: 0%
Rock Type: Quartz Gneiss

FGD Scrubber Landfill	Boring:	BC-9
Duke Power - Belews Creek Steam Station	Sample Depth:	13.8 - 28.8'
Belews Creek, Stokes County, North Carolina	Box:	1 of 2
S&ME Project No. 1054-04-955		

Run 3 (13.8 - 28.8')
Recovery: 4.1'
RQD: 22%
Rock Type: Quartz Gneiss

FGD Scrubber Landfill	Boring:	BC-9
Duke Power - Belews Creek Steam Station	Sample Depth:	13.8 - 28.8'
Belews Creek, Stokes County, North Carolina	Box:	2 of 2
S&ME Project No. 1054-04-955		

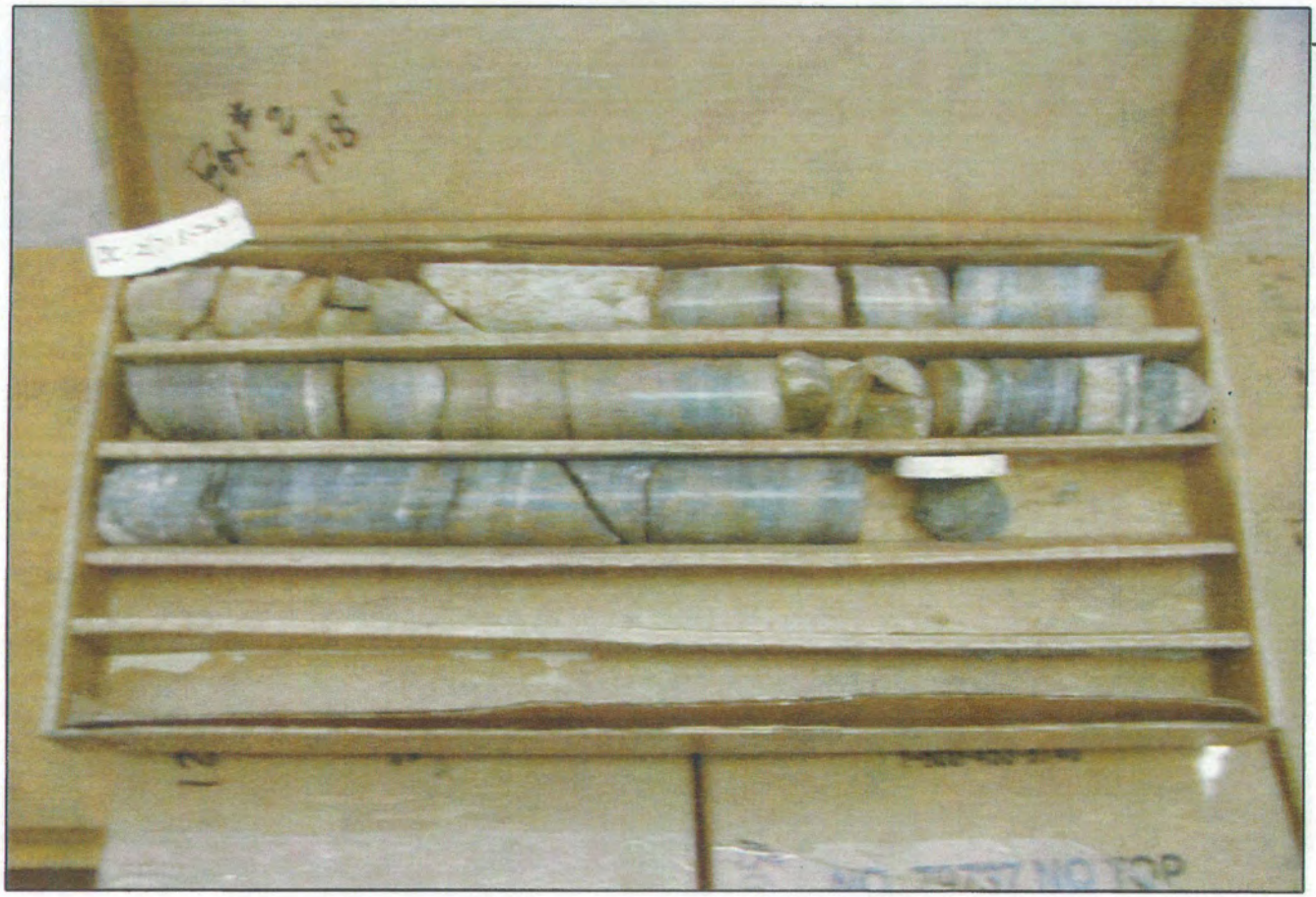
Run 1 (38.5 - 47.5')
Recovery: 7.75'
RQD: 31%
Rock Type: Mica Schist

FGD Scrubber Landfill	Boring:	BC-10
Duke Power - Belews Creek Steam Station	Sample Depth:	38.5 - 47.5'
Belews Creek, Stokes County, North Carolina	Box:	1 of 1
S&ME Project No. 1054-04-955		

Run 1 (62.8 - 71.8')

Recovery: 8.5'
RQD: 55%
Rock Type: Qrtz-Feldspar Gneiss

FGD Scrubber Landfill	Boring:	BC-12
Duke Power - Belews Creek Steam Station	Sample Depth:	62.8 - 76.8'
Belews Creek, Stokes County, North Carolina	Box:	1 of 2
S&ME Project No. 1054-04-955		



Run 2 (71.8 - 76.8')
Recovery: 5.0'
RQD: 52%
Rock Type: Qrtz-Feldspar Gneiss

FGD Scrubber Landfill	Boring:	BC-12
Duke Power - Belews Creek Steam Station	Sample Depth:	62.8 - 76.8'
Belews Creek, Stokes County, North Carolina	Box:	2 of 2
S&ME Project No. 1054-04-955		

Run 1 (25.0 - 30.0')

Recovery: 2.1'
RQD: 0%
Rock Type: Gneiss and Schist

Run 2 (30.0 - 35.0')

Recovery: 2.0'
RQD: 0%
Rock Type: Mica Schist

Run 3 (35.0 - 40.0')

Recovery: 2.0'
RQD: 0%
Rock Type: Schist and Biotite Gneiss

Run 4 (40.0 - 45.0')

Recovery: 3.5'
RQD: 16%
Rock Type: Augen Gneiss and Schist

FGD Scrubber Landfill	Boring:	BC-13
Duke Power - Belews Creek Steam Station	Sample Depth:	25.0 - 45.0'
Belews Creek, Stokes County, North Carolina	Box:	1 of 1
S&ME Project No. 1054-04-955		

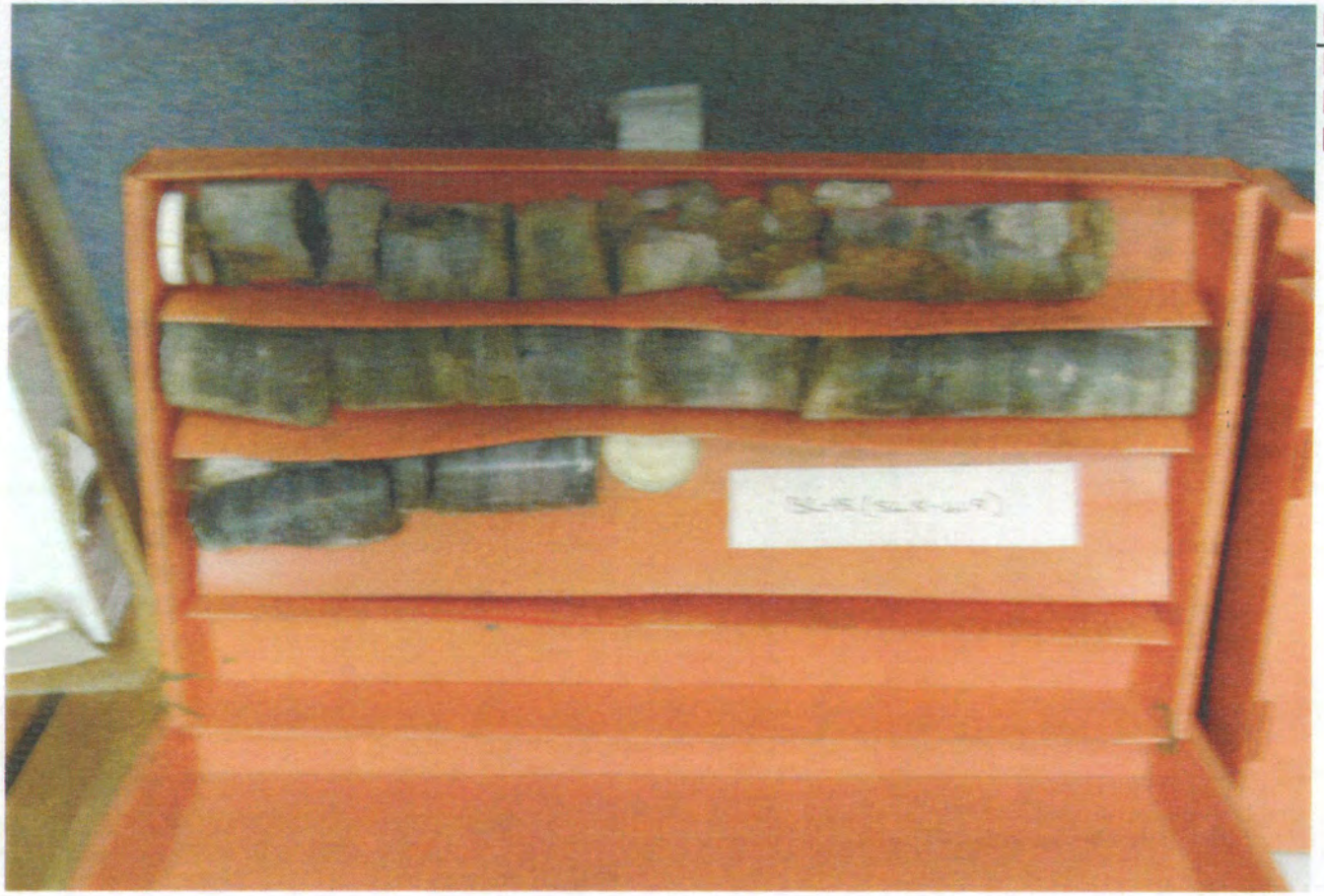
Run 1 (48.9 - 51.8')

Recovery: 2.08'
RQD: 43%
Rock Type: Quartz Gneiss

Run 2 (51.8 - 56.8')

Recovery: 5'
RQD: 22%
Rock Type: Quartz Gneiss

FGD Scrubber Landfill	Boring:	BC-15
Duke Power - Belews Creek Steam Station	Sample Depth:	48.9 - 56.8'
Belews Creek, Stokes County, North Carolina	Box:	1 of 2
S&ME Project No. 1054-04-955		



Run 3 (56.8 - 61.8')
Recovery: 4.8'
RQD: 50%
Rock Type: Mica Schist

FGD Scrubber Landfill	Boring:	BC-15
Duke Power - Belews Creek Steam Station	Sample Depth:	56.8 - 61.8'
Belews Creek, Stokes County, North Carolina	Box:	2 of 2
S&ME Project No. 1054-04-955		

Run 1 (68.3 - 71.4')
Recovery: 4.3'
RQD: 13%
Rock Type: Quartz Biotite Gneiss

Run 2 (71.4 - 76.4')
Recovery: 5'
RQD: 41%
Rock Type: Quartz Biotite Gneiss

Part of Run 3 (76.4 - 81.4')
Recovery: 5'
RQD: 23%
Rock Type: Quartz Gneiss

FGD Scrubber Landfill	Boring:	BC-16
Duke Power - Belews Creek Steam Station	Sample Depth:	68.3 - 81.4'
Belews Creek, Stokes County, North Carolina	Box:	1 of 4
S&ME Project No. 1054-04-955		

Part of Run 3
(76.4 - 81.4')
Recovery: 5'
RQD: 23%
Rock Type: Quartz Gneiss

Run 4 (81.4 - 86.4')
Recovery: 5'
RQD: 52%
Rock Type: Quartz Gneiss

FGD Scrubber Landfill	Boring:	BC-16
Duke Power - Belews Creek Steam Station	Sample Depth:	76.4 - 86.4'
Belews Creek, Stokes County, North Carolina	Box:	2 of 4
S&ME Project No. 1054-04-955		

Run 5 (86.4 - 91.4)

Recovery: 5'
RQD: 27%
Rock Type: Biotite Gneiss

Run 6 (91.4 - 96.4')

Recovery: 5'
RQD: 0%
Rock Type: Biotite Gneiss

FGD Scrubber Landfill	Boring:	BC-16
Duke Power - Belews Creek Steam Station	Sample Depth:	86.4 - 96.4
Belews Creek, Stokes County, North Carolina	Box:	3 of 4
S&ME Project No. 1054-04-955		

Run 7 (96.4 - 101.4)

Recovery: 5'
RQD: 70%
Rock Type: Quartz Gneiss and Mica Schist

Run 8 (101.4 - 106.4')

Recovery: 4.75'
RQD: 21%
Rock Type: Quartz Gneiss and Mica Schist

FGD Scrubber Landfill	Boring:	BC-16
Duke Power - Belews Creek Steam Station	Sample Depth:	96.4 - 106.4
Belews Creek, Stokes County, North Carolina	Box:	4 of 4
S&ME Project No. 1054-04-955		

Run 1 (49.2 - 51.0')
Recovery: 1.1'
RQD: 0%
Rock Type: Quartz Gneiss

Run 2 (51.0 - 52.4')
Recovery: 0.7'
RQD: 0%
Rock Type: Quartz Gneiss

Run 3 (52.4 - 56.1')
Recovery: 2.2'
RQD: 27%
Rock Type: Quartz Gneiss

Run 4 (56.1 - 61.1')
Recovery: 4.4'
RQD: 32%
Rock Type: Quartz Gneiss

FGD Scrubber Landfill	Boring:	BC-17
Duke Power - Belews Creek Steam Station	Sample Depth:	49.2 - 61.1'
Belews Creek, Stokes County, North Carolina	Box:	1 of 2
S&ME Project No. 1054-04-955		

Run 5 (61.1 - 65.0')
Recovery: 3.9'
RQD: 64%
Rock Type: Quartz Gneiss

Run 6 (65.0 - 68.7')
Recovery: 3.2'
RQD: 46%
Rock Type: Quartz Gneiss

Run 7 (68.7 - 71.1')
Recovery: 100'
RQD: 100%
Rock Type: Mica Schist

FGD Scrubber Landfill	Boring:	BC-17
Duke Power - Belews Creek Steam Station	Sample Depth:	61.1 - 69.2'
Belews Creek, Stokes County, North Carolina	Box:	2 of 2
S&ME Project No. 1054-04-955		

Run 1 (22.9 - 25.6')
Recovery: 2.0'
RQD: 0%
Rock Type: Quartz Gneiss

Run 2 (25.6 - 30.6')
Recovery: 3.1'
RQD: 28%
Rock Type: Quartz Gneiss

Run 3 (30.6 - 34.4')
Recovery: 3.3'
RQD: 0%
Rock Type: Quartz Gneiss

FGD Scrubber Landfill	Boring:	BC-20
Duke Power - Belews Creek Steam Station	Sample Depth:	22.9 - 34.4'
Belews Creek, Stokes County, North Carolina	Box:	1 of 1
S&ME Project No. 1054-04-955		

Run 1 (34.6 - 39.6')

Recovery: 4.2'
RQD: 56%
Rock Type: Quartz Gneiss

Run 2 (39.6 - 44.6')

Recovery: 4.0'
RQD: 8%
Rock Type: Quartz Gneiss

FGD Scrubber Landfill	Boring:	BC-21A
Duke Power - Belews Creek Steam Station	Sample Depth:	34.6 - 44.6'
Belews Creek, Stokes County, North Carolina	Box:	1 of 1
S&ME Project No. 1054-04-955		

Run 1 (21.9 - 26.9')
Recovery: 4.6'
RQD: 26%
Rock Type: Quartzite

Run 2 (26.9 - 31.9')
Recovery: 4.55'
RQD: 45%
Rock Type: Quartzite

FGD Scrubber Landfill	Boring:	BC-22
Duke Power - Belews Creek Steam Station	Sample Depth:	21.9 - 31.9'
Belews Creek, Stokes County, North Carolina	Box:	1 of 1
S&ME Project No. 1054-04-955		

Run 1 (84.6 - 87.7')
Recovery: 2.39'
RQD: 21%
Rock Type: Quartz Gneiss

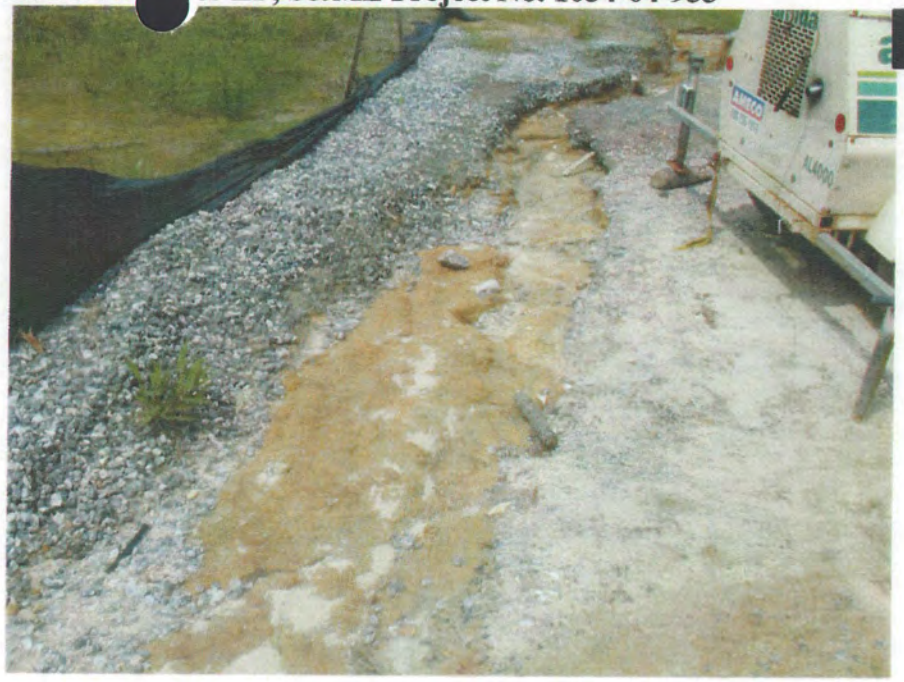
Run 2 (87.7 - 92.7')
Recovery: 2.15'
RQD: 6%
Rock Type: Quartz Gneiss

Run 3 (92.7 - 97.7')
Recovery: 3.0'
RQD: 13%
Rock Type: Quartz Gneiss

FGD Scrubber Landfill Duke Power - Belews Creek Steam Station Belews Creek, Stokes County, North Carolina S&ME Project No. 1054-04-955	Boring: Sample Depth: Box:	BC-23A 84.6 - 97.7' 1 of 2

Run 4 (97.7 - 102.7')
Recovery: 5'
RQD: 21%
Rock Type: Quartz Gneiss

FGD Scrubber Landfill	Boring:	BC-23A
Duke Power - Belews Creek Steam Station	Sample Depth:	97.7 - 102.7'
Belews Creek, Stokes County, North Carolina	Box:	2 of 2
S&ME Project No. 1054-04-955		



Rock Outcrop # 1

Rock Outcrop # 1

Rock Outcrop # 1

Rock Outcrop # 1

Rock Outcrop # 1

Rock Outcrop # 1

Rock Outcrop # 1

Rock Outcrop # 1

Rock Outcrop # 1

Rock Outcrop # 1

Rock Outcrop # 2

Rock Outcrop # 2

13

Rock Outcrop # 2

14

Rock Outcrop # 3

15

Rock Outcrop # 3

16

Rock Outcrop # 3

Rock Outcrop # 3

Rock Outcrop # 4

Rock Outcrop # 4

Rock Outcrop # 4

Rock Outcrop # 4

Rock Outcrop # 5

Rock Outcrop # 5

Rock Outcrop # 5

Panoramic View of Rock Outcrop # 5

APPENDIX IV

WELL COMPLETION REPORTS

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print): Micheal Mosely — CERTIFICATION #: 3210

WELL CONTRACTOR COMPANY NAME: S&ME, Inc. — PHONE #: 919-872-2660

STATE WELL CONSTRUCTION PERMIT# (if applicable): — ASSOCIATED WQ PERMIT# (if applicable):

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultral ☐ Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use:

2. WELL LOCATION:
Nearest Town: Walnut Cove County: Stokes
SR 1908 (Pine Hall Road) - Duke Power Belews Creek Steam Station
(Street Name, Numbers, Community, Sudivision, Lot No.,Zip Code)

Topographic/Land setting
☐ Ridge ☐ Slope ☒ Valley ☐ Flat
(check appropriate box)

Latitude/longitude of well location
(degrees/minutes/seconds)
Latitude/longitude scource: ☐GPS ☐Topographic Map
(check box)

3. OWNER: Duke Power - Belews Creek Steam Station
Address: 3195 Pine Hall Road
(Street or Route No.)
Belews Creek | NC | 27009
City or Town | State | Zip Code
336-427-0274
Area code - Phone Number

DEPTH From	DEPTH To	DRILLING LOG Formation Descrpition
0	10.5	Orange silty, gravelly sand
10.5	20	Weathered quartz gneiss

4. DATE DRILLED: 11/13/02
5. TOTAL DEPTH: 20
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: 16.54 ft.
(Use "+" if Above Top of Casing)
8. TOP OF CASING IS 2.25 FT. Above Land Surface*
***Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.**
9. YIELD (gpm): ____ METHOD OF TEST: ____
10. WATER ZONES (depth): ____
11. DISINFECTION: Type: NA Amount: ____
12. CASING:

	Depth From	To	Diameter		Wall Thickness or Weight/Ft.	Material
	0	5 Ft.	2	in.	Schedule 40	PVC
		Ft.				
		Ft.				

13. GROUT:

	Depth From	To	Material	Method
	0	2 Ft.	Cement	Grout
	2	4 Ft.	Bentonite	Chips

14. SCREEN:

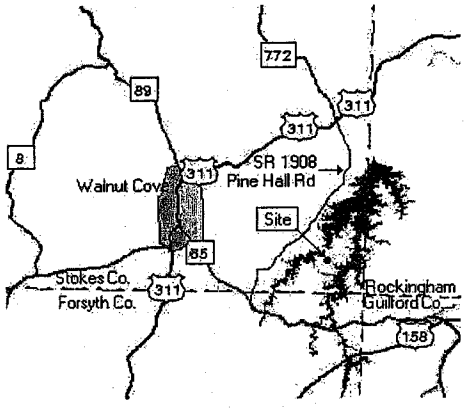
	Depth From	To	Diameter		Slot Size		Material
	4	19 Ft.	2	in.	0.01	in.	PVC
		Ft.		in.		in.	

15. SAND/GRAVEL PACK:

	Depth From	To	Size	Material
	4	20 Ft.		Filter Sand #2
		Ft.		

LOCATION SKETCH

Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common names.



16. REMARKS: Monitor Well Number BC-1

I DO HERE BY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

Micheal A Mosely — 4-7-03

SIGNATURE OF PERSON CONSTRUCTING THE WELL — DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) Micheal Mosely **CERTIFICATION #** 3210

WELL CONTRACTOR COMPANY NAME S&ME, Inc. **PHONE #** 919-872-2660

STATE WELL CONSTRUCTION PERMIT# (if applicable) _____ **ASSOCIATED WQ PERMIT#** (if applicable) _____

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultral ☐
   Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use _____
2. WELL LOCATION:
   earest Town Walnut Cove County Stokes
   SR 1908 (Pine Hall Road) - Duke Power Belews Creek Steam Station
   (Street Name, Numbers, Community, Sudivision, Lot No.,Zip Code)

   Topographic/Land setting
   ☐ Ridge ☐ Slope ☒ Valley ☐ Flat
   (check appropriate box)

   Latitude/longitude of well location _____
   (degrees/minutes/seconds)

   Latitude/longitude scource: ☐GPS ☐Topographic Map
   (check box)
3. OWNER: Duke Power - Belews Creek Steam Station
   Address 3195 Pine Hall Road
   (Street or Route No.)
   Belews Creek NC 27009
   City or Town State Zip Code
   336-427-0274
   Area code - Phone Number
4. DATE DRILLED 11/20/2002
5. TOTAL DEPTH 43.5
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: 19.22 ft.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 2.25 FT. Above Land Surface*
   ***Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.**
9. YIELD (gpm _____ METHOD OF TEST _____
0. WATER ZONES (depth): _____

DEPTH From	DEPTH To	DRILLING LOG Formation Descrpition
0	3	Crush and run gravel
3	8.5	Brown sandy silt
8.5	43.5	Orange silty sand (saprolite)

1. DISINFECTION: Type NA Amount _____
2. CASING:

	Depth			Diameter		Wall Thickness or Weight/Ft.	Material
From	0	To 27.28	Ft.	2	in.	Schedule 40	PVC
From		To	Ft.				
From		To	Ft.				

3. GROUT:

	Depth			Material	Method
From	0	To 18	Ft.	Cement	Grout
From	18	To 23	Ft.	Bentonite	Chips

4. SCREEN:

	Depth			Diameter		Slot Size		Material
From	27.28	To 42.28	Ft.	2	in.	0.01	in.	PVC
From		To	Ft.		in.		in.	

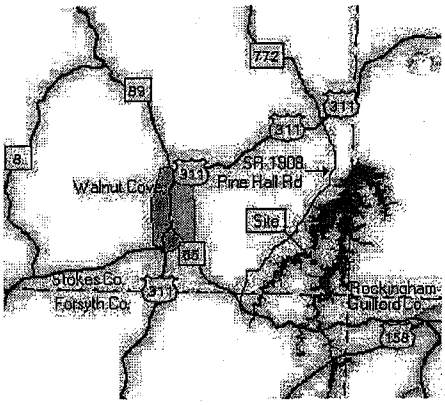
5. SAND/GRAVEL PACK:

	Depth			Size	Material
From	23	To 42.28	Ft.		Filter Sand #2
From		To	Ft.		

6. REMARKS: Monitor Well Number BC-2

LOCATION SKETCH

Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common names.



I DO HERE BY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

Michael A Mosely 4-7-03

SIGNATURE OF PERSON CONSTRUCTING THE WELL DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) Micheal Mosely **CERTIFICATION #** 3210

WELL CONTRACTOR COMPANY NAME S&ME, Inc. **PHONE #** 919-872-2660

STATE WELL CONSTRUCTION PERMIT# (if applicable) _____ **ASSOCIATED WQ PERMIT#** (if applicable) _____

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultral ☐
   Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use _____
2. WELL LOCATION:
   Nearest Town: Walnut Cove County Stokes
   SR 1908 (Pine Hall Road) - Duke Power Belews Creek Steam Station
   (Street Name, Numbers, Community, Sudivision, Lot No.,Zip Code)

   Topographic/Land setting
   ☐ Ridge ☐ Slope ☒ Valley ☐ Flat
   (check appropriate box)

   Latitude/longitude of well location
   _____
   (degrees/minutes/seconds)

   Latitude/longitude scource: ☐GPS ☐Topographic Map
   (check box)
3. OWNER: Duke Power - Belews Creek Steam Station
   Address 3195 Pine Hall Road
   (Street or Route No.)
   Belews Creek NC 27009
   City or Town State Zip Code
   336-427-0274
   Area code - Phone Number
4. DATE DRILLED 11/12/02
5. TOTAL DEPTH 48
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: – ft.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 2.5 FT. Above Land Surface*
   ***Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.**
9. YIELD (gpm) _____ METHOD OF TEST _____
10. WATER ZONES (depth): _____
11. DISINFECTION: Type NA Amount _____
12. CASING:

	Depth		Diameter		Wall Thickness or Weight/Ft.	Material
From 0	To 33	Ft.	2	in.	Schedule 40	PVC
From	To	Ft.				
From	To	Ft.				

13. GROUT:

	Depth		Material	Method
From 0	To 27	Ft.	Cement	Grout
From 27	To 31	Ft.	Bentonite	Chips

14. SCREEN:

	Depth		Diameter		Slot Size		Material
From 33	To 45.07	Ft.	2	in.	0.01	in.	PVC
From	To	Ft.		in.		in.	

15. SAND/GRAVEL PACK:

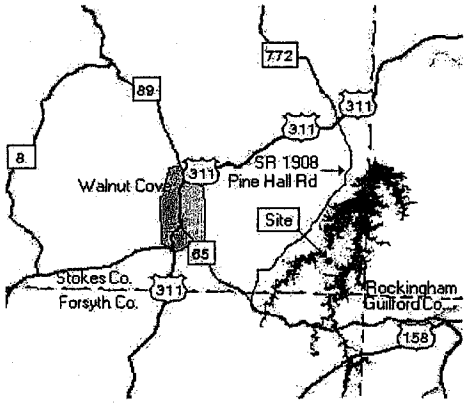
	Depth		Size	Material
From 31	To 48	Ft.		Filter Sand #2
From	To	Ft.		

16. REMARKS: Monitor Well Number BC-3

DEPTH From	DEPTH To	DRILLING LOG Formation Descrpition
0	1	Brown clayey silt
1	13.5	Lt. Red to pink sandy silt
13.5	28.5	Red silty sand
28.5	29.25	White silty sand
29.25	38	Red silty sand
38	48	Interbedded schist and quartz

LOCATION SKETCH

Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common names.



I DO HERE BY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

Micheal S Mosely 4-7-03

SIGNATURE OF PERSON CONSTRUCTING THE WELL DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print): Earl Mosely — CERTIFICATION #: 2252

WELL CONTRACTOR COMPANY NAME: S&ME, Inc. — PHONE #: 919-872-2660

STATE WELL CONSTRUCTION PERMIT# (if applicable): — ASSOCIATED WQ PERMIT# (if applicable):

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultral ☐
   Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use:

2. WELL LOCATION:
   earest Town: Walnut Cove — County: Stokes
   SR 1908 (Pine Hall Road) - Duke Power Belews Creek Steam Station
   (Street Name, Numbers, Community, Sudivision, Lot No.,Zip Code)

   Topographic/Land setting (check appropriate box): ☐ Ridge ☐ Slope ☒ Valley ☐ Flat

   Latitude/longitude of well location (degrees/minutes/seconds):

   Latitude/longitude scource: ☐GPS ☐Topographic Map (check box)

3. OWNER: Duke Power - Belews Creek Steam Station
   Address: 3195 Pine Hall Road
   (Street or Route No.)
   Belews Creek — NC — 27009
   City or Town — State — Zip Code
   336-427-0274
   Area code - Phone Number

4. DATE DRILLED: 11/26/2002
5. TOTAL DEPTH: 71.8
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: 56 ft.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 1.83 FT. Above Land Surface*
   *Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.
9. YIELD (gpm): — METHOD OF TEST:
0. WATER ZONES (depth):

DEPTH From	DEPTH To	DRILLING LOG Formation Descrpition
0	1	Brown clayey silt
1	13.5	Lt. Red to pink sandy silt
13.5	28.5	Red silty sand
28.5	29.25	White silty sand
29.25	40.8	Red silty sand
40.8	71.8	Gray Quartz Gneiss

1. DISINFECTION: Type: NA — Amount:
2. CASING:

	Depth From	Depth To		Diameter		Wall Thickness or Weight/Ft.	Material
	0	46.4	Ft.	2	in.	Schedule 40	PVC
			Ft.				
			Ft.				

3. GROUT:

	Depth From	Depth To		Material	Method
	0	34	Ft.	Cement	Grout
	34	40	Ft.	Bentonite	Chips

4. SCREEN:

	Depth From	Depth To		Diameter		Slot Size		Material
	46.4	71.4	Ft.	2	in.	0.01	in.	PVC
			Ft.		in.		in.	

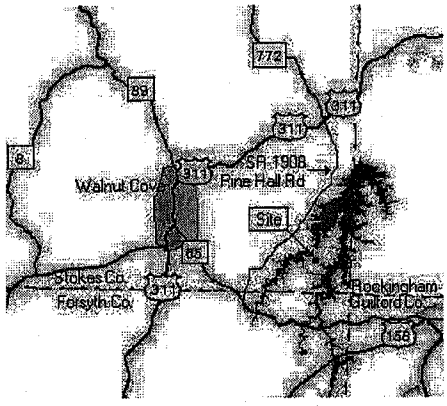
5. SAND/GRAVEL PACK:

	Depth From	Depth To		Size	Material
	40	71.8	Ft.		Filter Sand #2
			Ft.		

6. REMARKS: Monitor Well Number BC-3A

LOCATION SKETCH

Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common names.



I DO HERE BY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

Earl Mosely — 4-9-03

SIGNATURE OF PERSON CONSTRUCTING THE WELL — DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print): Earl Mosely — CERTIFICATION #: 2252
WELL CONTRACTOR COMPANY NAME: S&ME, Inc. — PHONE #: 919-872-2660
STATE WELL CONSTRUCTION PERMIT# (if applicable): — ASSOCIATED WQ PERMIT# (if applicable):

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultral ☐
   Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use
2. WELL LOCATION:
   earest Town: Walnut Cove County: Stokes
   SR 1908 (Pine Hall Road) - Duke Power Belews Creek Steam Station
   (Street Name, Numbers, Community, Sudivision, Lot No.,Zip Code)

   Topographic/Land setting
   ☐ Ridge ☐ Slope ☒ Valley ☐ Flat
   (check appropriate box)
   Latitude/longitude of well location
   (degrees/minutes/seconds)
   Latitude/longitude scource: ☐GPS ☐Topographic Map
   (check box)
3. OWNER: Duke Power - Belews Creek Steam Station
   Address: 3195 Pine Hall Road
   (Street or Route No.)
   Belews Creek | NC | 27009
   City or Town | State | Zip Code
   336-427-0274
   Area code - Phone Number
4. DATE DRILLED: 11/15/2002
5. TOTAL DEPTH: 62
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: 56.46 ft.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 1.75 FT. Above Land Surface*
   *Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.
9. YIELD (gpm): METHOD OF TEST:
0. WATER ZONES (depth):

DEPTH From	DEPTH To	DRILLING LOG Formation Descrpition
0	50	Brown silt and sand
50	62	Gray quartz-feldspar gneiss

1. DISINFECTION: Type: NA Amount:
2. CASING:

	Depth From	Depth To		Diameter		Wall Thickness or Weight/Ft.	Material
	0	46.44	Ft.	2	in.	Schedule 40	PVC
			Ft.				
			Ft.				

3. GROUT:

Depth From	Depth To		Material	Method
0	38.5	Ft.	Cement	Grout
38.5	45	Ft.	Bentonite	Chips

4. SCREEN:

Depth From	Depth To		Diameter		Slot Size		Material
46.44	61.44	Ft.	2	in.	0.01	in.	PVC
		Ft.		in.		in.	

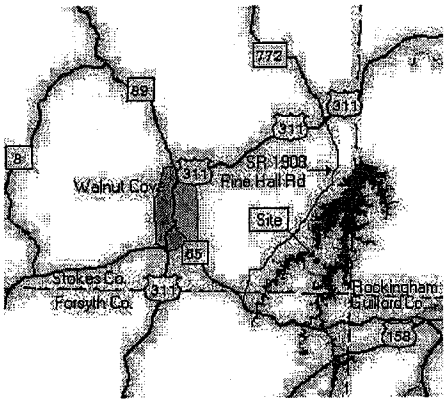
5. SAND/GRAVEL PACK:

Depth From	Depth To		Size	Material
45	62	Ft.		Filter Sand #2
		Ft.		

6. REMARKS: Monitor Well Number BC-4

LOCATION SKETCH

Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common names.



I DO HERE BY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

Earl Mosely — 4-9-03

SIGNATURE OF PERSON CONSTRUCTING THE WELL — DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) Earl Mosely **CERTIFICATION #** 2252

WELL CONTRACTOR COMPANY NAME S&ME, Inc. **PHONE #** 919-872-2660

STATE WELL CONSTRUCTION PERMIT# (if applicable) _____ **ASSOCIATED WQ PERMIT#** (if applicable) _____

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultral ☐
   Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use _____
2. WELL LOCATION:
   earest Town Walnut Cove County Stokes
   SR 1908 (Pine Hall Road) - Duke Power Belews Creek Steam Station
   (Street Name, Numbers, Community, Sudivision, Lot No.,Zip Code)

   Topographic/Land setting
   ☐ Ridge ☐ Slope ☒ Valley ☐ Flat
   (check appropriate box)
   Latitude/longitude of well location
   _____
   (degrees/minutes/seconds)
   Latitude/longitude scource: ☐GPS ☐Topographic Map
   (check box)
3. OWNER: Duke Power - Belews Creek Steam Station
   Address 3195 Pine Hall Road
   (Street or Route No.)
   Belews Creek NC 27009
   City or Town State Zip Code
   336-427-0274
   Area code - Phone Number
4. DATE DRILLED 11/19/2002
5. TOTAL DEPTH 46
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: – ft.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 1.83 FT. Above Land Surface*
   ***Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.**
9. YIELD (gpm _____ METHOD OF TEST _____
0. WATER ZONES (depth): _____

DEPTH From	DEPTH To	DRILLING LOG Formation Descrpition
0	46	Brown silt and sand

1. DISINFECTION: Type NA Amount _____
2. CASING:

	Depth			Diameter		Wall Thickness or Weight/Ft.	Material
From	0	To	30.92 Ft.	2	in.	Schedule 40	PVC
From		To	Ft.				
From		To	Ft.				

3. GROUT:

	Depth			Material	Method
From	0	To	25 Ft.	Cement	Grout
From	25	To	29 Ft.	Bentonite	Chips

4. SCREEN:

	Depth			Diameter		Slot Size		Material
From	30.92	To	45.92 Ft.	2	in.	0.01	in.	PVC
From		To	Ft.		in.		in.	

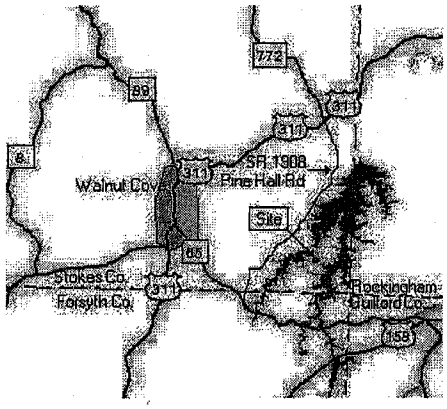
5. SAND/GRAVEL PACK:

	Depth			Size	Material
From	29	To	46 Ft.		Filter Sand #2
From		To	Ft.		

6. REMARKS: Monitor Well Number BC-5

LOCATION SKETCH

Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common names.



I DO HERE BY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

Earl Mosely 4-9-03

SIGNATURE OF PERSON CONSTRUCTING THE WELL DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) Micheal Mosely **CERTIFICATION #** 3210

WELL CONTRACTOR COMPANY NAME S&ME, Inc. **PHONE #** 919-872-2660

STATE WELL CONSTRUCTION PERMIT# (if applicable) _____ **ASSOCIATED WQ PERMIT#** (if applicable) _____

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultral ☐
   Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use _____
2. WELL LOCATION:
   Nearest Town: Walnut Cove County Stokes
   SR 1908 (Pine Hall Road) - Duke Power Belews Creek Steam Station
   (Street Name, Numbers, Community, Sudivision, Lot No.,Zip Code)

   Topographic/Land setting
   ☐ Ridge ☐ Slope ☒ Valley ☐ Flat
   (check appropriate box)
   Latitude/longitude of well location _____
   (degrees/minutes/seconds)
   Latitude/longitude scource: ☐GPS ☐Topographic Map
   (check box)
3. OWNER: Duke Power - Belews Creek Steam Station
   Address 3195 Pine Hall Road
   (Street or Route No.)
   Belews Creek NC 27009
   City or Town State Zip Code
   336-427-0274
   Area code - Phone Number
4. DATE DRILLED 11/7/02
5. TOTAL DEPTH 38.72
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: 39.21 ft.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 1.42 FT. Above Land Surface*
   ***Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.**
9. YIELD (gpm) _____ METHOD OF TEST _____
10. WATER ZONES (depth): _____
11. DISINFECTION: Type NA Amount _____
12. CASING:

	Depth		Diameter		Wall Thickness or Weight/Ft.	Material
From 0	To 23.5	Ft.	2	in.	Schedule 40	PVC
From	To	Ft.				
From	To	Ft.				

13. GROUT:

	Depth		Material	Method
From 0	To 18.8	Ft.	Cement	Grout
From 18.8	To 23.5	Ft.	Bentonite	Chips

14. SCREEN:

	Depth		Diameter		Slot Size		Material
From 23.5	To 38.72	Ft.	2	in.	0.01	in.	PVC
From	To	Ft.		in.		in.	

15. SAND/GRAVEL PACK:

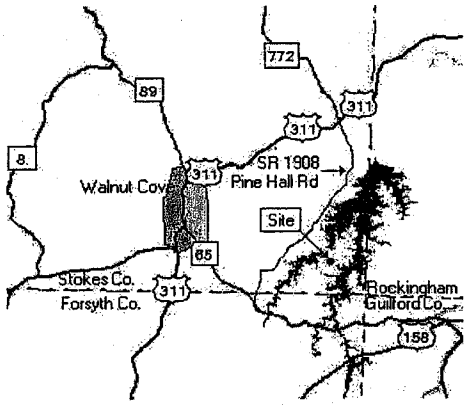
	Depth		Size	Material
From 23.5	To 38.72	Ft.		Filter Sand #2
From	To	Ft.		

16. REMARKS: Monitor Well Number BC-6

DEPTH From	DEPTH To	DRILLING LOG Formation Descrpition
	0 – 13.5	brown to orange sandy silt
	13.5 – 28.5	brown to yellow sandy silt
		with thin layer of weathered
		rock (quartz crystals).
	28.5 – 38.5	Gray granitic gneiss

LOCATION SKETCH

Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common names.



I DO HERE BY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

Michael A Mosely 4-7-03

SIGNATURE OF PERSON CONSTRUCTING THE WELL DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print): Earl Mosely — CERTIFICATION #: 2252

WELL CONTRACTOR COMPANY NAME: S&ME, Inc. — PHONE #: 919-872-2660

STATE WELL CONSTRUCTION PERMIT# (if applicable): — ASSOCIATED WQ PERMIT# (if applicable):

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultral ☐
   Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use:

2. WELL LOCATION:
   earest Town: Walnut Cove — County: Stokes
   SR 1908 (Pine Hall Road) - Duke Power Belews Creek Steam Station
   (Street Name, Numbers, Community, Sudivision, Lot No.,Zip Code)

   Topographic/Land setting
   ☐ Ridge ☐ Slope ☒ Valley ☐ Flat
   (check appropriate box)

   Latitude/longitude of well location
   (degrees/minutes/seconds)

   Latitude/longitude scource: ☐GPS ☐Topographic Map
   (check box)

3. OWNER: Duke Power - Belews Creek Steam Station
   Address: 3195 Pine Hall Road
   (Street or Route No.)
   Belews Creek — NC — 27009
   City or Town — State — Zip Code
   336-427-0274
   Area code - Phone Number

4. DATE DRILLED: 11/21/2002
5. TOTAL DEPTH: 52.38
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: 43.51 ft.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 1.94 FT. Above Land Surface*
   ***Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.**
9. YIELD (gpm): — METHOD OF TEST:
0. WATER ZONES (depth):

DEPTH From	DEPTH To	DRILLING LOG Formation Description
	0 -- 3.5	red clayey silt w/some gravel
	3.5 -- 36.3	brown to yellow sandy silt
		with thin layer of weathered
		rock (quartz crystals).
	36.3 -- 52.3	gray weathered qtz. gneiss

1. DISINFECTION: Type: NA — Amount:
2. CASING:

	Depth		Diameter		Wall Thickness or Weight/Ft.	Material
From 0	To 37.38	Ft.	2	in.	Schedule 40	PVC
From	To	Ft.				
From	To	Ft.				

3. GROUT:

	Depth		Material	Method
From 0	To 31.5	Ft.	Cement	Grout
From 31.5	To 36	Ft.	Bentonite	Chips

4. SCREEN:

	Depth		Diameter		Slot Size		Material
From 37.38	To 52.38	Ft.	2	in.	0.01	in.	PVC
From	To	Ft.		in.		in.	

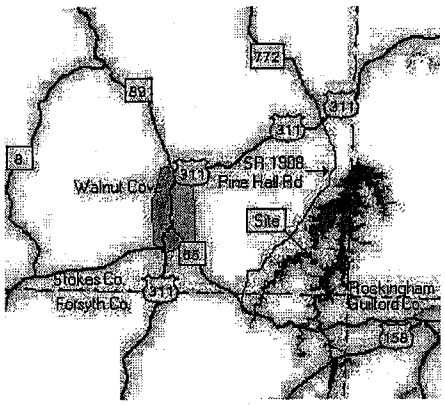
5. SAND/GRAVEL PACK:

	Depth		Size	Material
From 36	To 52.38	Ft.		Filter Sand #2
From	To	Ft.		

6. REMARKS: Monitor Well Number BC-7

LOCATION SKETCH

Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common names.



I DO HERE BY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

Earl Mosely — 4-9-03

SIGNATURE OF PERSON CONSTRUCTING THE WELL — DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) Micheal Mosely **CERTIFICATION #** 3210

WELL CONTRACTOR COMPANY NAME S&ME, Inc. **PHONE #** 919-872-2660

STATE WELL CONSTRUCTION PERMIT# (if applicable) _____ **ASSOCIATED WQ PERMIT#** (if applicable) _____

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultral ☐
   Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use _____
2. WELL LOCATION:
   Nearest Town: Walnut Cove County Stokes
   SR 1908 (Pine Hall Road) - Duke Power Belews Creek Steam Station
   (Street Name, Numbers, Community, Sudivision, Lot No.,Zip Code)

   Topographic/Land setting
   ☐ Ridge ☐ Slope ☒ Valley ☐ Flat
   (check appropriate box)
   Latitude/longitude of well location _____
   (degrees/minutes/seconds)
   Latitude/longitude scource: ☐GPS ☐Topographic Map
   (check box)
3. OWNER: Duke Power - Belews Creek Steam Station
   Address 3195 Pine Hall Road
   (Street or Route No.)
   Belews Creek NC 27009
   City or Town State Zip Code
   336-427-0274
   Area code - Phone Number
4. DATE DRILLED 11/26/02
5. TOTAL DEPTH 43.37
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: 35.81 ft.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 1.83 FT. Above Land Surface*
   ***Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.**
9. YIELD (gpm) _____ METHOD OF TEST _____
10. WATER ZONES (depth): _____
11. DISINFECTION: Type NA Amount _____
12. CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From 0	To 28	Ft.	2 in.	Schedule 40	PVC
From _____	To _____	Ft.	_____	_____	_____
From _____	To _____	Ft.	_____	_____	_____

13. GROUT:

	Depth		Material	Method
From 0	To 22	Ft.	Cement	Grout
From 22	To 25	Ft.	Bentonite	Chips

14. SCREEN:

	Depth		Diameter	Slot Size	Material
From 28	To 43.37	Ft.	2 in.	0.01 in.	PVC
From _____	To _____	Ft.	_____ in.	_____ in.	_____

15. SAND/GRAVEL PACK:

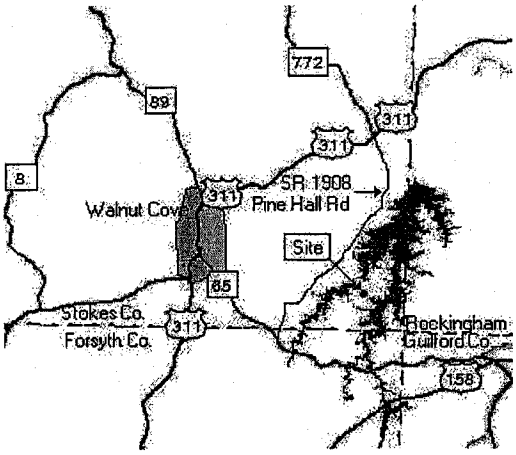
	Depth		Size	Material
From 25	To 43.37	Ft.	_____	Filter Sand #2
From _____	To _____	Ft.	_____	_____

16. REMARKS: Monitor Well Number BC-8

DEPTH From	DEPTH To	DRILLING LOG Formation Descrpition
0	8.5	red/brown silt
8.5	25.2	brown to yellow sandy silt
25.2	43.5	gray qtz. Gneiss

LOCATION SKETCH

Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common names.



I DO HERE BY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

Micheal Mosely 4-7-03

SIGNATURE OF PERSON CONSTRUCTING THE WELL DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) Micheal Mosely **CERTIFICATION #** 3210

WELL CONTRACTOR COMPANY NAME S&ME, Inc. **PHONE #** 919-872-2660

STATE WELL CONSTRUCTION PERMIT# (if applicable) _____ **ASSOCIATED WQ PERMIT#** (if applicable) _____

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultral ☐
   Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use _____
2. WELL LOCATION:
   earest Town Walnut Cove County Stokes
   SR 1908 (Pine Hall Road) - Duke Power Belews Creek Steam Station
   (Street Name, Numbers, Community, Sudivision, Lot No.,Zip Code)

   Topographic/Land setting
   ☐ Ridge ☐ Slope ☒ Valley ☐ Flat
   (check appropriate box)
   Latitude/longitude of well location _____
   (degrees/minutes/seconds)
   Latitude/longitude scource: ☐GPS ☐Topographic Map
   (check box)
3. OWNER: Duke Power - Belews Creek Steam Station
   Address 3195 Pine Hall Road
   (Street or Route No.)
   Belews Creek NC 27009
   City or Town State Zip Code
   336-427-0274
   Area code - Phone Number
4. DATE DRILLED 11/21/2002
5. TOTAL DEPTH 28.8
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: 23.5 ft.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 2 FT. Above Land Surface*
   ***Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.**
9. YIELD (gpm _____ METHOD OF TEST _____
0. WATER ZONES (depth): _____

DEPTH From	DEPTH To	DRILLING LOG Formation Descrpition
	0 -- 0.5	crush and run gravel
	0.5 -- 13.8	brown/orange silty gravelly
		sand w/ weathered rock.
	13.8 -- 28.8	gray/tan/blck/red qtz. gneiss

1. DISINFECTION: Type NA Amount _____
2. CASING:

	Depth			Diameter		Wall Thickness or Weight/Ft.	Material
From	0	To 13.8	Ft.	2	in.	Schedule 40	PVC
From		To	Ft.				
From		To	Ft.				

3. GROUT:

	Depth			Material	Method
From	0	To 6.5	Ft.	Cement	Grout
From	6.5	To 12.5	Ft.	Bentonite	Chips

4. SCREEN:

	Depth			Diameter		Slot Size		Material
From	13.8	To 28.8	Ft.	2	in.	0.01	in.	PVC
From		To	Ft.		in.		in.	

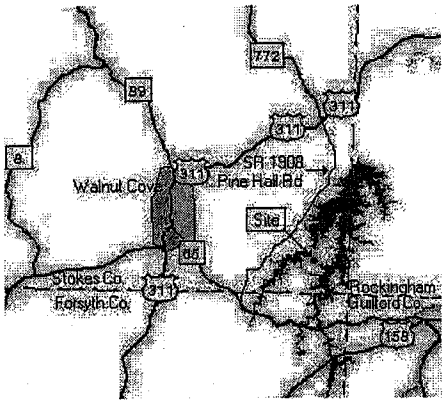
5. SAND/GRAVEL PACK:

	Depth			Size	Material
From	12.5	To 28.8	Ft.		Filter Sand #2
From		To	Ft.		

6. REMARKS: Monitor Well Number BC-9

LOCATION SKETCH

Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common names.



I DO HERE BY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

Michael A Mosely 4-7-03

SIGNATURE OF PERSON CONSTRUCTING THE WELL DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days. GW-1 REV. 07/2001

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) Earl Mosely **CERTIFICATION #** 2252

WELL CONTRACTOR COMPANY NAME S&ME, Inc. **PHONE #** 919-872-2660

STATE WELL CONSTRUCTION PERMIT# (if applicable) **ASSOCIATED WQ PERMIT#** (if applicable)

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultral ☐ Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use

2. WELL LOCATION:
earest Town Walnut Cove County Stokes
SR 1908 (Pine Hall Road) - Duke Power Belews Creek Steam Station
(Street Name, Numbers, Community, Sudivision, Lot No.,Zip Code)

Topographic/Land setting
☐ Ridge ☐ Slope ☒ Valley ☐ Flat
(check appropriate box)

Latitude/longitude of well location
(degrees/minutes/seconds)

Latitude/longitude scource: ☐GPS ☐Topographic Map
(check box)

3. OWNER: Duke Power - Belews Creek Steam Station
Address 3195 Pine Hall Road
(Street or Route No.)
Belews Creek NC 27009
City or Town State Zip Code
336-427-0274
Area code - Phone Number

4. DATE DRILLED 11/20/2002
5. TOTAL DEPTH 47.5
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: 30.44 ft.
(Use "+" if Above Top of Casing)
8. TOP OF CASING IS 2.23 FT. Above Land Surface*
*Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.
9. YIELD (gpm) METHOD OF TEST
0. WATER ZONES (depth):

DEPTH From	DEPTH To	DRILLING LOG Formation Descrpition
	0 -- 7.5	tan/brn sandy silt
	7.5 -- 13.5	brown/orange silty sand w/
		qtz. Fragments
	13.5 -- 18.5	brn/orange silt
	18.5 -- 23	lt. brn sand w/ rock frgmnts
	23 -- 25	quartzite (PWR)
	25 -- 27.5	red/brn silty sand
	27.5 -- 38.5	brn/gray mica schist (PWR)
	38.5 -- 47.5	mica schist weathered rock

1. DISINFECTION: Type NA Amount
2. CASING:

	Depth		Diameter		Wall Thickness or Weight/Ft.	Material
From 0	To 31.12	Ft.	2	in.	Schedule 40	PVC
From	To	Ft.				
From	To	Ft.				

3. GROUT:

	Depth		Material	Method
From 0	To 26.5	Ft.	Cement	Grout
From 26.5	To 30.5	Ft.	Bentonite	Chips

4. SCREEN:

	Depth		Diameter		Slot Size		Material
From 31.12	To 46.12	Ft.	2	in.	0.01	in.	PVC
From	To	Ft.		in.		in.	

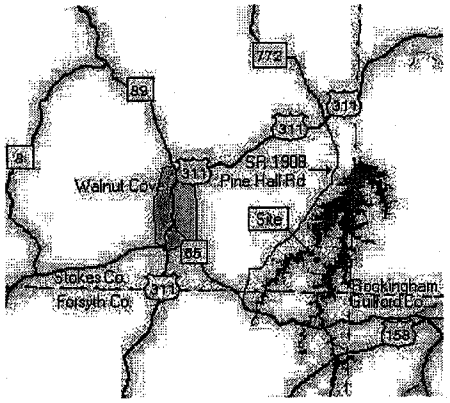
5. SAND/GRAVEL PACK:

	Depth		Size	Material
From 30.5	To 47.5	Ft.		Filter Sand #2
From	To	Ft.		

6. REMARKS: Monitor Well Number BC-10

LOCATION SKETCH

Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common names.



I DO HERE BY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

Earl Mosely 4-9-03

SIGNATURE OF PERSON CONSTRUCTING THE WELL DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) Micheal Mosely **CERTIFICATION #** 3210

WELL CONTRACTOR COMPANY NAME S&ME, Inc. **PHONE #** 919-872-2660

STATE WELL CONSTRUCTION PERMIT# (if applicable) _____ **ASSOCIATED WQ PERMIT#** (if applicable) _____

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultral ☐
   Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use _____
2. WELL LOCATION:
   earest Town Walnut Cove County Stokes
   SR 1908 (Pine Hall Road) - Duke Power Belews Creek Steam Station
   (Street Name, Numbers, Community, Sudivision, Lot No.,Zip Code)

   Topographic/Land setting
   ☐ Ridge ☐ Slope ☒ Valley ☐ Flat
   (check appropriate box)

   Latitude/longitude of well location
   _____
   (degrees/minutes/seconds)

   Latitude/longitude scource: ☐GPS ☐Topographic Map
   (check box)
3. OWNER: Duke Power - Belews Creek Steam Station
   Address 3195 Pine Hall Road
   (Street or Route No.)
   Belews Creek NC 27009
   City or Town State Zip Code
   336-427-0274
   Area code - Phone Number
4. DATE DRILLED 11/21/2002
5. TOTAL DEPTH 67.9
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: 42.72 ft.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 1.7 FT. Above Land Surface*
   ***Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.**
9. YIELD (gpm _____ METHOD OF TEST _____
0. WATER ZONES (depth): _____

DEPTH From	DEPTH To	DRILLING LOG Formation Descrpition
0	13.75	brn clayey silt w/ organics
		and small gravel
13.75	14.5	mica schist (PWR)
14.5	33.5	orange silty sand (saprolite)
33.5	38.5	tan/yellow silt
38.5	67.9	mica schist (PWR) w/ some
		quartzite fragments.

1. DISINFECTION: Type NA Amount _____
2. CASING:

	Depth			Diameter		Wall Thickness or Weight/Ft.	Material
From	0	To 51.45	Ft.	2	in.	Schedule 40	PVC
From		To	Ft.				
From		To	Ft.				

3. GROUT:

	Depth			Material	Method
From	0	To 41	Ft.	Cement	Grout
From	41	To 47	Ft.	Bentonite	Chips

4. SCREEN:

	Depth			Diameter		Slot Size		Material
From	51.45	To 66.45	Ft.	2	in.	0.01	in.	PVC
From		To	Ft.		in.		in.	

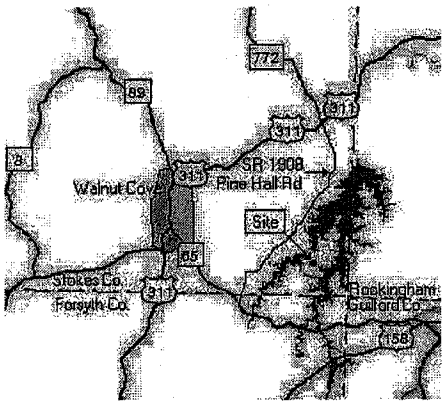
5. SAND/GRAVEL PACK:

	Depth			Size	Material
From	47	To 67.9	Ft.		Filter Sand #2
From		To	Ft.		

6. REMARKS: Monitor Well Number BC-11

LOCATION SKETCH

Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common names.



I DO HERE BY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

Micheal G Mosely 4-7-03

SIGNATURE OF PERSON CONSTRUCTING THE WELL DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days. GW-1 REV. 07/2001

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print): Earl Mosely — CERTIFICATION #: 2252

WELL CONTRACTOR COMPANY NAME: S&ME, Inc. — PHONE #: 919-872-2660

STATE WELL CONSTRUCTION PERMIT# (if applicable): — ASSOCIATED WQ PERMIT# (if applicable):

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultral ☐
   Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use: _____
2. WELL LOCATION:
   earest Town: Walnut Cove — County: Stokes
   SR 1908 (Pine Hall Road) - Duke Power Belews Creek Steam Station
   (Street Name, Numbers, Community, Sudivision, Lot No.,Zip Code)

   Topographic/Land setting
   ☐ Ridge ☐ Slope ☒ Valley ☐ Flat
   (check appropriate box)

   Latitude/longitude of well location _____
   (degrees/minutes/seconds)

   Latitude/longitude scource: ☐GPS ☐Topographic Map
   (check box)
3. OWNER: Duke Power - Belews Creek Steam Station
   Address: 3195 Pine Hall Road
   (Street or Route No.)
   Belews Creek — NC — 27009
   City or Town — State — Zip Code
   336-427-0274
   Area code - Phone Number
4. DATE DRILLED: 11/13/2002
5. TOTAL DEPTH: 76.8
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: 57.96 ft.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 1.71 FT. Above Land Surface*
   *Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.
9. YIELD (gpm): _____ METHOD OF TEST: _____
0. WATER ZONES (depth): _____

DEPTH From	DEPTH To	DRILLING LOG Formation Descrpition
	0 -- 35	brn silt and sand (saprolite)
	35 -- 62.8	brn/gray qtzite fragments
		w/ sand and silt.
	62.8 -- 76.8	gray qtz-feldspar gneiss

1. DISINFECTION: Type: NA — Amount: _____
2. CASING:

	Depth			Diameter		Wall Thickness or Weight/Ft.	Material
From	0	To 61.09	Ft.	2	in.	Schedule 40	PVC
From		To	Ft.				
From		To	Ft.				

3. GROUT:

	Depth			Material	Method
From	0	To 56.5	Ft.	Cement	Grout
From	56.5	To 60	Ft.	Bentonite	Chips

4. SCREEN:

	Depth			Diameter		Slot Size		Material
From	61.09	To 76.09	Ft.	2	in.	0.01	in.	PVC
From		To	Ft.		in.		in.	

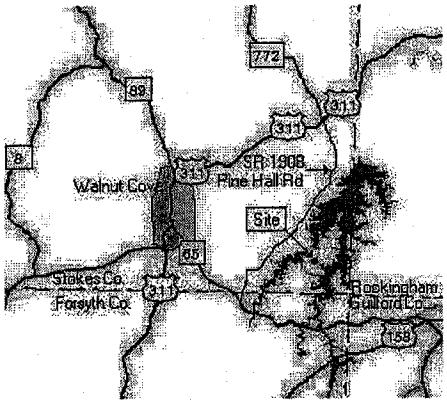
5. SAND/GRAVEL PACK:

	Depth			Size	Material
From	60	To 76.8	Ft.		Filter Sand #2
From		To	Ft.		

6. REMARKS: Monitor Well Number BC-12

LOCATION SKETCH

Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common names.



I DO HERE BY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

Earl Mosely — 4-9-03

SIGNATURE OF PERSON CONSTRUCTING THE WELL — DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) Micheal Mosely **CERTIFICATION #** 3210

WELL CONTRACTOR COMPANY NAME S&ME, Inc. **PHONE #** 919-872-2660

STATE WELL CONSTRUCTION PERMIT# (if applicable) _____ **ASSOCIATED WQ PERMIT#** (if applicable) _____

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultral ☐
   Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use _____
2. WELL LOCATION:
   Nearest Town: Walnut Cove County Stokes
   SR 1908 (Pine Hall Road) - Duke Power Belews Creek Steam Station
   (Street Name, Numbers, Community, Sudivision, Lot No.,Zip Code)

   Topographic/Land setting
   ☐ Ridge ☐ Slope ☒ Valley ☐ Flat
   (check appropriate box)
   Latitude/longitude of well location _____
   (degrees/minutes/seconds)
   Latitude/longitude scource: ☐GPS ☐Topographic Map
   (check box)
3. OWNER: Duke Power - Belews Creek Steam Station
   Address 3195 Pine Hall Road
   (Street or Route No.)
   Belews Creek NC 27009
   City or Town State Zip Code
   336-427-0274
   Area code - Phone Number
4. DATE DRILLED 11/5/02
5. TOTAL DEPTH 45
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: – ft.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 1.5 FT. Above Land Surface*
   ***Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.**
9. YIELD (gpm) _____ METHOD OF TEST _____
10. WATER ZONES (depth): _____
11. DISINFECTION: Type NA Amount _____
12. CASING:

	Depth			Diameter		Wall Thickness or Weight/Ft.	Material
From	0	To 25	Ft.	40.8	in.	Schedule 40	PVC
From		To	Ft.				
From		To	Ft.				

13. GROUT:

	Depth			Material	Method
From	0	To 18	Ft.	Cement	Grout
From	18	To 22	Ft.	Bentonite	Chips

14. SCREEN:

	Depth			Diameter		Slot Size		Material
From	25	To 43.3	Ft.	2	in.	0.01	in.	PVC
From		To	Ft.		in.		in.	

15. SAND/GRAVEL PACK:

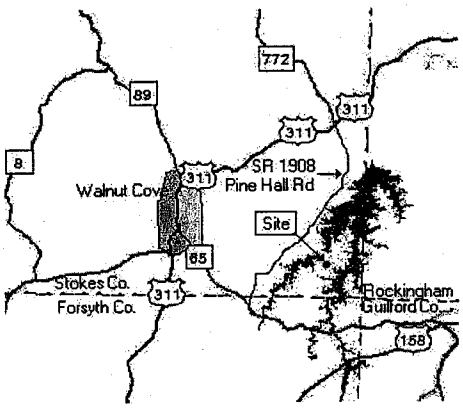
	Depth			Size	Material
From	22	To 45	Ft.		Filter Sand #2
From		To	Ft.		

16. REMARKS: Monitor Well Number BC-13

DEPTH From	DEPTH To	DRILLING LOG Formation Descrpition
0	8.5	red/brn clayey silt
8.5	13.5	red/brn silt
13.5	25	orange sandy silt
25	45	gray/brn calc-silicate gneiss and schist w/ sandy silt

LOCATION SKETCH

Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common names.



I DO HERE BY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

Micheal A Mosely 4-7-03

SIGNATURE OF PERSON CONSTRUCTING THE WELL DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) Earl Mosely **CERTIFICATION #** 2252

WELL CONTRACTOR COMPANY NAME S&ME, Inc. **PHONE #** 919-872-2660

STATE WELL CONSTRUCTION PERMIT# (if applicable) _____ **ASSOCIATED WQ PERMIT#** (if applicable) _____

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultral ☐
   Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use _____
2. WELL LOCATION:
   Nearest Town: Walnut Cove County Stokes
   SR 1908 (Pine Hall Road) - Duke Power Belews Creek Steam Station
   (Street Name, Numbers, Community, Sudivision, Lot No.,Zip Code)

   Topographic/Land setting
   ☐ Ridge ☐ Slope ☒ Valley ☐ Flat
   (check appropriate box)
   Latitude/longitude of well location _____
   (degrees/minutes/seconds)
   Latitude/longitude scource: ☐GPS ☐Topographic Map
   (check box)
3. OWNER: Duke Power - Belews Creek Steam Station
   Address 3195 Pine Hall Road
   (Street or Route No.)
   Belews Creek NC 27009
   City or Town State Zip Code
   336-427-0274
   Area code - Phone Number
4. DATE DRILLED 11/11/02
5. TOTAL DEPTH 31.4
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: 17.79 ft.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 1.63 FT. Above Land Surface*
   ***Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.**
9. YIELD (gpm) _____ METHOD OF TEST _____
10. WATER ZONES (depth): _____

DEPTH From	DEPTH To	DRILLING LOG Formation Descrpition
0	8.5	orange/brn silt and sand
8.5	21.8	orange weathered rock
		(gneissic saprolite)
21.8	25	gray qtz-feldspar gneiss

11. DISINFECTION: Type NA Amount _____
12. CASING:

	Depth		Diameter		Wall Thickness or Weight/Ft.	Material
From 0	To 16.4	Ft.	2	in.	Schedule 40	PVC
From _____	To _____	Ft.				
From _____	To _____	Ft.				

13. GROUT:

	Depth		Material	Method
From 0	To 12.4	Ft.	Cement	Grout
From 12.4	To 15.4	Ft.	Bentonite	Chips

14. SCREEN:

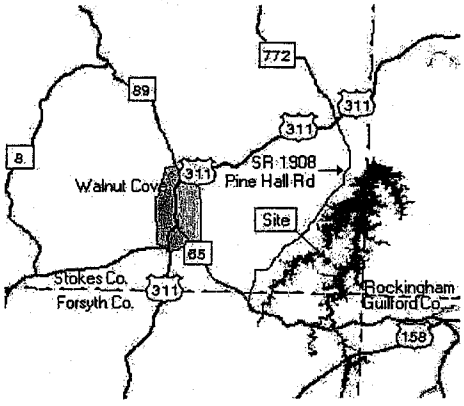
	Depth		Diameter		Slot Size		Material
From 16.4	To 31.02	Ft.	2	in.	0.01	in.	PVC
From _____	To _____	Ft.		in.		in.	

15. SAND/GRAVEL PACK:

	Depth		Size	Material
From 15.4	To 31.4	Ft.		Filter Sand #2
From _____	To _____	Ft.		

LOCATION SKETCH

Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common names.



16. REMARKS: Monitor Well Number BC-14

I DO HERE BY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

Earl Mosely 4-9-03

SIGNATURE OF PERSON CONSTRUCTING THE WELL DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print): Seth D. Low — CERTIFICATION #: 2254

WELL CONTRACTOR COMPANY NAME: S&ME, Inc. — PHONE #: 919-872-2660

STATE WELL CONSTRUCTION PERMIT# (if applicable): — ASSOCIATED WQ PERMIT# (if applicable):

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultral ☐
   Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use: _____

2. WELL LOCATION:
   Nearest Town: Walnut Cove County: Stokes
   SR 1908 (Pine Hall Road) - Duke Power Belews Creek Steam Station
   (Street Name, Numbers, Community, Sudivision, Lot No.,Zip Code)

   Topographic/Land setting
   ☐ Ridge ☐ Slope ☐ Valley ☐ Flat ☒
   (check appropriate box)
   Latitude/longitude of well location _____
   (degrees/minutes/seconds)
   Latitude/longitude scource: ☐GPS ☐Topographic Map
   (check box)

3. OWNER: Duke Power - Belews Creek Steam Station
   Address: 3195 Pine Hall Road
   (Street or Route No.)
   Belews Creek | NC | 27009
   City or Town | State | Zip Code
   336-427-0274
   Area code - Phone Number

4. DATE DRILLED: 9/22/2004
5. TOTAL DEPTH: 43.4
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: 26.14 ft.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 1.6 FT. Above Land Surface*
   ***Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.**
9. YIELD (gpm): _____ METHOD OF TEST: _____
10. WATER ZONES (depth): _____
11. DISINFECTION: Type: NA Amount: _____
12. CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From 0	To 28.4	Ft.	2 in.	Schedule	PVC
From	To	Ft.			
From	To	Ft.			

13. GROUT:

	Depth		Material	Method
From 0	To 24	Ft.	Cement	Grout
From 24	To 26	Ft.	Bentonite	Chips

14. SCREEN:

	Depth		Diameter	Slot Size	Material
From 28.4	To 43.4	Ft.	2 in.	0.01 in.	PVC
From	To	Ft.	in.	in.	

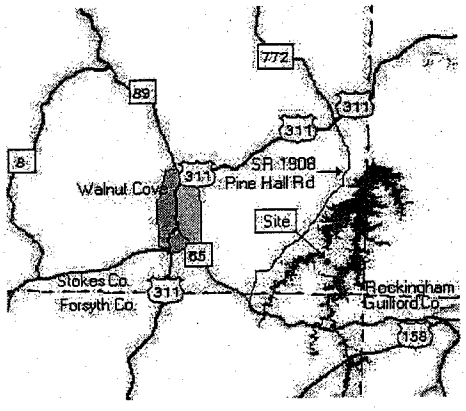
15. SAND/GRAVEL PACK:

	Depth		Size	Material
From 26	To 43.4	Ft.		Filter Sand #2
From	To	Ft.		

DEPTH From	To	DRILLING LOG Formation Description
0	13.5	Orange/brown sandy SILT
13.5	48.9	Brown silty sand Saprolite
48.9	56.8	Quartz Gneiss
56.8	61.8	Gray mica Schist

LOCATION SKETCH

Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common names.



16. REMARKS: Monitoring Well BC-15

I DO HERE BY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

Seth D. Low — 10-04-04

SIGNATURE OF PERSON CONSTRUCTING THE WELL — DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print): Seth D. Low — CERTIFICATION #: 2254

WELL CONTRACTOR COMPANY NAME: S&ME, Inc. — PHONE #: 919-872-2660

STATE WELL CONSTRUCTION PERMIT# (if applicable): _____ — ASSOCIATED WQ PERMIT# (if applicable): _____

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultral ☐
   Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use _____

2. WELL LOCATION:
   Nearest Town: Walnut Cove County Stokes
   SR 1908 (Pine Hall Road) - Duke Power Belews Creek Steam Station
   (Street Name, Numbers, Community, Sudivision, Lot No.,Zip Code)

   Topographic/Land setting
   ☐ Ridge ☐ Slope ☐ Valley ☐ Flat ☒
   (check appropriate box)
   Latitude/longitude of well location _____
   (degrees/minutes/seconds)
   Latitude/longitude scource: ☐GPS ☐Topographic Map
   (check box)

3. OWNER: Duke Power - Belews Creek Steam Station
   Address: 3195 Pine Hall Road
   (Street or Route No.)
   Belews Creek | NC | 27009
   City or Town | State | Zip Code
   336-427-0274
   Area code - Phone Number

4. DATE DRILLED: 9/18/2004
5. TOTAL DEPTH: 106
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: 73.8 ft.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 2 FT. Above Land Surface*
   ***Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.**
9. YIELD (gpm) _____ METHOD OF TEST _____
10. WATER ZONES (depth): _____
11. DISINFECTION: Type NA Amount _____
12. CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From 0	To 96	Ft.	1 in.	Schedule	PVC
From _____	To _____	Ft.	_____	_____	_____
From _____	To _____	Ft.	_____	_____	_____

13. GROUT:

	Depth		Material	Method
From 0	To 90.5	Ft.	Cement	Grout
From 90.5	To 93	Ft.	Bentonite	Chips

14. SCREEN:

	Depth		Diameter	Slot Size	Material
From 96	To 106	Ft.	_____ in.	0.01 in.	PVC
From _____	To _____	Ft.	_____ in.	_____ in.	_____

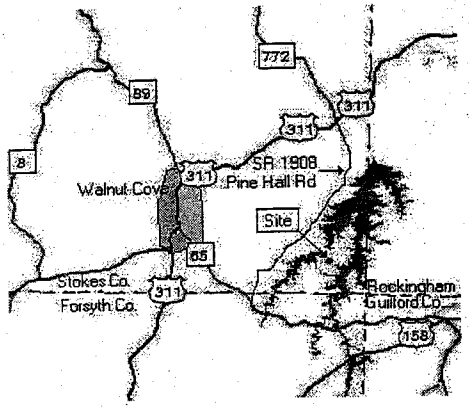
15. SAND/GRAVEL PACK:

	Depth		Size	Material
From 93	To 106	Ft.	_____	Filter Sand #2
From _____	To _____	Ft.	_____	_____

DEPTH From	DEPTH To	DRILLING LOG Formation Description
0	23.5	Brown sandy Silt
23.5	28.5	Pink/brown silt Saprolite
28.5	48.5	Tan silt Saprolite
48.5	68.3	Tan Sand PWR
68.3	106.4	Quartz Gneiss (crystalline rock)

LOCATION SKETCH

Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common names.



16. REMARKS: Monitoring Well BC-16

I DO HERE BY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

Seth D. Low — SIGNATURE OF PERSON CONSTRUCTING THE WELL

10-04-04 — DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) Michael Mosely **CERTIFICATION #** 3210

WELL CONTRACTOR COMPANY NAME S&ME, Inc. **PHONE #** 919-872-2660

STATE WELL CONSTRUCTION PERMIT# (if applicable) _____ **ASSOCIATED WQ PERMIT#** (if applicable) _____

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultral ☐
   Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use _____

2. WELL LOCATION:
   Nearest Town: Walnut Cove County Stokes
   SR 1908 (Pine Hall Road) - Duke Power Belews Creek Steam Station
   (Street Name, Numbers, Community, Sudivision, Lot No.,Zip Code)

   Topographic/Land setting
   ☐ Ridge ☐ Slope ☐ Valley ☐ Flat ☒
   (check appropriate box)
   Latitude/longitude of well location _____
   (degrees/minutes/seconds)
   Latitude/longitude scource: ☐GPS ☐Topographic Map
   (check box)

3. OWNER: Duke Power - Belews Creek Steam Station
   Address 3195 Pine Hall Road
   (Street or Route No.)
   Belews Creek NC 27009
   City or Town State Zip Code
   336-427-0274
   Area code - Phone Number

4. DATE DRILLED 9/2/2004
5. TOTAL DEPTH 70.8
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: 58 ft.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 2 FT. Above Land Surface*
   ***Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.**
9. YIELD (gpm) _____ METHOD OF TEST _____
10. WATER ZONES (depth): _____
11. DISINFECTION: Type NA Amount _____
12. CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From 0	To 60.8	Ft.	1 in.	Schedule 40	PVC
From _____	To _____	Ft.			
From _____	To _____	Ft.			

13. GROUT:

	Depth		Material	Method
From 0	To 47.5	Ft.	Cement	Grout
From 47.5	To 49	Ft.	Bentonite	Chips

14. SCREEN:

	Depth		Diameter	Slot Size	Material
From 60.8	To 70.8	Ft.	1 in.	0.01 in.	PVC
From _____	To _____	Ft.	_____ in.	_____ in.	

15. SAND/GRAVEL PACK:

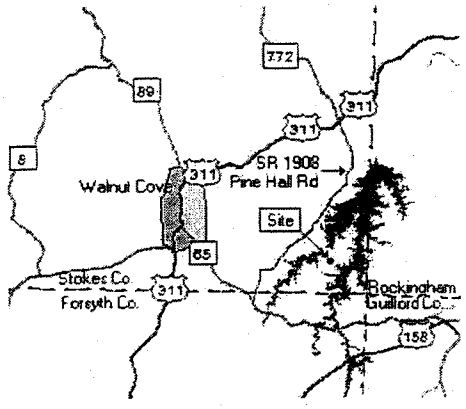
	Depth		Size	Material
From 49	To 70.8	Ft.		Filter Sand #2
From _____	To _____	Ft.		

16. REMARKS: Monitor Well Number BC-17

DEPTH From	DEPTH To	DRILLING LOG Formation Descrpition
0	38.9	Tan/yellow sandy silt
38.9	39.9	quartz rock layer (PWR)
39.9	43.9	tan/orange sandy silt
43.9	48.9	tan/white silty sand
48.9	56.1	quartz gneiss (crystalline rock)
56.1	70.9	mica schist (crystalline rock)

LOCATION SKETCH

Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common names.



I DO HERE BY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

Michael Mosely 9-17-04

SIGNATURE OF PERSON CONSTRUCTING THE WELL DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) Michael Mosely **CERTIFICATION #** 3210

WELL CONTRACTOR COMPANY NAME S&ME, Inc. **PHONE #** 919-872-2660

STATE WELL CONSTRUCTION PERMIT# (if applicable) _____ **ASSOCIATED WQ PERMIT#** (if applicable) _____

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultral ☐
   Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use _____

2. WELL LOCATION:
   Nearest Town: Walnut Cove County Stokes
   SR 1908 (Pine Hall Road) - Duke Power Belews Creek Steam Station
   (Street Name, Numbers, Community, Sudivision, Lot No.,Zip Code)

   Topographic/Land setting
   ☐ Ridge ☐ Slope ☐ Valley ☐ Flat ☒
   (check appropriate box)
   Latitude/longitude of well location _____
   (degrees/minutes/seconds)
   Latitude/longitude source: ☐GPS ☐Topographic Map
   (check box)

3. OWNER: Duke Power - Belews Creek Steam Station
   Address 3195 Pine Hall Road
   (Street or Route No.)
   Belews Creek NC 27009
   City or Town State Zip Code
   336-427-0274
   Area code - Phone Number

4. DATE DRILLED 8/30/2004
5. TOTAL DEPTH 37.8
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: 24.6 ft.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 2.2 FT. Above Land Surface*
   ***Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.**
9. YIELD (gpm) _____ METHOD OF TEST _____
10. WATER ZONES (depth): _____

DEPTH From	DEPTH To	DRILLING LOG Formation Description
0	8.5	brown sandy silt
8.5	9.5	brown silty sand
9.5	38.3	PWR: sampled as silty fine sand

11. DISINFECTION: Type NA Amount _____
12. CASING:

	Depth		Diameter		Wall Thickness or Weight/Ft.	Material
From 0	To 27.8	Ft.	2	in.	Schedule 40	PVC
From _____	To _____	Ft.	_____		_____	_____
From _____	To _____	Ft.	_____		_____	_____

13. GROUT:

	Depth		Material	Method
From 0	To 22	Ft.	Cement	Grout
From 22	To 25.5	Ft.	Bentonite	Chips

14. SCREEN:

	Depth		Diameter		Slot Size		Material
From 27.8	To 37.8	Ft.	2	in.	0.01	in.	PVC
From _____	To _____	Ft.	_____	in.	_____	in.	_____

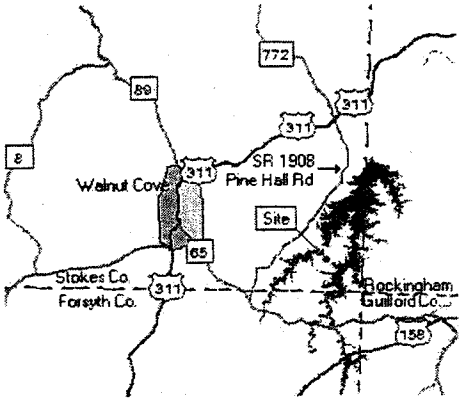
15. SAND/GRAVEL PACK:

	Depth		Size	Material
From 25.5	To 37.8	Ft.	_____	Filter Sand #2
From _____	To _____	Ft.	_____	_____

16. REMARKS: Monitor Well Number BC-18

LOCATION SKETCH

Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common names.



I DO HERE BY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

Michael J. Mosely 9-17-04

SIGNATURE OF PERSON CONSTRUCTING THE WELL DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print): Seth D. Low — CERTIFICATION #: 2254

WELL CONTRACTOR COMPANY NAME: S&ME, Inc. — PHONE #: 919-872-2660

STATE WELL CONSTRUCTION PERMIT# (if applicable): _____ — ASSOCIATED WQ PERMIT# (if applicable): _____

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultral ☐
   Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use _____

2. WELL LOCATION:
   Nearest Town: Walnut Cove County Stokes
   SR 1908 (Pine Hall Road) - Duke Power Belews Creek Steam Station
   (Street Name, Numbers, Community, Subdivision, Lot No.,Zip Code)

   Topographic/Land setting
   ☐ Ridge ☒ Slope ☐ Valley ☐ Flat ☐
   (check appropriate box)

   Latitude/longitude of well location _____
   (degrees/minutes/seconds)
   Latitude/longitude scource: ☐GPS ☐Topographic Map
   (check box)

3. OWNER: Duke Power - Belews Creek Steam Station
   Address: 3195 Pine Hall Road
   (Street or Route No.)
   Belews Creek | NC | 27009
   City or Town | State | Zip Code
   336-427-0274
   Area code - Phone Number

4. DATE DRILLED 9/21/2004
5. TOTAL DEPTH 56
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: 39 ft.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 2 FT. Above Land Surface*
   ***Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.**
9. YIELD (gpm) _____ METHOD OF TEST _____
10. WATER ZONES (depth): _____
11. DISINFECTION: Type NA Amount _____
12. CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From 0	To 46	Ft.	1 in.	Schedule	PVC
From _____	To _____	Ft.	_____	_____	_____
From _____	To _____	Ft.	_____	_____	_____

13. GROUT:

	Depth		Material	Method
From 0	To 41	Ft.	Cement	Grout
From 41	To 42.6	Ft.	Bentonite	Chips

14. SCREEN:

	Depth		Diameter	Slot Size	Material
From 46	To 56	Ft.	_____ in.	0.01 in.	PVC
From _____	To _____	Ft.	_____ in.	_____ in.	_____

15. SAND/GRAVEL PACK:

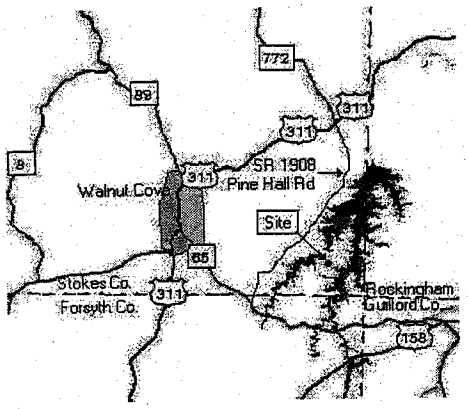
	Depth		Size	Material
From 42.6	To 56	Ft.	_____	Filter Sand #2
From _____	To _____	Ft.	_____	_____

DEPTH / DRILLING LOG

From	To	Formation Descrpition
0	23.5	Yellow/orange sandy Silt
23.5	39	Brown sand Saprolite
39	57.2	Brown/Gray PWR

LOCATION SKETCH

Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common names.



16. REMARKS: Monitoring Well BC-19

I DO HERE BY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

Seth D. Low — 10-04-04

SIGNATURE OF PERSON CONSTRUCTING THE WELL — DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) Michael Mosely **CERTIFICATION #** 3210

WELL CONTRACTOR COMPANY NAME S&ME, Inc. **PHONE #** 919-872-2660

STATE WELL CONSTRUCTION PERMIT# (if applicable) _____ **ASSOCIATED WQ PERMIT#** (if applicable) _____

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultral ☐
   Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use _____

2. WELL LOCATION:
   Nearest Town: Walnut Cove County Stokes
   SR 1908 (Pine Hall Road) - Duke Power Belews Creek Steam Station
   (Street Name, Numbers, Community, Sudivision, Lot No.,Zip Code)

   Topographic/Land setting
   ☐ Ridge ☐ Slope ☐ Valley ☐ Flat ☒
   (check appropriate box)

   Latitude/longitude of well location _____
   (degrees/minutes/seconds)
   Latitude/longitude source: ☐GPS ☐Topographic Map
   (check box)

3. OWNER: Duke Power - Belews Creek Steam Station
   Address 3195 Pine Hall Road
   (Street or Route No.)
   Belews Creek NC 27009
   City or Town State Zip Code
   336-427-0274
   Area code - Phone Number

4. DATE DRILLED 8/31/2004
5. TOTAL DEPTH 21.6
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: 14.6 ft.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 3.4 FT. Above Land Surface*
   ***Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.**
9. YIELD (gpm) _____ METHOD OF TEST _____
10. WATER ZONES (depth): _____

DEPTH From	To	DRILLING LOG Formation Descrpition
0	13.5	orange/brn sandy silt
13.5	21.9	PWR: sampled as silty sand
		and sandy silt
21.9	34.4	quartz gneiss

11. DISINFECTION: Type NA Amount _____
12. CASING:

	Depth			Diameter		Wall Thickness or Weight/Ft.	Material
From	0	To	11.6 Ft.	2	in.	Schedule 40	PVC
From		To	Ft.				
From		To	Ft.				

13. GROUT:

	Depth			Material	Method
From	0	To	7.3 Ft.	Cement	Grout
From	7.3	To	9.6 Ft.	Bentonite	Chips

14. SCREEN:

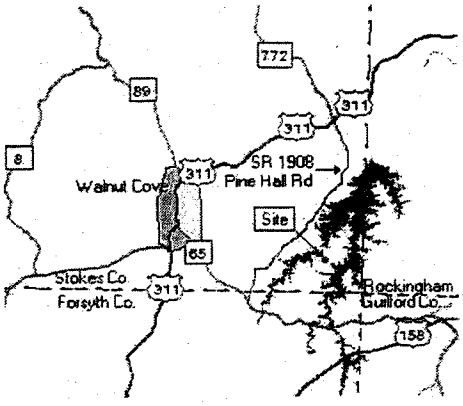
	Depth			Diameter		Slot Size		Material
From	11.6	To	21.6 Ft.	2	in.	0.01	in.	PVC
From		To	Ft.		in.		in.	

15. SAND/GRAVEL PACK:

	Depth			Size	Material
From	9.6	To	21.6 Ft.		Filter Sand #2
From		To	Ft.		

LOCATION SKETCH

Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common names.



16. REMARKS: Monitor Well Number BC-20

I DO HERE BY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

Michael S Mosely 9-17-04

SIGNATURE OF PERSON CONSTRUCTING THE WELL DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) Michael Mosely **CERTIFICATION #** 3210

WELL CONTRACTOR COMPANY NAME S&ME, Inc. **PHONE #** 919-872-2660

STATE WELL CONSTRUCTION PERMIT# (if applicable) _____ **ASSOCIATED WQ PERMIT#** (if applicable) _____

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultral ☐
   Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use _____
2. WELL LOCATION:
   Nearest Town: Walnut Cove County Stokes
   SR 1908 (Pine Hall Road) - Duke Power Belews Creek Steam Station
   (Street Name, Numbers, Community, Sudivision, Lot No.,Zip Code)

   Topographic/Land setting
   ☐ Ridge ☐ Slope ☐ Valley ☐ Flat ☒
   (check appropriate box)
   Latitude/longitude of well location
   _____
   (degrees/minutes/seconds)
   Latitude/longitude scource: ☐GPS ☐Topographic Map
   (check box)
3. OWNER: Duke Power - Belews Creek Steam Station
   Address 3195 Pine Hall Road
   (Street or Route No.)
   Belews Creek NC 27009
   City or Town State Zip Code
   336-427-0274
   Area code - Phone Number
4. DATE DRILLED 9/1/2004
5. TOTAL DEPTH 13.9
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: 8.8 ft.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 1.1 FT. Above Land Surface*
   ***Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.**
9. YIELD (gpm) _____ METHOD OF TEST _____
10. WATER ZONES (depth): _____
11. DISINFECTION: Type NA Amount _____
12. CASING:

	Depth		Diameter		Wall Thickness or Weight/Ft.	Material
From	0	To 3.9 Ft.	2	in.	Schedule	PVC
From		To Ft.				
From		To Ft.				

13. GROUT:

	Depth		Material	Method
From	0	To 1.3 Ft.	Cement	Grout
From	1.3	To 3 Ft.	Bentonite	Chips

14. SCREEN:

	Depth		Diameter		Slot Size		Material
From	3.9	To 13.9 Ft.	2	in.	0.01	in.	PVC
From		To Ft.		in.		in.	

15. SAND/GRAVEL PACK:

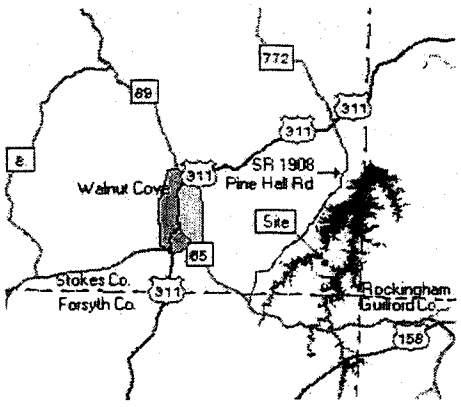
	Depth		Size	Material
From	3	To 13.9 Ft.		Filter Sand #2
From		To Ft.		

16. REMARKS: Monitor Well Number BC-21

DEPTH From	DEPTH To	DRILLING LOG Formation Descrpition
0	13.7	tan/oragne silty sand
13.7	35.2	PWR: sampled as silty sand
35.2	44.6	quartz gneiss (crystalline rock)

LOCATION SKETCH

Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common names.



I DO HERE BY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C. WELL CONSTRUCTION STANDARDS AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

Michael Mosely 9-17-04

SIGNATURE OF PERSON CONSTRUCTING THE WELL DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print): Seth D. Low — CERTIFICATION #: 2254

WELL CONTRACTOR COMPANY NAME: S&ME, Inc. — PHONE #: 919-872-2660

STATE WELL CONSTRUCTION PERMIT# (if applicable): — ASSOCIATED WQ PERMIT# (if applicable):

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultral ☐
   Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use: _____

2. WELL LOCATION:
   Nearest Town: Walnut Cove County: Stokes
   SR 1908 (Pine Hall Road) - Duke Power Belews Creek Steam Station
   (Street Name, Numbers, Community, Sudivision, Lot No.,Zip Code)

   Topographic/Land setting
   ☐ Ridge ☐ Slope ☐ Valley ☐ Flat ☒
   (check appropriate box)
   Latitude/longitude of well location _____
   (degrees/minutes/seconds)
   Latitude/longitude scource: ☐GPS ☐Topographic Map
   (check box)

3. OWNER: Duke Power - Belews Creek Steam Station
   Address: 3195 Pine Hall Road
   (Street or Route No.)
   Belews Creek | NC | 27009
   City or Town | State | Zip Code
   336-427-0274
   Area code - Phone Number

DEPTH From	DEPTH To	DRILLING LOG Formation Description
0	13.5	Tan silty Sand
13.5	21.9	Gray/tan sand Saprolite
21.9	31.9	Gray Quartzite

4. DATE DRILLED: 9/10/2004
5. TOTAL DEPTH: 13
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: 1.5 ft.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 2 FT. Above Land Surface*
   *Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.
9. YIELD (gpm): _____ METHOD OF TEST: _____
10. WATER ZONES (depth): _____
11. DISINFECTION: Type: NA Amount: _____
12. CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From	0	To 3 Ft.	2 in.	Schedule	PVC
From		To Ft.			
From		To Ft.			

13. GROUT:

	Depth		Material	Method
From	0	To 1 Ft.	Cement	Grout
From	1	To 2 Ft.	Bentonite	Chips

14. SCREEN:

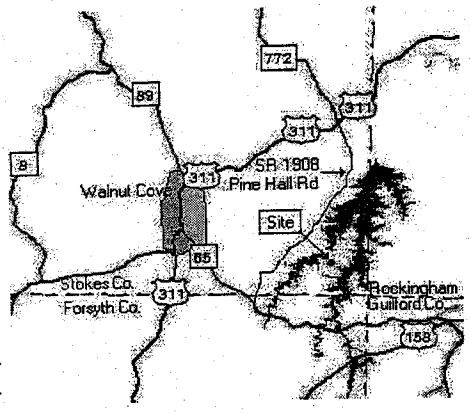
	Depth		Diameter	Slot Size	Material
From	3	To 13 Ft.	in.	0.01 in.	PVC
From		To Ft.	in.	in.	

15. SAND/GRAVEL PACK:

	Depth		Size	Material
From	2	To 13 Ft.		Filter Sand #2
From		To Ft.		

LOCATION SKETCH

Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common names.



16. REMARKS: Monitoring Well BC-22

I DO HERE BY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

Seth D. Low — 10-04-04

SIGNATURE OF PERSON CONSTRUCTING THE WELL — DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print): Seth D. Low — CERTIFICATION #: 2254

WELL CONTRACTOR COMPANY NAME: S&ME, Inc. — PHONE #: 919-872-2660

STATE WELL CONSTRUCTION PERMIT# (if applicable): — ASSOCIATED WQ PERMIT# (if applicable):

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultral ☐
   Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use: _____

2. WELL LOCATION:
   Nearest Town: Walnut Cove County: Stokes
   SR 1908 (Pine Hall Road) - Duke Power Belews Creek Steam Station
   (Street Name, Numbers, Community, Sudivision, Lot No.,Zip Code)

   Topographic/Land setting
   ☒ Ridge ☐ Slope ☐ Valley ☐ Flat q
   (check appropriate box)
   Latitude/longitude of well location _____
   (degrees/minutes/seconds)
   Latitude/longitude scource: ☐GPS ☐Topographic Map
   (check box)

3. OWNER: Duke Power - Belews Creek Steam Station
   Address: 3195 Pine Hall Road
   (Street or Route No.)
   Belews Creek | NC | 27009
   City or Town | State | Zip Code
   336-427-0274
   Area code - Phone Number

4. DATE DRILLED: 9/2/2004
5. TOTAL DEPTH: 101.7
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: 81.42 ft.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 2 FT. Above Land Surface*
   ***Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.**
9. YIELD (gpm): _____ METHOD OF TEST: _____
10. WATER ZONES (depth): _____
11. DISINFECTION: Type: NA Amount: _____
12. CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From 0	To 76.7 Ft.		2 in.	Schedule	PVC
From _____	To _____ Ft.		_____	_____	_____
From _____	To _____ Ft.		_____	_____	_____

13. GROUT:

	Depth		Material	Method
From 0	To 72.1 Ft.		Cement	Grout
From 72.1	To 74 Ft.		Bentonite	Chips

14. SCREEN:

	Depth		Diameter	Slot Size	Material
From 76.7	To 101.7 Ft.		2 in.	0.01 in.	PVC
From _____	To _____ Ft.		_____ in.	_____ in.	_____

15. SAND/GRAVEL PACK:

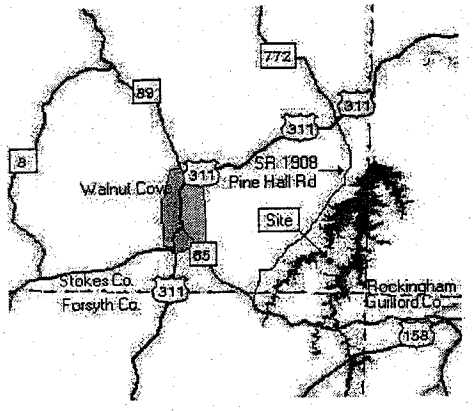
	Depth		Size	Material
From 74	To 101.7 Ft.		_____	Filter Sand #2
From _____	To _____ Ft.		_____	_____

DEPTH / DRILLING LOG

From	To	Formation Descrpition
0	23.5	Tan/orange sandy Silt
23.5	39	Brown fine sandy Saprolite
39	49	Pink/Red brown PWR
49	63.5	Olive gray silt Saprolite
63.5	84.6	Brown silty sand PWR
84.6	102.7	Quartz Gneiss (Crystaline rock)

LOCATION SKETCH

Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common names.



16. REMARKS: Monitoring Well Number BC-23A

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

Seth D. Low — 10-04-04

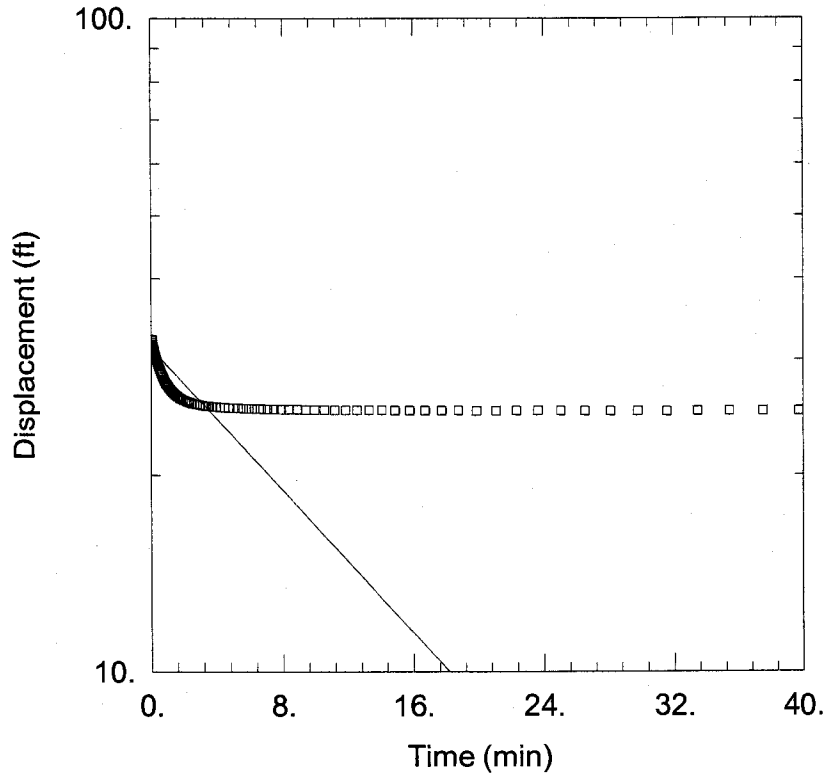
SIGNATURE OF PERSON CONSTRUCTING THE WELL — DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

APPENDIX V

HYDRAULIC CONDUCTIVITY TEST DATA



BC-2 TEST #1

Data Set: S:\...\BC-2#1rev.AQT
Date: 11/19/04 Time: 10:23:12

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Well: BC-2
Test Date: 12/10/02

AQUIFER DATA

Saturated Thickness: 80.78 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BC-2rev)

Initial Displacement: 7.23 ft
Total Well Penetration Depth: 25.31 ft
Casing Radius: 0.0835 ft
Static Water Column Height: 25.31 ft
Screen Length: 15. ft
Wellbore Radius: 0.3125 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 9.947E-5 cm/sec
y0 = 31.33 ft

Data Set: S:\Environ\JOB FILES\Other Branch Jobs\1264 Jobs\1264-02-576 Belews Scrubber LF\Slug Test Data
Title: BC-2 Test #1
Date: 11/19/04
Time: 10:23:17

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Date: 12/10/02
Test Well: BC-2

AQUIFER DATA

Saturated Thickness: 80.78 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : BC-2rev

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 7.23 ft
Static Water Column Height: 25.31 ft
Casing Radius: 0.0835 ft
Wellbore Radius: 0.3125 ft
Well Skin Radius: 0.3125 ft
Screen Length: 15. ft
Total Well Penetration Depth: 25.31 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.1849 ft
Gravel Pack Porosity: 0.3

No. of Observations: 124

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.005	31.07	1.168	27.07
0.01	30.66	1.238	26.94
0.015	31.19	1.311	26.82
0.02	31.03	1.39	26.69
0.025	31.44	1.473	26.58
0.03	31.02	1.561	26.46
0.035	31.66	1.655	26.36
0.04	32.3	1.753	26.26
0.045	31.57	1.858	26.16
0.05	31.52	1.968	26.07
0.055	31.68	2.085	25.99
0.06	31.74	2.21	25.92
0.065	31.8	2.341	25.85
0.07	31.98	2.481	25.78
0.075	31.5	2.63	25.72
0.08	31.7	2.786	25.67
0.0848	32.18	2.953	25.62
0.09	31.67	3.13	25.57
0.095	31.49	3.316	25.53
0.1	32.15	3.515	25.5

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.1058	31.38	3.725	25.47
0.112	31.18	3.946	25.44
0.1185	31.81	4.181	25.42
0.1255	31.51	4.43	25.39
0.1328	31.55	4.693	25.37
0.1407	31.49	4.973	25.35
0.149	31.42	5.27	25.33
0.1578	31.32	5.583	25.31
0.167	31.26	5.915	25.3
0.177	31.19	6.266	25.28
0.1875	31.11	6.64	25.27
0.1985	31.02	7.035	25.25
0.2102	30.93	7.453	25.24
0.2227	30.84	7.896	25.23
0.2358	30.75	8.366	25.22
0.2498	30.64	8.865	25.21
0.2647	30.55	9.391	25.2
0.2803	30.44	9.95	25.19
0.297	30.32	10.54	25.18
0.3147	30.22	11.17	25.18
0.3333	30.1	11.83	25.17
0.3532	29.98	12.53	25.16
0.3742	29.85	13.28	25.16
0.3963	29.73	14.07	25.15
0.4198	29.6	14.91	25.15
0.4447	29.47	15.79	25.14
0.4697	29.34	16.73	25.13
0.4963	29.21	17.72	25.13
0.5247	29.07	18.78	25.12
0.5547	28.93	19.89	25.12
0.5863	28.8	21.07	25.11
0.6213	28.65	22.32	25.11
0.6578	28.5	23.65	25.11
0.6963	28.36	25.05	25.1
0.738	28.21	26.54	25.09
0.7813	28.06	28.12	25.09
0.828	27.91	29.79	25.08
0.8763	27.77	31.55	25.08
0.928	27.63	33.43	25.08
0.983	27.48	35.41	25.08
1.041	27.34	37.51	25.07
1.103	27.21	39.74	25.07

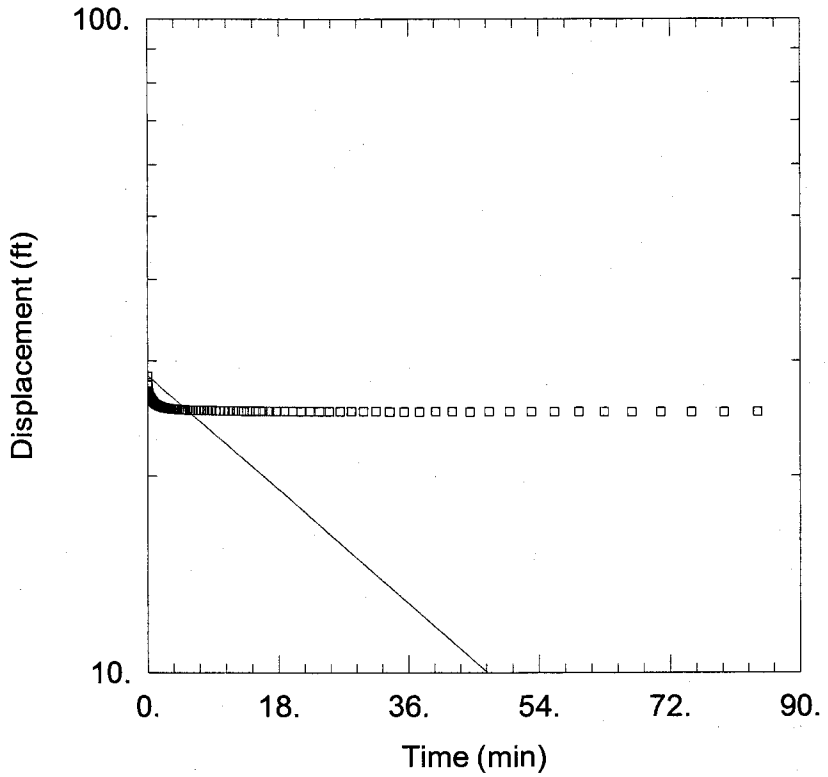
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.737

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	9.947E-5	cm/sec
y0	31.33	ft



BC-2 TEST #2

Data Set: S:\...\BC-2#2rev.AQT
Date: 11/18/04 Time: 16:12:23

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Well: BC-2
Test Date: 12/10/02

AQUIFER DATA

Saturated Thickness: 80.78 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BC-2)

Initial Displacement: 3.43 ft
Total Well Penetration Depth: 25.31 ft
Casing Radius: 0.0835 ft
Static Water Column Height: 25.31 ft
Screen Length: 15. ft
Wellbore Radius: 0.3125 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 3.53E-5 cm/sec y0 = 28.49 ft

Data Set: S:\Environ\JOB FILES\Other Branch Jobs\1264 Jobs\1264-02-576 Belews Scrubber LF\Slug Test Data
Title: BC-2 Test #2
Date: 11/18/04
Time: 16:12:33

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Date: 12/10/02
Test Well: BC-2

AQUIFER DATA

Saturated Thickness: 80.78 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : BC-2

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 3.43 ft
Static Water Column Height: 25.31 ft
Casing Radius: 0.0835 ft
Wellbore Radius: 0.3125 ft
Well Skin Radius: 0.3125 ft
Screen Length: 15. ft
Total Well Penetration Depth: 25.31 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.1849 ft
Gravel Pack Porosity: 0.3

No. of Observations: 117

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.01	28.41	3.13	25.35
0.04	27.78	3.316	25.34
0.05	27.52	3.515	25.32
0.1255	26.88	3.725	25.31
0.1328	26.85	3.946	25.29
0.1407	26.82	4.181	25.28
0.149	26.77	4.43	25.27
0.1578	26.73	4.693	25.26
0.167	26.72	4.973	25.25
0.177	26.69	5.27	25.24
0.1875	26.67	5.583	25.23
0.1985	26.64	5.915	25.23
0.2102	26.62	6.266	25.23
0.2227	26.59	6.64	25.22
0.2358	26.56	7.035	25.21
0.2498	26.54	7.453	25.2
0.2647	26.51	7.896	25.2
0.2803	26.48	8.366	25.19
0.297	26.46	8.865	25.18
0.3147	26.43	9.391	25.18

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.3333	26.41	9.95	25.17
0.3532	26.38	10.54	25.16
0.3742	26.35	11.17	25.16
0.3963	26.32	11.83	25.15
0.4198	26.29	12.53	25.15
0.4447	26.26	13.28	25.15
0.4697	26.23	14.07	25.14
0.4963	26.2	14.91	25.14
0.5247	26.18	15.79	25.13
0.5547	26.15	16.73	25.13
0.5863	26.12	17.72	25.13
0.6213	26.09	18.78	25.12
0.6578	26.06	19.89	25.12
0.6963	26.03	21.07	25.11
0.738	26.	22.32	25.11
0.7813	25.97	23.65	25.11
0.828	25.94	25.05	25.11
0.8763	25.9	26.54	25.1
0.928	25.88	28.12	25.1
0.983	25.84	29.79	25.09
1.041	25.81	31.55	25.09
1.103	25.78	33.43	25.09
1.168	25.75	35.41	25.09
1.238	25.72	37.51	25.08
1.311	25.69	39.74	25.08
1.39	25.66	42.1	25.08
1.473	25.63	44.6	25.08
1.561	25.61	47.24	25.07
1.655	25.58	50.05	25.07
1.753	25.56	53.01	25.07
1.858	25.53	56.16	25.07
1.968	25.51	59.49	25.07
2.085	25.48	63.02	25.06
2.21	25.46	66.76	25.06
2.341	25.44	70.72	25.06
2.481	25.42	74.91	25.06
2.63	25.4	79.35	25.06
2.786	25.38	84.06	25.06
2.953	25.36		

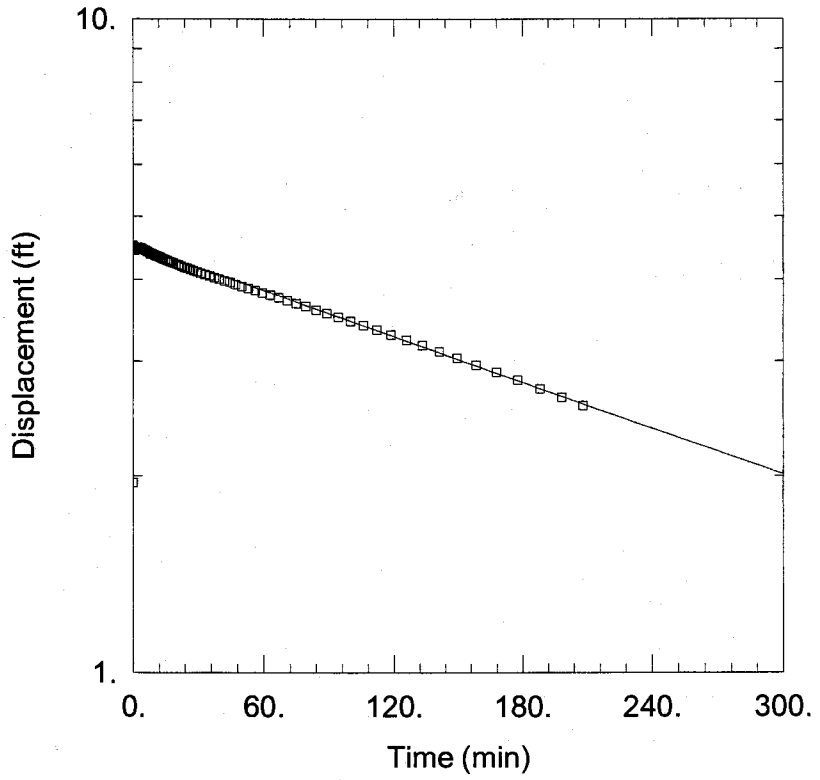
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.737

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	3.53E-5	cm/sec
y0	28.49	ft



BC-4 TEST #1

Data Set: S:\...\BC-4#1rev.AQT
Date: 11/18/04 Time: 16:27:56

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Well: BC-4
Test Date: 12/11/02

AQUIFER DATA

Saturated Thickness: 43.54 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BC-4)

Initial Displacement: 1.952 ft
Total Well Penetration Depth: 6.73 ft
Casing Radius: 0.0835 ft
Static Water Column Height: 6.73 ft
Screen Length: 15. ft
Wellbore Radius: 0.125 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 1.236E-6 cm/sec
y0 = 4.53 ft

Data Set: S:\Environ\JOB FILES\Other Branch Jobs\1264 Jobs\1264-02-576 Belews Scrubber LF\Slug Test Data
Title: BC-4 Test #1
Date: 11/18/04
Time: 16:28:03

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Date: 12/11/02
Test Well: BC-4

AQUIFER DATA

Saturated Thickness: 43.54 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : BC-4

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 1.952 ft
Static Water Column Height: 6.73 ft
Casing Radius: 0.0835 ft
Wellbore Radius: 0.125 ft
Well Skin Radius: 0.125 ft
Screen Length: 15. ft
Total Well Penetration Depth: 6.73 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.09782 ft
Gravel Pack Porosity: 0.3

No. of Observations: 153

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.005	4.516	2.786	4.481
0.01	4.513	2.953	4.478
0.015	4.507	3.13	4.477
0.02	4.504	3.316	4.475
0.025	4.499	3.515	4.471
0.03	4.495	3.725	4.469
0.035	4.492	3.946	4.464
0.04	4.489	4.181	4.461
0.045	4.483	4.43	4.458
0.05	4.482	4.693	4.453
0.055	4.479	4.973	4.449
0.06	4.476	5.27	4.443
0.065	4.473	5.583	4.437
0.07	4.472	5.915	4.433
0.075	4.469	6.266	4.425
0.08	4.468	6.64	4.418
0.0848	4.465	7.035	4.411
0.09	4.464	7.453	4.405
0.095	4.461	7.896	4.373
0.1	4.46	8.366	4.393

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.1058	4.459	8.865	4.381
0.112	4.456	9.391	4.374
0.1185	4.453	9.95	4.365
0.1255	4.45	10.54	4.355
0.1328	4.45	11.17	4.346
0.1407	4.448	11.83	4.336
0.149	4.445	12.53	4.326
0.1578	4.445	13.28	4.314
0.167	4.44	14.07	4.304
0.177	4.436	14.91	4.292
0.1875	4.437	15.79	4.279
0.1985	4.435	16.73	4.267
0.2102	4.436	17.72	4.254
0.2227	4.435	18.78	4.24
0.2358	4.434	19.89	4.227
0.2498	4.433	21.07	4.212
0.2647	4.432	22.32	4.195
0.2803	4.433	23.65	4.179
0.297	4.433	25.05	4.164
0.3147	4.433	26.54	4.145
0.3333	4.432	28.12	4.126
0.3532	4.432	29.79	4.11
0.3742	4.434	31.55	4.091
0.3963	4.435	33.43	4.072
0.4198	4.435	35.41	4.051
0.4447	4.435	37.51	4.03
0.4697	4.438	39.74	4.008
0.4963	4.438	42.1	3.985
0.5247	4.439	44.6	3.96
0.5547	4.441	47.24	3.935
0.5863	4.44	50.05	3.909
0.6213	4.443	53.01	3.88
0.6578	4.444	56.16	3.851
0.6963	4.447	59.49	3.821
0.738	4.448	63.02	3.788
0.7813	4.451	66.76	3.754
0.828	4.452	70.72	3.717
0.8763	4.454	74.91	3.68
0.928	4.457	79.35	3.64
0.983	4.458	84.06	3.597
1.041	4.461	89.05	3.553
1.103	4.464	94.33	3.506
1.168	4.466	99.92	3.456
1.238	4.467	105.8	3.405
1.311	4.47	112.1	3.352
1.39	4.471	118.8	3.294
1.473	4.472	125.8	3.235
1.561	4.475	133.3	3.172
1.655	4.478	141.2	3.106
1.753	4.478	149.5	3.037
1.858	4.478	158.4	2.962
1.968	4.478	167.8	2.887
2.085	4.481	177.7	2.805
2.21	4.48	188.3	2.72
2.341	4.48	198.3	2.641
2.481	4.481	208.3	2.564
2.63	4.481		

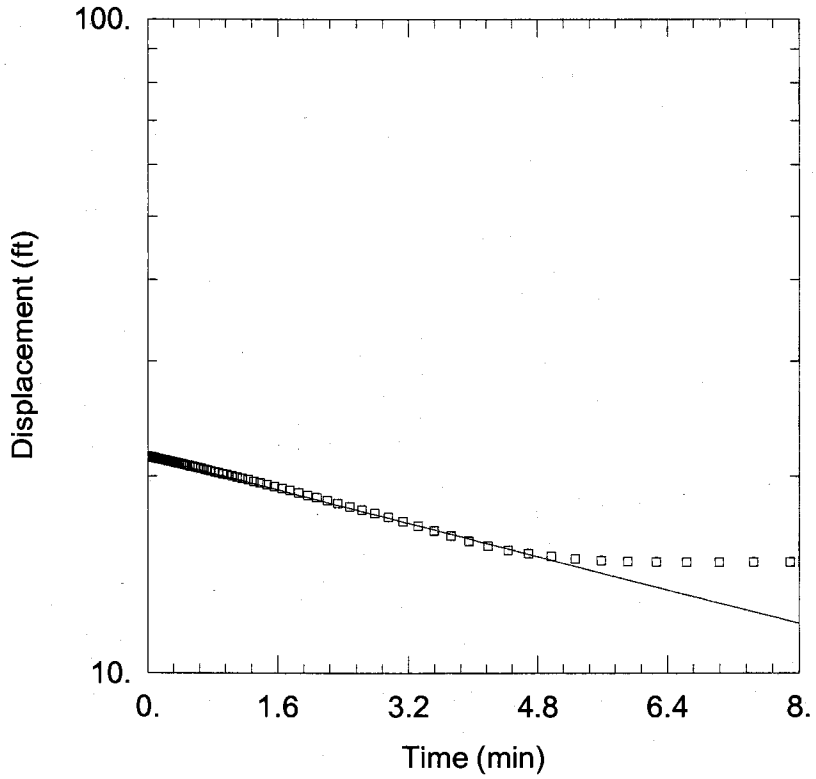
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.819

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	1.236E-6	cm/sec
y0	4.53	ft



BC-7 TEST #1

Data Set: S:\...\BC-7#1rev.AQT
Date: 11/19/04 Time: 08:08:10

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Well: BC-7
Test Date: 12/11/02

AQUIFER DATA

Saturated Thickness: 56.49 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BC-7)

Initial Displacement: 6.69 ft
Total Well Penetration Depth: 10.81 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 10.81 ft
Screen Length: 15. ft
Wellbore Radius: 0.125 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 3.636E-5 cm/sec
y0 = 21.44 ft

Data Set: S:\Environ\JOB FILES\Other Branch Jobs\1264 Jobs\1264-02-576 Belews Scrubber LF\Slug Test Data
Title: BC-7 Test #1
Date: 11/19/04
Time: 08:08:19

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Date: 12/11/02
Test Well: BC-7

AQUIFER DATA

Saturated Thickness: 56.49 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : BC-7

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 6.69 ft
Static Water Column Height: 10.81 ft
Casing Radius: 0.08333 ft
Wellbore Radius: 0.125 ft
Well Skin Radius: 0.125 ft
Screen Length: 15. ft
Total Well Penetration Depth: 10.81 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.09772 ft
Gravel Pack Porosity: 0.3

No. of Observations: 96

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.005	21.46	0.5247	20.75
0.01	21.45	0.5547	20.71
0.015	21.45	0.5863	20.66
0.02	21.44	0.6213	20.61
0.025	21.43	0.6578	20.57
0.03	21.42	0.6963	20.51
0.035	21.42	0.738	20.45
0.04	21.41	0.7813	20.39
0.045	21.4	0.828	20.33
0.05	21.4	0.8763	20.26
0.055	21.39	0.928	20.19
0.06	21.38	0.983	20.11
0.065	21.38	1.041	20.03
0.07	21.37	1.103	19.94
0.075	21.36	1.168	19.85
0.08	21.36	1.238	19.75
0.0848	21.35	1.311	19.65
0.09	21.34	1.39	19.53
0.095	21.34	1.473	19.42
0.1	21.33	1.561	19.29

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.1058	21.32	1.655	19.16
0.112	21.31	1.753	19.02
0.1185	21.3	1.858	18.87
0.1255	21.3	1.968	18.71
0.1328	21.29	2.085	18.55
0.1407	21.28	2.21	18.37
0.149	21.26	2.341	18.18
0.1578	21.25	2.481	17.98
0.167	21.24	2.63	17.77
0.177	21.23	2.786	17.54
0.1875	21.21	2.953	17.3
0.1985	21.2	3.13	17.05
0.2102	21.18	3.316	16.79
0.2227	21.17	3.515	16.5
0.2358	21.15	3.725	16.21
0.2498	21.13	3.946	15.91
0.2647	21.11	4.181	15.65
0.2803	21.09	4.43	15.42
0.297	21.06	4.693	15.24
0.3147	21.04	4.973	15.08
0.3333	21.01	5.27	14.95
0.3532	20.98	5.583	14.86
0.3742	20.95	5.915	14.81
0.3963	20.93	6.266	14.79
0.4198	20.89	6.64	14.79
0.4447	20.86	7.035	14.78
0.4697	20.82	7.453	14.78
0.4963	20.79	7.896	14.77

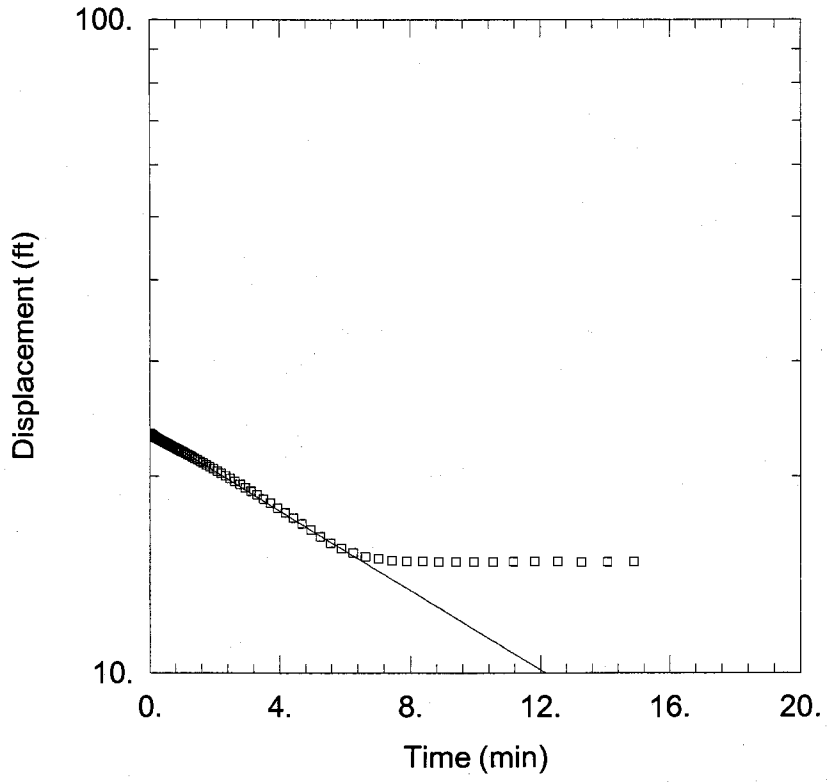
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 3.06

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	3.636E-5	cm/sec
y0	21.44	ft



BC-7 TEST #2

Data Set: S:\...\BC-7#2rev.AQT
Date: 11/19/04 Time: 08:23:45

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Well: BC-7
Test Date: 12/11/02

AQUIFER DATA

Saturated Thickness: 56.49 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BC-7)

Initial Displacement: 9.07 ft
Total Well Penetration Depth: 10.81 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 10.81 ft
Screen Length: 15. ft
Wellbore Radius: 0.125 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 3.468E-5 cm/sec
y0 = 23.44 ft

Data Set: S:\Environ\JOB FILES\Other Branch Jobs\1264 Jobs\1264-02-576 Belews Scrubber LF\Slug Test Data
Title: BC-7 Test #2
Date: 11/19/04
Time: 08:23:52

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Date: 12/11/02
Test Well: BC-7

AQUIFER DATA

Saturated Thickness: 56.49 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : BC-7

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 9.07 ft
Static Water Column Height: 10.81 ft
Casing Radius: 0.08333 ft
Wellbore Radius: 0.125 ft
Well Skin Radius: 0.125 ft
Screen Length: 15. ft
Total Well Penetration Depth: 10.81 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.09772 ft
Gravel Pack Porosity: 0.3

No. of Observations: 107

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.005	23.25	0.738	22.15
0.01	23.24	0.7813	22.1
0.015	23.23	0.828	22.04
0.02	23.22	0.8763	21.97
0.025	23.2	0.928	21.91
0.03	23.19	0.983	21.83
0.035	23.18	1.041	21.76
0.04	23.17	1.103	21.67
0.045	23.16	1.168	21.59
0.05	23.15	1.238	21.5
0.055	23.14	1.311	21.4
0.06	23.13	1.39	21.3
0.065	23.12	1.473	21.19
0.07	23.11	1.561	21.07
0.075	23.1	1.655	20.95
0.08	23.09	1.753	20.81
0.0848	23.08	1.858	20.67
0.09	23.07	1.968	20.53
0.095	23.06	2.085	20.37
0.1	23.06	2.21	20.2

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.1058	23.04	2.341	20.03
0.112	23.04	2.481	19.84
0.1185	23.02	2.63	19.65
0.1255	23.01	2.786	19.44
0.1328	23.	2.953	19.22
0.1407	22.99	3.13	18.98
0.149	22.97	3.316	18.73
0.1578	22.96	3.515	18.47
0.167	22.94	3.725	18.19
0.177	22.93	3.946	17.9
0.1875	22.91	4.181	17.59
0.1985	22.89	4.43	17.26
0.2102	22.87	4.693	16.92
0.2227	22.86	4.973	16.55
0.2358	22.84	5.27	16.17
0.2498	22.82	5.583	15.8
0.2647	22.79	5.915	15.51
0.2803	22.77	6.266	15.27
0.297	22.75	6.64	15.07
0.3147	22.73	7.035	14.94
0.3333	22.7	7.453	14.86
0.3532	22.67	7.896	14.82
0.3742	22.64	8.366	14.8
0.3963	22.61	8.865	14.8
0.4198	22.58	9.391	14.8
0.4447	22.55	9.95	14.8
0.4697	22.51	10.54	14.79
0.4963	22.48	11.17	14.79
0.5247	22.44	11.83	14.79
0.5547	22.4	12.53	14.79
0.5863	22.36	13.28	14.78
0.6213	22.31	14.07	14.78
0.6578	22.26	14.91	14.78
0.6963	22.21		

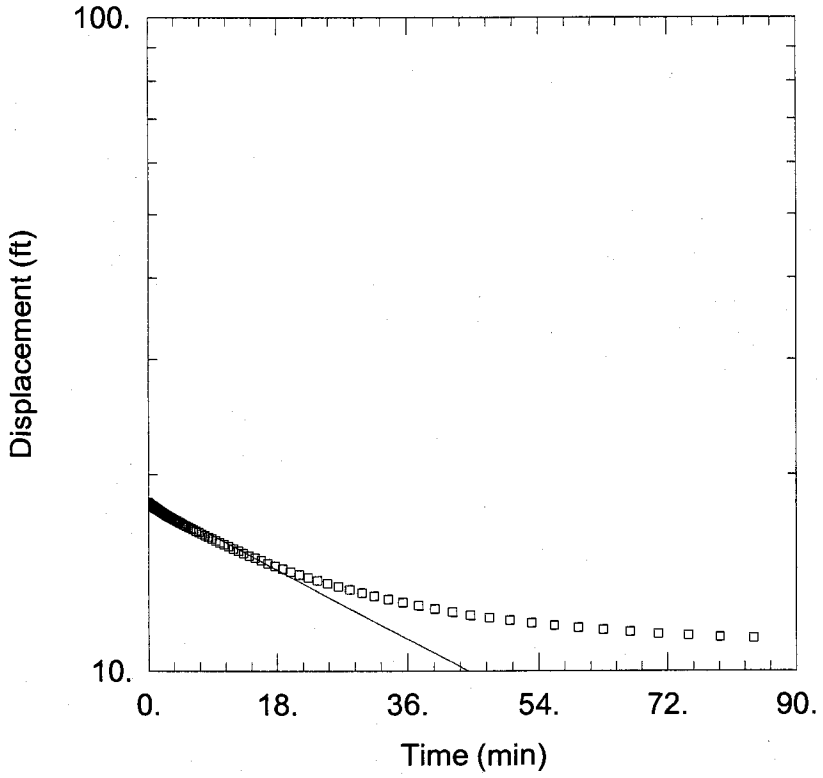
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 3.06

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	3.468E-5	cm/sec
y0	23.44	ft



BC-8 TEST #1

Data Set: S:\...\BC-8#1rev.AQT
Date: 11/19/04 Time: 08:33:29

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Well: BC-8
Test Date: 12/10/02

AQUIFER DATA

Saturated Thickness: 64.19 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BC-8)

Initial Displacement: 7.52 ft
Total Well Penetration Depth: 9.39 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 9.39 ft
Screen Length: 15. ft
Wellbore Radius: 0.125 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 6.494E-6 cm/sec
y0 = 18.18 ft

Data Set: S:\Environ\JOB FILES\Other Branch Jobs\1264 Jobs\1264-02-576 Belews Scrubber LF\Slug Test Data
Title: BC-8 Test #1
Date: 11/19/04
Time: 08:33:37

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Date: 12/10/02
Test Well: BC-8

AQUIFER DATA

Saturated Thickness: 64.19 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : BC-8

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 7.52 ft
Static Water Column Height: 9.39 ft
Casing Radius: 0.08333 ft
Wellbore Radius: 0.125 ft
Well Skin Radius: 0.125 ft
Screen Length: 15. ft
Total Well Penetration Depth: 9.39 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.09772 ft
Gravel Pack Porosity: 0.3

No. of Observations: 137

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.005	18.11	1.753	17.53
0.01	18.09	1.858	17.5
0.015	18.09	1.968	17.47
0.02	18.05	2.085	17.44
0.025	18.08	2.21	17.41
0.03	18.07	2.341	17.37
0.035	18.07	2.481	17.34
0.04	18.06	2.63	17.3
0.045	18.05	2.786	17.26
0.05	18.06	2.953	17.22
0.055	18.05	3.13	17.17
0.06	18.05	3.316	17.13
0.065	18.04	3.515	17.08
0.07	18.05	3.725	17.03
0.075	18.05	3.946	16.98
0.08	18.05	4.181	16.92
0.0848	18.03	4.43	16.86
0.09	18.03	4.693	16.8
0.095	18.03	4.973	16.74
0.1	18.03	5.27	16.67

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.1058	18.03	5.583	16.6
0.112	18.02	5.915	16.53
0.1185	18.02	6.266	16.46
0.1255	18.02	6.64	16.38
0.1328	18.01	7.035	16.3
0.1407	18.	7.453	16.21
0.149	18.	7.896	16.12
0.1578	18.	8.366	16.02
0.167	18.01	8.865	15.92
0.177	18.01	9.391	15.82
0.1875	18.	9.95	15.72
0.1985	18.	10.54	15.61
0.2102	18.	11.17	15.5
0.2227	18.	11.83	15.38
0.2358	17.98	12.53	15.26
0.2498	17.98	13.28	15.14
0.2647	17.98	14.07	15.01
0.2803	17.98	14.91	14.88
0.297	17.97	15.79	14.74
0.3147	17.96	16.73	14.6
0.3333	17.96	17.72	14.46
0.3532	17.95	18.78	14.32
0.3742	17.94	19.89	14.17
0.3963	17.93	21.07	14.03
0.4198	17.93	22.32	13.89
0.4447	17.92	23.65	13.75
0.4697	17.91	25.05	13.6
0.4963	17.9	26.54	13.45
0.5247	17.89	28.12	13.31
0.5547	17.88	29.79	13.16
0.5863	17.87	31.55	13.01
0.6213	17.86	33.43	12.86
0.6578	17.85	35.41	12.72
0.6963	17.84	37.51	12.57
0.738	17.83	39.74	12.44
0.7813	17.81	42.1	12.3
0.828	17.8	44.6	12.17
0.8763	17.79	47.24	12.06
0.928	17.77	50.05	11.95
0.983	17.75	53.01	11.84
1.041	17.74	56.16	11.74
1.103	17.72	59.49	11.64
1.168	17.7	63.02	11.55
1.238	17.68	66.76	11.47
1.311	17.66	70.72	11.39
1.39	17.64	74.91	11.32
1.473	17.61	79.35	11.26
1.561	17.59	84.06	11.21
1.655	17.56		

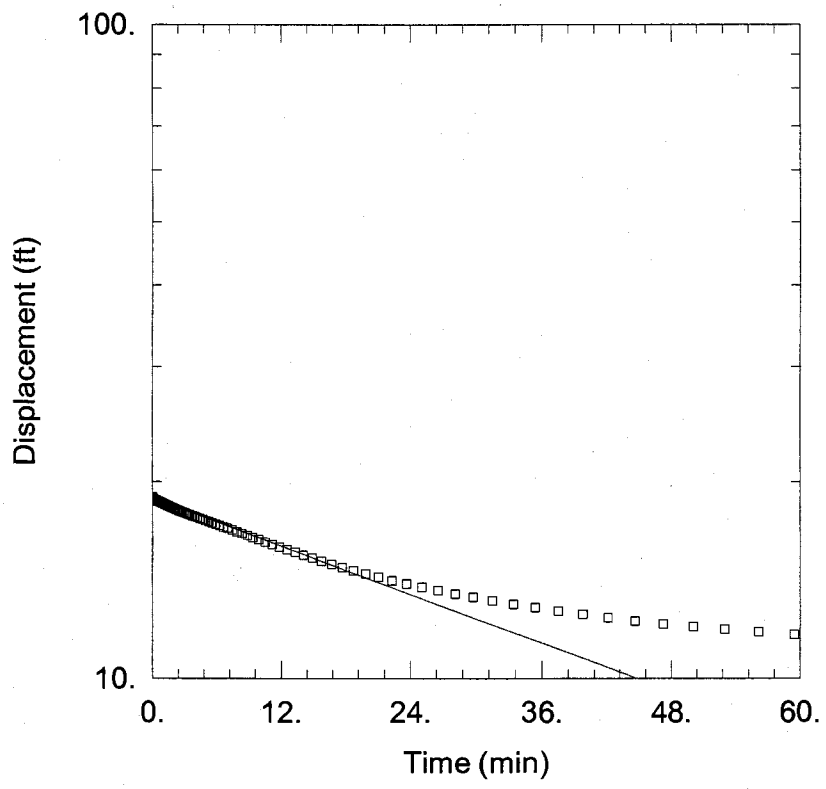
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.98

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	6.494E-6	cm/sec
y0	18.18	ft



BC-8 TEST #2

Data Set: S:\...\BC-8#2rev.AQT
Date: 11/19/04 Time: 08:37:06

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Well: BC-8
Test Date: 12/10/02

AQUIFER DATA

Saturated Thickness: 64.19 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BC-8)

Initial Displacement: 8.27 ft
Total Well Penetration Depth: 9.39 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 9.39 ft
Screen Length: 15. ft
Wellbore Radius: 0.125 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 6.848E-6 cm/sec
y0 = 18.9 ft

Data Set: S:\Environ\JOB FILES\Other Branch Jobs\1264 Jobs\1264-02-576 Belews Scrubber LF\Slug Test Data
Title: BC-8 Test #2
Date: 11/19/04
Time: 08:37:15

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Date: 12/10/02
Test Well: BC-8

AQUIFER DATA

Saturated Thickness: 64.19 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : BC-8

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 8.27 ft
Static Water Column Height: 9.39 ft
Casing Radius: 0.0833 ft
Wellbore Radius: 0.125 ft
Well Skin Radius: 0.125 ft
Screen Length: 15. ft
Total Well Penetration Depth: 9.39 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.0977 ft
Gravel Pack Porosity: 0.3

No. of Observations: 131

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.005	18.87	1.473	18.36
0.01	18.87	1.561	18.33
0.015	18.96	1.655	18.3
0.02	18.86	1.753	18.27
0.025	18.86	1.858	18.24
0.03	18.86	1.968	18.2
0.035	18.85	2.085	18.17
0.04	18.85	2.21	18.13
0.045	18.85	2.341	18.09
0.05	18.84	2.481	18.05
0.055	18.84	2.63	18.01
0.06	18.84	2.786	17.97
0.065	18.83	2.953	17.93
0.07	18.83	3.13	17.88
0.075	18.83	3.316	17.84
0.08	18.82	3.515	17.79
0.0848	18.82	3.725	17.74
0.09	18.82	3.946	17.68
0.095	18.82	4.181	17.63
0.1	18.81	4.43	17.57

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.1058	18.81	4.693	17.51
0.112	18.81	4.973	17.43
0.1185	18.8	5.27	17.36
0.1255	18.8	5.583	17.29
0.1328	18.8	5.915	17.21
0.1407	18.79	6.266	17.13
0.149	18.79	6.64	17.04
0.1578	18.78	7.035	16.95
0.167	18.78	7.453	16.86
0.177	18.78	7.896	16.75
0.1875	18.77	8.366	16.65
0.1985	18.77	8.865	16.54
0.2102	18.76	9.391	16.41
0.2227	18.76	9.95	16.29
0.2358	18.76	10.54	16.16
0.2498	18.75	11.17	16.02
0.2647	18.75	11.83	15.88
0.2803	18.74	12.53	15.73
0.297	18.73	13.28	15.58
0.3147	18.73	14.07	15.43
0.3333	18.72	14.91	15.27
0.3532	18.72	15.79	15.11
0.3742	18.71	16.73	14.94
0.3963	18.7	17.72	14.78
0.4198	18.7	18.78	14.61
0.4447	18.69	19.89	14.45
0.4697	18.68	21.07	14.28
0.4963	18.67	22.32	14.11
0.5247	18.66	23.65	13.95
0.5547	18.65	25.05	13.79
0.5863	18.64	26.54	13.63
0.6213	18.63	28.12	13.47
0.6578	18.62	29.79	13.31
0.6963	18.61	31.55	13.15
0.738	18.59	33.43	12.99
0.7813	18.58	35.41	12.83
0.828	18.57	37.51	12.67
0.8763	18.55	39.74	12.53
0.928	18.53	42.1	12.38
0.983	18.52	44.6	12.24
1.041	18.5	47.24	12.11
1.103	18.48	50.05	11.99
1.168	18.46	53.01	11.88
1.238	18.43	56.16	11.77
1.311	18.41	59.49	11.66
1.39	18.39		

SOLUTION

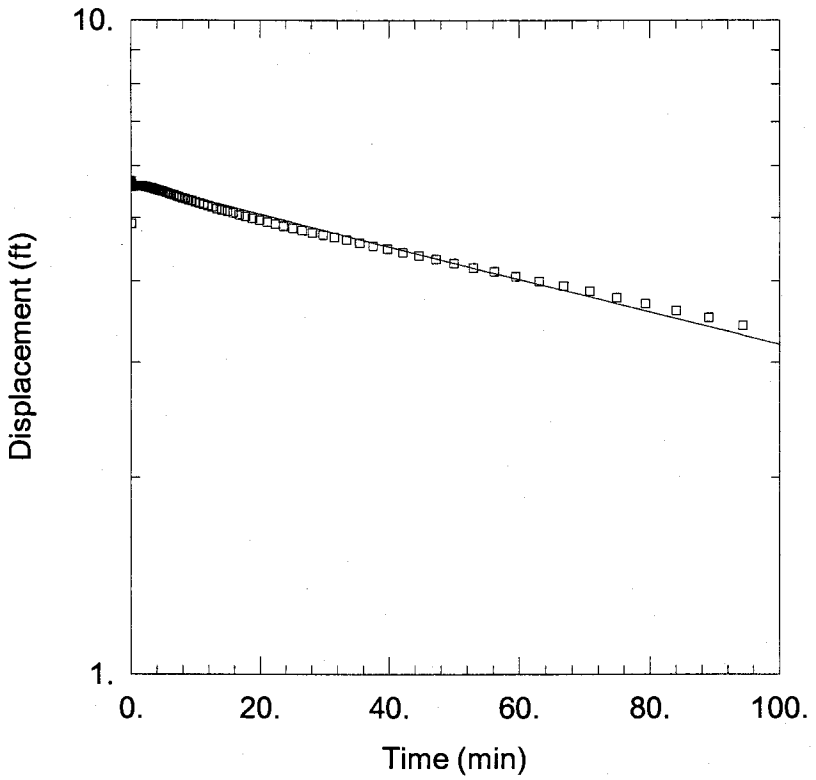
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.98

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	6.848E-6	cm/sec

y0	18.9	ft



BC-9 TEST #1

Data Set: S:\...\BC-9#1rev.AQT
Date: 11/19/04 Time: 08:41:33

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Well: BC-9
Test Date: 12/10/02

AQUIFER DATA

Saturated Thickness: 76.5 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BC-9)

Initial Displacement: 4.9 ft
Total Well Penetration Depth: 5.19 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 5.19 ft
Screen Length: 15. ft
Wellbore Radius: 0.125 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 2.467E-6 cm/sec
y0 = 5.68 ft

Data Set: S:\Environ\JOB FILES\Other Branch Jobs\1264 Jobs\1264-02-576 Belews Scrubber LF\Slug Test Data
Title: BC-9 Test #1
Date: 11/19/04
Time: 08:42:16

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Date: 12/10/02
Test Well: BC-9

AQUIFER DATA

Saturated Thickness: 76.5 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : BC-9

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 4.9 ft
Static Water Column Height: 5.19 ft
Casing Radius: 0.0833 ft
Wellbore Radius: 0.125 ft
Well Skin Radius: 0.125 ft
Screen Length: 15. ft
Total Well Penetration Depth: 5.19 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.0977 ft
Gravel Pack Porosity: 0.3

No. of Observations: 139

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.005	5.687	1.858	5.585
0.01	5.676	1.968	5.586
0.015	5.668	2.085	5.581
0.02	5.66	2.21	5.578
0.025	5.657	2.341	5.575
0.03	5.651	2.481	5.571
0.035	5.646	2.63	5.567
0.04	5.64	2.786	5.561
0.045	5.637	2.953	5.557
0.05	5.632	3.13	5.55
0.055	5.628	3.316	5.545
0.06	5.623	3.515	5.535
0.065	5.62	3.725	5.528
0.07	5.617	3.946	5.52
0.075	5.616	4.181	5.511
0.08	5.611	4.43	5.501
0.0848	5.608	4.693	5.49
0.09	5.605	4.973	5.48
0.095	5.602	5.27	5.468
0.1	5.601	5.583	5.456

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.1058	5.597	5.915	5.441
0.112	5.594	6.266	5.427
0.1185	5.592	6.64	5.412
0.1255	5.588	7.035	5.396
0.1328	5.588	7.453	5.381
0.1407	5.584	7.896	5.361
0.149	5.58	8.366	5.345
0.1578	5.579	8.865	5.324
0.167	5.589	9.391	5.303
0.177	5.59	9.95	5.283
0.1875	5.589	10.54	5.263
0.1985	5.589	11.17	5.239
0.2102	5.589	11.83	5.214
0.2227	5.589	12.53	5.19
0.2358	5.586	13.28	5.165
0.2498	5.585	14.07	5.141
0.2647	5.586	14.91	5.113
0.2803	5.584	15.79	5.084
0.297	5.582	16.73	5.054
0.3147	5.584	17.72	5.021
0.3333	5.583	18.78	4.991
0.3532	5.582	19.89	4.959
0.3742	5.584	21.07	4.926
0.3963	5.582	22.32	4.892
0.4198	5.583	23.65	4.857
0.4447	5.584	25.05	4.821
0.4697	5.585	26.54	4.785
0.4963	5.582	28.12	4.746
0.5247	5.583	29.79	4.708
0.5547	5.584	31.55	4.67
0.5863	5.588	33.43	4.627
0.6213	5.585	35.41	4.58
0.6578	5.587	37.51	4.532
0.6963	5.589	39.74	4.483
0.738	5.589	42.1	4.429
0.7813	5.589	44.6	4.378
0.828	5.591	47.24	4.321
0.8763	5.59	50.05	4.263
0.928	5.592	53.01	4.198
0.983	5.592	56.16	4.139
1.041	5.591	59.49	4.068
1.103	5.593	63.02	3.997
1.168	5.592	66.76	3.936
1.238	5.592	70.72	3.861
1.311	5.593	74.91	3.778
1.39	5.592	79.35	3.696
1.473	5.59	84.06	3.603
1.561	5.591	89.05	3.519
1.655	5.589	94.33	3.42
1.753	5.587		

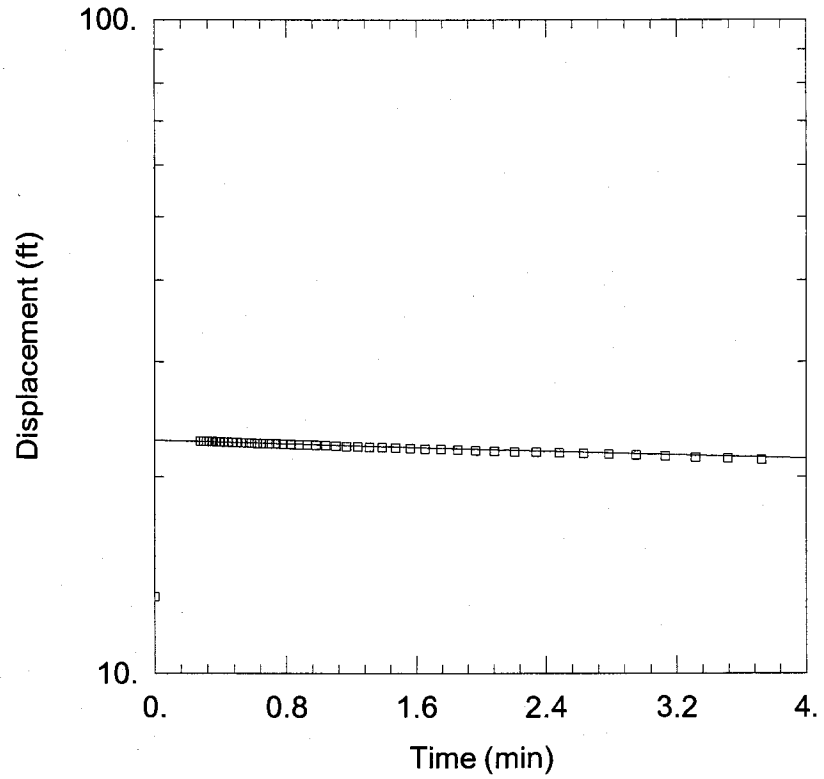
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.659

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	2.467E-6	cm/sec
y0	5.68	ft



BC-10 TEST #1

Data Set: S:\...\BC-10#1rev.AQT
Date: 11/19/04 Time: 11:40:03

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Well: BC-10
Test Date: 12/19/02

AQUIFER DATA

Saturated Thickness: 69.56 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BC-10)

Initial Displacement: 13.09 ft
Total Well Penetration Depth: 17.91 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 17.91 ft
Screen Length: 15. ft
Wellbore Radius: 0.3125 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 4.867E-6 cm/sec y0 = 22.74 ft

Data Set: S:\Environ\JOB FILES\Other Branch Jobs\1264 Jobs\1264-02-576 Belews Scrubber LF\Slug Test Data
Title: BC-10 Test #1
Date: 11/19/04
Time: 11:40:10

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Date: 12/19/02
Test Well: BC-10

AQUIFER DATA

Saturated Thickness: 69.56 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : BC-10

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 13.09 ft
Static Water Column Height: 17.91 ft
Casing Radius: 0.0833 ft
Wellbore Radius: 0.3125 ft
Well Skin Radius: 0.3125 ft
Screen Length: 15. ft
Total Well Penetration Depth: 17.91 ft

No. of Observations: 46

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.2803	22.66	1.041	22.32
0.297	22.65	1.103	22.29
0.3147	22.65	1.168	22.26
0.3333	22.63	1.238	22.23
0.3532	22.63	1.311	22.2
0.3742	22.62	1.39	22.17
0.3963	22.61	1.473	22.14
0.4198	22.59	1.561	22.1
0.4447	22.58	1.655	22.06
0.4697	22.57	1.753	22.02
0.4963	22.55	1.858	21.98
0.5247	22.54	1.968	21.93
0.5547	22.52	2.085	21.88
0.5863	22.51	2.21	21.84
0.6213	22.49	2.341	21.81
0.6578	22.48	2.481	21.76
0.6963	22.46	2.63	21.71
0.738	22.45	2.786	21.64
0.7813	22.43	2.953	21.57
0.828	22.41	3.13	21.5
0.8763	22.39	3.316	21.42
0.928	22.37	3.515	21.34

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.983	22.34	3.725	21.23

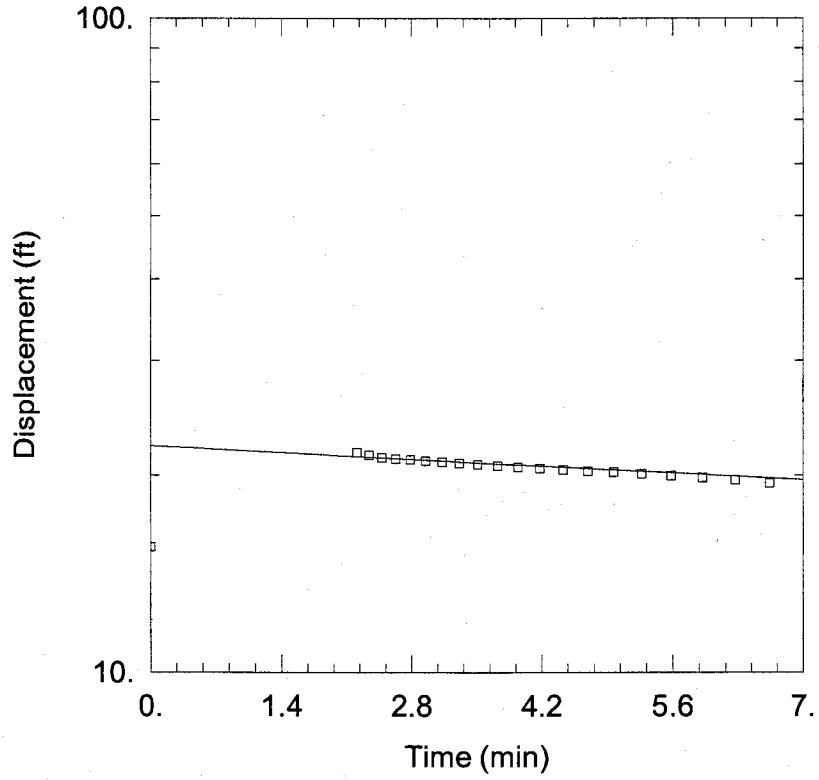
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.59

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	4.867E-6	cm/sec
y0	22.74	ft



BC-10 TEST #2

Data Set: S:\...\BC-10#2rev.AQT
Date: 11/19/04 Time: 11:34:05

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Well: BC-10
Test Date: 12/19/02

AQUIFER DATA

Saturated Thickness: 69.56 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BC-10)

Initial Displacement: 15.56 ft
Total Well Penetration Depth: 17.91 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 17.91 ft
Screen Length: 15. ft
Wellbore Radius: 0.3125 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 5.201E-6 cm/sec y0 = 22.2 ft

Data Set: S:\Environ\JOB FILES\Other Branch Jobs\1264 Jobs\1264-02-576 Belews Scrubber LF\Slug Test Data
Title: BC-10 Test #2
Date: 11/19/04
Time: 11:34:11

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Date: 12/19/02
Test Well: BC-10

AQUIFER DATA

Saturated Thickness: 69.56 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : BC-10

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 15.56 ft
Static Water Column Height: 17.91 ft
Casing Radius: 0.0833 ft
Wellbore Radius: 0.3125 ft
Well Skin Radius: 0.3125 ft
Screen Length: 15. ft
Total Well Penetration Depth: 17.91 ft

No. of Observations: 20

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
2.21	21.7	3.946	20.61
2.341	21.49	4.181	20.51
2.481	21.3	4.43	20.41
2.63	21.2	4.693	20.3
2.786	21.13	4.973	20.22
2.953	21.05	5.27	20.11
3.13	20.97	5.583	19.98
3.316	20.89	5.915	19.84
3.515	20.79	6.266	19.68
3.725	20.7	6.64	19.46

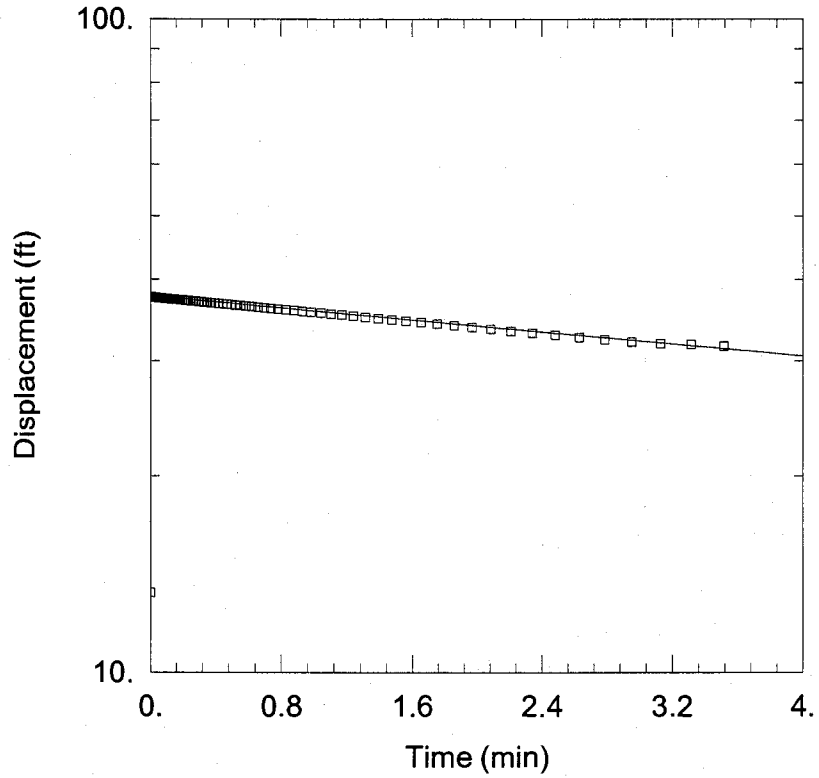
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.59

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate



BC-10 TEST #4

Data Set: S:\...\BC-10#4rev.AQT
Date: 11/19/04 Time: 11:28:52

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Well: BC-10
Test Date: 12/19/02

AQUIFER DATA

Saturated Thickness: 69.56 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BC-10)

Initial Displacement: 13.23 ft
Total Well Penetration Depth: 17.91 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 17.91 ft
Screen Length: 15. ft
Wellbore Radius: 0.3125 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 1.613E-5 cm/sec y0 = 37.76 ft

Data Set: S:\Environ\JOB FILES\Other Branch Jobs\1264 Jobs\1264-02-576 Belews Scrubber LF\Slug Test Data
Title: BC-10 Test #4
Date: 11/19/04
Time: 11:29:01

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Date: 12/19/02
Test Well: BC-10

AQUIFER DATA

Saturated Thickness: 69.56 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : BC-10

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 13.23 ft
Static Water Column Height: 17.91 ft
Casing Radius: 0.0833 ft
Wellbore Radius: 0.3125 ft
Well Skin Radius: 0.3125 ft
Screen Length: 15. ft
Total Well Penetration Depth: 17.91 ft

No. of Observations: 82

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.005	37.61	0.3532	36.88
0.01	37.6	0.3742	36.84
0.015	37.58	0.3963	36.8
0.02	37.56	0.4198	36.75
0.025	37.55	0.4447	36.7
0.03	37.54	0.4697	36.65
0.035	37.53	0.4963	36.6
0.04	37.51	0.5247	36.54
0.045	37.5	0.5547	36.48
0.05	37.49	0.5863	36.42
0.055	37.48	0.6213	36.35
0.06	37.47	0.6578	36.28
0.065	37.45	0.6963	36.21
0.07	37.44	0.738	36.13
0.075	37.43	0.7813	36.04
0.08	37.42	0.828	35.95
0.0848	37.41	0.8763	35.86
0.09	37.4	0.928	35.76
0.095	37.39	0.983	35.66
0.1	37.38	1.041	35.55
0.1058	37.37	1.103	35.43
0.112	37.35	1.168	35.31

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.1185	37.34	1.238	35.17
0.1255	37.32	1.311	35.04
0.1328	37.31	1.39	34.89
0.1407	37.29	1.473	34.73
0.149	37.27	1.561	34.57
0.1578	37.25	1.655	34.39
0.167	37.25	1.753	34.21
0.177	37.23	1.858	34.02
0.1875	37.21	1.968	33.82
0.1985	37.19	2.085	33.6
0.2102	37.16	2.21	33.38
0.2227	37.14	2.341	33.14
0.2358	37.11	2.481	32.89
0.2498	37.09	2.63	32.63
0.2647	37.06	2.786	32.35
0.2803	37.03	2.953	32.08
0.297	36.99	3.13	31.92
0.3147	36.96	3.316	31.81
0.3333	36.92	3.515	31.62

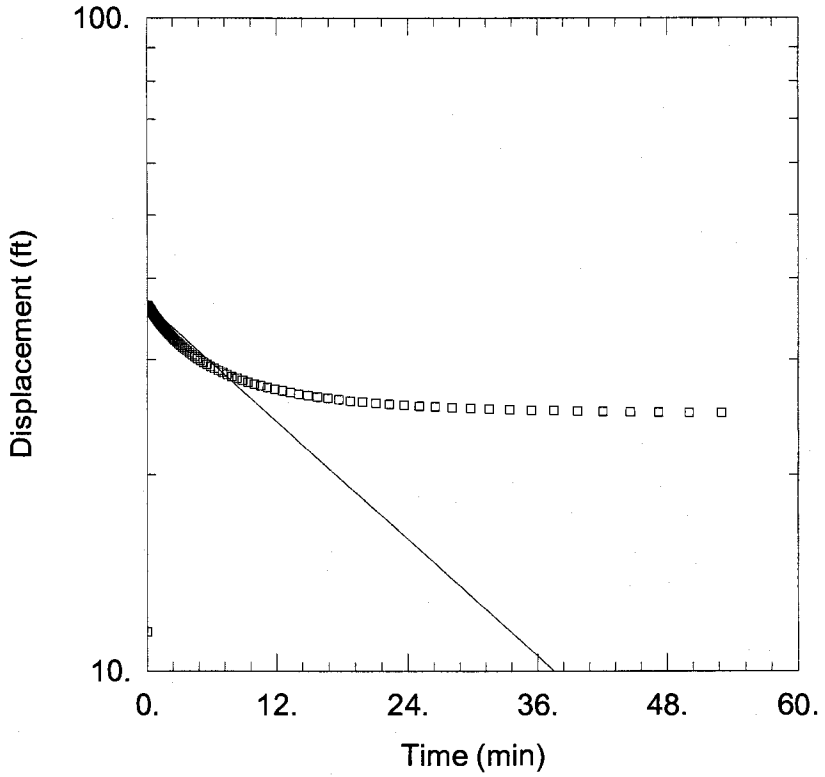
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.59

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	1.613E-5	cm/sec
y0	37.76	ft



BC-11 TEST #1

Data Set: S:\...\BC-11#1rev.AQT
Date: 11/19/04 Time: 09:37:36

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Well: BC-11
Test Date: 12/10/02

AQUIFER DATA

Saturated Thickness: 57.28 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BC-11)

Initial Displacement: 11.48 ft
Total Well Penetration Depth: 25.43 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 25.43 ft
Screen Length: 15. ft
Wellbore Radius: 0.354 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 6.641E-5 cm/sec y0 = 36.48 ft

Data Set: S:\Environ\JOB FILES\Other Branch Jobs\1264 Jobs\1264-02-576 Belews Scrubber LF\Slug Test Data
Title: BC-11 Test #1
Date: 11/19/04
Time: 09:37:44

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Date: 12/10/02
Test Well: BC-11

AQUIFER DATA

Saturated Thickness: 57.28 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : BC-11

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 11.48 ft
Static Water Column Height: 25.43 ft
Casing Radius: 0.0833 ft
Wellbore Radius: 0.354 ft
Well Skin Radius: 0.354 ft
Screen Length: 15. ft
Total Well Penetration Depth: 25.43 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.206 ft
Gravel Pack Porosity: 0.3

No. of Observations: 129

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.005	36.35	1.39	33.8
0.01	36.35	1.473	33.67
0.015	36.35	1.561	33.54
0.02	36.35	1.655	33.4
0.025	36.34	1.753	33.26
0.03	36.34	1.858	33.11
0.035	36.33	1.968	32.95
0.04	36.32	2.085	32.79
0.045	36.31	2.21	32.63
0.05	36.3	2.341	32.46
0.055	36.3	2.481	32.28
0.06	36.29	2.63	32.11
0.065	36.28	2.786	31.92
0.07	36.27	2.953	31.73
0.075	36.26	3.13	31.54
0.08	36.25	3.316	31.34
0.0848	36.24	3.515	31.15
0.09	36.23	3.725	30.94
0.095	36.22	3.946	30.74
0.1	36.21	4.181	30.53

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.1058	36.2	4.43	30.33
0.112	36.19	4.693	30.12
0.1185	36.17	4.973	29.91
0.1255	36.16	5.27	29.7
0.1328	36.14	5.583	29.49
0.1407	36.12	5.915	29.28
0.149	36.11	6.266	29.08
0.1578	36.09	6.64	28.87
0.167	36.07	7.035	28.67
0.177	36.05	7.453	28.47
0.1875	36.03	7.896	28.27
0.1985	36.01	8.366	28.08
0.2102	35.98	8.865	27.89
0.2227	35.95	9.391	27.71
0.2358	35.92	9.95	27.53
0.2498	35.9	10.54	27.36
0.2647	35.86	11.17	27.19
0.2803	35.83	11.83	27.03
0.297	35.79	12.53	26.87
0.3147	35.76	13.28	26.72
0.3333	35.72	14.07	26.57
0.3532	35.68	14.91	26.44
0.3742	35.63	15.79	26.31
0.3963	35.59	16.73	26.18
0.4198	35.55	17.72	26.07
0.4447	35.49	18.78	25.96
0.4697	35.45	19.89	25.85
0.4963	35.4	21.07	25.75
0.5247	35.34	22.32	25.66
0.5547	35.27	23.65	25.57
0.5863	35.21	25.05	25.49
0.6213	35.16	26.54	25.41
0.6578	35.08	28.12	25.34
0.6963	34.99	29.79	25.28
0.738	34.93	31.55	25.22
0.7813	34.84	33.43	25.17
0.828	34.76	35.41	25.11
0.8763	34.66	37.51	25.07
0.928	34.57	39.74	25.02
0.983	34.47	42.1	24.98
1.041	34.37	44.6	24.95
1.103	34.27	47.24	24.91
1.168	34.16	50.05	24.88
1.238	34.05	53.01	24.85
1.311	33.93		

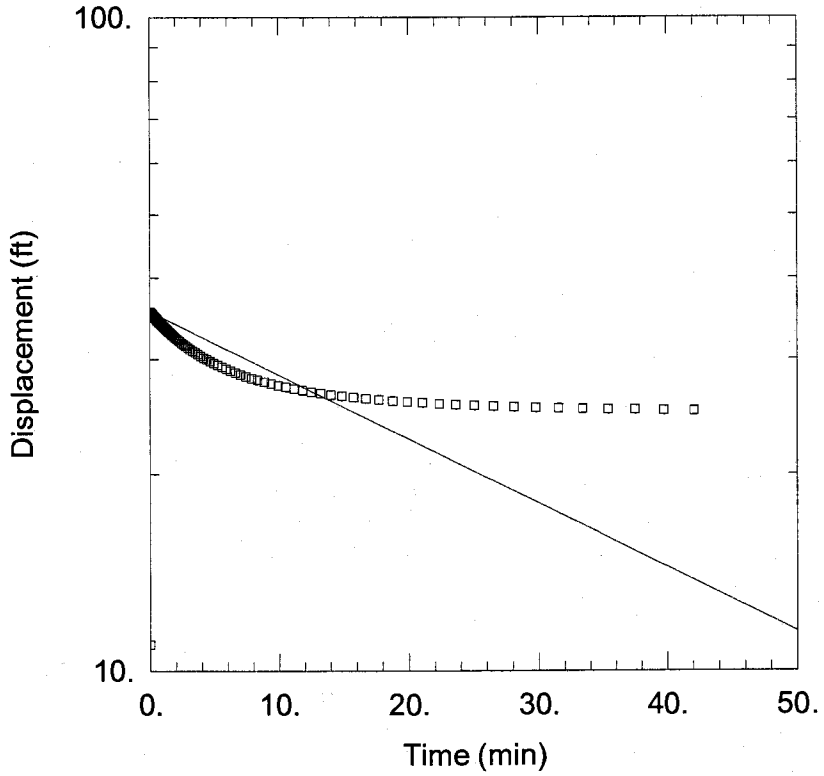
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.681

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	6.641E-5	cm/sec
y0	36.48	ft



BC-11 TEST #2

Data Set: S:\...\BC-11#2rev.AQT
Date: 11/19/04 Time: 09:42:16

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Well: BC-11
Test Date: 12/10/02

AQUIFER DATA

Saturated Thickness: 57.28 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BC-11)

Initial Displacement: 10.97 ft
Total Well Penetration Depth: 25.43 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 25.43 ft
Screen Length: 15. ft
Wellbore Radius: 0.354 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 4.35E-5 cm/sec
y0 = 35.54 ft

Data Set: S:\Environ\JOB FILES\Other Branch Jobs\1264 Jobs\1264-02-576 Belews Scrubber LF\Slug Test Data
Title: BC-11 Test #2
Date: 11/19/04
Time: 09:42:22

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Date: 12/10/02
Test Well: BC-11

AQUIFER DATA

Saturated Thickness: 57.28 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : BC-11

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 10.97 ft
Static Water Column Height: 25.43 ft
Casing Radius: 0.0833 ft
Wellbore Radius: 0.354 ft
Well Skin Radius: 0.354 ft
Screen Length: 15. ft
Total Well Penetration Depth: 25.43 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.206 ft
Gravel Pack Porosity: 0.3

No. of Observations: 125

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.005	35.53	1.238	33.41
0.01	35.52	1.311	33.3
0.015	35.51	1.39	33.18
0.02	35.5	1.473	33.06
0.025	35.49	1.561	32.94
0.03	35.48	1.655	32.81
0.035	35.47	1.753	32.68
0.04	35.47	1.858	32.54
0.045	35.46	1.968	32.4
0.05	35.45	2.085	32.26
0.055	35.44	2.21	32.1
0.06	35.43	2.341	31.95
0.065	35.42	2.481	31.79
0.07	35.42	2.63	31.62
0.075	35.41	2.786	31.45
0.08	35.4	2.953	31.28
0.0848	35.39	3.13	31.1
0.09	35.38	3.316	30.92
0.095	35.37	3.515	30.73
0.1	35.36	3.725	30.55

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.1058	35.35	3.946	30.36
0.112	35.34	4.181	30.16
0.1185	35.32	4.43	29.97
0.1255	35.31	4.693	29.78
0.1328	35.3	4.973	29.58
0.1407	35.29	5.27	29.39
0.149	35.27	5.583	29.19
0.1578	35.25	5.915	29.
0.167	35.24	6.266	28.8
0.177	35.22	6.64	28.61
0.1875	35.2	7.035	28.42
0.1985	35.18	7.453	28.23
0.2102	35.16	7.896	28.05
0.2227	35.13	8.366	27.86
0.2358	35.11	8.865	27.69
0.2498	35.08	9.391	27.52
0.2647	35.06	9.95	27.35
0.2803	35.02	10.54	27.18
0.297	34.99	11.17	27.03
0.3147	34.95	11.83	26.88
0.3333	34.92	12.53	26.73
0.3532	34.88	13.28	26.59
0.3742	34.84	14.07	26.46
0.3963	34.8	14.91	26.33
0.4198	34.76	15.79	26.21
0.4447	34.71	16.73	26.1
0.4697	34.67	17.72	25.99
0.4963	34.62	18.78	25.89
0.5247	34.57	19.89	25.79
0.5547	34.51	21.07	25.7
0.5863	34.46	22.32	25.62
0.6213	34.4	23.65	25.54
0.6578	34.34	25.05	25.47
0.6963	34.27	26.54	25.4
0.738	34.2	28.12	25.34
0.7813	34.13	29.79	25.28
0.828	34.05	31.55	25.22
0.8763	33.97	33.43	25.17
0.928	33.89	35.41	25.12
0.983	33.8	37.51	25.08
1.041	33.71	39.74	25.04
1.103	33.61	42.1	25.
1.168	33.51		

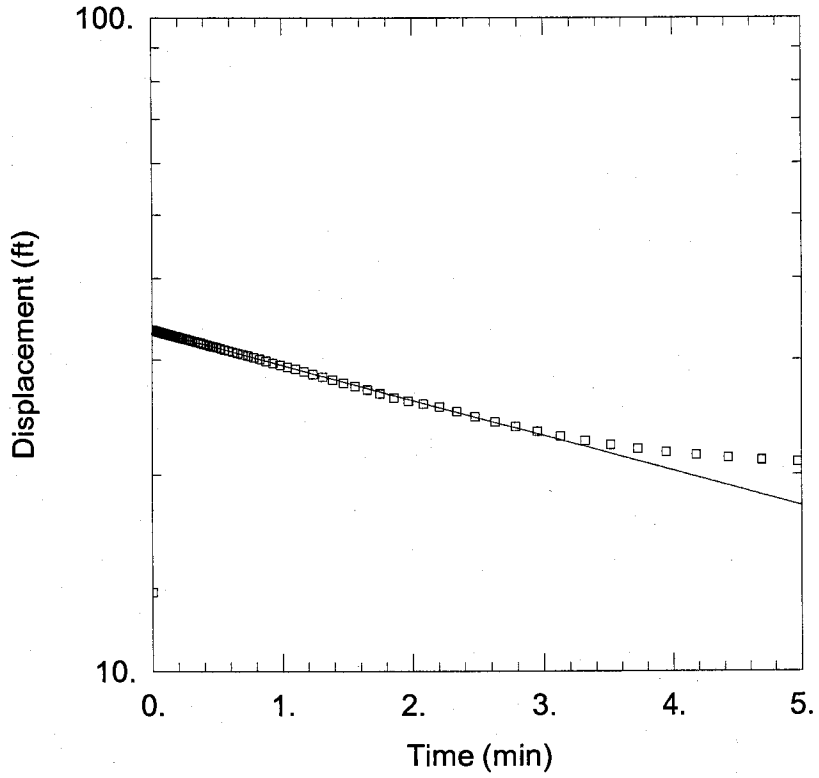
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.681

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	4.35E-5	cm/sec
y0	35.54	ft



BC-12 TEST #1

Data Set: S:\...\BC-12#1rev.AQT
Date: 11/19/04 Time: 09:52:09

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Well: BC-12
Test Date: 12/11/02

AQUIFER DATA

Saturated Thickness: 42.04 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BC-12)

Initial Displacement: 13.2 ft
Total Well Penetration Depth: 19.84 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 19.84 ft
Screen Length: 15. ft
Wellbore Radius: 0.125 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 6.849E-5 cm/sec
y0 = 33.31 ft

Data Set: S:\Environ\JOB FILES\Other Branch Jobs\1264 Jobs\1264-02-576 Belews Scrubber LF\Slug Test Data
Title: BC-12 Test #1
Date: 11/19/04
Time: 09:52:16

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Date: 12/11/02
Test Well: BC-12

AQUIFER DATA

Saturated Thickness: 42.04 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : BC-12

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 13.2 ft
Static Water Column Height: 19.84 ft
Casing Radius: 0.0833 ft
Wellbore Radius: 0.125 ft
Well Skin Radius: 0.125 ft
Screen Length: 15. ft
Total Well Penetration Depth: 19.84 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.0977 ft
Gravel Pack Porosity: 0.3

No. of Observations: 88

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.005	33.34	0.4198	31.63
0.01	33.32	0.4447	31.53
0.015	33.3	0.4697	31.43
0.02	33.27	0.4963	31.33
0.025	33.25	0.5247	31.22
0.03	33.23	0.5547	31.1
0.035	33.21	0.5863	30.98
0.04	33.19	0.6213	30.84
0.045	33.17	0.6578	30.71
0.05	33.14	0.6963	30.57
0.055	33.12	0.738	30.41
0.06	33.1	0.7813	30.24
0.065	33.08	0.828	30.07
0.07	33.06	0.8763	29.88
0.075	33.04	0.928	29.68
0.08	33.01	0.983	29.47
0.0848	32.99	1.041	29.25
0.09	32.98	1.103	29.02
0.095	32.95	1.168	28.78
0.1	32.93	1.238	28.52

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.1058	32.91	1.311	28.24
0.112	32.88	1.39	27.95
0.1185	32.85	1.473	27.64
0.1255	32.82	1.561	27.32
0.1328	32.79	1.655	26.99
0.1407	32.76	1.753	26.63
0.149	32.73	1.858	26.25
0.1578	32.69	1.968	25.94
0.167	32.65	2.085	25.68
0.177	32.61	2.21	25.43
0.1875	32.57	2.341	25.
0.1985	32.53	2.481	24.55
0.2102	32.48	2.63	24.11
0.2227	32.43	2.786	23.68
0.2358	32.38	2.953	23.28
0.2498	32.32	3.13	22.89
0.2647	32.26	3.316	22.54
0.2803	32.2	3.515	22.21
0.297	32.14	3.725	21.91
0.3147	32.06	3.946	21.64
0.3333	31.99	4.181	21.41
0.3532	31.91	4.43	21.21
0.3742	31.82	4.693	21.04
0.3963	31.73	4.973	20.89

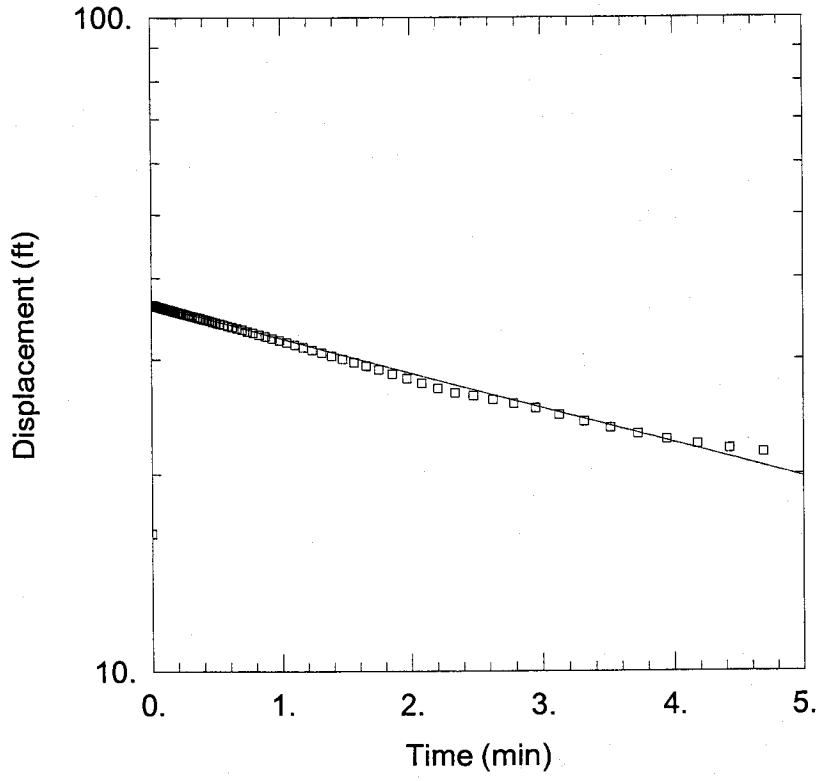
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 3.42

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	6.849E-5	cm/sec
y0	33.31	ft



BC-12 TEST #2

Data Set: S:\...\BC-12#2rev.AQT
Date: 11/19/04 Time: 09:55:27

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Well: BC-12
Test Date: 12/11/02

AQUIFER DATA

Saturated Thickness: 42.02 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BC-12)

Initial Displacement: 16.23 ft
Total Well Penetration Depth: 19.84 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 19.84 ft
Screen Length: 15. ft
Wellbore Radius: 0.125 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 6.753E-5 cm/sec
y0 = 36.5 ft

Data Set: S:\Environ\JOB FILES\Other Branch Jobs\1264 Jobs\1264-02-576 Belews Scrubber LF\Slug Test Data
Title: BC-12 Test #2
Date: 11/19/04
Time: 09:55:35

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Date: 12/11/02
Test Well: BC-12

AQUIFER DATA

Saturated Thickness: 42.02 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : BC-12

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 16.23 ft
Static Water Column Height: 19.84 ft
Casing Radius: 0.0833 ft
Wellbore Radius: 0.125 ft
Well Skin Radius: 0.125 ft
Screen Length: 15. ft
Total Well Penetration Depth: 19.84 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.0977 ft
Gravel Pack Porosity: 0.3

No. of Observations: 87

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.005	36.42	0.4198	34.51
0.01	36.39	0.4447	34.4
0.015	36.37	0.4697	34.29
0.02	36.34	0.4963	34.18
0.025	36.31	0.5247	34.06
0.03	36.28	0.5547	33.93
0.035	36.26	0.5863	33.8
0.04	36.23	0.6213	33.65
0.045	36.2	0.6578	33.49
0.05	36.18	0.6963	33.33
0.055	36.15	0.738	33.15
0.06	36.13	0.7813	32.97
0.065	36.1	0.828	32.77
0.07	36.08	0.8763	32.57
0.075	36.05	0.928	32.35
0.08	36.03	0.983	32.12
0.0848	36.01	1.041	31.88
0.09	35.98	1.103	31.62
0.095	35.96	1.168	31.35
0.1	35.93	1.238	31.06

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.1058	35.91	1.311	30.76
0.112	35.88	1.39	30.43
0.1185	35.84	1.473	30.08
0.1255	35.81	1.561	29.71
0.1328	35.78	1.655	29.33
0.1407	35.74	1.753	28.93
0.149	35.7	1.858	28.5
0.1578	35.66	1.968	28.07
0.167	35.62	2.085	27.6
0.177	35.58	2.21	27.1
0.1875	35.53	2.341	26.68
0.1985	35.48	2.481	26.38
0.2102	35.42	2.63	26.04
0.2227	35.37	2.786	25.7
0.2358	35.31	2.953	25.26
0.2498	35.25	3.13	24.67
0.2647	35.19	3.316	24.1
0.2803	35.11	3.515	23.58
0.297	35.04	3.725	23.09
0.3147	34.96	3.946	22.65
0.3333	34.88	4.181	22.25
0.3532	34.79	4.43	21.91
0.3742	34.7	4.693	21.62
0.3963	34.61		

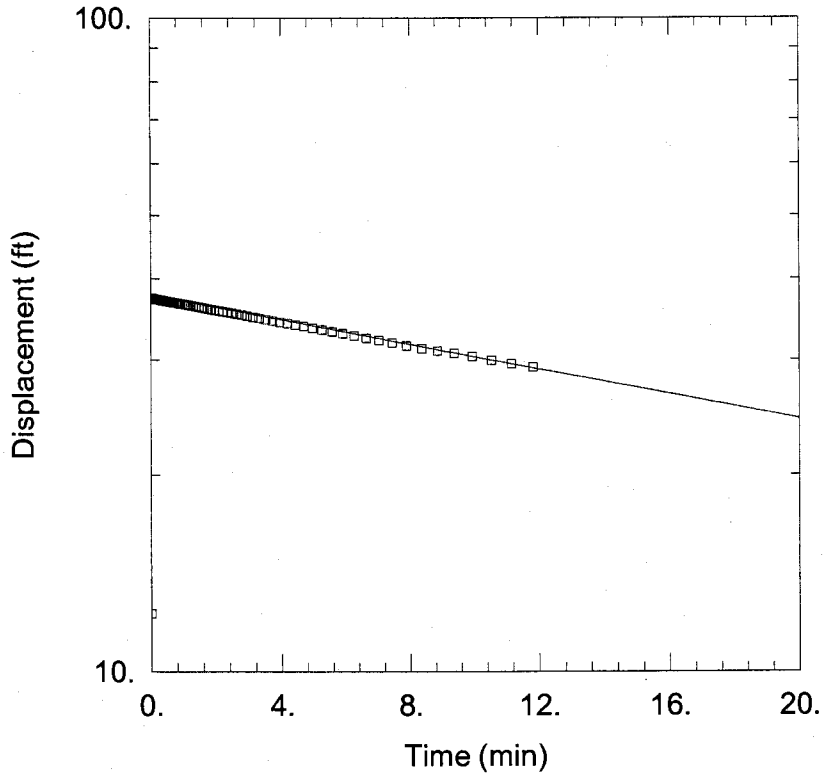
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 3.42

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	6.753E-5	cm/sec
y0	36.5	ft



BC-14 TEST #1

Data Set: S:\...\BC-14#1rev.AQT
Date: 11/19/04 Time: 11:12:30

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Well: BC-14
Test Date: 12/11/02

AQUIFER DATA

Saturated Thickness: 82.21 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BC-14)

Initial Displacement: 12.26 ft
Total Well Penetration Depth: 14.86 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 14.86 ft
Screen Length: 15. ft
Wellbore Radius: 0.3125 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 3.152E-5 cm/sec
y0 = 37.79 ft

Data Set: S:\Environ\JOB FILES\Other Branch Jobs\1264 Jobs\1264-02-576 Belews Scrubber LF\Slug Test Data
Title: BC-14 Test #1
Date: 11/19/04
Time: 11:13:51

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Date: 12/11/02
Test Well: BC-14

AQUIFER DATA

Saturated Thickness: 82.21 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : BC-14

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 12.26 ft
Static Water Column Height: 14.86 ft
Casing Radius: 0.0833 ft
Wellbore Radius: 0.3125 ft
Well Skin Radius: 0.3125 ft
Screen Length: 15. ft
Total Well Penetration Depth: 14.86 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.1848 ft
Gravel Pack Porosity: 0.3

No. of Observations: 103

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.005	37.4	0.6578	36.82
0.01	37.39	0.6963	36.79
0.015	37.38	0.738	36.76
0.02	37.38	0.7813	36.73
0.025	37.37	0.828	36.69
0.03	37.36	0.8763	36.66
0.035	37.35	0.928	36.62
0.04	37.35	0.983	36.58
0.045	37.34	1.041	36.53
0.05	37.34	1.103	36.49
0.055	37.33	1.168	36.44
0.06	37.33	1.238	36.38
0.065	37.32	1.311	36.33
0.07	37.31	1.39	36.26
0.075	37.31	1.473	36.2
0.08	37.3	1.561	36.13
0.0848	37.3	1.655	36.06
0.09	37.29	1.753	35.98
0.095	37.29	1.858	35.9
0.1	37.28	1.968	35.81

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.1058	37.28	2.085	35.72
0.112	37.27	2.21	35.62
0.1185	37.26	2.341	35.52
0.1255	37.26	2.481	35.41
0.1328	37.25	2.63	35.3
0.1407	37.24	2.786	35.18
0.149	37.23	2.953	35.06
0.1578	37.23	3.13	34.93
0.167	37.22	3.316	34.79
0.177	37.21	3.515	34.64
0.1875	37.2	3.725	34.49
0.1985	37.19	3.946	34.33
0.2102	37.18	4.181	34.16
0.2227	37.17	4.43	33.98
0.2358	37.16	4.693	33.8
0.2498	37.15	4.973	33.6
0.2647	37.13	5.27	33.4
0.2803	37.12	5.583	33.17
0.297	37.11	5.915	32.94
0.3147	37.09	6.266	32.69
0.3333	37.08	6.64	32.43
0.3532	37.06	7.035	32.15
0.3742	37.05	7.453	31.87
0.3963	37.03	7.896	31.56
0.4198	37.01	8.366	31.24
0.4447	36.99	8.865	30.98
0.4697	36.97	9.391	30.74
0.4963	36.95	9.95	30.38
0.5247	36.93	10.54	29.99
0.5547	36.91	11.17	29.61
0.5863	36.88	11.83	29.23
0.6213	36.86		

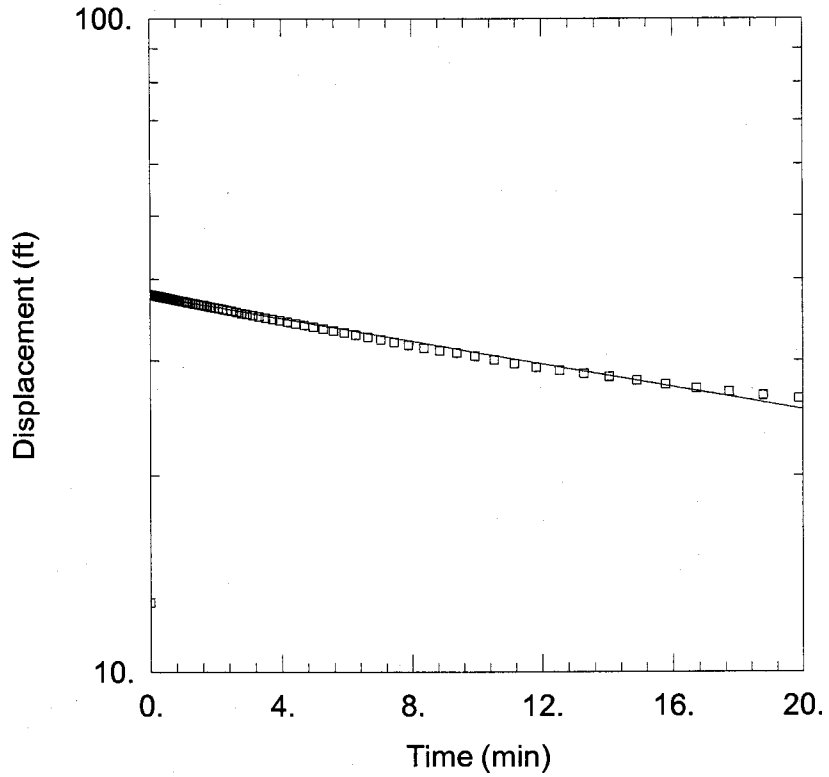
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.488

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	3.152E-5	cm/sec
y0	37.79	ft



BC-14 TEST #2

Data Set: S:\...\BC-14#2rev.AQT
Date: 11/19/04 Time: 11:09:45

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Well: BC-14
Test Date: 12/11/02

AQUIFER DATA

Saturated Thickness: 82.21 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BC-14)

Initial Displacement: 12.78 ft
Total Well Penetration Depth: 14.86 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 14.86 ft
Screen Length: 15. ft
Wellbore Radius: 0.312 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 2.884E-5 cm/sec y0 = 37.74 ft

Data Set: S:\Environ\JOB FILES\Other Branch Jobs\1264 Jobs\1264-02-576 Belews Scrubber LF\Slug Test Data
Title: BC-14 Test #2
Date: 11/19/04
Time: 11:09:53

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Power
Project: 1264-02-576
Location: Belews Creek, NC
Test Date: 12/11/02
Test Well: BC-14

AQUIFER DATA

Saturated Thickness: 82.21 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : BC-14

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 12.78 ft
Static Water Column Height: 14.86 ft
Casing Radius: 0.0833 ft
Wellbore Radius: 0.312 ft
Well Skin Radius: 0.312 ft
Screen Length: 15. ft
Total Well Penetration Depth: 14.86 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.1846 ft
Gravel Pack Porosity: 0.3

No. of Observations: 112

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.005	37.91	0.828	37.14
0.01	37.9	0.8763	37.09
0.015	37.89	0.928	37.05
0.02	37.89	0.983	37.
0.025	37.88	1.041	36.95
0.03	37.87	1.103	36.9
0.035	37.87	1.168	36.84
0.04	37.86	1.238	36.78
0.045	37.85	1.311	36.72
0.05	37.85	1.39	36.66
0.055	37.84	1.473	36.59
0.06	37.84	1.561	36.51
0.065	37.83	1.655	36.44
0.07	37.82	1.753	36.35
0.075	37.82	1.858	36.26
0.08	37.81	1.968	36.17
0.0848	37.81	2.085	36.07
0.09	37.8	2.21	35.97
0.095	37.8	2.341	35.86
0.1	37.79	2.481	35.74

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.1058	37.79	2.63	35.62
0.112	37.78	2.786	35.49
0.1185	37.77	2.953	35.35
0.1255	37.77	3.13	35.22
0.1328	37.76	3.316	35.07
0.1407	37.75	3.515	34.92
0.149	37.74	3.725	34.76
0.1578	37.73	3.946	34.59
0.167	37.73	4.181	34.41
0.177	37.72	4.43	34.22
0.1875	37.71	4.693	34.02
0.1985	37.7	4.973	33.81
0.2102	37.69	5.27	33.59
0.2227	37.67	5.583	33.36
0.2358	37.66	5.915	33.12
0.2498	37.65	6.266	32.86
0.2647	37.63	6.64	32.59
0.2803	37.62	7.035	32.31
0.297	37.61	7.453	32.01
0.3147	37.59	7.896	31.7
0.3333	37.57	8.366	31.38
0.3532	37.56	8.865	31.08
0.3742	37.54	9.391	30.83
0.3963	37.52	9.95	30.51
0.4198	37.49	10.54	30.11
0.4447	37.47	11.17	29.71
0.4697	37.45	11.83	29.31
0.4963	37.43	12.53	28.97
0.5247	37.4	13.28	28.67
0.5547	37.38	14.07	28.36
0.5863	37.35	14.91	27.97
0.6213	37.32	15.79	27.6
0.6578	37.29	16.73	27.23
0.6963	37.25	17.72	26.89
0.738	37.22	18.78	26.56
0.7813	37.18	19.89	26.25

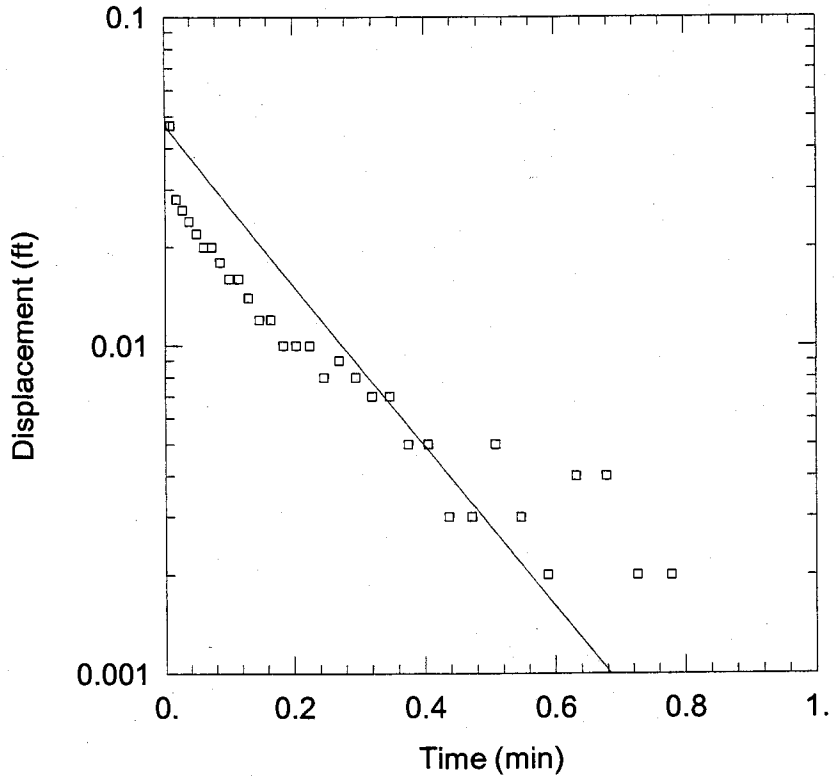
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.489

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	2.884E-5	cm/sec
y0	37.74	ft



SLUG TEST ANALYSIS BC-15

Data Set: S:\...\BC15A.aqt
Date: 11/08/04 Time: 11:38:37

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Well: BC-15
Test Date: 10-08-04

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (BC-15-A)

Initial Displacement: 0.047 ft
Total Well Penetration Depth: 17.71 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 17.71 ft
Screen Length: 15. ft
Wellbore Radius: 0.3542 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.00442 ft/min
y0 = 0.047 ft

Data Set: S:\Environ\JOB FILES\2004 Jobs\04-955 Belews Creek Landfill\Belews Creek Slug Data\BC15A.aqt
Title: Slug Test Analysis BC-15
Date: 11/08/04
Time: 11:38:44

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Date: 10-08-04
Test Well: BC-15

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

SLUG TEST WELL DATA

Test Well: : BC-15-A

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 0.047 ft
Static Water Column Height: 17.71 ft
Casing Radius: 0.08333 ft
Wellbore Radius: 0.3542 ft
Well Skin Radius: 0.5 ft
Screen Length: 15. ft
Total Well Penetration Depth: 17.71 ft

No. of Observations: 35

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.0088	0.047	0.2957	0.008
0.018	0.028	0.3207	0.007
0.028	0.026	0.3473	0.007
0.0385	0.024	0.3757	0.005
0.0495	0.022	0.4057	0.005
0.0612	0.02	0.4373	0.003
0.0737	0.02	0.4723	0.003
0.0868	0.018	0.5088	0.005
0.1008	0.016	0.5473	0.003
0.1157	0.016	0.589	0.002
0.1313	0.014	0.6323	0.004
0.148	0.012	0.679	0.004
0.1657	0.012	0.7273	0.002
0.1843	0.01	0.779	0.002
0.2042	0.01	0.834	0.
0.2252	0.01	0.8923	0.
0.2473	0.008	0.954	0.
0.2708	0.009		

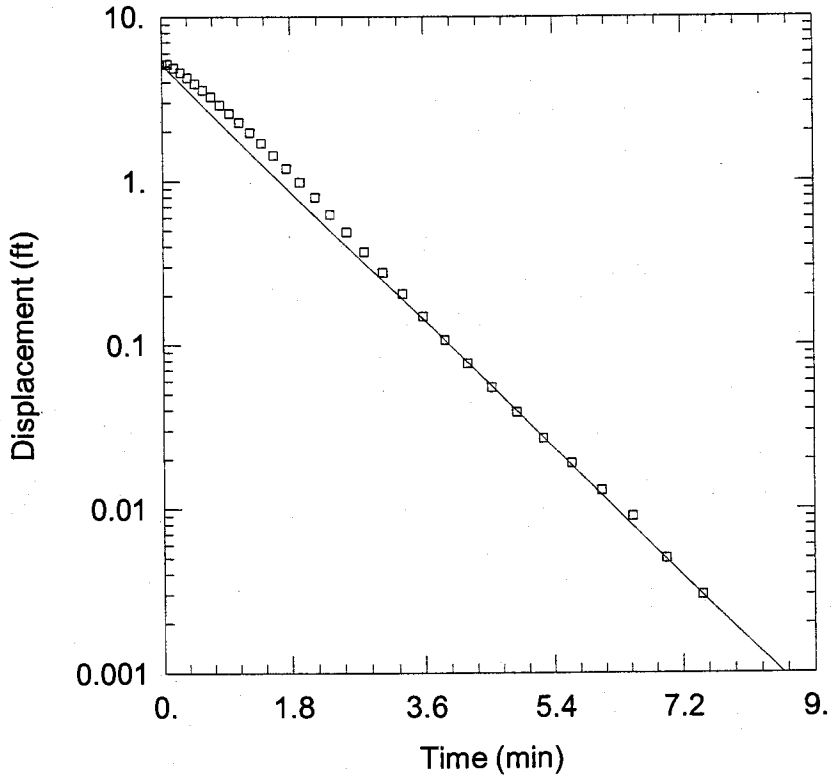
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 3.396

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.00442	ft/min
y0	0.047	ft



SLUG TEST ANALYSIS BC-16

Data Set: S:\...\BC16A.aqt
Date: 11/08/04 Time: 11:03:59

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Well: BC-16
Test Date: 10-08-04

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (BC-16-A)

Initial Displacement: 5.171 ft
Total Well Penetration Depth: 32.72 ft
Casing Radius: 0.04167 ft
Static Water Column Height: 32.72 ft
Screen Length: 10. ft
Wellbore Radius: 0.1578 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0003685 ft/min
y0 = 5.123 ft

Data Set: S:\Environ\JOB FILES\2004 Jobs\04-955 Belews Creek Landfill\Belews Creek Slug Data\BC16A.aqt
Title: Slug Test Analysis BC-16
Date: 11/08/04
Time: 11:04:08

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Date: 10-08-04
Test Well: BC-16

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

SLUG TEST WELL DATA

Test Well: : BC-16-A

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 5.171 ft
Static Water Column Height: 32.72 ft
Casing Radius: 0.04167 ft
Wellbore Radius: 0.1578 ft
Well Skin Radius: 0.16 ft
Screen Length: 10. ft
Total Well Penetration Depth: 32.72 ft

No. of Observations: 33

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.0833	5.171	2.557	0.489
0.1716	4.889	2.792	0.37
0.265	4.591	3.04	0.277
0.3633	4.262	3.303	0.205
0.4683	3.932	3.583	0.149
0.5783	3.592	3.88	0.107
0.695	3.255	4.193	0.077
0.82	2.915	4.525	0.055
0.9515	2.587	4.877	0.039
1.092	2.271	5.25	0.027
1.24	1.976	5.645	0.019
1.397	1.698	6.063	0.013
1.563	1.438	6.507	0.009
1.74	1.198	6.977	0.005
1.927	0.986	7.475	0.003
2.125	0.794	8.002	0.
2.335	0.628		

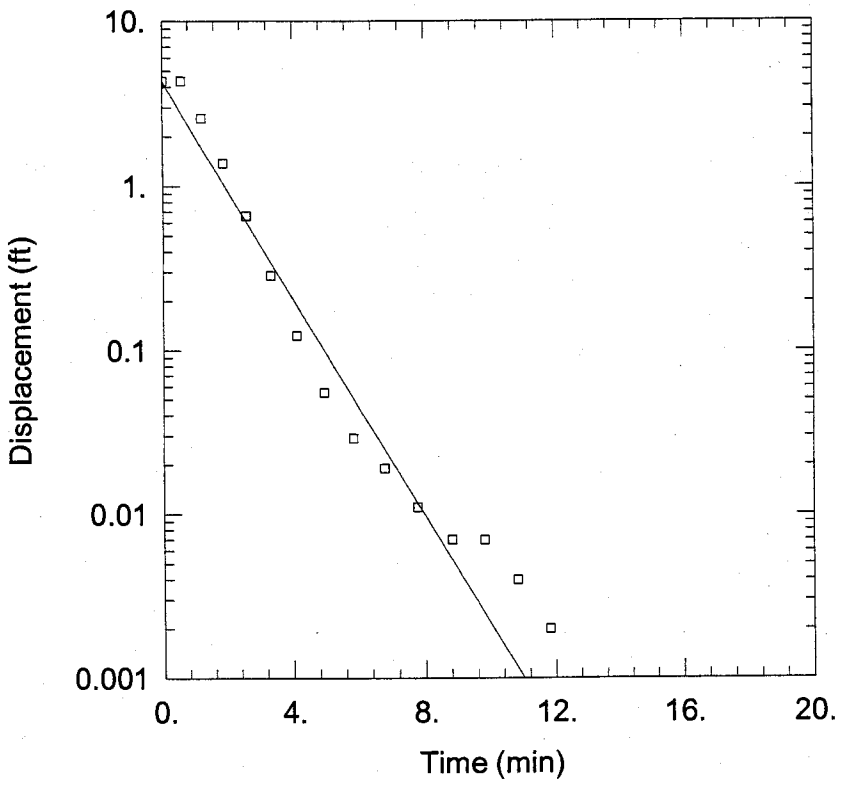
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 4.26

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.0003685	ft/min
y0	5.123	ft



SLUG TEST ANALYSIS BC-16

Data Set: S:\...\BC16B.aqt
Date: 11/08/04 Time: 11:14:23

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Well: BC-16
Test Date: 10-08-04

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (BC-16-B)

Initial Displacement: 4.343 ft
Total Well Penetration Depth: 32.72 ft
Casing Radius: 0.04167 ft
Static Water Column Height: 32.72 ft
Screen Length: 10. ft
Wellbore Radius: 0.1578 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0002813 ft/min
y0 = 4.33 ft

Data Set: S:\Environ\JOB FILES\2004 Jobs\04-955 Belews Creek Landfill\Belews Creek Slug Data\BC16B.aqt
Title: Slug Test Analysis BC-16
Date: 11/08/04
Time: 11:14:35

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Date: 10-08-04
Test Well: BC-16

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

SLUG TEST WELL DATA

Test Well: : BC-16-B

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 4.343 ft
Static Water Column Height: 32.72 ft
Casing Radius: 0.04167 ft
Wellbore Radius: 0.1578 ft
Well Skin Radius: 0.16 ft
Screen Length: 10. ft
Total Well Penetration Depth: 32.72 ft

No. of Observations: 15

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.5916	4.343	6.78	0.019
1.218	2.579	7.773	0.011
1.882	1.38	8.827	0.007
2.585	0.66	9.827	0.007
3.33	0.286	10.83	0.004
4.12	0.123	11.83	0.002
4.957	0.055	12.83	0.
5.842	0.029		

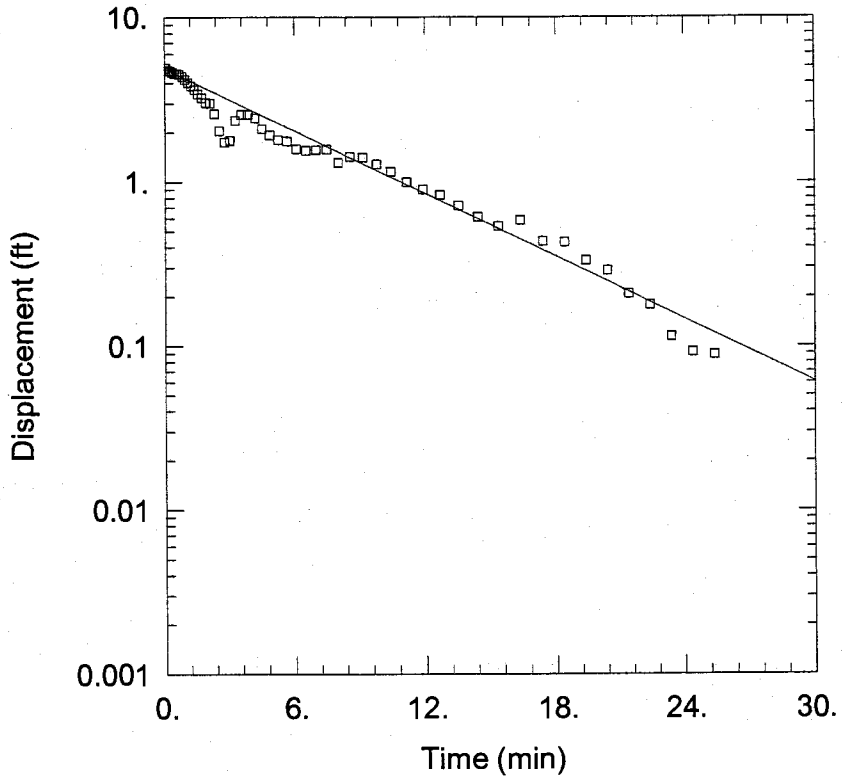
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 4.26

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.0002813	ft/min
y0	4.33	ft



SLUG TEST ANALYSIS BC-17

Data Set: S:\...\BC17A.aqt
Date: 11/08/04 Time: 11:21:52

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Well: BC-17
Test Date: 10-08-04

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (BC-17-A)

Initial Displacement: 4.921 ft
Total Well Penetration Depth: 12.06 ft
Casing Radius: 0.04167 ft
Static Water Column Height: 12.06 ft
Screen Length: 10. ft
Wellbore Radius: 0.125 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 5.067E-5 ft/min
y0 = 4.926 ft

Data Set: S:\Environ\JOB FILES\2004 Jobs\04-955 Belews Creek Landfill\Belews Creek Slug Data\BC17A.aqt
Title: Slug Test Analysis BC-17
Date: 11/08/04
Time: 11:22:04

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Date: 10-08-04
Test Well: BC-17

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

SLUG TEST WELL DATA

Test Well: : BC-17-A

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 4.921 ft
Static Water Column Height: 12.06 ft
Casing Radius: 0.04167 ft
Wellbore Radius: 0.125 ft
Well Skin Radius: 0.13 ft
Screen Length: 10. ft
Total Well Penetration Depth: 12.06 ft

No. of Observations: 54

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.0833	4.921	5.645	1.774
0.1716	4.782	6.063	1.589
0.265	4.727	6.507	1.553
0.3633	4.64	6.977	1.565
0.4683	4.564	7.475	1.581
0.5783	4.572	8.002	1.311
0.695	4.532	8.56	1.427
0.82	4.378	9.152	1.411
0.9515	4.206	9.778	1.285
1.092	4.018	10.44	1.155
1.24	3.837	11.15	1.001
1.397	3.652	11.89	0.898
1.563	3.441	12.68	0.833
1.74	3.263	13.52	0.717
1.927	3.051	14.4	0.61
2.125	3.021	15.34	0.538
2.335	2.61	16.33	0.588
2.557	2.046	17.39	0.436
2.792	1.751	18.39	0.43
3.04	1.785	19.39	0.332

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
3.303	2.368	20.39	0.288
3.583	2.578	21.39	0.208
3.88	2.576	22.39	0.178
4.193	2.45	23.39	0.114
4.525	2.11	24.39	0.092
4.877	1.93	25.39	0.088
5.25	1.805	26.39	0.

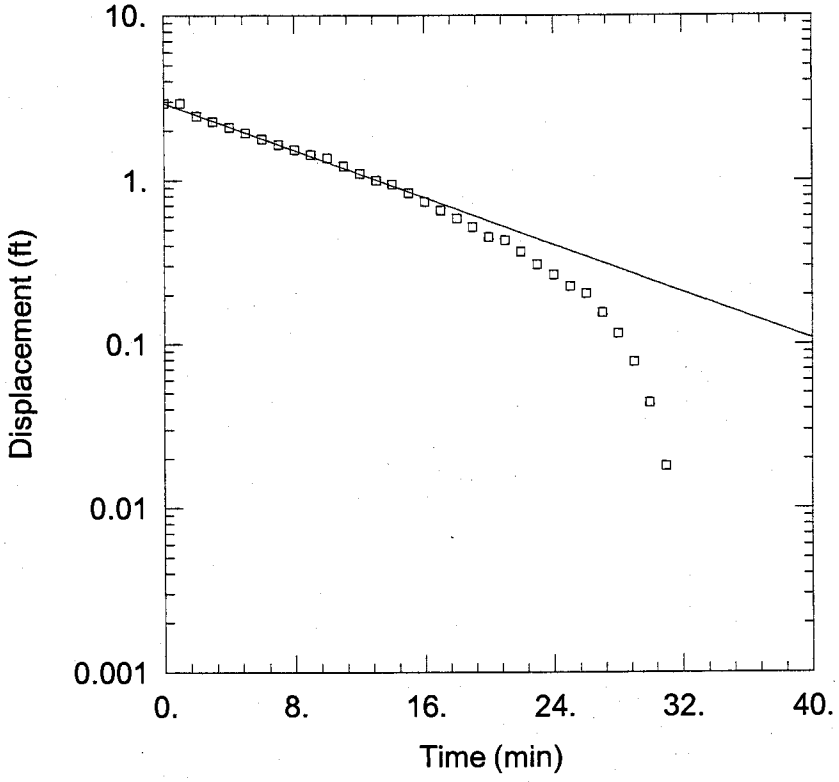
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 3.983

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	5.067E-5	ft/min
y0	4.926	ft



SLUG TEST ANALYSIS BC-17

Data Set: S:\...\BC17B.aqt
Date: 11/08/04 Time: 11:25:17

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Well: BC-17
Test Date: 10-08-04

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (BC-17-B)

Initial Displacement: 2.934 ft
Total Well Penetration Depth: 12.06 ft
Casing Radius: 0.04167 ft
Static Water Column Height: 12.06 ft
Screen Length: 10. ft
Wellbore Radius: 0.125 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 2.851E-5 ft/min
y0 = 2.934 ft

Data Set: S:\Environ\JOB FILES\2004 Jobs\04-955 Belews Creek Landfill\Belews Creek Slug Data\BC17B.aqt
Title: Slug Test Analysis BC-17
Date: 11/08/04
Time: 11:25:26

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Date: 10-08-04
Test Well: BC-17

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

SLUG TEST WELL DATA

Test Well: : BC-17-B

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.934 ft
Static Water Column Height: 12.06 ft
Casing Radius: 0.04167 ft
Wellbore Radius: 0.125 ft
Well Skin Radius: 0.13 ft
Screen Length: 10. ft
Total Well Penetration Depth: 12.06 ft

No. of Observations: 32

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
1.	2.934	17.	0.655
2.	2.461	18.	0.585
3.	2.273	19.	0.519
4.	2.097	20.	0.451
5.	1.941	21.	0.431
6.	1.782	22.	0.367
7.	1.646	23.	0.308
8.	1.534	24.	0.266
9.	1.428	25.	0.226
10.	1.366	26.	0.204
11.	1.218	27.	0.156
12.	1.101	28.	0.116
13.	0.997	29.	0.078
14.	0.945	30.	0.044
15.	0.835	31.	0.018
16.	0.741	32.	0.

SOLUTION

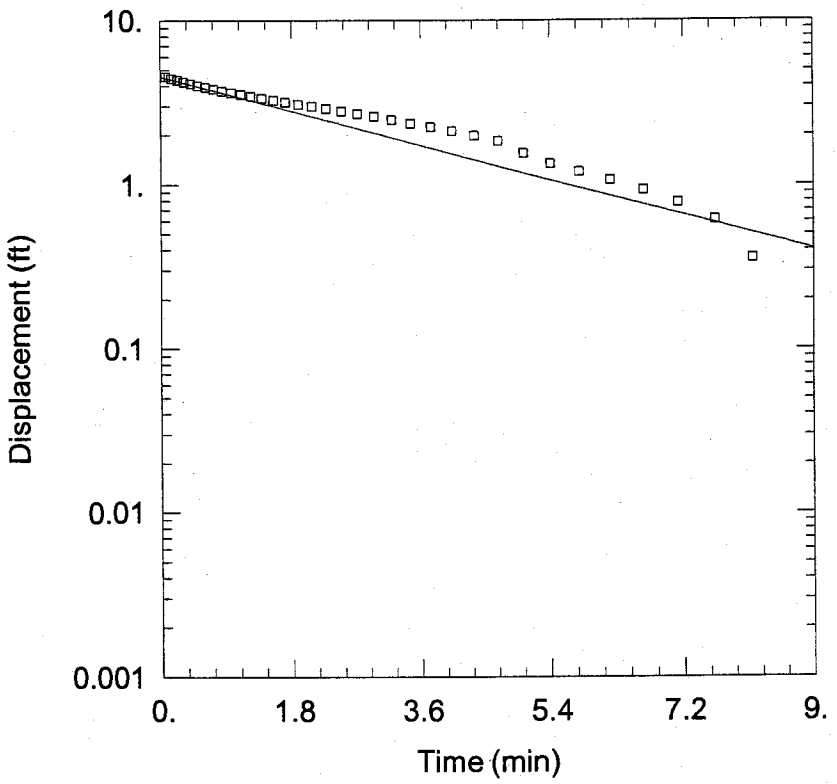
Aquifer Model: Unconfined

Solution Method: Bouwer-Rice
Shape Factor: 3.983

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	2.851E-5	ft/min
y0	2.934	ft



SLUG TEST ANALYSIS BC-18

Data Set: S:\...\BC18A.aqt
Date: 11/08/04 Time: 11:51:46

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Well: BC-18
Test Date: 10-08-04

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (BC-18-1)

Initial Displacement: 4.553 ft
Total Well Penetration Depth: 11.82 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 11.82 ft
Screen Length: 10. ft
Wellbore Radius: 0.3542 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.001743 ft/min
y0 = 4.553 ft

Data Set: S:\Environ\JOB FILES\2004 Jobs\04-955 Belews Creek Landfill\Belews Creek Slug Data\BC18A.aqt
Title: Slug Test Analysis BC-18
Date: 11/08/04
Time: 11:51:53

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Date: 10-08-04
Test Well: BC-18

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

SLUG TEST WELL DATA

Test Well: : BC-18-1

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 4.553 ft
Static Water Column Height: 11.82 ft
Casing Radius: 0.08333 ft
Wellbore Radius: 0.3542 ft
Well Skin Radius: 0.5 ft
Screen Length: 10. ft
Total Well Penetration Depth: 11.82 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.2062 ft
Gravel Pack Porosity: 0.3

No. of Observations: 36

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.0733	4.553	2.487	2.81
0.1517	4.437	2.708	2.705
0.235	4.331	2.943	2.592
0.3233	4.223	3.192	2.479
0.4167	4.12	3.455	2.364
0.515	4.019	3.735	2.243
0.62	3.92	4.032	2.119
0.73	3.82	4.345	1.987
0.8467	3.726	4.677	1.849
0.9717	3.633	5.028	1.553
1.103	3.546	5.402	1.34
1.243	3.456	5.797	1.206
1.392	3.369	6.215	1.07
1.548	3.279	6.658	0.931
1.715	3.184	7.128	0.779
1.892	3.087	7.627	0.613
2.078	2.998	8.153	0.355
2.277	2.907	8.712	0.

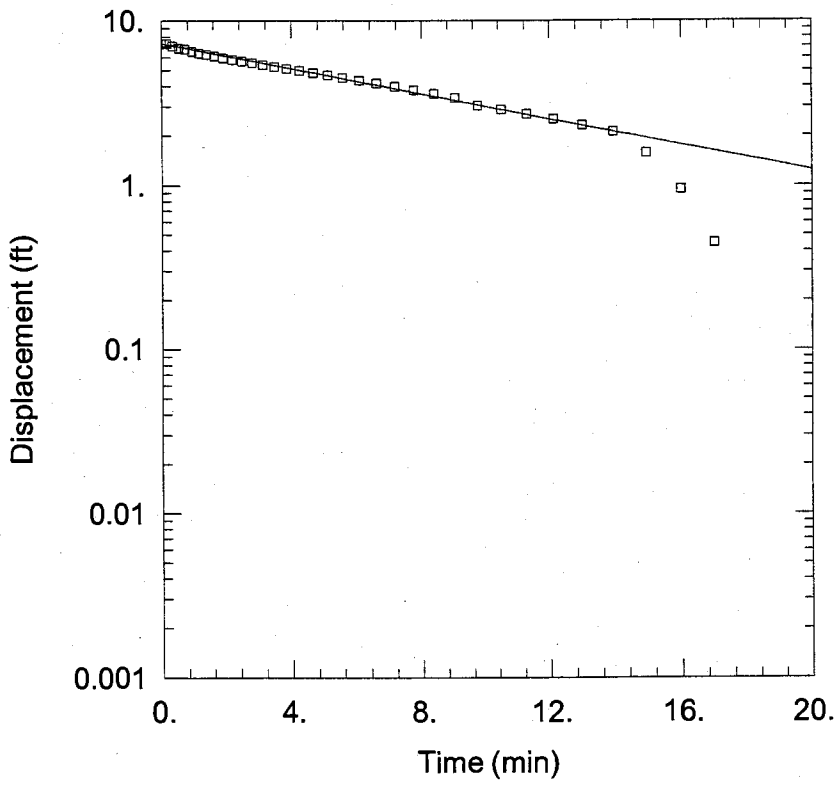
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 3.05

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.001743	ft/min
y0	4.553	ft



SLUG TEST ANALYSIS BC-18

Data Set: S:\...\BC182.aqt
Date: 11/08/04 Time: 11:55:09

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Well: BC-18
Test Date: 10-08-04

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (BC-18-2)

Initial Displacement: 7.271 ft
Total Well Penetration Depth: 11.82 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 11.82 ft
Screen Length: 10. ft
Wellbore Radius: 0.3542 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0005746 ft/min
y0 = 7.296 ft

Data Set: S:\Environ\JOB FILES\2004 Jobs\04-955 Belews Creek Landfill\Belews Creek Slug Data\BC182.aqt
Title: Slug Test Analysis BC-18
Date: 11/08/04
Time: 11:55:18

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Date: 10-08-04
Test Well: BC-18

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

SLUG TEST WELL DATA

Test Well: : BC-18-2

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 7.271 ft
Static Water Column Height: 11.82 ft
Casing Radius: 0.08333 ft
Wellbore Radius: 0.3542 ft
Well Skin Radius: 0.5 ft
Screen Length: 10. ft
Total Well Penetration Depth: 11.82 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.2062 ft
Gravel Pack Porosity: 0.3

No. of Observations: 35

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.1667	7.271	5.58	4.502
0.3434	7.027	6.078	4.338
0.53	6.824	6.605	4.158
0.7284	6.705	7.163	3.974
0.9384	6.506	7.755	3.792
1.16	6.366	8.382	3.602
1.395	6.234	9.045	3.398
1.643	6.104	9.748	3.044
1.907	5.935	10.49	2.876
2.187	5.796	11.28	2.702
2.483	5.672	12.12	2.528
2.797	5.543	13.01	2.318
3.128	5.41	13.94	2.116
3.48	5.257	14.94	1.577
3.853	5.117	15.99	0.95
4.248	4.971	16.99	0.449
4.667	4.82	17.99	0.
5.11	4.662		

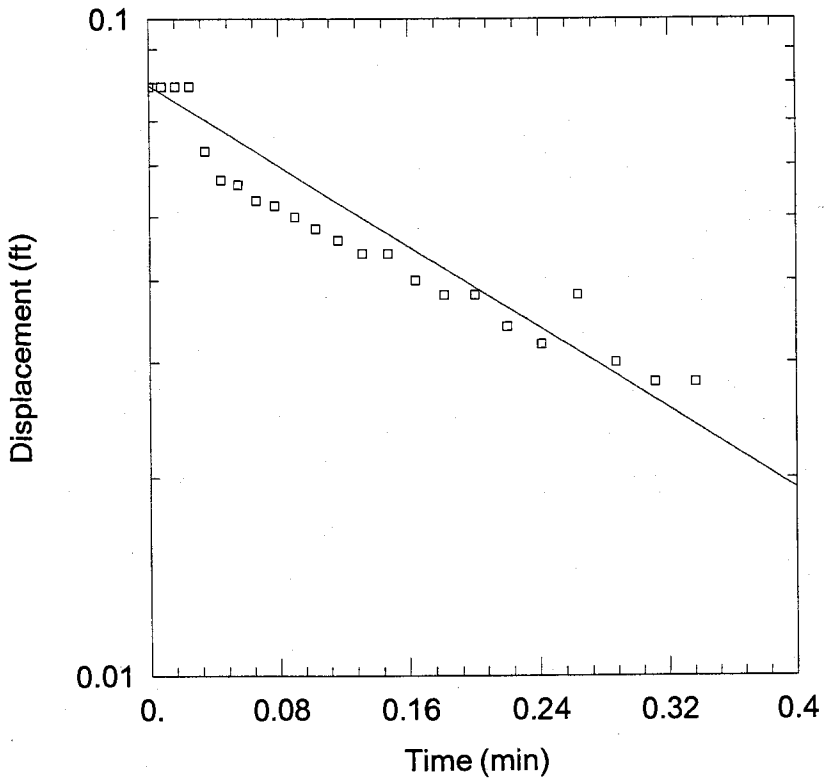
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 3.05

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.0005746	ft/min
y0	7.296	ft



SLUG TEST ANALYSIS BC-18

Data Set: S:\...\BC183.aqt
Date: 11/08/04 Time: 11:59:23

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Well: BC-18
Test Date: 10-08-04

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (BC-18-3)

Initial Displacement: 0.079 ft
Total Well Penetration Depth: 11.82 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 11.82 ft
Screen Length: 10. ft
Wellbore Radius: 0.3542 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0229 ft/min
y0 = 0.07929 ft

Data Set: S:\Environ\JOB FILES\2004 Jobs\04-955 Belews Creek Landfill\Belews Creek Slug Data\BC183.aqt
Title: Slug Test Analysis BC-18
Date: 11/08/04
Time: 11:59:32

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Date: 10-08-04
Test Well: BC-18

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

SLUG TEST WELL DATA

Test Well: : BC-18-3

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 0.079 ft
Static Water Column Height: 11.82 ft
Casing Radius: 0.08333 ft
Wellbore Radius: 0.3542 ft
Well Skin Radius: 0.5 ft
Screen Length: 10. ft
Total Well Penetration Depth: 11.82 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.2062 ft
Gravel Pack Porosity: 0.3

No. of Observations: 22

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.0079	0.079	0.1319	0.044
0.0162	0.079	0.1475	0.044
0.025	0.079	0.1642	0.04
0.0342	0.063	0.1819	0.038
0.0442	0.057	0.2005	0.038
0.0547	0.056	0.2204	0.034
0.0657	0.053	0.2414	0.032
0.0774	0.052	0.2635	0.038
0.0899	0.05	0.287	0.03
0.103	0.048	0.3119	0.028
0.117	0.046	0.3369	0.028

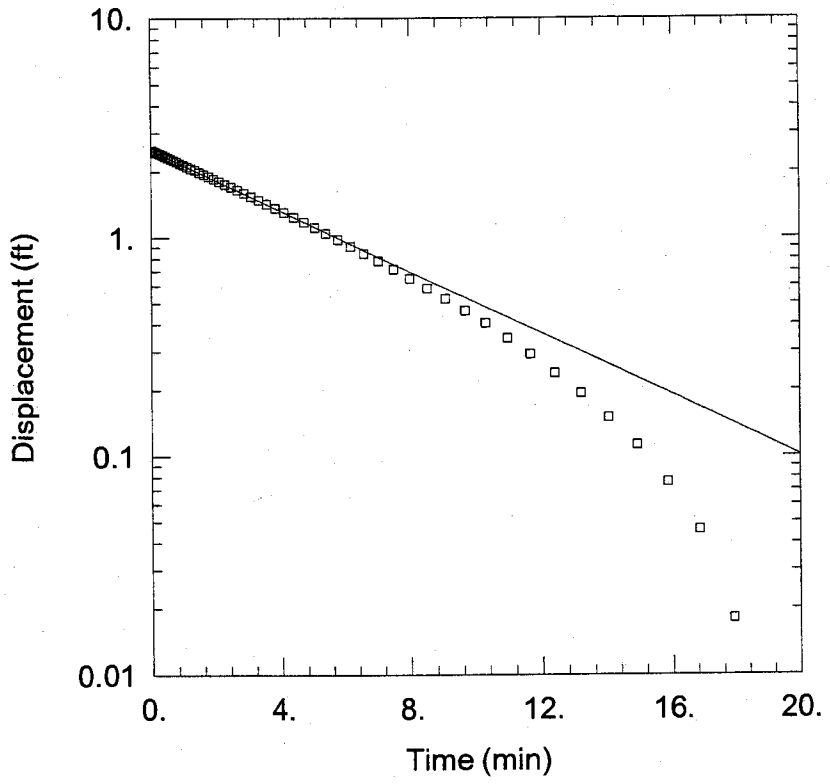
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 3.05

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.0229	ft/min
y0	0.07929	ft



SLUG TEST ANALYSIS BC-18

Data Set: S:\...\BC183B.aqt
Date: 11/08/04 Time: 12:03:36

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Well: BC-18
Test Date: 10-08-04

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (BC-18-3B)

Initial Displacement: 2.508 ft
Total Well Penetration Depth: 11.82 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 11.82 ft
Screen Length: 10. ft
Wellbore Radius: 0.3542 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.001042 ft/min
y0 = 2.508 ft

Data Set: S:\Environ\JOB FILES\2004 Jobs\04-955 Belews Creek Landfill\Belews Creek Slug Data\BC183B.aqt
Title: Slug Test Analysis BC-18
Date: 11/08/04
Time: 12:03:46

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Date: 10-08-04
Test Well: BC-18

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

SLUG TEST WELL DATA

Test Well: : BC-18-3B

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.508 ft
Static Water Column Height: 11.82 ft
Casing Radius: 0.08333 ft
Wellbore Radius: 0.3542 ft
Well Skin Radius: 0.5 ft
Screen Length: 10. ft
Total Well Penetration Depth: 11.82 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.2062 ft
Gravel Pack Porosity: 0.3

No. of Observations: 54

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.0517	2.508	3.553	1.423
0.1067	2.484	3.817	1.363
0.165	2.458	4.097	1.301
0.2267	2.434	4.393	1.239
0.2917	2.406	4.707	1.175
0.3617	2.38	5.038	1.109
0.435	2.35	5.39	1.045
0.5134	2.32	5.763	0.977
0.5967	2.288	6.158	0.911
0.685	2.256	6.577	0.846
0.7784	2.222	7.02	0.781
0.8767	2.188	7.49	0.714
0.9817	2.152	7.988	0.648
1.092	2.114	8.515	0.584
1.208	2.074	9.073	0.524
1.333	2.034	9.665	0.462
1.465	1.99	10.29	0.404
1.605	1.948	10.96	0.346

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
1.753	1.902	11.66	0.292
1.91	1.856	12.4	0.24
2.077	1.805	13.19	0.194
2.253	1.755	14.03	0.15
2.44	1.704	14.91	0.112
2.638	1.652	15.85	0.076
2.848	1.597	16.85	0.046
3.07	1.541	17.9	0.018
3.305	1.483	18.9	0.

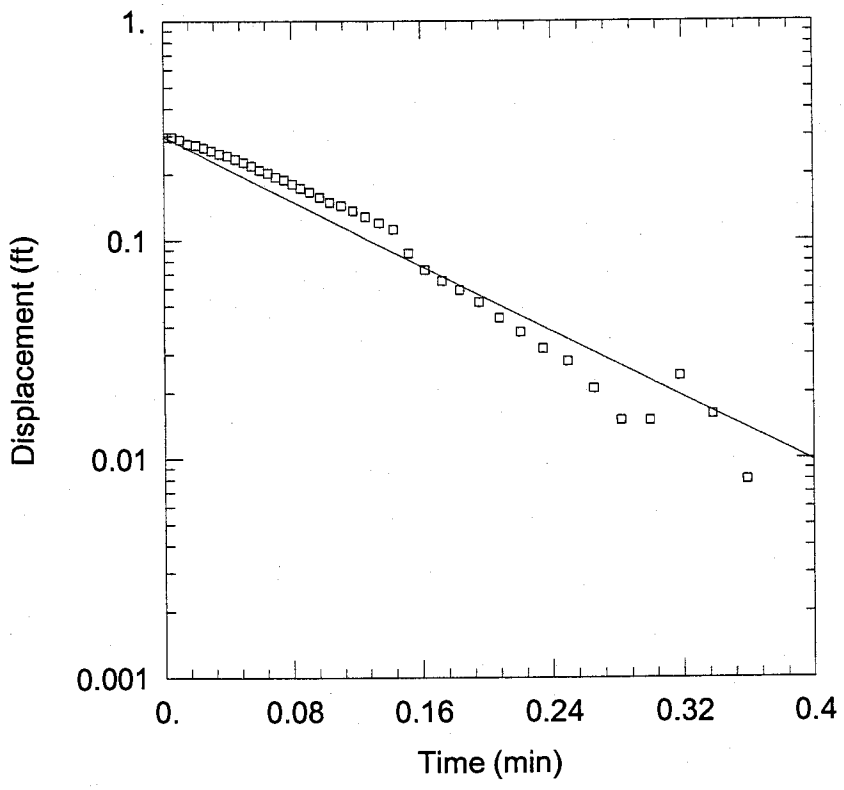
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 3.05

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.001042	ft/min
y0	2.508	ft



SLUG TEST ANALYSIS BC-19

Data Set: S:\...\BC19A.aqt
Date: 11/08/04 Time: 12:11:09

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Well: BC-19
Test Date: 10-08-04

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (BC-19-A)

Initial Displacement: 0.296 ft
Total Well Penetration Depth: 17.03 ft
Casing Radius: 0.04167 ft
Static Water Column Height: 17.03 ft
Screen Length: 10. ft
Wellbore Radius: 0.3542 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.00239 ft/min
y0 = 0.2978 ft

Data Set: S:\Environ\JOB FILES\2004 Jobs\04-955 Belews Creek Landfill\Belews Creek Slug Data\BC19A.aqt
Title: Slug Test Analysis BC-19
Date: 11/08/04
Time: 12:11:16

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Date: 10-08-04
Test Well: BC-19

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

SLUG TEST WELL DATA

Test Well: : BC-19-A

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 0.296 ft
Static Water Column Height: 17.03 ft
Casing Radius: 0.04167 ft
Wellbore Radius: 0.3542 ft
Well Skin Radius: 0.5 ft
Screen Length: 10. ft
Total Well Penetration Depth: 17.03 ft

No. of Observations: 40

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.005	0.296	0.1105	0.144
0.01	0.288	0.1178	0.136
0.015	0.276	0.1257	0.128
0.02	0.272	0.134	0.12
0.025	0.265	0.1428	0.112
0.03	0.257	0.152	0.087
0.035	0.248	0.162	0.073
0.04	0.243	0.1725	0.065
0.045	0.235	0.1835	0.059
0.05	0.227	0.1952	0.052
0.055	0.219	0.2077	0.044
0.06	0.209	0.2208	0.038
0.065	0.203	0.2348	0.032
0.0698	0.195	0.2497	0.028
0.075	0.189	0.2653	0.021
0.08	0.181	0.282	0.015
0.085	0.173	0.2997	0.015
0.0908	0.166	0.3183	0.024
0.097	0.157	0.3382	0.016
0.1035	0.149	0.3592	0.008

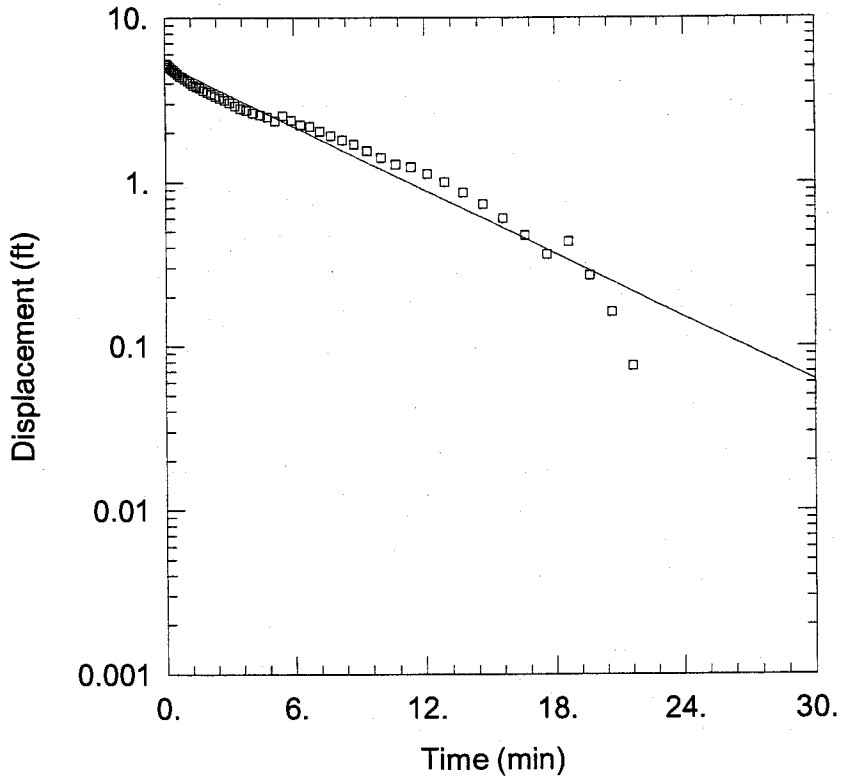
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 3.219

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.00239	ft/min
y0	0.2978	ft



SLUG TEST ANALYSIS BC-19

Data Set: S:\...\BC19B.aqt
Date: 11/08/04 Time: 12:15:28

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Well: BC-19
Test Date: 10-08-04

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (BC-19-B)

Initial Displacement: 5.264 ft
Total Well Penetration Depth: 17.03 ft
Casing Radius: 0.04167 ft
Static Water Column Height: 17.03 ft
Screen Length: 10. ft
Wellbore Radius: 0.3542 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 4.132E-5 ft/min
y0 = 5.264 ft

Data Set: S:\Environ\JOB FILES\2004 Jobs\04-955 Belews Creek Landfill\Belews Creek Slug Data\BC19B.aqt
Title: Slug Test Analysis BC-19
Date: 11/08/04
Time: 12:15:41

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Date: 10-08-04
Test Well: BC-19

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

SLUG TEST WELL DATA

Test Well: : BC-19-B

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 5.264 ft
Static Water Column Height: 17.03 ft
Casing Radius: 0.04167 ft
Wellbore Radius: 0.3542 ft
Well Skin Radius: 0.5 ft
Screen Length: 10. ft
Total Well Penetration Depth: 17.03 ft

No. of Observations: 53

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.07	5.264	4.747	2.491
0.1433	5.152	5.098	2.359
0.2217	5.017	5.472	2.535
0.305	4.893	5.867	2.381
0.3933	4.803	6.285	2.235
0.4867	4.667	6.728	2.183
0.585	4.536	7.198	2.041
0.69	4.408	7.697	1.917
0.8	4.356	8.223	1.803
0.9167	4.246	8.782	1.703
1.042	4.145	9.373	1.551
1.173	4.021	10.	1.413
1.313	3.899	10.66	1.281
1.462	3.811	11.37	1.239
1.618	3.751	12.11	1.123
1.785	3.618	12.9	1.005
1.962	3.53	13.74	0.869
2.148	3.44	14.62	0.735
2.347	3.338	15.56	0.603
2.557	3.238	16.56	0.477

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
2.778	3.156	17.61	0.364
3.013	3.045	18.61	0.435
3.261	2.908	19.61	0.271
3.525	2.801	20.61	0.162
3.805	2.739	21.61	0.076
4.102	2.637	22.61	0.
4.415	2.557		

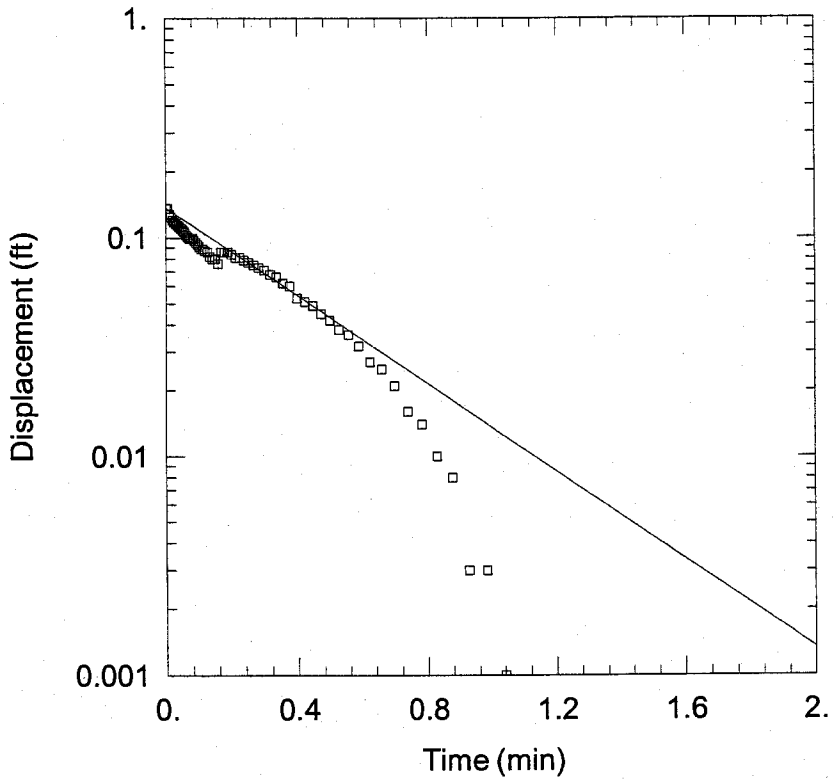
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 3.219

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	4.132E-5	ft/min
y0	5.264	ft



SLUG TEST ANALYSIS BC-20

Data Set: S:\...\BC20.aqt
Date: 11/08/04 Time: 12:28:43

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Well: BC-20
Test Date: 10-07-04

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (BC-20-A)

Initial Displacement: 0.136 ft
Total Well Penetration Depth: 8.93 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 8.93 ft
Screen Length: 10. ft
Wellbore Radius: 0.3542 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.01433 ft/min
y0 = 0.1369 ft

Data Set: S:\Environ\JOB FILES\2004 Jobs\04-955 Belews Creek Landfill\Belews Creek Slug Data\BC20.aqt
Title: Slug Test Analysis BC-20
Date: 11/08/04
Time: 12:28:50

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Date: 10-07-04
Test Well: BC-20

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

SLUG TEST WELL DATA

Test Well: : BC-20-A

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 0.136 ft
Static Water Column Height: 8.93 ft
Casing Radius: 0.08333 ft
Wellbore Radius: 0.3542 ft
Well Skin Radius: 0.5 ft
Screen Length: 10. ft
Total Well Penetration Depth: 8.93 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.2062 ft
Gravel Pack Porosity: 0.3

No. of Observations: 61

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.005	0.136	0.1985	0.084
0.01	0.128	0.2102	0.081
0.015	0.124	0.2227	0.081
0.02	0.12	0.2358	0.079
0.025	0.118	0.2498	0.077
0.03	0.116	0.2647	0.075
0.035	0.114	0.2803	0.073
0.04	0.112	0.297	0.071
0.045	0.11	0.3147	0.068
0.05	0.108	0.3333	0.066
0.055	0.106	0.3532	0.062
0.06	0.103	0.3742	0.06
0.065	0.101	0.3963	0.053
0.07	0.099	0.4198	0.051
0.075	0.099	0.4447	0.049
0.08	0.099	0.4697	0.045
0.0848	0.097	0.4963	0.042
0.09	0.095	0.5247	0.038

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.095	0.093	0.5547	0.036
0.1	0.091	0.5863	0.032
0.1058	0.089	0.6213	0.027
0.112	0.089	0.6578	0.025
0.1185	0.087	0.6963	0.021
0.1255	0.086	0.738	0.016
0.1328	0.082	0.7813	0.014
0.1407	0.08	0.828	0.01
0.149	0.08	0.8763	0.008
0.1578	0.076	0.928	0.003
0.167	0.086	0.983	0.003
0.177	0.086	1.041	0.001
0.1875	0.086		

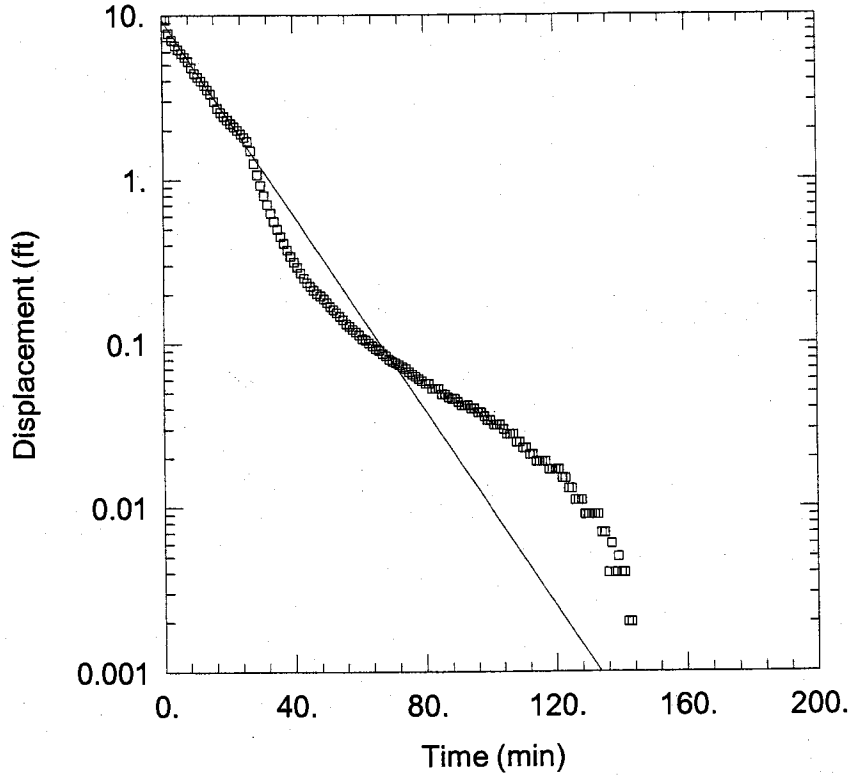
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.916

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.01433	ft/min
y0	0.1369	ft



SLUG TEST ANALYSIS BC-20

Data Set: S:\...\BC20B.aqt
Date: 11/08/04 Time: 12:31:02

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Well: BC-20
Test Date: 10-07-04

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (BC-20-B)

Initial Displacement: 9.352 ft
Total Well Penetration Depth: 8.93 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 8.93 ft
Screen Length: 10. ft
Wellbore Radius: 0.3542 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0004242 ft/min
y0 = 9.351 ft

Data Set: S:\Environ\JOB FILES\2004 Jobs\04-955 Belews Creek Landfill\Belews Creek Slug Data\BC20B.aqt
Title: Slug Test Analysis BC-20
Date: 11/08/04
Time: 12:31:10

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Date: 10-07-04
Test Well: BC-20

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

SLUG TEST WELL DATA

Test Well: : BC-20-B

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 9.352 ft
Static Water Column Height: 8.93 ft
Casing Radius: 0.08333 ft
Wellbore Radius: 0.3542 ft
Well Skin Radius: 0.5 ft
Screen Length: 10. ft
Total Well Penetration Depth: 8.93 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.2062 ft
Gravel Pack Porosity: 0.3

No. of Observations: 145

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
1.	9.352	74.	0.07
2.	7.785	75.	0.067
3.	7.077	76.	0.065
4.	6.561	77.	0.063
5.	6.184	78.	0.061
6.	5.868	79.	0.059
7.	5.565	80.	0.057
8.	5.261	81.	0.057
9.	4.809	82.	0.053
10.	4.448	83.	0.053
11.	4.214	84.	0.053
12.	3.996	85.	0.049
13.	3.777	86.	0.049
14.	3.542	87.	0.047
15.	3.331	88.	0.046
16.	3.001	89.	0.046
17.	2.73	90.	0.044
18.	2.577	91.	0.042

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
19.	2.437	92.	0.042
20.	2.317	93.	0.042
21.	2.204	94.	0.04
22.	2.103	95.	0.04
23.	2.006	96.	0.038
24.	1.908	97.	0.038
25.	1.811	98.	0.036
26.	1.716	99.	0.034
27.	1.502	100.	0.034
28.	1.262	101.	0.032
29.	1.072	102.	0.032
30.	0.924	103.	0.032
31.	0.804	104.	0.03
32.	0.707	105.	0.028
33.	0.626	106.	0.028
34.	0.558	107.	0.028
35.	0.5	108.	0.025
36.	0.451	109.	0.025
37.	0.409	110.	0.023
38.	0.374	111.	0.023
39.	0.343	112.	0.021
40.	0.316	113.	0.021
41.	0.294	114.	0.019
42.	0.271	115.	0.019
43.	0.252	116.	0.019
44.	0.236	117.	0.019
45.	0.225	118.	0.017
46.	0.213	119.	0.017
47.	0.202	120.	0.017
48.	0.196	121.	0.017
49.	0.188	122.	0.015
50.	0.178	123.	0.015
51.	0.169	124.	0.013
52.	0.161	125.	0.013
53.	0.155	126.	0.011
54.	0.147	127.	0.011
55.	0.14	128.	0.011
56.	0.132	129.	0.009
57.	0.128	130.	0.009
58.	0.122	131.	0.009
59.	0.118	132.	0.009
60.	0.113	133.	0.009
61.	0.107	134.	0.007
62.	0.105	135.	0.007
63.	0.101	136.	0.004
64.	0.097	137.	0.006
65.	0.093	138.	0.004
66.	0.091	139.	0.005
67.	0.087	140.	0.004
68.	0.084	141.	0.004
69.	0.08	142.	0.002
70.	0.078	143.	0.002
71.	0.076	144.	0.
72.	0.074	145.	0.
73.	0.072		

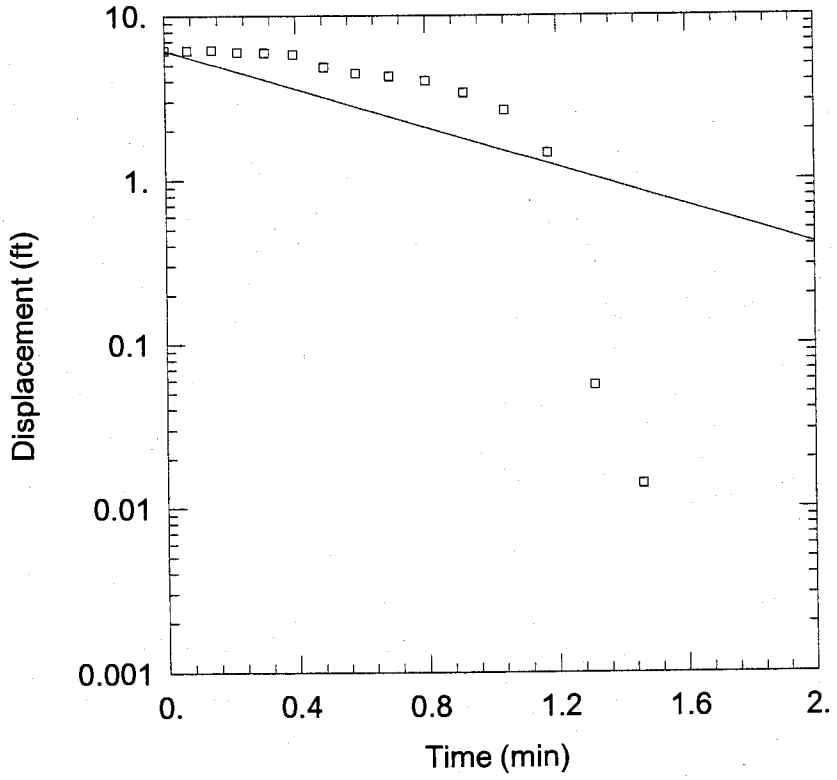
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.916

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.0004242	ft/min
y0	9.351	ft



SLUG TEST ANALYSIS BC-21

Data Set: S:\...\BC21A.aqt
Date: 11/08/04 Time: 12:39:19

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Well: BC-21
Test Date: 10-07-04

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (BC-21-A)

Initial Displacement: 6.165 ft
Total Well Penetration Depth: 3.48 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 3.48 ft
Screen Length: 10. ft
Wellbore Radius: 0.3542 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.006989 ft/min
y0 = 6.165 ft

Data Set: S:\Environ\JOB FILES\2004 Jobs\04-955 Belews Creek Landfill\Belews Creek Slug Data\BC21A.aqt
Title: Slug Test Analysis BC-21
Date: 11/08/04
Time: 12:39:26

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Date: 10-07-04
Test Well: BC-21

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

SLUG TEST WELL DATA

Test Well: : BC-21-A

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 6.165 ft
Static Water Column Height: 3.48 ft
Casing Radius: 0.08333 ft
Wellbore Radius: 0.3542 ft
Well Skin Radius: 0.5 ft
Screen Length: 10. ft
Total Well Penetration Depth: 3.48 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.2062 ft
Gravel Pack Porosity: 0.3

No. of Observations: 15

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.07	6.165	0.8	4.011
0.1433	6.179	0.9167	3.385
0.2217	6.01	1.042	2.65
0.305	5.958	1.173	1.46
0.3933	5.842	1.313	0.056
0.4867	4.853	1.462	0.014
0.585	4.47	1.618	0.
0.69	4.284		

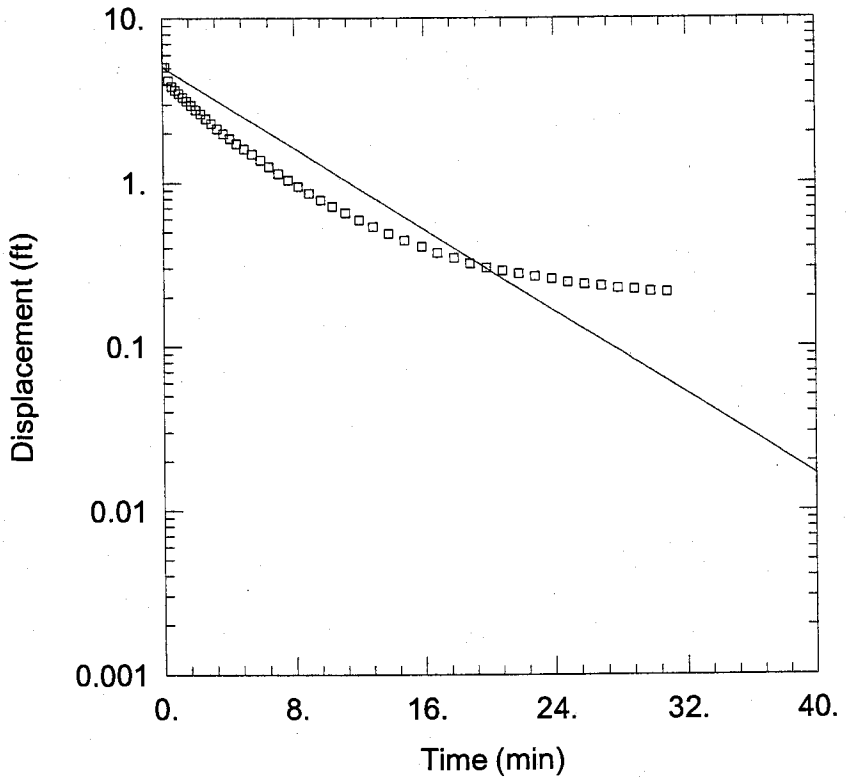
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.428

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.006989	ft/min
y0	6.165	ft



SLUG TEST ANALYSIS BC-21

Data Set: S:\...\BC21B.aqt
Date: 11/08/04 Time: 12:42:58

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Well: BC-21
Test Date: 10-07-04

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (BC-21-B)

Initial Displacement: 5.059 ft
Total Well Penetration Depth: 3.48 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 3.48 ft
Screen Length: 10. ft
Wellbore Radius: 0.3542 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0007375 ft/min
y0 = 5.079 ft

Data Set: S:\Environ\JOB FILES\2004 Jobs\04-955 Belews Creek Landfill\Belews Creek Slug Data\BC21B.aqt
Title: Slug Test Analysis BC-21
Date: 11/08/04
Time: 12:43:05

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Date: 10-07-04
Test Well: BC-21

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

SLUG TEST WELL DATA

Test Well: : BC-21-B

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 5.059 ft
Static Water Column Height: 3.48 ft
Casing Radius: 0.08333 ft
Wellbore Radius: 0.3542 ft
Well Skin Radius: 0.5 ft
Screen Length: 10. ft
Total Well Penetration Depth: 3.48 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.2062 ft
Gravel Pack Porosity: 0.3

No. of Observations: 48

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.1767	5.059	9.582	0.786
0.3633	4.187	10.33	0.717
0.5617	3.872	11.12	0.653
0.7717	3.669	11.95	0.591
0.9933	3.501	12.84	0.539
1.228	3.325	13.78	0.487
1.476	3.155	14.77	0.444
1.74	2.973	15.82	0.406
2.02	2.791	16.82	0.373
2.317	2.629	17.82	0.346
2.63	2.455	18.82	0.321
2.962	2.292	19.82	0.302
3.313	2.136	20.82	0.29
3.687	1.991	21.82	0.278
4.082	1.859	22.82	0.267
4.5	1.732	23.82	0.257
4.943	1.61	24.82	0.246
5.413	1.494	25.82	0.24

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
5.912	1.374	26.82	0.234
6.438	1.254	27.82	0.227
6.997	1.142	28.82	0.223
7.588	1.04	29.82	0.217
8.215	0.951	30.82	0.215
8.878	0.864	31.82	0.

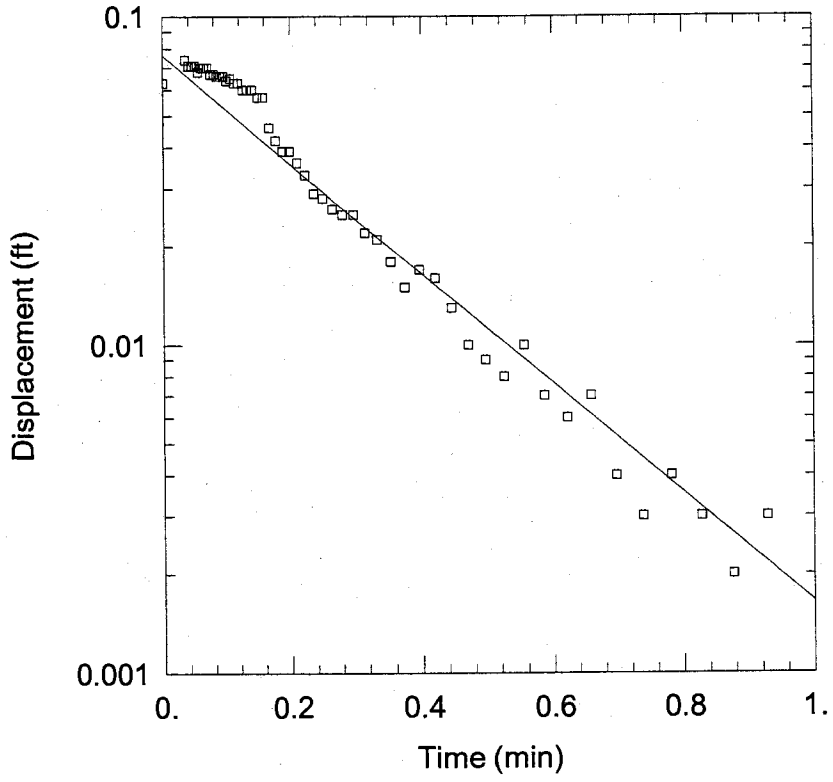
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.428

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.0007375	ft/min
y0	5.079	ft



SLUG TEST ANALYSIS BC-22

Data Set: S:\...\BC22A.aqt
Date: 11/08/04 Time: 12:51:43

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Well: BC-22
Test Date: 10-07-04

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (BC-22-A)

Initial Displacement: 0.063 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.08333 ft
Static Water Column Height: 10. ft
Screen Length: 10. ft
Wellbore Radius: 0.3542 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0242 ft/min
y0 = 0.0764 ft

Data Set: S:\Environ\JOB FILES\2004 Jobs\04-955 Belews Creek Landfill\Belews Creek Slug Data\BC22A.aqt
Title: Slug Test Analysis BC-22
Date: 11/08/04
Time: 12:51:51

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Date: 10-07-04
Test Well: BC-22

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

SLUG TEST WELL DATA

Test Well: : BC-22-A

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 0.063 ft
Static Water Column Height: 10. ft
Casing Radius: 0.08333 ft
Wellbore Radius: 0.3542 ft
Well Skin Radius: 0.5 ft
Screen Length: 10. ft
Total Well Penetration Depth: 10. ft
Corrected Casing Radius (Bouwer-Rice Method): 0.2062 ft
Gravel Pack Porosity: 0.3

No. of Observations: 54

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.035	0.074	0.2227	0.033
0.04	0.071	0.2358	0.029
0.045	0.071	0.2498	0.028
0.05	0.071	0.2647	0.026
0.055	0.068	0.2803	0.025
0.06	0.07	0.297	0.025
0.065	0.07	0.3147	0.022
0.07	0.07	0.3333	0.021
0.075	0.067	0.3532	0.018
0.08	0.067	0.3742	0.015
0.0848	0.066	0.3963	0.017
0.09	0.066	0.4198	0.016
0.095	0.066	0.4447	0.013
0.1	0.064	0.4697	0.01
0.1058	0.065	0.4963	0.009
0.112	0.063	0.5247	0.008
0.1185	0.063	0.5547	0.01
0.1255	0.06	0.5863	0.007

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.1328	0.06	0.6213	0.006
0.1407	0.06	0.6578	0.007
0.149	0.057	0.6963	0.004
0.1578	0.057	0.738	0.003
0.167	0.046	0.7813	0.004
0.177	0.042	0.828	0.003
0.1875	0.039	0.8763	0.002
0.1985	0.039	0.928	0.003
0.2102	0.036	0.983	0.

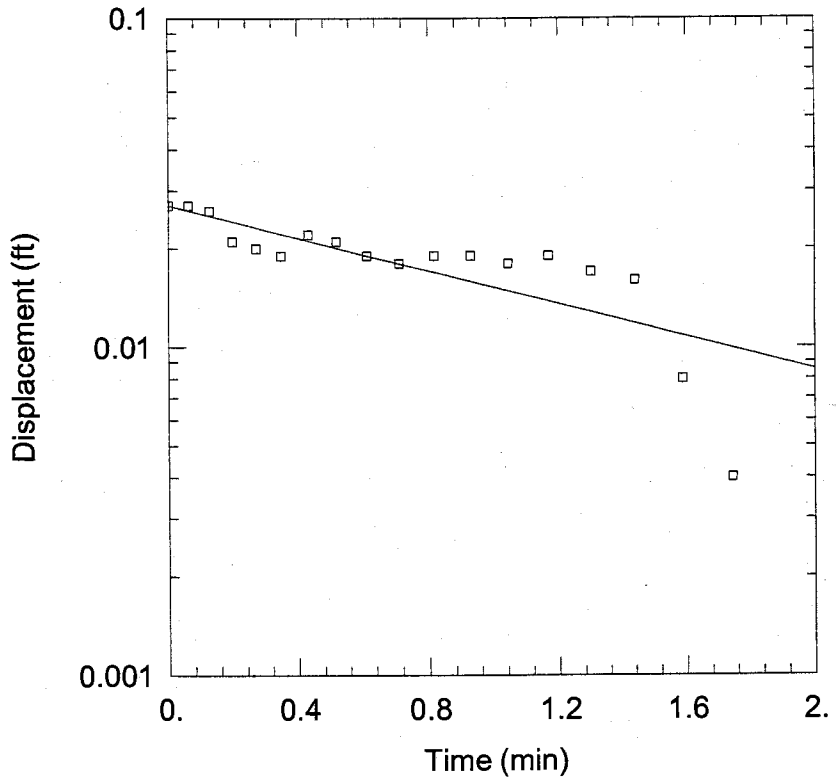
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.971

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.0242	ft/min
y0	0.0764	ft



SLUG TEST ANALYSIS BC-22

Data Set: S:\...\BC22B.aqt
Date: 11/08/04 Time: 12:54:45

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Well: BC-22
Test Date: 10-07-04

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (BC-22-B)

Initial Displacement: 0.027 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.08333 ft
Static Water Column Height: 10. ft
Screen Length: 10. ft
Wellbore Radius: 0.3542 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.003634 ft/min
y0 = 0.02703 ft

Data Set: S:\Environ\JOB FILES\2004 Jobs\04-955 Belews Creek Landfill\Belews Creek Slug Data\BC22B.aqt
Title: Slug Test Analysis BC-22
Date: 11/08/04
Time: 12:54:55

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Date: 10-07-04
Test Well: BC-22

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

SLUG TEST WELL DATA

Test Well: : BC-22-B

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 0.027 ft
Static Water Column Height: 10. ft
Casing Radius: 0.08333 ft
Wellbore Radius: 0.3542 ft
Well Skin Radius: 0.5 ft
Screen Length: 10. ft
Total Well Penetration Depth: 10. ft
Corrected Casing Radius (Bouwer-Rice Method): 0.2062 ft
Gravel Pack Porosity: 0.3

No. of Observations: 18

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.0617	0.027	0.8167	0.019
0.1267	0.026	0.9267	0.019
0.1967	0.021	1.043	0.018
0.27	0.02	1.168	0.019
0.3484	0.019	1.3	0.017
0.4317	0.022	1.44	0.016
0.52	0.021	1.588	0.008
0.6134	0.019	1.745	0.004
0.7117	0.018	1.912	0.

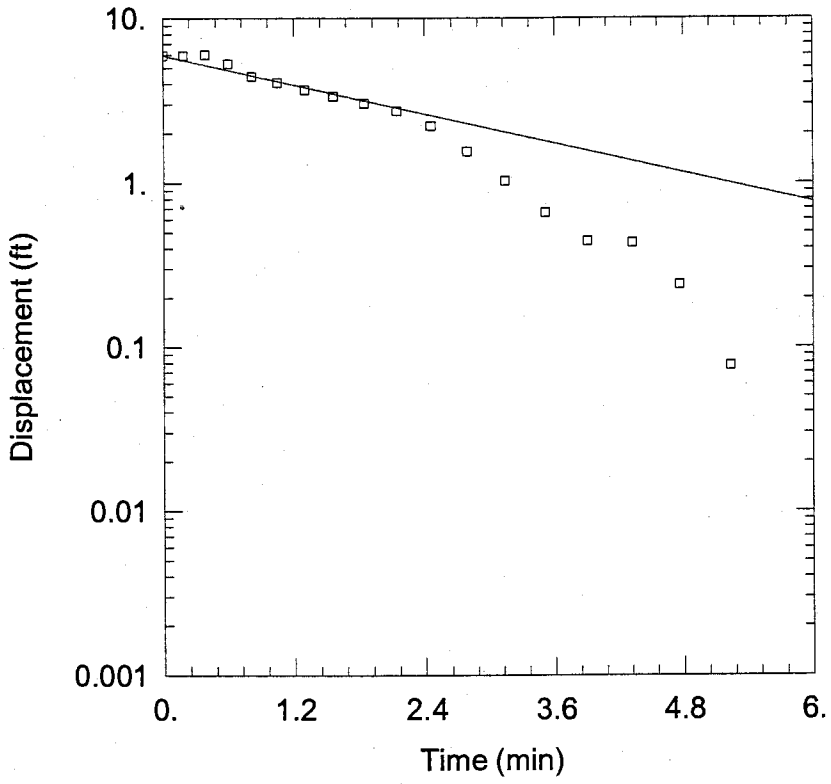
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.971

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.003634	ft/min
y0	0.02703	ft



SLUG TEST ANALYSIS BC-22

Data Set: S:\...\BC22C.aqt
Date: 11/08/04 Time: 13:03:24

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Well: BC-22
Test Date: 10-07-04

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (BC-22-C)

Initial Displacement: 5.933 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.08333 ft
Static Water Column Height: 10. ft
Screen Length: 10. ft
Wellbore Radius: 0.3542 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.00215 ft/min
y0 = 5.933 ft

Data Set: S:\Environ\JOB FILES\2004 Jobs\04-955 Belews Creek Landfill\Belews Creek Slug Data\BC22C.aqt
Title: Slug Test Analysis BC-22
Date: 11/08/04
Time: 13:03:33

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Date: 10-07-04
Test Well: BC-22

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

SLUG TEST WELL DATA

Test Well: : BC-22-C

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 5.933 ft
Static Water Column Height: 10. ft
Casing Radius: 0.08333 ft
Wellbore Radius: 0.3542 ft
Well Skin Radius: 0.5 ft
Screen Length: 10. ft
Total Well Penetration Depth: 10. ft
Corrected Casing Radius (Bouwer-Rice Method): 0.2062 ft
Gravel Pack Porosity: 0.3

No. of Observations: 18

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.1866	5.933	2.453	2.22
0.385	6.028	2.785	1.55
0.595	5.303	3.137	1.032
0.8166	4.448	3.51	0.664
1.052	4.077	3.905	0.443
1.3	3.689	4.323	0.433
1.563	3.359	4.767	0.239
1.843	3.045	5.237	0.077
2.14	2.738	5.735	0.

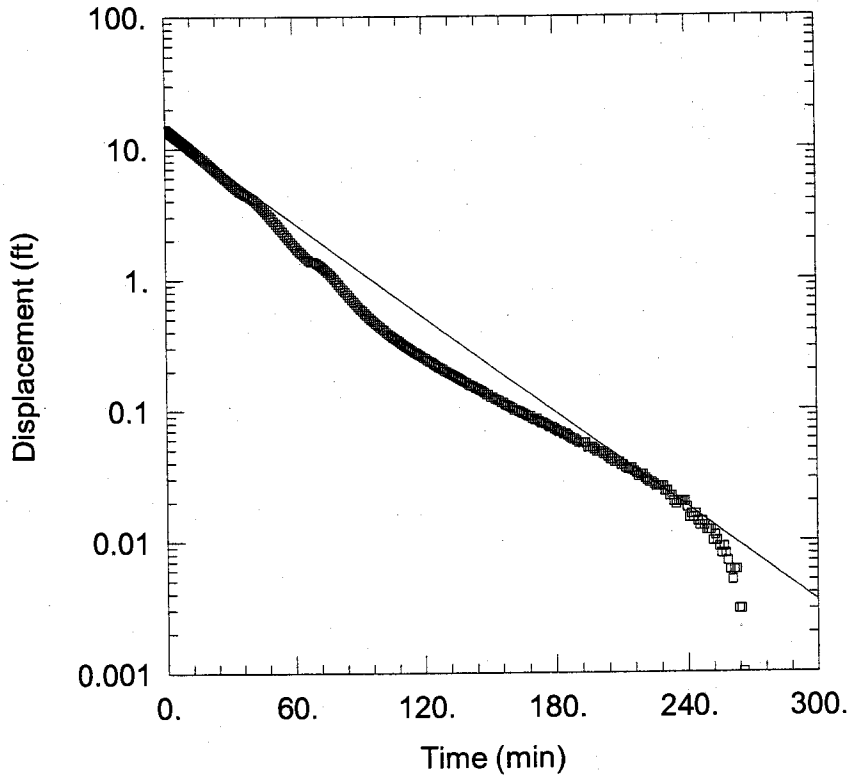
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.971

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.00215	ft/min
y0	5.933	ft



SLUG TEST ANALYSIS BC-23A

Data Set: S:\...\BC23A.aqt
Date: 11/08/04 Time: 13:20:32

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Well: BC-23A
Test Date: 10-07-04

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (BC-23A-A)

Initial Displacement: 14.12 ft
Total Well Penetration Depth: 20.31 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 20.31 ft
Screen Length: 25. ft
Wellbore Radius: 0.3542 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 8.609E-5 ft/min
y0 = 14.3 ft

Data Set: S:\Environ\JOB FILES\2004 Jobs\04-955 Belews Creek Landfill\Belews Creek Slug Data\BC23A.aqt
Title: Slug Test Analysis BC-23A
Date: 11/08/04
Time: 13:20:38

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Date: 10-07-04
Test Well: BC-23A

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

SLUG TEST WELL DATA

Test Well: : BC-23A-A

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 14.12 ft
Static Water Column Height: 20.31 ft
Casing Radius: 0.08333 ft
Wellbore Radius: 0.3542 ft
Well Skin Radius: 0.5 ft
Screen Length: 25. ft
Total Well Penetration Depth: 20.31 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.2062 ft
Gravel Pack Porosity: 0.3

No. of Observations: 361

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.005	14.12	89.78	0.623
0.01	14.11	90.78	0.599
0.015	14.1	91.78	0.577
0.02	14.1	92.78	0.553
0.025	14.1	93.78	0.535
0.03	14.09	94.78	0.513
0.035	14.09	95.78	0.495
0.04	14.09	96.78	0.481
0.045	14.09	97.78	0.462
0.05	14.08	98.78	0.449
0.055	14.08	99.78	0.435
0.06	14.08	100.8	0.421
0.065	14.08	101.8	0.411
0.07	14.08	102.8	0.396
0.075	14.07	103.8	0.384
0.08	14.07	104.8	0.372
0.0848	14.07	105.8	0.362
0.09	14.07	106.8	0.354

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.095	14.06	107.8	0.344
0.1	14.06	108.8	0.334
0.1058	14.06	109.8	0.325
0.112	14.06	110.8	0.316
0.1185	14.05	111.8	0.308
0.1255	14.05	112.8	0.3
0.1328	14.05	113.8	0.294
0.1407	14.05	114.8	0.286
0.149	14.04	115.8	0.278
0.1578	14.04	116.8	0.272
0.167	14.05	117.8	0.266
0.177	14.04	118.8	0.26
0.1875	14.04	119.8	0.254
0.1985	14.04	120.8	0.25
0.2102	14.03	121.8	0.242
0.2227	14.03	122.8	0.236
0.2358	14.02	123.8	0.232
0.2498	14.02	124.8	0.226
0.2647	14.01	125.8	0.22
0.2803	14.01	126.8	0.214
0.297	14.	127.8	0.21
0.3147	13.99	128.8	0.206
0.3333	13.99	129.8	0.2
0.3532	13.98	130.8	0.196
0.3742	13.97	131.8	0.192
0.3963	13.96	132.8	0.188
0.4198	13.96	133.8	0.184
0.4447	13.94	134.8	0.18
0.4697	13.94	135.8	0.176
0.4963	13.92	136.8	0.172
0.5247	13.91	137.8	0.168
0.5547	13.9	138.8	0.164
0.5863	13.89	139.8	0.162
0.6213	13.88	140.8	0.156
0.6578	13.86	141.8	0.154
0.6963	13.85	142.8	0.152
0.738	13.83	143.8	0.148
0.7813	13.81	144.8	0.146
0.828	13.79	145.8	0.142
0.8763	13.77	146.8	0.14
0.928	13.75	147.8	0.136
0.983	13.73	148.8	0.132
1.041	13.71	149.8	0.132
1.103	13.68	150.8	0.126
1.168	13.66	151.8	0.126
1.238	13.63	152.8	0.122
1.311	13.6	153.8	0.12
1.39	13.57	154.8	0.118
1.473	13.54	155.8	0.114
1.561	13.5	156.8	0.114
1.655	13.46	157.8	0.11
1.753	13.42	158.8	0.108
1.858	13.38	159.8	0.106
1.968	13.34	160.8	0.104
2.085	13.29	161.8	0.1
2.21	13.24	162.8	0.1
2.341	13.19	163.8	0.098

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
2.481	13.13	164.8	0.096
2.63	13.08	165.8	0.094
2.786	13.02	166.8	0.092
2.953	12.95	167.8	0.09
3.13	12.88	168.8	0.09
3.316	12.81	169.8	0.086
3.515	12.72	170.8	0.084
3.725	12.64	171.8	0.086
3.946	12.56	172.8	0.082
4.181	12.47	173.8	0.08
4.43	12.38	174.8	0.08
4.693	12.29	175.8	0.078
4.973	12.19	176.8	0.076
5.27	12.09	177.8	0.074
5.583	11.98	178.8	0.074
5.915	11.86	179.8	0.072
6.266	11.74	180.8	0.07
6.64	11.61	181.8	0.068
7.035	11.47	182.8	0.068
7.453	11.33	183.8	0.066
7.896	11.18	184.8	0.066
8.366	11.03	185.8	0.064
8.865	10.86	186.8	0.062
9.391	10.69	187.8	0.06
9.95	10.51	188.8	0.06
10.54	10.32	189.8	0.058
11.17	10.12	190.8	0.056
11.83	9.918	191.8	0.056
12.53	9.7	192.8	0.056
13.28	9.475	193.8	0.056
14.07	9.243	194.8	0.052
14.91	9.002	195.8	0.052
15.79	8.758	196.8	0.052
16.73	8.507	197.8	0.05
17.72	8.245	198.8	0.048
18.78	7.971	199.8	0.048
19.78	7.718	200.8	0.048
20.78	7.474	201.8	0.046
21.78	7.235	202.8	0.046
22.78	7.005	203.8	0.044
23.78	6.783	204.8	0.042
24.78	6.567	205.8	0.042
25.78	6.356	206.8	0.04
26.78	6.154	207.8	0.04
27.78	5.956	208.8	0.04
28.78	5.763	209.8	0.038
29.78	5.577	210.8	0.038
30.78	5.395	211.8	0.036
31.78	5.219	212.8	0.035
32.78	5.049	213.8	0.036
33.78	4.888	214.8	0.036
34.78	4.744	215.8	0.034
35.78	4.644	216.8	0.033
36.78	4.552	217.8	0.031
37.78	4.46	218.8	0.032
38.78	4.362	219.8	0.032
39.78	4.257	220.8	0.03

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
40.78	4.149	221.8	0.029
41.78	4.039	222.8	0.028
42.78	3.907	223.8	0.028
43.78	3.757	224.8	0.027
44.78	3.613	225.8	0.026
45.78	3.471	226.8	0.026
46.78	3.33	227.8	0.026
47.78	3.196	228.8	0.026
48.78	3.064	229.8	0.024
49.78	2.934	230.8	0.024
50.78	2.809	231.8	0.022
51.78	2.687	232.8	0.022
52.78	2.567	233.8	0.02
53.78	2.449	234.8	0.019
54.78	2.333	235.8	0.02
55.78	2.223	236.8	0.02
56.78	2.123	237.8	0.02
57.78	2.027	238.8	0.02
58.78	1.935	239.8	0.018
59.78	1.853	240.8	0.015
60.78	1.776	241.8	0.016
61.78	1.704	242.8	0.015
62.78	1.638	243.8	0.016
63.78	1.576	244.8	0.014
64.78	1.52	245.8	0.013
65.78	1.466	246.8	0.014
66.78	1.414	247.8	0.013
67.78	1.37	248.8	0.012
68.78	1.372	249.8	0.012
69.78	1.366	250.8	0.012
70.78	1.332	251.8	0.01
71.78	1.294	252.8	0.011
72.78	1.256	253.8	0.01
73.78	1.219	254.8	0.009
74.78	1.182	255.8	0.008
75.78	1.142	256.8	0.009
76.78	1.1	257.8	0.008
77.78	1.057	258.8	0.007
78.78	1.013	259.8	0.006
79.78	0.967	260.8	0.005
80.78	0.923	261.8	0.006
81.78	0.881	262.8	0.006
82.78	0.843	263.8	0.003
83.78	0.807	264.8	0.003
84.78	0.771	265.8	0.001
85.78	0.737	266.8	-0.006
86.78	0.705	267.8	0.
87.78	0.677	268.8	0.
88.78	0.649		

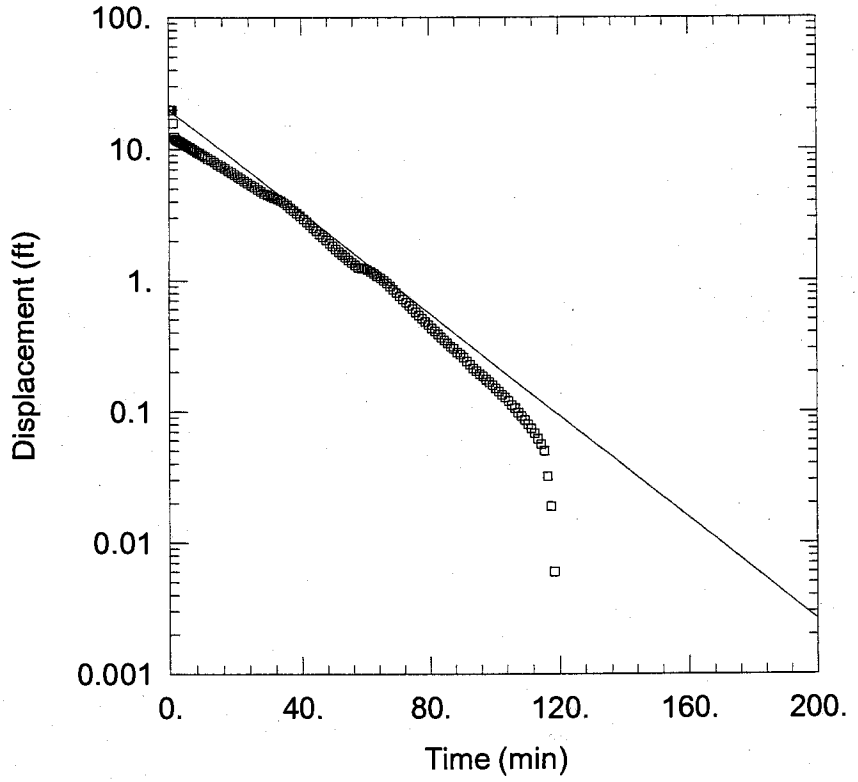
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 3.654

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	8.609E-5	ft/min
y0	14.3	ft



SLUG TEST ANALYSIS BC-23A

Data Set: S:\...\BC23A-2.aqt
Date: 11/08/04 Time: 13:13:08

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Well: BC-23A
Test Date: 10-07-04

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (BC-23A-B)

Initial Displacement: 19.8 ft
Total Well Penetration Depth: 20.31 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 20.31 ft
Screen Length: 25. ft
Wellbore Radius: 0.3542 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0001387 ft/min
y0 = 19.85 ft

Data Set: S:\Environ\JOB FILES\2004 Jobs\04-955 Belews Creek Landfill\Belews Creek Slug Data\BC23A-2.aqt
Title: Slug Test Analysis BC-23A
Date: 11/08/04
Time: 13:13:20

PROJECT INFORMATION

Company: S&ME, Inc.
Client: Duke Energy
Project: 1054-04-955
Location: Belews Creek
Test Date: 10-07-04
Test Well: BC-23A

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

SLUG TEST WELL DATA

Test Well: : BC-23A-B

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 19.8 ft
Static Water Column Height: 20.31 ft
Casing Radius: 0.08333 ft
Wellbore Radius: 0.3542 ft
Well Skin Radius: 0.5 ft
Screen Length: 25. ft
Total Well Penetration Depth: 20.31 ft
Corrected Casing Radius (Bouwer-Rice Method): 0.2062 ft
Gravel Pack Porosity: 0.3

No. of Observations: 132

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.2482	19.8	55.59	1.378
0.5117	19.81	56.59	1.318
0.7917	19.79	57.59	1.262
1.088	19.77	58.59	1.248
1.402	15.69	59.59	1.244
1.733	12.32	60.59	1.212
2.085	11.88	61.59	1.168
2.458	11.73	62.59	1.128
2.853	11.57	63.59	1.086
3.272	11.41	64.59	1.044
3.715	11.23	65.59	1.002
4.185	11.05	66.59	0.954
4.683	10.87	67.59	0.906
5.21	10.67	68.59	0.855
5.768	10.46	69.59	0.808
6.36	10.24	70.59	0.76
6.987	10.02	71.59	0.718
7.65	9.78	72.59	0.677

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
8.353	9.539	73.59	0.639
9.098	9.29	74.59	0.605
9.888	9.037	75.59	0.571
10.73	8.776	76.59	0.539
11.61	8.515	77.59	0.511
12.55	8.249	78.59	0.481
13.54	7.968	79.59	0.457
14.6	7.679	80.59	0.431
15.6	7.413	81.59	0.409
16.59	7.152	82.59	0.387
17.59	6.902	83.59	0.367
18.59	6.659	84.59	0.349
19.59	6.425	85.59	0.331
20.59	6.197	86.59	0.313
21.59	5.974	87.59	0.301
22.59	5.76	88.59	0.283
23.59	5.549	89.59	0.271
24.59	5.347	90.59	0.257
25.59	5.149	91.59	0.241
26.59	4.956	92.59	0.227
27.59	4.782	93.59	0.213
28.59	4.614	94.59	0.203
29.59	4.493	95.59	0.193
30.59	4.389	96.59	0.185
31.59	4.283	97.59	0.175
32.59	4.169	98.59	0.167
33.59	4.05	99.59	0.159
34.59	3.92	100.6	0.15
35.59	3.764	101.6	0.142
36.59	3.586	102.6	0.134
37.59	3.42	103.6	0.128
38.59	3.259	104.6	0.12
39.59	3.101	105.6	0.112
40.59	2.943	106.6	0.106
41.59	2.797	107.6	0.098
42.59	2.656	108.6	0.092
43.59	2.524	109.6	0.086
44.59	2.392	110.6	0.08
45.59	2.266	111.6	0.074
46.59	2.147	112.6	0.068
47.59	2.038	113.6	0.062
48.59	1.931	114.6	0.056
49.59	1.833	115.6	0.05
50.59	1.741	116.6	0.032
51.59	1.655	117.6	0.019
52.59	1.577	118.6	0.006
53.59	1.507	119.6	0.
54.59	1.438	120.6	0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 3.654

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.0001387	ft/min
y0	19.85	ft

APPENDIX VI

LABORATORY TEST RESULTS
SPLIT SPOON SAMPLES

S&ME

LAB ASSIGNMENT SHEET

Request Completion Date:
Date Assigned:
Sampling Date:
Date Completed:

Log Number 1834

Project #: 1264-02-576 **Project Name:** Duke Power-Belews Cr. Landfill
Project Address: 3195 Pine Hall Road, Belews Creek, NC 27009 **Engineer in Charge:** Sam Watts
Client Name: Duke Energy Corp. **Sampled By:** Sam Watts
Client Address: 526 South Church street, Charlotte, NC 28202 **Sample Location:** Scrubber Waste Landfill

Alternate Test: AASHTO ☐ NCDOT ☐ Other ☐

Boring #	Sample #	DEPT	Moisture Content D2216	Plastic Index D4318	Grain Size (200 Wash) D422	Hydrometer D422	Standard Proctor D698	Modified Proctor D1557	Soil Specific Gravity D854	Aggregate Gradation C136	Fine Aggregate Specific Gravity C128	Coarse Agg. Specific Gravity C127	Marshall Test D1559 ☐ D5581 ☐	Extraction / Gradation D2172 / D5444	Maximum Theoretical D2041	Core Bulk Specific Gravity D2726	Compressive Str. Concrete Core	CMU Prism Compressive Stength	Flex. Strenght Concrete Beam	Bill	CBR D1883 Compaction	CBR D1883 Moisture	CBR D1883 Soak	One-Dimensional Consolidation Test D2435 Preload	One-Dimensional Consolidation Test D2435 Saturate	One-Dimensional Consolidation Test D2435 Loads	Permeability D5084	Triaxial Shear CU D4767 ☐ UU D2850 ☐ Confining Pressures	UD Tube / Remold Sample U/R
BC-13	10'-20'	1048	X	X	X				X																				R
BC-12	5'-10'	1048	X	X	X				X																				R
BC-1	2	1048		/		/			X																				
BC-3	5	1048		/		/			X																				
BC-10	7	1048		/		/			X																				
BC-11	8	1048		/		/			X																				
BC-12	6	1048		/		/			X																				

SAVE ALL BAG SAMPLES

95% @ OPT+3

3 PSI

NOTE: Field Samples obtained from: Stockpiles ☐ Roadway ☐ Conveyor belt ☐ ggregate Stream ☐ Borehole ☐
Material Suppliers, Sampling Parameters, and Project Specifications.

S&ME LAB ASSIGNMENT SHEET

Date Assigned: 01/01/02
Sampling Date:
Date Completed:

1909

Project #: 1264-02-576 **Project Name:** Duke Power - Belews Cr. Landfill
Project Address: 3195 Pine Hall Road, Belews Creek, NC 27009 **Engineer in Charge:** Sam Watts
Client Name: Duke Energy Corp. **Sampled By:** Sam Watts
Client Address: 526 South Church Street **Sample Location:** Scrubber Waste Landfill

Alternate Test: AASHTO ☐ NCDOT ☐ Other ☐

226

Boring #	Sample #	DEPT	Moisture Content D2216	Plastic Index D4318	Grain Size (200 Wash) D422	Hydrometer D422	Standard Proctor D698	Modified Proctor D1557	Soil Specific Gravity D854	Aggregate Gradation C136	Fine Aggregate Specific Gravity C128	Coarse Agg. Specific Gravity C127	Marshall Test D1559 ☐ D5581 ☐	Extraction / Gradation D2172 / D5444	Maximum Theoretical D2041	Core Bulk Specific Gravity D2726	Compressive Str. Concrete Core	CMU Prism Compressive Stength	Flex. Strenght Concrete Beam		CBR D1883 Compaction	Moisture	Soak	One-Dimensional Consolidation Test D2435 Preload	Saturate	Loads	Permeability D5084	Triaxial Shear CU D4767 ☐ UU D2850 ☐ Confining Pressures	UD Tube / Remold Sample U/R
BC-2	0'-10'	1048	X	X	X		X		X																				R
BC-3	0'-10'		X	X	X	✓	X		X																		✓		R
BC-6	0'-10'		X	X	X		X		X																				R
BC-7	0'-10'		X	X	X	✓	X		X																		✓		B
BC-8	0'-10'		X	X	X		X		X																				R
BC-9	0'-10'		X	X	X		X		X																				R
BC-10	0'-10'		X	X	X	✓	X		X																		✓		R
BC-11	0'-10'		X	X	X	✓	X		X																		✓		R
BC-13	0'-10'		X	X	X	✓	X		X																		✓		R
BC-14	5'-10'		X	X	X		X		X																				R

B

SAVE SAMPLE

95% @ 3% Wet of OPT

2 PSI confining pressure

NOTE: Field Samples obtained from: Stockpiles ☐ Roadway ☐ Conveyor belt ☐ ggregate Stream ☐ Borehole ☒

Material Suppliers, Sampling Parameters, and Project Specifications.

S&ME LAB ASSIGNMENT SHEET

Date Assigned: [illegible]
Sampling Date:
Date Completed:

Project #: 1264-02-576 **Project Name:** Duke Power - Belews Cr. Landfill
Project Address: 3195 Pine Hall Road, Belews Creek, NC 27009 **Engineer in Charge:** Sam Watts
Client Name: Duke Energy Corp. **Sampled By:** Sam Watts
Client Address: 526 South Church Street **Sample Location:** Scrubber Waste Landfill

Alternate Test: AASHTO ☐ NCDOT ☐ Other ☐

226

Boring #	Sample #	DEPT	Moisture Content D2216	Plastic Index D4318	Grain Size (200 Wash) D422	Hydrometer D422	Standard Proctor D698	Modified Proctor D1557	Soil Specific Gravity D854	Aggregate Gradation C136	Fine Aggregate Specific Gravity C128	Coarse Agg. Specific Gravity C127	Marshall Test D1559 ☐ D5581 ☐	Extraction / Gradation D2172 / D5444	Maximum Theoretical D2041	Core Bulk Specific Gravity D2726	Compressive Str. Concrete Core	CMU Prism Compressive Stength	Flex. Strenght Concrete Beam		CBR D1883 Compaction	CBR D1883 Moisture	CBR D1883 Soak	One-Dimensional Consolidation Test D2435 Preload	One-Dimensional Consolidation Test D2435 Saturate	One-Dimensional Consolidation Test D2435 Loads	Permeability D5084	Triaxial Shear CU D4767 ☐ UU D2850 ☐ Confining Pressures	UD Tube / Remold Sample U/R
BC-2	0'-10'	1048	X	X	X		X		X																				R
BC-3	0'-10'		X	X	X	✓	X		X																		✓		R
BC-6	0'-10'		X	X	X		X		X																				R
BC-7	0'-10'		X	X	X	✓	X		X																		✓		B
BC-8	0'-10'		X	X	X		X		X																				R
BC-9	0'-10'		X	X	X		X		X																				R
BC-10	0'-10'		X	X	X	✓	X		X																		✓		R
BC-11	0'-10'		X	X	X	✓	X		X																		✓		R
BC-13	0'-10'		X	X	X	✓	X		X																		✓		R
BC-14	5'-10'		X	X	X		X		X																				R

B

SAVE SAMPLE

95% @ 3% wet of OPT

2 PSI confining pressure

NOTE: Field Samples obtained from: Stockpiles ☐ Roadway ☐ Conveyor belt ☐ ggregate Stream ☐ Borehole ☒

Material Suppliers, Sampling Parameters, and Project Specifications.

S&ME

LAB ASSIGNMENT SHEET

Request Completion Date:
Date Assigned:
Sampling Date:
Date Completed:

Log Number 1839

Project #: 1264-02-576 **Project Name:** Duke Power-Belews Cr. Landfill

Project Address: 3195 Pine Hall Road, Belews Creek, NC 27009 **Engineer in Charge:** Sam Watts

Client Name: Duke Energy Corp. **Sampled By:** Sam Watts

Client Address: 526 South Church Street, Charlotte, NC 28202 **Sample Location:** Scrubber Waste Landfill

Alternate Test
AASHTO ☐
NCDOT ☐
Other ☐

	Boring #	Sample #	DEPT	Moisture Content D2216	Plastic Index D4318	Grain Size (200 Wash) D422	Hydrometer D422	Standard Proctor D698	Modified Proctor D1557	Soil Specific Gravity D854	Aggregate Gradation C136	Fine Aggregate Specific Gravity C128	Coarse Agg. Specific Gravity C127	Marshall Test D1559 ☐ D5581 ☐	Extraction / Gradation D2172-/ D5444	Maximum Theoretical D2041	Core Bulk Specific Gravity D2726	Compressive Str. Concrete Core	CMU Prism Compressive Stength	Flex. Strenght Concrete Beam	B/U	CBR D1883 Compaction	CBR D1883 Moisture	CBR D1883 Soak	One-Dimensional Consolidation Test D2435 Preload	One-Dimensional Consolidation Test D2435 Saturate	One-Dimensional Consolidation Test D2435 Loads	Permeability D5084	Triaxial Shear CU D4767 ☐ UU D2850 ☐ Confining Pressures	UD Tube / Remold Sample U/R
K	BC-13	10'-20'	1048	X	X	X				X																				R
K	BC-12	5'-10'	1048	X	X	X				X																				R
K	BC-1	2	1048		/		/			X																				
K	BC-3	5	1048		/		/			X																				
K	BC-10	7	1048		/		/			X																				
K	BC-11	8	1048		/		/			X																				
K	BC-12	6	1048		/		/			X																				

SAVE ALL BAG SAMPLES

95 lbs @ 44+13 B1511

NOTE: Field Samples obtained from: Stockpiles ☐ Roadway ☐ Conveyor belt ☐ ggregate Stream ☐ Borehole ☐

Material Suppliers, Sampling Parameters, and Project Specifications.

LAB ASSIGNMENT SHEET

Date Assigned:
Sampling Date:
Date Completed:
Log Number

Project #: 1264-02-576 **Project Name:** Duke Power - Belew's Creek Landfill

Project Address: **Engineer in Charge:**

Client Name: **Sampled By:**

Client Address: **Sample Location:**

Alternate Test
AASHTO ☐
NCDOT ☐
Other ☐

Boring #	Sample #	DEPT	Moisture Content D2216	Plastic Index D4318	Grain Size (200 Wash) D422	Hydrometer D422	Standard Proctor D698	Modified Proctor D1557	Soil Specific Gravity D854	Aggregate Gradation C136	Fine Aggregate Specific Gravity C128	Coarse Agg. Specific Gravity C127	Marshall Test D1559 ☐ D5581 ☐	Extraction / Gradation D2172 / D5444	Maximum Theoretical D2041	Core Bulk Specific Gravity D2726	Compressive Str. Concrete Core	CMU Prism Compressive Stength	Flex. Strenght Concrete Beam		CBR D1883 Compaction	CBR D1883 Moisture	CBR D1883 Soak	One-Dimensional Consolidation Test D2435 Preload	One-Dimensional Consolidation Test D2435 Saturate	One-Dimensional Consolidation Test D2435 Loads	Permeability D5084	Triaxial Shear CU D4767 ☐ UU D2850 ☐ Confining Pressures		UD Tube / Remold Sample U/R
BC-10	12-14	1048	✓	✓		✓			✓																		✓	5	13		U
BC-11	23-25	1048	✓	✓		✓			✓																		✓	8	28		U
BC-12	27-28	1048	✓	✓		✓			✓																		✓	9	29		U
BC-6	18-20	1048	✓	✓		✓			✓																		✓	7	25		U
BC-7	14-16	1048	✓	✓		✓			✓																		✓	5	12		U

NOTE: Field Samples obtained from: Stockpiles ☐ Roadway ☐ Conveyor belt ☐ ggregate Stream ☐ Borehole ☐

Material Suppliers, Sampling Parameters, and Project Specifications.

LAB ASSIGNMENT SHEET

S&ME

Sampling Date: 9/1-9/8

Date Completed:

2917

Project #: 1054-04-955 **Project Name:** BELEWS CREEK STEAM PLANT

Project Address: STOKES COUNTY **Engineer in Charge:** S. WATTS

Client Name: DUKE ENERGY **Sampled By:** A. SMITH

Client Address: **Sample Location:** ON-SITE / BORINGS

Alternate Test
AASHTO ☐
NCDOT ☐
Other ☐

Boring #	Sample #	DEPT	Moisture Content D2216	Plastic Index D4318	Grain Size (200 Wash) D422	Hydrometer D422	Standard Proctor D698	Modified Proctor D1557	Soil Specific Gravity D854	Aggregate Gradation C136	Fine Aggregate Specific Gravity C128	Coarse Agg. Specific Gravity C127	Marshall Test D1559 ☐ D5581 ☐	Extraction / Gradation D2172 / D5444	Maximum Theoretical D2041	Core Bulk Specific Gravity D2726	Compressive Str. Concrete Core	CMU Prism Compressive Stength	Flex. Strenght Concrete Beam	POROSITY	CBR D1883 Compaction	CBR D1883 Moisture	CBR D1883 Soak	One-Dimensional Consolidation Test D2435 Preload	One-Dimensional Consolidation Test D2435 Saturate	One-Dimensional Consolidation Test D2435 Loads	Permeability D5084	Triaxial Shear CU D4767 ☐ UU D2850 ☐ Confining Pressures	UD Tube / Remold Sample U/R
BC-17	3	13.9		/		/			/																				
BC17	BAG	0-6	/	/		/	/		/											/								7psi	95% COMP. @OPT W.C	R
BC-17	TUBE	5.9-8.4		/		/																					/	7psi	IN-SITU LOW GRAD	U
BC18	4	18.5		/		/			/																					
BC18	BAG																													
BC-20	2	8.5		/		/			/																					
BC-20	BAG	1-6	/	/		/	/		/											/								7psi	95% @OPT W.C.	R
BC21	1	3.5		/		/			/																					
BC21	BAG	0-5	/	/		/	/		/											/								7psi	95% @OPT W.C.	R
BC16	BAG	0-5	/	/		/	/		/											/								/			

LOW GRA

NOTE: Field Samples obtained from: Stockpiles ☐ Roadway ☐ Conveyor belt ☐ ggregate Stream ☐ Borehole ☐

Material Suppliers, Sampling Parameters, and Project Specifications.

S&ME

LAB ASSIGNMENT SHEET

Request Completion Date:
Date Assigned: 9/28/04
Sampling Date: 9/1-9/24
Date Completed:

Log Number: 295

Project #: 1054-04-955
Project Name: Belews Creek Steam Plant
Project Address: Stokes County
Engineer In Charge: S. Watts
Client Name: Duke Energy
Sampled By: L. Ennis
Client Address:
Sample Location: on site / Boring

Alternate Test: AASHTO ☐ NCDOT ☐ Other ☐

Boring #	Sample #	DEPT	Moisture Content D2216	Plastic Index D4318	Grain Size (200 Wash) D422	Hydrometer D422	Standard Proctor D698	Modified Proctor D1557	Soil Specific Gravity D854	Aggregate Gradation C136	Fine Aggregate Specific Gravity C128	Coarse Agg. Specific Gravity C127	Marshall Test D1559 ☐ D5581 ☐	Extraction / Gradation D2172 / D5444	Maximum Theoretical D2041	Core Bulk Specific Gravity D2726	Compressive Str. Concrete Core	CMU Prism Compressive Stength	Flex. Strenght Concrete Beam	Porosity	CBR D1883 Compaction	CBR D1883 Moisture	CBR D1883 Soak	One-Dimensional Consolidation Test D2435 Preload	One-Dimensional Consolidation Test D2435 Saturate	One-Dimensional Consolidation Test D2435 Loads	Permeability D5084	Triaxial Shear CU D4767 ☐ UU D2850 ☐ Confining Pressures	UD Tube / Remold Sample U/R
BC-15	4	18.5-20		/		/			/																				
BC-15	BAG	0-5	/	/		/	/		/											/							/	7psi 95% COMP. @ OPT. MOIST.	
BC-16	3	13.5-15		/		/			/																				
BC-19	4	~~18.5-20~~		/		/			/																				
BC-19	BAG	2-7	/	/		/	/		/											/							/	7psi 95% ~~[illegible]~~ COMP. @ OPT M.C	
BC-19	TUBE	27-29		/		/														/							/	7psi IN-SITU LOW GRAD.	
~~BC-20~~	~~3~~	~~[illegible]~~																											
BC-20	BAG	0-5	/	/		/	/		/											/							/	7psi 95% COMP @ OPT. M.C	
BC-23	13	~~20.5-30~~ 63.5-65		/		/			/																		⊗		
BC-23	BAG	1-6	/	/		/	/		/											/							/	7psi 95% COMP @ OPT MC	

LOW GRADIENT

NOTE: Field Samples obtained from: Stockpiles ☐ Roadway ☐ Conveyor belt ☐ ggregate Stream ☐ Borehole ☐
Material Suppliers, Sampling Parameters, and Project Specifications.

Laboratory Report Version 4.0

Particle Size Analysis of Soils

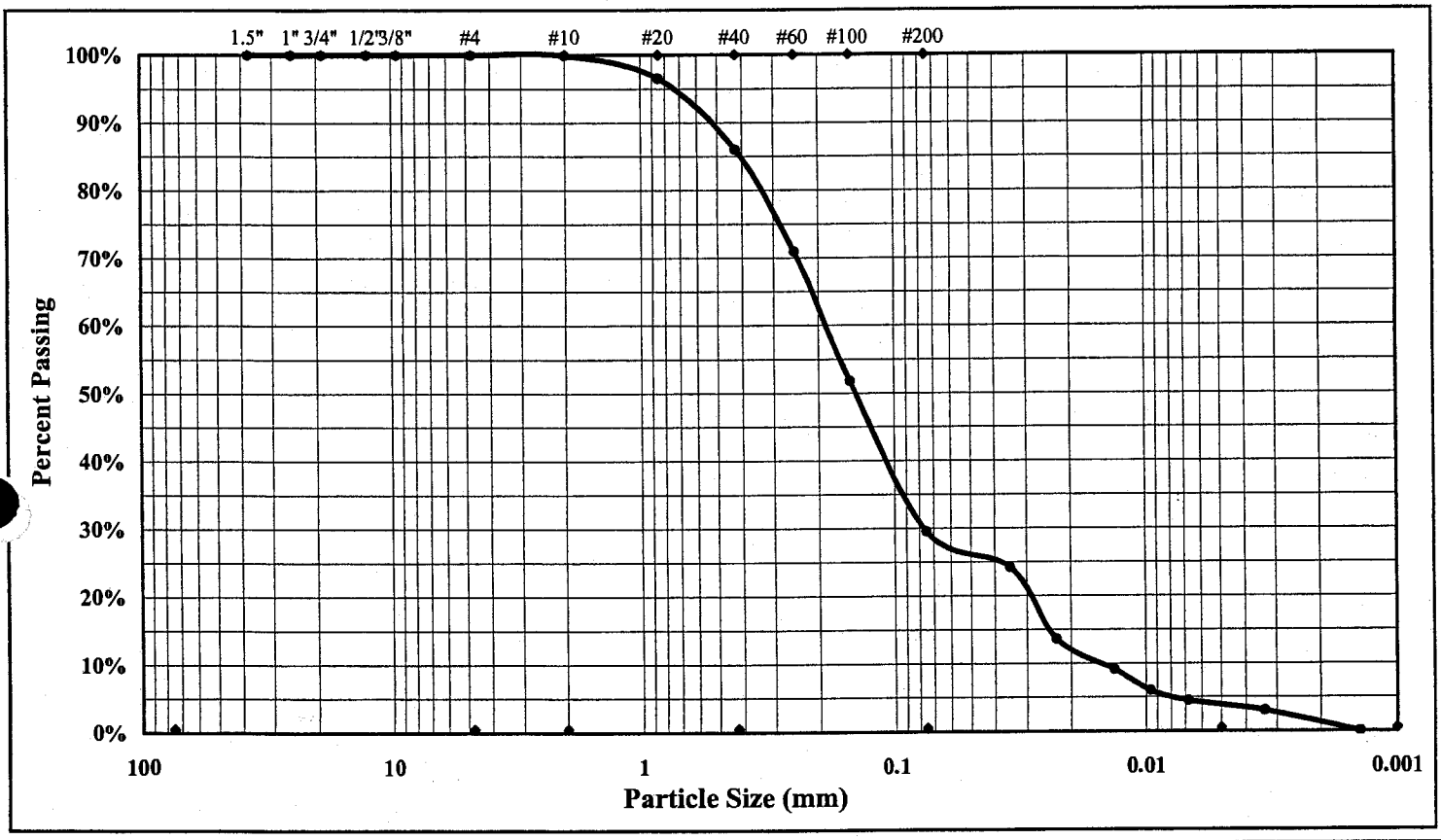
ASTM D 422

S&ME

ME Project #: **1264-02-576**
Project Name: **Duke Power-Belews Creek Landfill**
Client Name: Duke Energy Corp.
Client Address: 526 South Church Street, Charlotte, NC 28202

Report Date: November 10, 2002
Test Date(s): 1/15/03-1/22/03

Boring #:	BC-1	Sample #:	SS-2	Sample Date:	NA
Location:	Scrubber Waste L.F.	Offset:		Depth (ft):	NA
Sample Description:	Tan Silty Clayey Fine SAND				



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Moisture Content		Gravel	0.0%	Liquid Limit	37
Silt & Clay (% Passing #200)	29.5%	Sand	70.5%	Plastic Limit	
Maximum Particle Size	#10	Silt	25.0%	Plastic Index	N.P.
Specific Gravity	2.701	Clay	4.5%	Colloids	0.0%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

ASTM D 422: Particle Size Analysis of Soils Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter
Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min.

References: ASTM D 854: Specific Gravity of Soils
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility / Position: Mal Krajan — Laboratory Supervisor

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

roject #: 1264-02-576 Report Date: January 22, 2003

Project Name: Duke Power-Belews Creek Landfill Test Date(s): 1/15/03-1/22/03

Client Name: Duke Energy Corp.

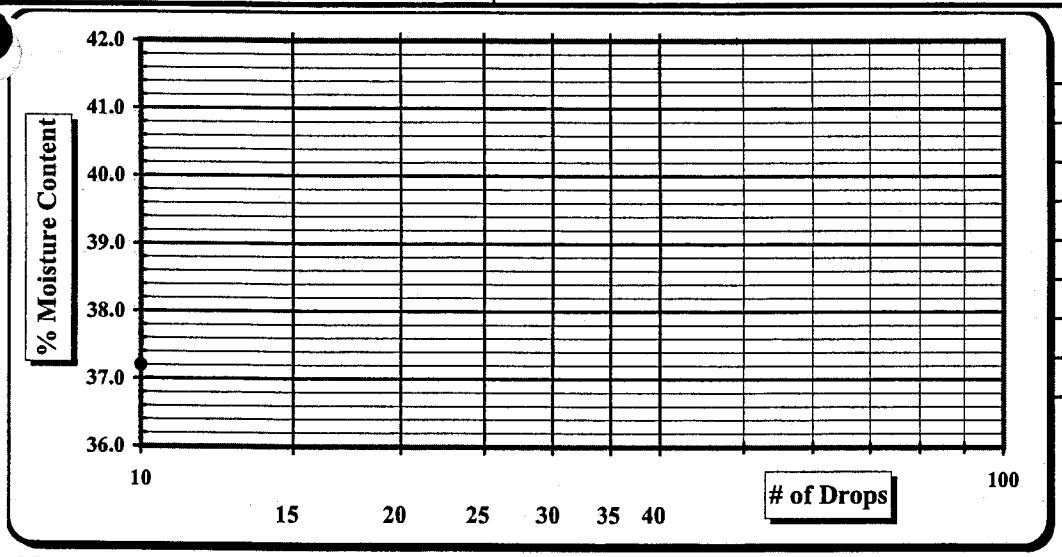
Client Address: 526 South Church Street, Charlotte, NC 28202

Boring #: BC-1 Sample #: SS-2 Sample Date: NA

Location: Scrubber Waste L.F. Offset: Depth (ft): NA

Sample Description: Tan Silty Clayey Fine SAND

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	23								
A	Tare Weight	8.29								
B	Wet Soil Weight + A	19.75								
C	Dry Soil Weight + A	16.64								
D	Water Weight (B-C)	3.11								
E	Dry Soil Weight (C-A)	8.35								
F	% Moisture Content (D/E)*100	37.2								
N	# OF DROPS	10								
LL	LL = F * FACTOR									
Ave.	Average									



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation ☐	Dry Preparation ☐	Air Dried ☒	NP, Non-Plastic	☒
Liquid limit Test:	Multipoint Method ☒	One-point Method ☐		Liquid Limit	37
Classification:	ASTM D 2487 ☒	AASHTO M 145 ☐		Plastic Limit	
Liquid limit Test:	ASTM D 4318 ☒	AASHTO T 89 ☐		Plastic Index	N.P.
stic limit Test:	ASTM D 4318 ☒	AASHTO T 90 ☐		Group Symbol	N.P.

Technician Name / Certification #: Tom Savanpridi

Technical Responsibility / Position: Mal Krajan Laboratory Supervisor

S&ME

Specific Gravity of Soils

ASTM D 854

Project #:	**1264-02-576**	Report Date:	1/20/03
Project Name:	**Duke Power - Belews Cr. Landfill**	Test Date(s)	1/15/03-1/20/03
Client Name:	Duke Energy Corp.		
Client Address:	526 South Street, Charlotte, NC 28202		

Boring No.	BC-1	Sample No.	SS-2	Sample Date:	NA
Location:	Scrubber Waste L.F.	Offset:		Elevation (ft):	NA

Sample Description: Tan Silty Clayey Fine SAND

Percent of Soil Passing the #4 Sieve: Material Excluded: Plus # 4 Material (%)

LL = PL = PI =

	Pychnometer #	**101**	**Balance ID#:** **01001**	Radability:	**.01 gram**
V_p	Pychnometer Volume (V_p)	**249.71 ml.**		Calibration Date:	**9/17/02**
PM	Pychnometer Mass	**115.67 g.**	**Balance Verification**		
M_p	Ave. Pychnometer Mass (Mp)	**115.67 g.**		Mass	**500 gram**
[PM-M_p]	Verify Pychnometer Mass	**g.**		Mass Determination	**500.00**

If [PM-M_p] is greater than .06 grams recalibrate the dry mass of the pychnometer

Method A: Moist Specimens ☒ Method B: Oven-dried Specimens ☐

Method A: Moist Specimens

	Initial Moisture Content	Tare #:	
A	Tare Weight		
B	Wet Wt + Tare Wt		
C	Dry Wt. + Tare Wt.		
D	Water Weight	B-C	
	Dry Weight	C-A	
	Moisture Content	100*D/E	

Target Dry Mass (see Table 1 ASTM D854)	Low Limit	High Limit
Target Wet Mass		

Note: Deviation

Wet Mass of test specimen _____ grams

Method B: Oven-dried Specimens

Initial Dry Mass of test specimen _____ grams

Note: Deviation

$M_{psw;t}$ Mass of the Pychnometer, soil, and water **388.91** grams

Mass of Dry Soil (grams)			
		Tare #	E
A	Tare Weight		171.20
C	Dry Wt. + Tare Wt.		209.36
M_s	Dry Weight	C-A	**38.16**

T_t	Test Temperature T_t	**21.1 °C**
K	Temperature Coefficient at T_t	**0.99977**
K	Temperature Coefficient at 23°C	**0.99933**
$p_{w;t}$	Density of Water at T_t	**0.99797** g./ml.
	See Table 2 ASTM D 854	

$M_{pw;t}$	Mass of the Pychnometer and water at T_t	$M_{pw;t} = M_p + (V_p \times p_{w;t})$	**364.87** grams
G_t	Specific Gravity of tSoil Solids at the T_t	$G_t = M_s / (M_{pw;t} - (M_{psw;t} - M_s))$	**2.702**
G	Specific Gravity of Soil Solids at the 20°C	$G = K \times G_t$	**2.701**

Soils containing plus #4 material tested per ASTM C 127:

Note: Deviation

R	% of Soil retained on the #4 sieve	
P	% of Soil passing the #4 sieve	**100.0%**

G_{+4} Apparent Specific Gravity of plus #4 material at the 23°C per ASTM C127 _____

Apparent Specific Gravity of plus #4 material corrected to 20°C _____

G_{total} The Average total sample Specific Gravity

$$G_{total} = \frac{1}{\frac{R}{100-G_{+4}} + \frac{P}{100-G}} = \textbf{2.701}$$

References: ASTM D854 Specific Gravity of Soil Solids by Water Pychnometer
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
M C 127: Specific Gravity and Absorption of Coarse Aggregates

Technician Name / Certification #: Tom S.

Technical Responsibility / Position: Mal Krajan Laboratory Supervisor

Particle Size Analysis of Soils

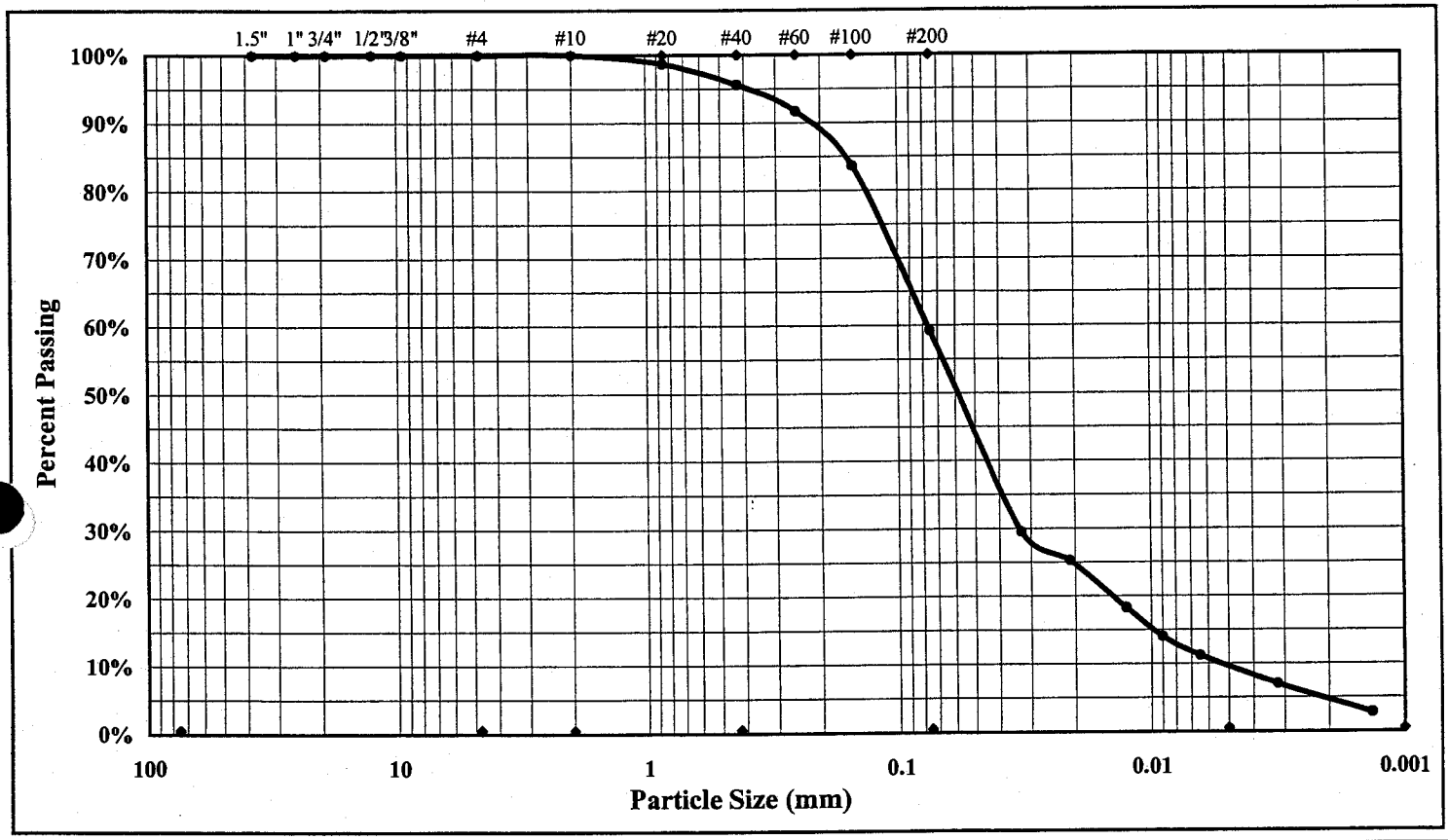
ASTM D 422

S&ME

ME Project #: **1264-02-576**
Project Name: **Duke Power-Belews Creek Landfill**
Client Name: Duke Energy Corp.
Client Address: 526 South Church Street, Charlotte, NC 28202

Report Date: January 22, 2003
Test Date(s): 1/15/03-1/22/03

Boring #:	BC-3	Sample #:	SS-5	Sample Date:	1/15/03
Location:	Scrubber Waste L.F.	Offset:		Depth (ft):	NA
Sample Description:	Tan Clayey Fine Sandy SILT (ML)				



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Moisture Content		Gravel	0.0%	Liquid Limit	36
Silt & Clay (% Passing #200)	59.2%	Sand	40.8%	Plastic Limit	30
Maximum Particle Size	#10	Silt	49.5%	Plastic Index	6
Specific Gravity	2.801	Clay	9.7%	Colloids	2.8%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

ASTM D 422: Particle Size Analysis of Soils Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter
Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min.

References: ASTM D 854: Specific Gravity of Soils
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

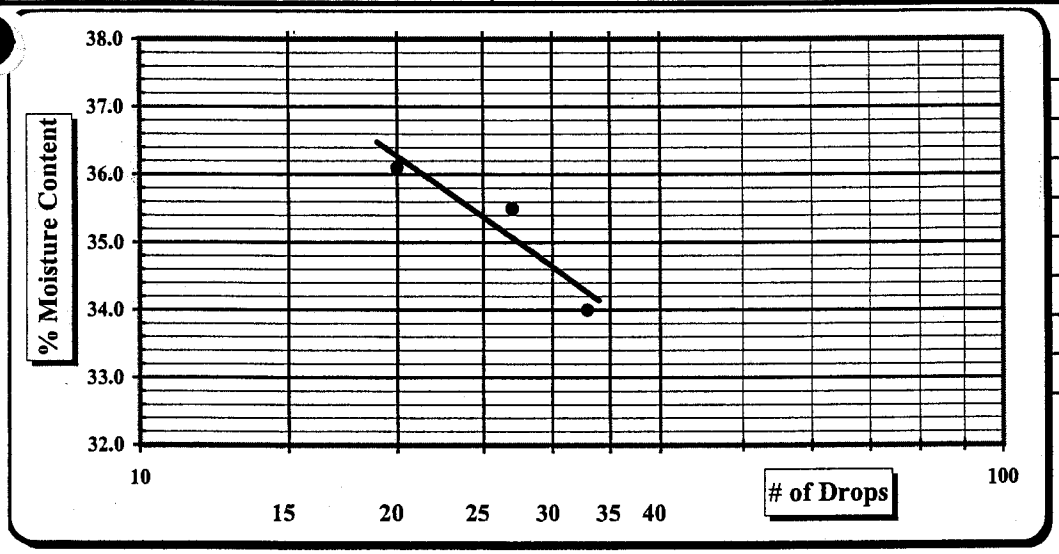
Technical Responsibility / Position: Mal Krajan — Laboratory Supervisor

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

Project #:	1264-02-576	Report Date:	January 22, 2003
Project Name:	Duke Power-Belews Creek Landfill	Test Date(s):	1/15/03-1/22/03
Client Name:	Duke Energy Corp.		
Client Address:	526 South Church Street, Charlotte, NC 28202		
Boring #:	BC-3	Sample #: SS-5	Sample Date: 01/15/03
Location:	Scrubber Waste L.F.	Offset:	Depth (ft): NA
Sample Description:	Tan Clayey Fine Sandy SILT (ML)		

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	41	2	38				12	37713	
A	Tare Weight	8.24	8.02	8.07				6.49	6.56	
B	Wet Soil Weight + A	28.53	22.22	27.71				13.22	13.85	
C	Dry Soil Weight + A	23.15	18.50	22.73				11.66	12.18	
D	Water Weight (B-C)	5.38	3.72	4.98				1.56	1.67	
E	Dry Soil Weight (C-A)	14.91	10.48	14.66				5.17	5.62	
F	% Moisture Content (D/E)*100	36.1	35.5	34.0				30.2	29.7	
N	# OF DROPS	20	27	33						
LL	LL = F * FACTOR									
Ave.	Average							30.0		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation ☐	Dry Preparation ☐	Air Dried ☒	NP, Non-Plastic	☐
Liquid limit Test:	Multipoint Method ☒	One-point Method ☐		Liquid Limit	36
Classification:	ASTM D 2487 ☒	AASHTO M 145 ☐		Plastic Limit	30
Liquid limit Test:	ASTM D 4318 ☒	AASHTO T 89 ☐		Plastic Index	6
Plastic limit Test:	ASTM D 4318 ☒	AASHTO T 90 ☐		Group Symbol	ML

Technician Name / Certification #: Tom Savanpridi

Technical Responsibility / Position: Mal Krajan Laboratory Supervisor

S&ME

Specific Gravity of Soils

ASTM D 854

Project #:	1264-02-576	Report Date:	1/20/03
Project Name:	Duke Power - Belews Cr. Landfill	Test Date(s)	1/15/03-1/20/03
Client Name:	Duke Energy Corp.		
Client Address:	526 South Street, Charlotte, NC 28202		

Boring No.	BC-3	Sample No.	SS-5	Sample Date:	NA
Location:	Scrubber Waste L.F.	Offset:		Elevation (ft):	NA

Sample Description: Tan Clayey Fine Sandy SILT (ML)

Percent of Soil Passing the #4 Sieve: Material Excluded: Plus # 4 Material (%)

LL = PL = PI =

	Pychnometer #	**105**	**Balance ID#:**	**01001** Radability:	**.01 gram**
V_p	Pychnometer Volume (V_p)	**499.04 ml.**		Calibration Date:	**9/17/02**
PM	Pychnometer Mass	**194.32 g.**	**Balance Verification**		
M_p	Ave. Pychnometer Mass (Mp)	**194.32 g.**		Mass	**500 gram**
[PM-M_p]	Verify Pychnometer Mass	**g.**		Mass Determination	**500.00**

If [PM-M_p] is greater than .06 grams recalibrate the dry mass of the pychnometer

Method A: Moist Specimens ☒ Method B: Oven-dried Specimens ☐

Method A: Moist Specimens

	Initial Moisture Content	Tare #:	
A	Tare Weight		
B	Wet Wt + Tare Wt		
C	Dry Wt. + Tare Wt.		
D	Water Weight	B-C	
E	Dry Weight	C-A	
	Moisture Content	100*D/E	

Target Dry Mass (see Table 1 ASTM D854)	Low Limit	High Limit
Target Wet Mass		

Note: Deviation

Wet Mass of test specimen _____ grams

Method B: Oven-dried Specimens

Initial Dry Mass of test specimen _____ grams

Note: Deviation

$M_{psw;t}$ Mass of the Pychnometer, soil, and water **726.77** grams

Mass of Dry Soil (grams)						
		Tare #	X-42	T_t	Test Temperature T_t	**21.2 °C**
A	Tare Weight		186.67	K	Temperature Coefficient at T_t	**0.99974**
C	Dry Wt. + Tare Wt.		240.21	K	Temperature Coefficient at 23°C	**0.99933**
M_s	Dry Weight	C-A	**53.54**	$p_{w;t}$	Density of Water at T_t	**0.99795** g./ml.
					See Table 2 ASTM D 854	

$M_{pw;t}$	Mass of the Pychnometer and water at T_t	$M_{pw;t} = M_p + (V_p \times p_{w;t})$	**692.34** grams
G_t	Specific Gravity of tSoil Solids at the T_t	$G_t = M_s / (M_{pw;t} - (M_{psw;t} - M_s))$	**2.802**
G	Specific Gravity of Soil Solids at the 20°C	$G = K \times G_t$	**2.801**

Soils containing plus #4 material tested per ASTM C 127:

Note: Deviation

R % of Soil retained on the #4 sieve _____

P % of Soil passing the #4 sieve **100.0%**

G_{+4} Apparent Specific Gravity of plus #4 material at the 23°C per ASTM C127 _____

Apparent Specific Gravity of plus #4 material corrected to 20°C _____

G_{total} The Average total sample Specific Gravity

$$G_{total} = \frac{1}{\frac{R}{100-G_{+4}} + \frac{P}{100-G}} = \textbf{2.801}$$

References: ASTM D854 Specific Gravity of Soil Solids by Water Pychnometer

ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

ASTM C 127: Specific Gravity and Absorption of Coarse Aggregates

Technician Name / Certification #: Tom S.

Technical Responsibility / Position: Mal Krajan Laboratory Supervisor

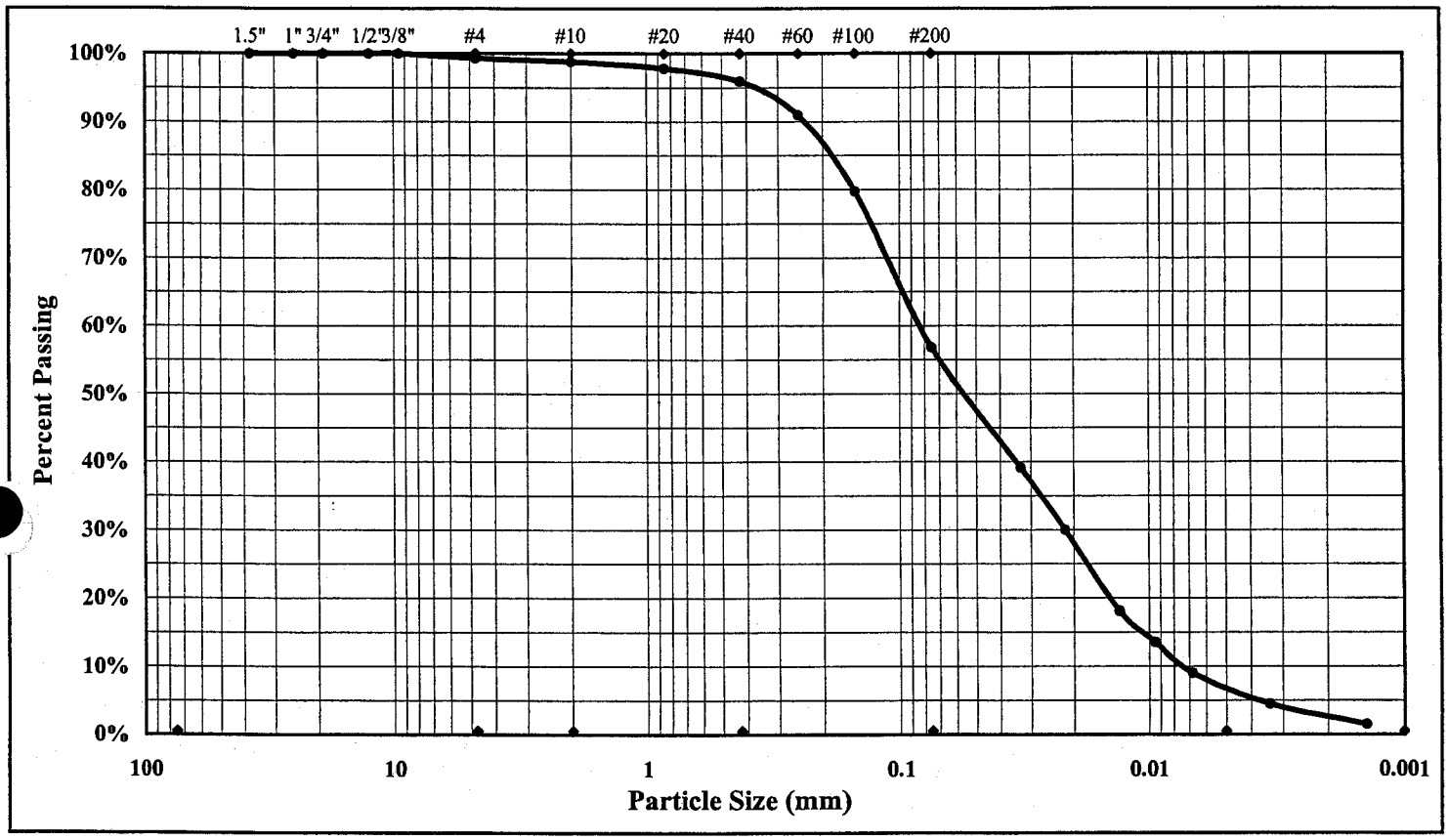
Particle Size Analysis of Soils

ASTM D 422

S&ME

ME Project #:	**1264-02-576**	Report Date:	January 22, 2003
Project Name:	**Duke Power-Belews Creek Landfill**	Test Date(s):	1/15/03-1/22/03
Client Name:	Duke Energy Corp.		
Client Address:	3195 Pine Hall Road, Belews Creek, NC 27009		

Boring #:	BC-10	Sample #:	SS-7	Sample Date:	NA
Location:		Offset:		Depth (ft):	NA
Sample Description:	Tan Clayey Fine Sandy SILT (ML)				



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Moisture Content		Gravel	0.7%	Liquid Limit	35
Silt & Clay (% Passing #200)	56.8%	Sand	42.5%	Plastic Limit	28
Maximum Particle Size	3/8"	Silt	50.4%	Plastic Index	7
Specific Gravity	2.666	Clay	6.4%	Colloids	1.5%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☒

ASTM D 422: Particle Size Analysis of Soils Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min.

References: ASTM D 854: Specific Gravity of Soils

M D 421: Dry Preparation of Soil Samples

M D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility / Position: Mal Krajan — Laboratory Supervisor

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

Project #: 1264-02-576 Report Date: January 22, 2003

Project Name: Duke Power-Belews Creek Landfill Test Date(s): 1/15/03-1/22/03

Client Name: Duke Energy Corp.

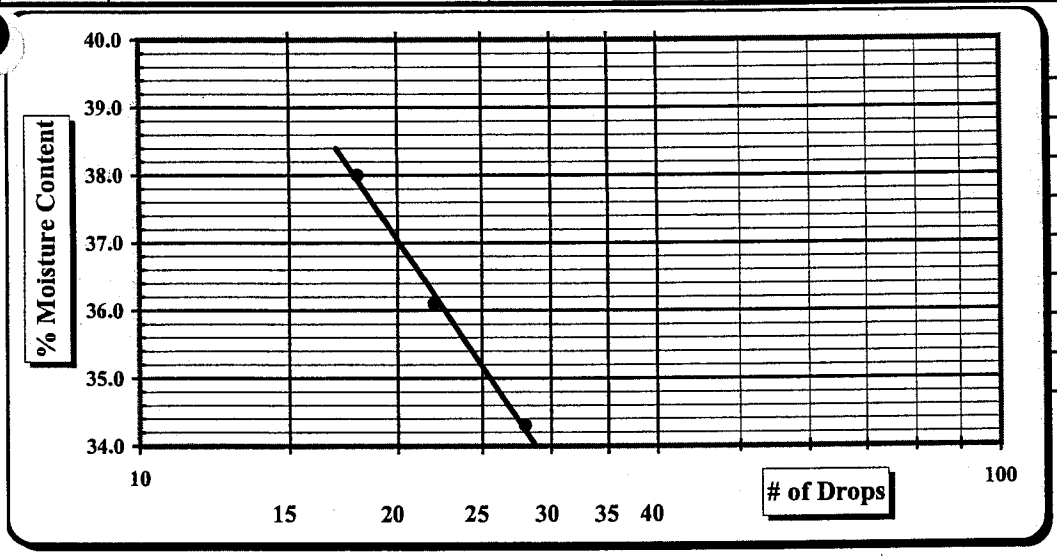
Client Address: 3195 Pine Hall Road, Belews Creek, NC 27009

Boring #: BC-10 Sample #: SS-7 Sample Date: NA

Location: Offset: Depth (ft): NA

Sample Description: Tan Clayey Fine Sandy SILT (ML)

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	261	31	34				98	716	
A	Tare Weight	8.32	8.01	8.46				6.43	6.53	
B	Wet Soil Weight + A	26.41	21.96	28.15				13.60	14.67	
C	Dry Soil Weight + A	21.43	18.40	22.93				12.07	12.89	
D	Water Weight (B-C)	4.98	3.56	5.22				1.53	1.78	
E	Dry Soil Weight (C-A)	13.11	10.39	14.47				5.64	6.36	
F	% Moisture Content (D/E)*100	38.0	34.3	36.1				27.1	28.0	
N	# OF DROPS	18	28	22						
LL	LL = F * FACTOR									
Ave.	Average							27.6		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation ☐	Dry Preparation ☐	Air Dried ☒	NP, Non-Plastic	☐
Liquid limit Test:	Multipoint Method ☒	One-point Method ☐		Liquid Limit	35
Classification:	ASTM D 2487 ☒	AASHTO M 145 ☐		Plastic Limit	28
Liquid limit Test:	ASTM D 4318 ☒	AASHTO T 89 ☐		Plastic Index	7
Plastic limit Test:	ASTM D 4318 ☒	AASHTO T 90 ☐		Group Symbol	ML

Technician Name / Certification #: Tom Savanpridi

Technical Responsibility / Position: Mal Krajan Laboratory Supervisor

S&ME

Specific Gravity of Soils

ASTM D 854

Project #: **1264-02-576** Report Date: 1/20/03
Project Name: **Duke Power - Belews Cr. Landfill** Test Date(s) 1/15/03-1/20/03
Client Name: Duke Energy Corp.
Client Address: 526 S. Church St.

Boring No. BC-10 Sample No. 7 Sample Date: NA
Location: Offset: Elevation (ft): NA
Sample Description: Tan Silty Sandy CLAY
Percent of Soil Passing the #4 Sieve: Material Excluded: Plus # 4 Material (%)
LL = PL = PI =

	Pychnometer #	**102**	**Balance ID#:**	**01001** Radability:	**.01 gram**
V_p	Pychnometer Volume (V_p)	**249.91 ml.**		Calibration Date:	**9/17/02**
PM	Pychnometer Mass	**116.94 g.**	**Balance Verification**		
M_p	Ave. Pychnometer Mass (Mp)	**116.94 g.**		Mass	**500 gram**
[PM-M_p]	Verify Pychnometer Mass	**g.**		Mass Determination	**500.00**

If [PM-M_p] is greater than .06 grams recalibrate the dry mass of the pychnometer

Method A: Moist Specimens ☒ Method B: Oven-dried Specimens ☐

Method A: Moist Specimens

	Initial Moisture Content	Tare #:	
A	Tare Weight		
B	Wet Wt + Tare Wt		
C	Dry Wt. + Tare Wt.		
D	Water Weight	B-C	
	Dry Weight	C-A	
	Moisture Content	100*D/E	

Target Dry Mass (see Table 1 ASTM D854)	Low Limit	High Limit
Target Wet Mass		

Note: Deviation

Wet Mass of test specimen _____ grams

Method B: Oven-dried Specimens

Initial Dry Mass of test specimen _____ grams

Note: Deviation

$M_{psw;t}$ Mass of the Pychnometer, soil, and water **393.02** grams

Mass of Dry Soil (grams)			
		Tare #	9
A	Tare Weight		137.45
C	Dry Wt. + Tare Wt.		180.15
M_s	Dry Weight	C-A	**42.70**

T_t	Test Temperature T_t	**21.3 °C**
K	Temperature Coefficient at T_t	**0.99972**
K	Temperature Coefficient at 23°C	**0.99933**
$p_{w;t}$	Density of Water at T_t	**0.99793** g./ml.
	See Table 2 ASTM D 854	

$M_{pw;t}$	Mass of the Pychnometer and water at T_t	$M_{pw;t} = M_p + (V_p \times p_{w;t})$	**366.33** grams
G_t	Specific Gravity of tSoil Solids at the T_t	$G_t = M_s / (M_{pw;t} - (M_{psw;t} - M_s))$	**2.667**
G	Specific Gravity of Soil Solids at the 20°C	$G = K \times G_t$	**2.666**

Soils containing plus #4 material tested per ASTM C 127: R % of Soil retained on the #4 sieve _____
Note: Deviation P % of Soil passing the #4 sieve **100.0%**

G_{+4} Apparent Specific Gravity of plus #4 material at the 23°C per ASTM C127 _____
Apparent Specific Gravity of plus #4 material corrected to 20°C _____

G_{total} The Average total sample Specific Gravity $G_{total} = \dfrac{1}{\dfrac{R}{100-G_{+4}} + \dfrac{P}{100-G}} =$ **2.666**

References: ASTM D854 Specific Gravity of Soil Solids by Water Pychnometer
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM C 127: Specific Gravity and Absorption of Coarse Aggregates

Technician Name / Certification #: Tom S.
Technical Responsibility / Position: Mal Krajan Laboratory Supervisor

Laboratory Report Version 4.0

Particle Size Analysis of Soils

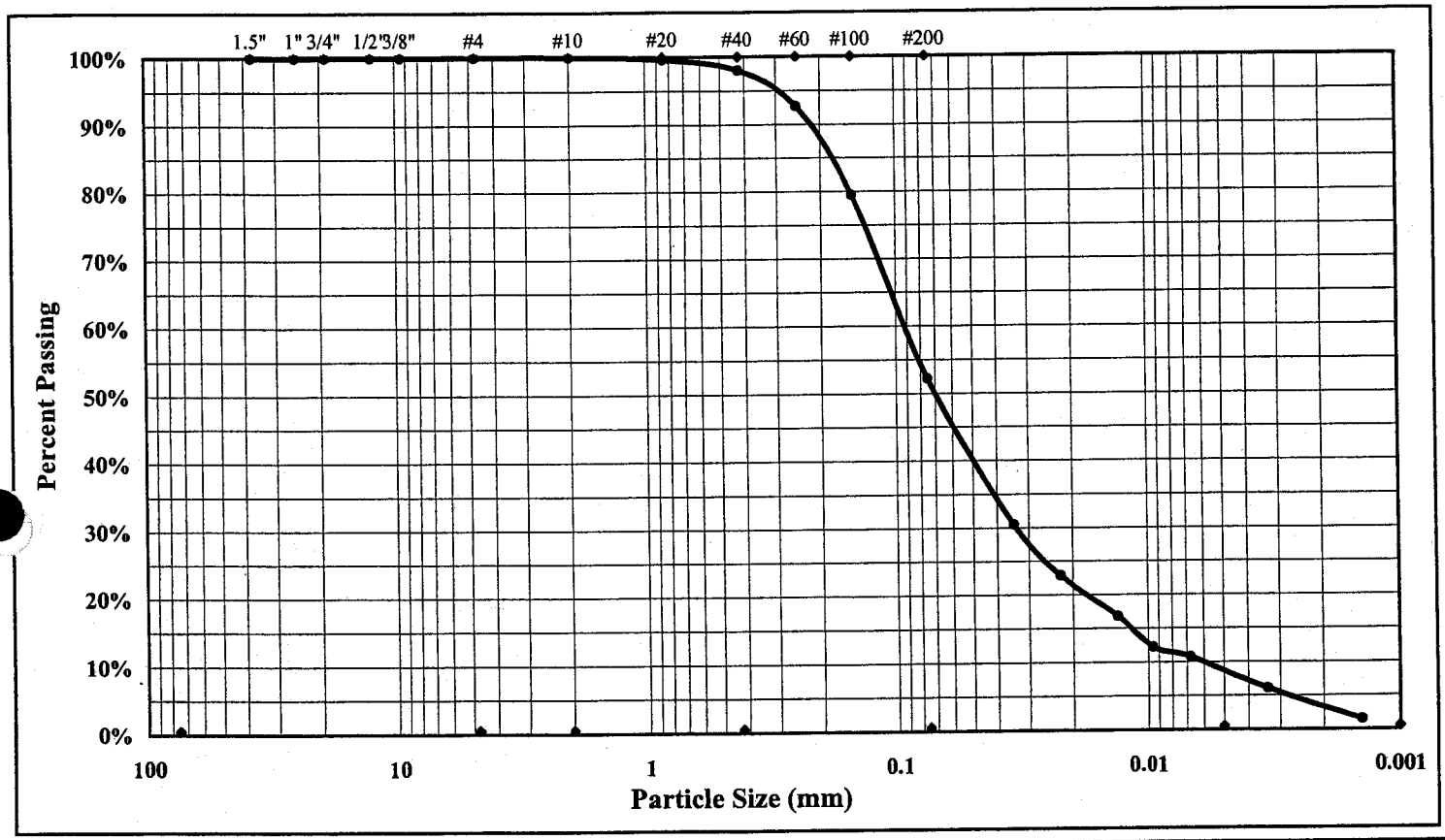
ASTM D 422

S&ME

ME Project #: **1264-02-576**
Project Name: **Duke Power-Belews Creek Landfill**
Client Name: Duke Energy Corp.
Client Address: 3195 Pine Hall Road, Belews Creek, NC 27009

Report Date: January 23, 2003
Test Date(s): 1/18/03-1/22/03

Boring #: BC-11	Sample #: SS-8	Sample Date: NA
Location:	Offset:	Depth (ft): NA
Sample Description: Brown Clayey Fine Sandy SILT (ML)		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Moisture Content		Gravel	0.0%	Liquid Limit	32
Silt & Clay (% Passing #200)	52.2%	Sand	47.8%	Plastic Limit	29
Maximum Particle Size	#10	Silt	44.4%	Plastic Index	3
Specific Gravity	2.676	Clay	7.8%	Colloids	1.5%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

ASTM D 422: Particle Size Analysis of Soils — Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter; Mechanical Stirring Apparatus (A) — Length of Dispersion Period: 1 min.

References: ASTM D 854: Specific Gravity of Soils
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

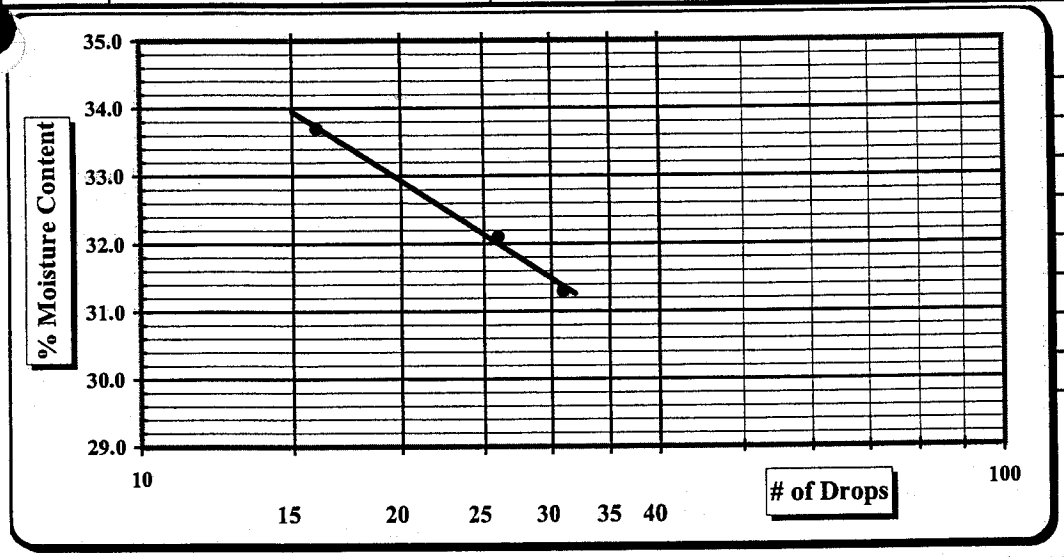
Technical Responsibility / Position: Mal Krajan — Laboratory Supervisor

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

Project #:	1264-02-576	Report Date:	January 22, 2003
Project Name:	Duke Power-Belews Creek Landfill	Test Date(s):	1/15/03-1/22/03
Client Name:	Duke Energy Corp.		
Client Address:	3195 Pine Hall Road, Belews Creek, NC 27009		
Boring #:	BC-11	Sample #: SS-8	Sample Date: NA
Location:		Offset:	Depth (ft): NA
Sample Description:	Brown Clayey Fine Sandy SILT (ML)		

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	38	6	10				37713	59	
A	Tare Weight	8.06	8.38	8.22				6.56	6.29	
B	Wet Soil Weight + A	26.86	26.86	23.46				13.72	13.76	
C	Dry Soil Weight + A	22.12	22.37	19.83				12.09	12.09	
D	Water Weight (B-C)	4.74	4.49	3.63				1.63	1.67	
E	Dry Soil Weight (C-A)	14.06	13.99	11.61				5.53	5.80	
F	% Moisture Content (D/E)*100	33.7	32.1	31.3				29.5	28.8	
N	# OF DROPS	16	26	31						
LL	LL = F * FACTOR									
Ave.	Average							29.2		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation ☐	Dry Preparation ☐	Air Dried ☒	NP, Non-Plastic	☐
Liquid limit Test:	Multipoint Method ☒	One-point Method ☐		Liquid Limit	32
Classification:	ASTM D 2487 ☒	AASHTO M 145 ☐		Plastic Limit	29
Liquid limit Test:	ASTM D 4318 ☒	AASHTO T 89 ☐		Plastic Index	3
Plastic limit Test:	ASTM D 4318 ☒	AASHTO T 90 ☐		Group Symbol	ML

Technician Name / Certification #: Tom Savanpridi

Technical Responsibility / Position: Mal Krajan Laboratory Supervisor

S&ME

Specific Gravity of Soils

ASTM D 854

Project #: 1264-02-576
Project Name: Duke Power - Belews Cr. Landfill
Client Name: Duke Energy Corp.
Client Address: 526 S. Church St.

Report Date: 1/20/03
Test Date(s) 1/15/03-1/20/03

Boring No. BC-11 Sample No. 8 Sample Date: NA
Location: Offset: Elevation (ft): NA
Sample Description: Brown Silty Sandy CLAY
Percent of Soil Passing the #4 Sieve: Material Excluded: Plus # 4 Material (%)
LL = PL = PI =

	Pychnometer #	**108**	**Balance ID#:**	**01001** Radability:	**.01 gram**
V_p	Pychnometer Volume (V_p)	**499.54 ml.**		Calibration Date:	**9/17/02**
PM	Pychnometer Mass	**182.39 g.**	**Balance Verification**		
M_p	Ave. Pychnometer Mass (Mp)	**182.39 g.**		Mass	**500 gram**
[PM-M_p]	Verify Pychnometer Mass	**g.**		Mass Determination	**500.00**

If [PM-M_p] is greater than .06 grams recalibrate the dry mass of the pychnometer

Method A: Moist Specimens ☒ Method B: Oven-dried Specimens ☐

Method A: Moist Specimens

Initial Moisture Content		Tare #:	
A	Tare Weight		
B	Wet Wt + Tare Wt		
C	Dry Wt. + Tare Wt.		
D	Water Weight	B-C	
	Dry Weight	C-A	
	Moisture Content	100*D/E	

Target Dry Mass (see Table 1 ASTM D854)	Low Limit	High Limit
Target Wet Mass		

Note: Deviation

Wet Mass of test specimen _____ grams

Method B: Oven-dried Specimens

Initial Dry Mass of test specimen _____ grams

Note: Deviation

$M_{psw;t}$ Mass of the Pychnometer, soil, and water **715.38** grams

Mass of Dry Soil (grams)			
		Tare #	64
A	Tare Weight		172.97
C	Dry Wt. + Tare Wt.		228.02
M_s	Dry Weight	C-A	**55.05**

T_t	Test Temperature T_t	**21.3** °C
K	Temperature Coefficient at T_t	**0.99972**
K	Temperature Coefficient at 23°C	**0.99933**
$p_{w;t}$	Density of Water at T_t	**0.99793** g./ml.
	See Table 2 ASTM D 854	

$M_{pw;t}$	Mass of the Pychnometer and water at T_t	$M_{pw;t} = M_p + (V_p \times p_{w;t})$	**680.90** grams
G_t	Specific Gravity of tSoil Solids at the T_t	$G_t = M_s / (M_{pw;t} - (M_{psw;t} - M_s))$	**2.677**
G	Specific Gravity of Soil Solids at the 20°C	$G = K \times G_t$	**2.676**

Soils containing plus #4 material tested per ASTM C 127:

Note: Deviation

R % of Soil retained on the #4 sieve _____
P % of Soil passing the #4 sieve **100.0%**

G_{+4} Apparent Specific Gravity of plus #4 material at the 23°C per ASTM C127 _____
Apparent Specific Gravity of plus #4 material corrected to 20°C _____

G_{total} The Average total sample Specific Gravity

$$G_{total} = \frac{1}{\frac{R}{100-G_{+4}} + \frac{P}{100-G}} = \textbf{2.676}$$

References: ASTM D854 Specific Gravity of Soil Solids by Water Pychnometer
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
M C 127: Specific Gravity and Absorption of Coarse Aggregates

Technician Name / Certification #: Tom S.
Technical Responsibility / Position: Mal Krajan Laboratory Supervisor

Particle Size Analysis of Soils

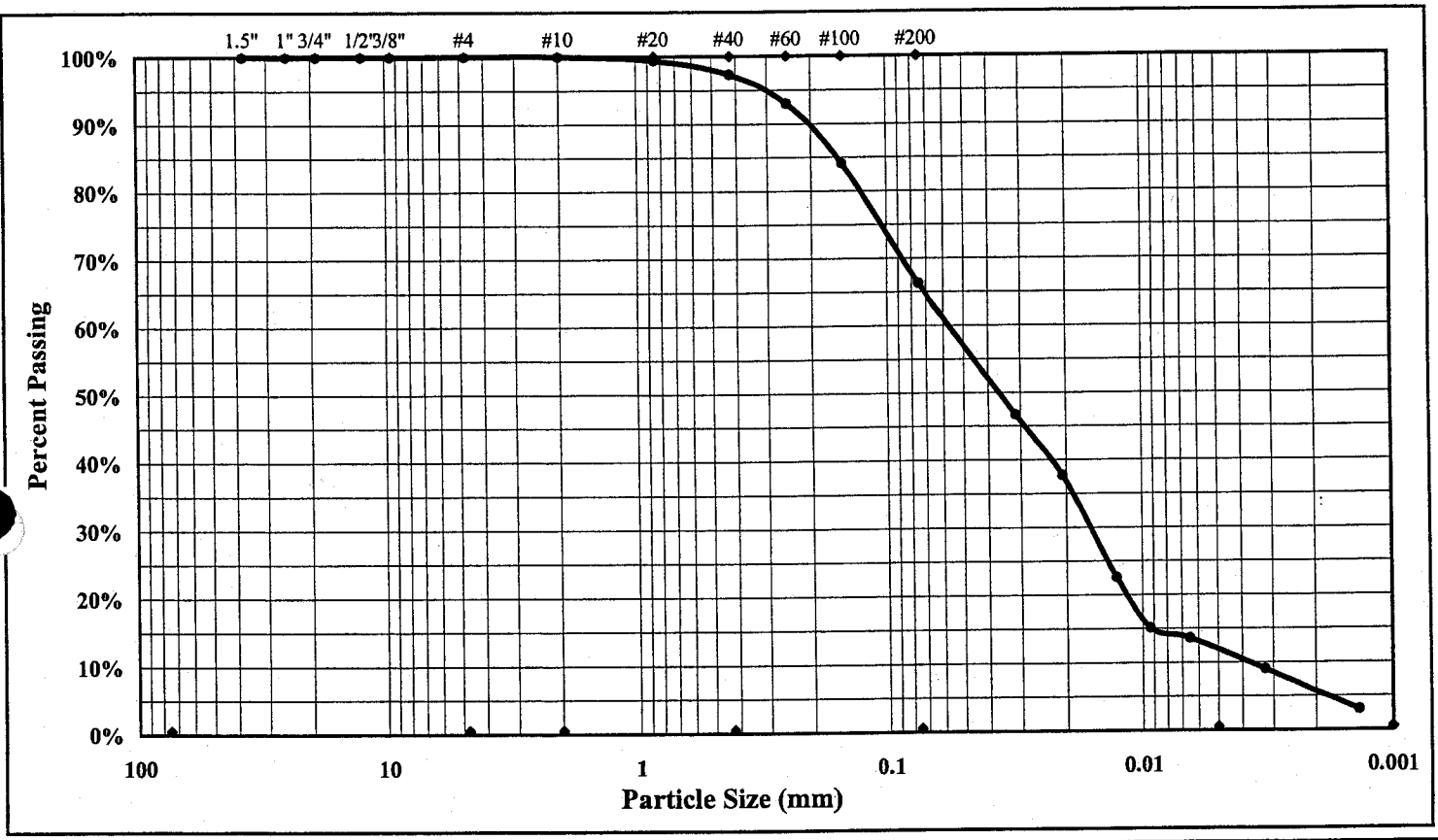
ASTM D 422

S&ME

S&ME Project #: **1264-02-576**
Project Name: **Duke Power-Belews Creek Landfill**
Client Name: Duke Energy Corp.
Client Address: 3195 Pine Hall Road, Belews Creek, NC 27009

Report Date: January 22, 2003
Test Date(s): 1/15/03-1/22/03

Boring #: BC-12	Sample #: SS-6	Sample Date: NA
Location:	Offset:	Depth (ft): 18.5 - 20.0
Sample Description: Tan Fine Sandy Clayey SILT (ML)		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Moisture Content		Gravel	0.0%	Liquid Limit	45
Silt & Clay (% Passing #200)	66.3%	Sand	33.7%	Plastic Limit	36
Maximum Particle Size	#10	Silt	53.8%	Plastic Index	9
Specific Gravity	2.757	Clay	12.5%	Colloids	3.0%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

ASTM D 422: Particle Size Analysis of Soils — Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter; Mechanical Stirring Apparatus (A) — Length of Dispersion Period: 1 min.

References: ASTM D 854: Specific Gravity of Soils
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

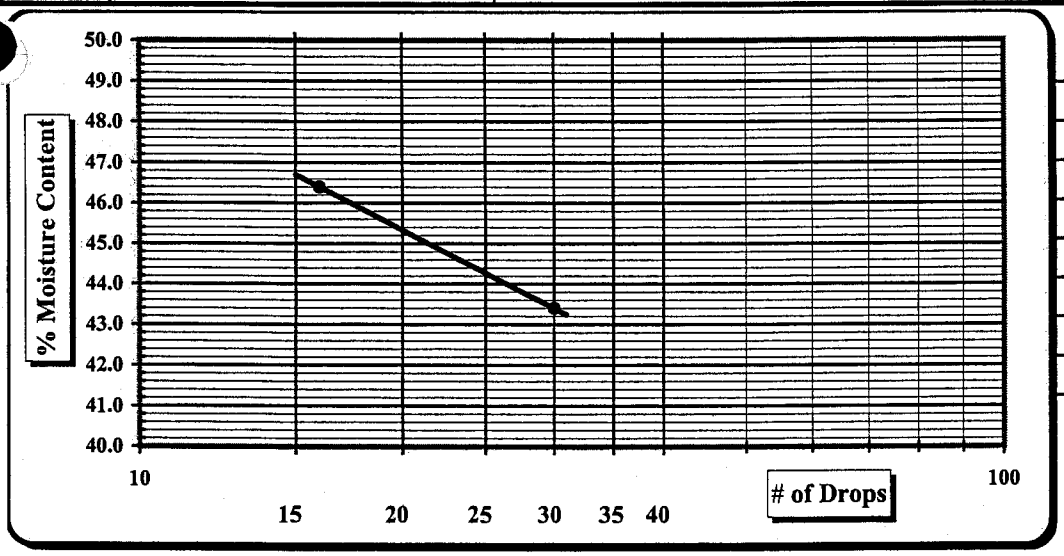
Technical Responsibility / Position: Mal Krajan — Laboratory Supervisor

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

Project #:	1264-02-576	Report Date:	January 22, 2003
Project Name:	Duke Power-Belews Creek Landfill	Test Date(s):	1/15/03-1/22/03
Client Name:	Duke Energy Corp.		
Client Address:	3195 Pine Hall Road, Belews Creek, NC 27009		
Boring #:	BC-12	Sample #: SS-6	Sample Date: NA
Location:		Offset:	Depth (ft): 18.5 - 20.0
Sample Description:	Tan Fine Sandy Clayey SILT (ML)		

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	6	91					67	59	
A	Tare Weight	8.35	8.21					6.17	6.27	
B	Wet Soil Weight + A	19.84	17.50					13.06	13.26	
C	Dry Soil Weight + A	16.20	14.69					11.29	11.39	
D	Water Weight (B-C)	3.64	2.81					1.77	1.87	
E	Dry Soil Weight (C-A)	7.85	6.48					5.12	5.12	
F	% Moisture Content (D/E)*100	46.4	43.4					34.6	36.5	
N	# OF DROPS	16	30							
LL	LL = F * FACTOR									
Ave.	Average							35.6		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation ☐	Dry Preparation ☐	Air Dried ☒	NP, Non-Plastic	☐
Liquid limit Test:	Multipoint Method ☒	One-point Method ☐		Liquid Limit	45
Classification:	ASTM D 2487 ☒	AASHTO M 145 ☐		Plastic Limit	36
Liquid limit Test:	ASTM D 4318 ☒	AASHTO T 89 ☐		Plastic Index	9
Plastic limit Test:	ASTM D 4318 ☒	AASHTO T 90 ☐		Group Symbol	ML

Technician Name / Certification #: Tom Savanpridi

Technical Responsibility / Position: Mal Krajan Laboratory Supervisor

S&ME

Specific Gravity of Soils

ASTM D 854

Project #: 1264-02-576 — Report Date: 1/20/03
Project Name: Duke Power - Belews Cr. Landfill — Test Date(s) 1/15/03-1/20/03
Client Name: Duke Energy Corp.
Client Address: 526 S. Church St.

Boring No.	BC-12	Sample No.	6	Sample Date:	NA
Location:		Offset:		Elevation (ft):	NA

Sample Description: Tan Silty Sandy CLAY

Percent of Soil Passing the #4 Sieve: Material Excluded: Plus # 4 Material (%)

LL = PL = PI =

	Pychnometer #	103	Balance ID#:	01001	Radability:	.01 gram
V_p	Pychnometer Volume (V_p)	249.68 ml.			Calibration Date:	9/17/02
PM	Pychnometer Mass	119.15 g.	Balance Verification			
M_p	Ave. Pychnometer Mass (Mp)	119.15 g.			Mass	500 gram
[PM-M_p]	Verify Pychnometer Mass	g.			Mass Determination	500.00

If [PM-M_p] is greater than .06 grams recalibrate the dry mass of the pychnometer

Method A: Moist Specimens ☒ Method B: Oven-dried Specimens ☐

Method A: Moist Specimens

	Initial Moisture Content	Tare #:	
A	Tare Weight		
B	Wet Wt + Tare Wt		
C	Dry Wt. + Tare Wt.		
D	Water Weight	B-C	
E	Dry Weight	C-A	
	Moisture Content	100*D/E	

Target Dry Mass (see Table 1 ASTM D854)	Low Limit	High Limit
Target Wet Mass		

Note: Deviation

Wet Mass of test specimen _____ grams

Method B: Oven-dried Specimens

Initial Dry Mass of test specimen _____ grams

Note: Deviation

$M_{psw;t}$ Mass of the Pychnometer, soil, and water **389.02** grams

Mass of Dry Soil (grams)				T_t	Test Temperature T_t	21.3 °C
		Tare #	60	K	Temperature Coefficient at T_t	0.99972
A	Tare Weight		222.12	K	Temperature Coefficient at 23°C	0.99933
C	Dry Wt. + Tare Wt.		254.61	$p_{w;t}$	Density of Water at T_t	0.99793 g./ml.
M_s	Dry Weight	C-A	32.49		See Table 2 ASTM D 854	

$M_{pw;t}$	Mass of the Pychnometer and water at T_t	$M_{pw;t} = M_p + (V_p \times p_{w;t})$	368.31 grams
G_t	Specific Gravity of tSoil Solids at the T_t	$G_t = M_s / (M_{pw;t} - (M_{psw;t} - M_s))$	2.757
G	Specific Gravity of Soil Solids at the 20°C	$G = K \times G_t$	2.757

Soils containing plus #4 material tested per ASTM C 127: R % of Soil retained on the #4 sieve _____

Note: Deviation P % of Soil passing the #4 sieve 100.0%

G_{+4} Apparent Specific Gravity of plus #4 material at the 23°C per ASTM C127 _____

Apparent Specific Gravity of plus #4 material corrected to 20°C _____

G_{total} The Average total sample Specific Gravity

$$G_{total} = \frac{1}{\frac{R}{100-G_{+4}} + \frac{P}{100-G}} = 2.757$$

References: ASTM D854 Specific Gravity of Soil Solids by Water Pychnometer
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM C 127: Specific Gravity and Absorption of Coarse Aggregates

Technician Name / Certification #: Tom S.

Technical Responsibility / Position: Mal Krajan — Laboratory Supervisor

Particle Size Analysis of Soils

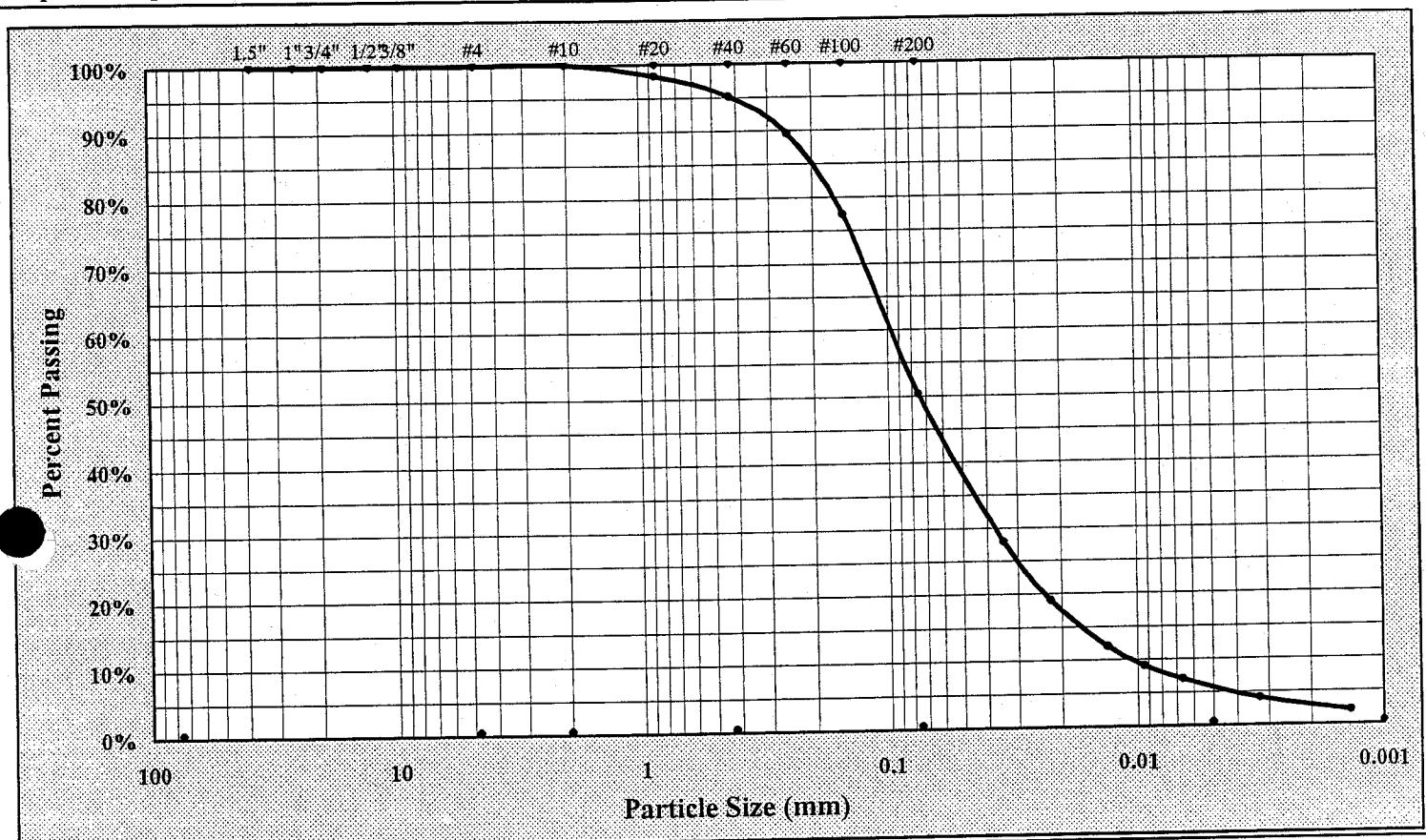
ASTM D 422

S&ME

S&ME Project #: **1054-04-955**
Project Name: **Belews Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: 10/08/2004
Test Date(s): 09/28 - 10/07/2004

Boring #:	BC-15	Sample #:	SS-4	Sample Date:	09/01 - 09/24/2004
Location:	Site Borehole	Offset:	NA	Depth (ft):	18.5 - 20'
Sample Description:	Tan-Brown Sandy SILT (ML)				



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#10	Gravel	0.0%	Silt	44.4%
Silt & Clay (% Passing #200)	50.2%	Sand	49.8%	Clay	5.8%
Apparent Relative Density	2.680	Moisture Content		Colloids	2.0%
Liquid Limit	38	Plastic Limit	27	Plastic Index	11

Description of Sand & Gravel Particles Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: ASTM D 422: Particle Size Analysis of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 854: Specific Gravity of Soils

Technical Responsibility: Mal Krajan — Signature — Laboratory Supervisor (Position)

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Liquid Limit, Plastic Limit, and Plastic Index

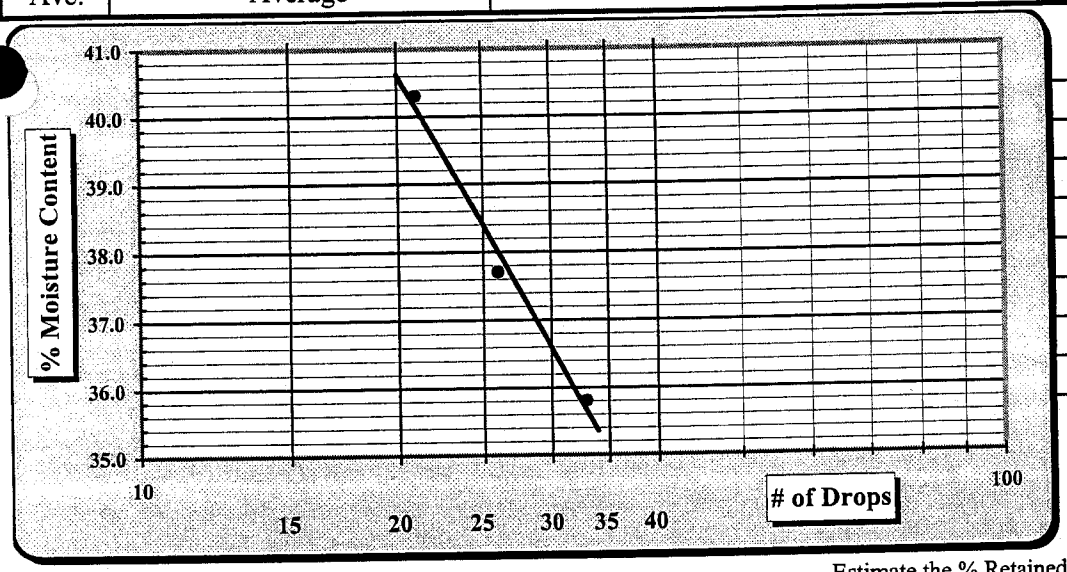
S&ME

Project #: **1054-04-955**
Project Name: Belews Creek Steam Plant
Client Name: Duke Energy
Client Address:

Report Date: 10/08/204
Test Date(s): 09/28 - 10/07/2004

Boring #: BC-15 Sample #: SS-4 Sample Date: 09/01 - 09/24/2004
Location: Site Borehole Offset: Depth (ft): 18.5 - 20
Sample Description: Tan-Brown Sandy SILT (ML)

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	24	7	2				33	51	
A	Tare Weight	18.55	15.39	18.56				20.79	20.89	
B	Wet Soil Weight + A	34.47	31.80	29.60				29.21	31.39	
C	Dry Soil Weight + A	30.27	27.31	26.43				27.44	29.09	
D	Water Weight (B-C)	4.20	4.49	3.17				1.77	2.30	
E	Dry Soil Weight (C-A)	11.72	11.92	7.87				6.65	8.20	
F	% Moisture Content (D/E)*100	35.8%	37.7%	40.3%				26.6%	28.0%	
N	# OF DROPS	33	26	21				*Moisture Contents determined by ASTM D 2216*		
LL	LL = F * FACTOR									
Ave.	Average							27.3%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation ☐	Dry Preparation ☐	Air Dried ☒	NP, Non-Plastic	☐
Liquid limit Test:	Multipoint Method ☒	One-point Method ☐		Liquid Limit	38
Classification:	ASTM D 2487 ☒	AASHTO M 145 ☐		Plastic Limit	27
Liquid limit Test:	ASTM D 4318 ☒	AASHTO T 89 ☐		Plastic Index	11
Plastic limit Test:	ASTM D 4318 ☒	AASHTO T 90 ☐		Group Symbol	ML

Technician Name: Chana Savanapridi OCT-1433 (Certification #)

Technical Responsibility: Mal Krajan (Signature) Laboratory Supervisor (Position)

Laboratory Report Version 4.2

Specific Gravity of Soils

S&ME

ASTM D 854 *Method A: Moist Specimens* ☒ *Method B: Oven-dried Specimens* ☐

Report Date: October 8, 2004
Test Date(s) 09/28 - 10/05/2004

Project #: **1054-04-955**
Project Name: **Belews Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Boring No. BC-15 Sample No. SS-4 Sample Date: 09/01 - 09/24/2004
Location: Site Borehole Offset: Depth (ft): 18.5 - 20'
Sample Description: Tan-Brown Sandy SILT (ML)
Percent of Soil Passing #4 Sieve: **100.0** Material Excluded:
LL = 38 PL = 27 PI = 11

	Pycnometer #	109	Balance ID#	Readability	.01 gram
V_p	Pycnometer Volume (V_p)	499.54 ml.		Calibration Date	
PM	Pycnometer Mass	182.88 g.	Balance Verification		
M_p	Ave. Pycnometer Mass (Mp)	182.86 g.		Mass	500 gram
[PM-M_p]	Verify Pycnometer Mass	0.02 g.		Mass Determination	500.00

If [PM-M_p] is greater than .06 grams recalibrate the dry mass of the pycnometer or the balance.

Method A: Moist Specimens

	Initial Moisture Content	Tare #:	
A	Tare Weight		
B	Wet Wt + Tare Wt		
C	Dry Wt. + Tare Wt.		
D	Water Weight	B-C	
E	Dry Weight	C-A	
F	**Moisture Content**	100*D/E	

Target Dry Mass (see Table 1 ASTM D854)	Low Limit	High Limit
Target Wet Mass		

Wet Mass of test specimen grams

Method B: Oven-dried Specimens Initial Dry Mass of test specimen **40.91** grams

T-100

$M_{psw;t}$ Mass of the Pycnometer, soil, and water **706.80** grams

Mass of Dry Soil (grams)		Tare #	5
A	Tare Weight		
C	Dry Wt. + Tare Wt.		40.91
M_s	Dry Weight	C-A	40.91

T_t	Test Temperature T_t	23.2 °C
K	Temperature Coefficient at T_t	0.99929
K	Temperature Coefficient at 23°C	0.99933
$p_{w;t}$	Density of Water at T_t	0.99749 g./ml.
	See Table 2 ASTM D 854	

$M_{pw;t}$ Mass of the Pycnometer and water at T_t $M_{pw;t} = M_p + (V_p \times p_{w;t})$ **681.15** grams
G_t Specific Gravity of Soil Solids at the T_t $G_t = M_s / (M_{pw;t} - (M_{psw;t} - M_s))$ **2.682**
G Specific Gravity of Soil Solids at the 20°C $G = K \times G_t$ **2.680**

Soils containing plus #4 material tested per ASTM C 127:
Note: Deviation or remove this note

R % of Soil retained on the #4 sieve
P % of Soil passing the #4 sieve
G_{+4} Apparent Specific Gravity of plus #4 material at the 23°C per ASTM C127
Apparent Specific Gravity of plus #4 material corrected to 20°C

G_{total} The Average total sample Specific Gravity $G_{total} = \dfrac{1}{\dfrac{R}{100-G_{+4}} + \dfrac{P}{100-G}} =$ **2.680**

References: ASTM D854 Specific Gravity of Soil Solids by Water Pycnometer ASTM C 127: Specific Gravity and Absorption of Coarse Aggregates
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Technician Name: Chana Savanapridi QCT - 1433 (Certification #)
Technical Responsibility: Mal Krajan (Signature) Laboratory Supervisor (Position)

Particle Size Analysis of Soils

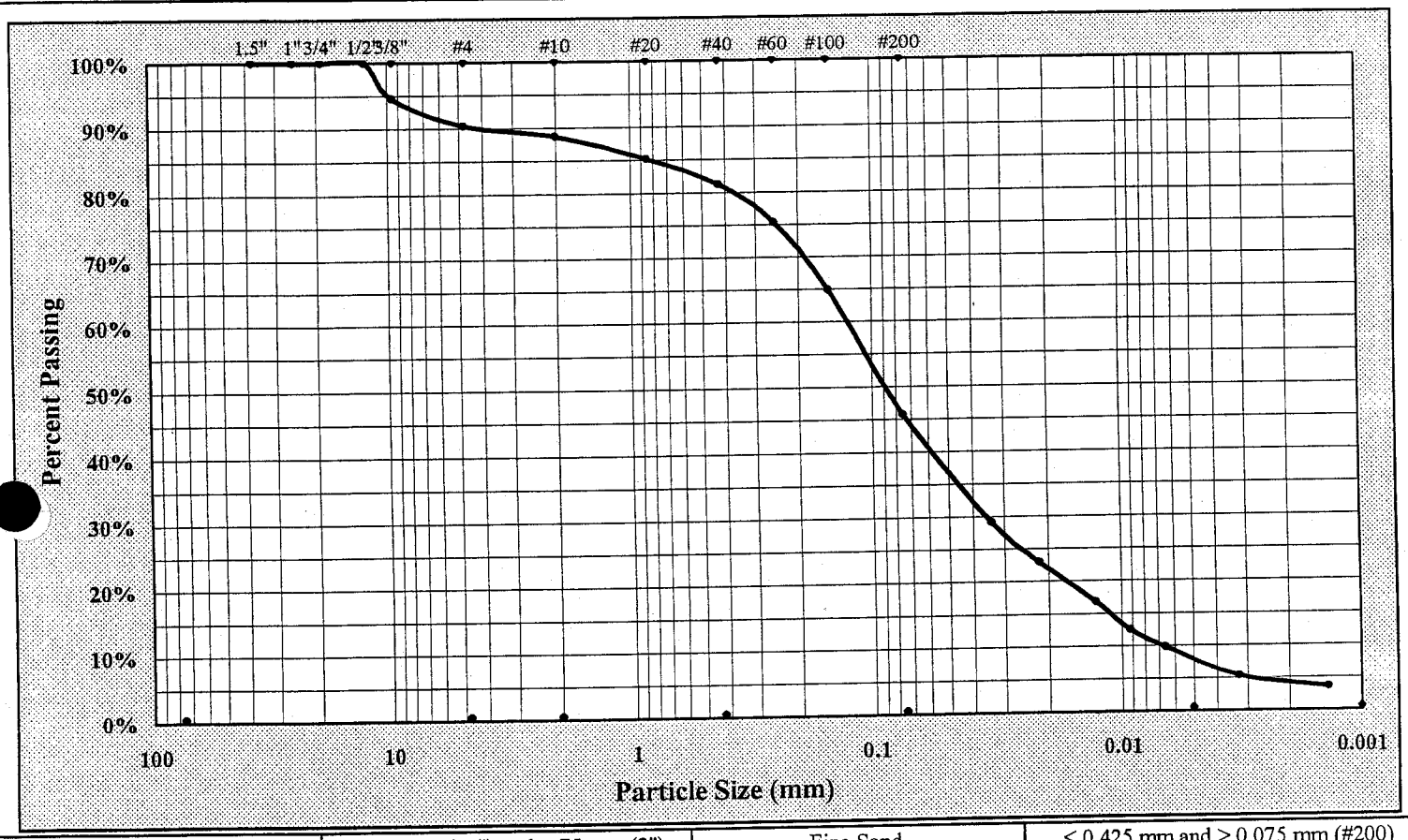
ASTM D 422

S&ME

S&ME Project #: **1054-04-955**
Project Name: **Belews Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: 10/08/2004
Test Date(s): 09/28 - 10/07/2004

Boring #:	BC-16	Sample #:	SS-3	Sample Date:	9/1/04
Location:	Site Borehole	Offset:	NA	Depth (ft):	13.5 - 15'
Sample Description:	Purple and Tan Clayey SAND with Gravel (SC)				



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	1/2"	Gravel	9.7%	Silt	38.1%
Silt & Clay (% Passing #200)	45.6%	Sand	44.7%	Clay	7.5%
Apparent Relative Density	2.677	Moisture Content		Colloids	3.5%
Liquid Limit	36	Plastic Limit	24	Plastic Index	12

Description of Sand & Gravel Particles Rounded ☐ Angular ☒ Hard & Durable ☐ Soft ☒ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: ASTM D 422: Particle Size Analysis of Soils
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan — Signature — Laboratory Supervisor — Position

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BC-16 SS-3 Classification.xls

Liquid Limit, Plastic Limit, and Plastic Index

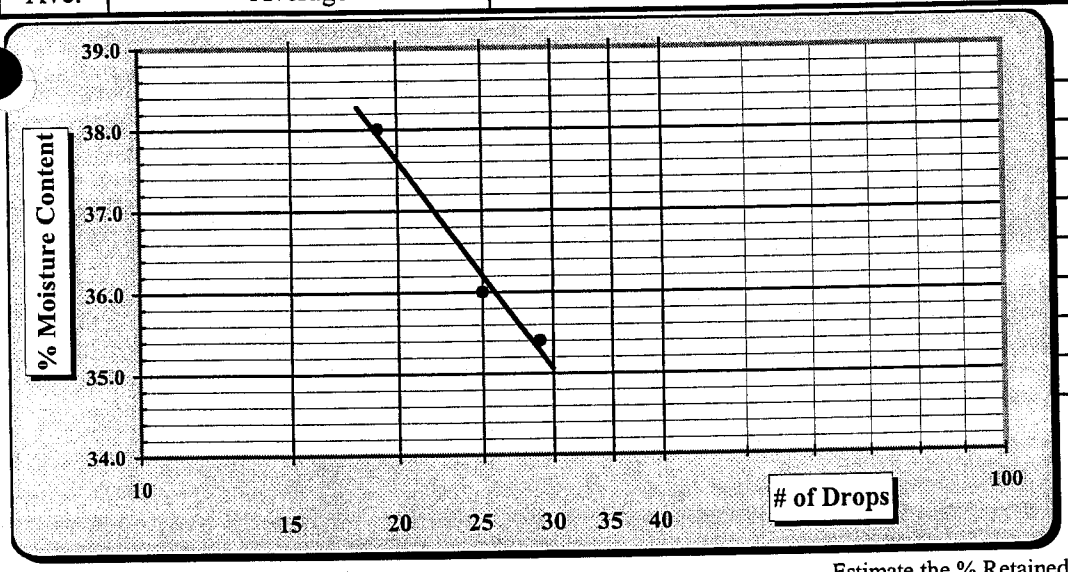
S&ME

Project #: 1054-04-955
Project Name: Belews Creek Steam Plant
Client Name: Duke Energy
Client Address:

Report Date: 10/08/204
Test Date(s): 09/28 - 10/07/2004

Boring #: BC-16 Sample #: SS-3 Sample Date: 09/01 - 09/24/2004
Location: Site Borehole Offset: Depth (ft): 13.5 - 15'
Sample Description: Purple and Tan Clayey SAND with Gravel (SC)

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	42	31	40				19	15	
A	Tare Weight	18.65	18.48	21.02				21.04	21.03	
B	Wet Soil Weight + A	32.59	33.75	36.38				30.34	31.51	
C	Dry Soil Weight + A	28.75	29.71	32.36				28.53	29.48	
D	Water Weight (B-C)	3.84	4.04	4.02				1.81	2.03	
E	Dry Soil Weight (C-A)	10.10	11.23	11.34				7.49	8.45	
F	% Moisture Content (D/E)*100	38.0%	36.0%	35.4%				24.2%	24.0%	
N	# OF DROPS	19	25	29				*Moisture Contents determined by ASTM D 2216*		
LL	LL = F * FACTOR									
Ave.	Average							24.1%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation ☐	Dry Preparation ☐	Air Dried ☒	NP, Non-Plastic	☐
Liquid limit Test:	Multipoint Method ☒	One-point Method ☐		Liquid Limit	36
Classification:	ASTM D 2487 ☒	AASHTO M 145 ☐		Plastic Limit	24
Liquid limit Test:	ASTM D 4318 ☒	AASHTO T 89 ☐		Plastic Index	12
Plastic limit Test:	ASTM D 4318 ☒	AASHTO T 90 ☐		Group Symbol	SC

Technician Name: Chana Savanapridi OCT-1433 (Certification #)

Technical Responsibility: Mal Krajan (Signature) Laboratory Supervisor (Position)

Laboratory Report Version 4.2

Specific Gravity of Soils

S&ME

ASTM D 854 *Method A: Moist Specimens* ☒ *Method B: Oven-dried Specimens* ☐

Project #: **1054-04-955**
Project Name: **Belews Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: October 8, 2004
Test Date(s) 09/28 - 10/01/2004

Boring No.	BC-16	Sample No.	SS-3	Sample Date:	09/10/04
Location:	Site Borehole	Offset:	NA	Depth (ft):	13.5 - 15'

Sample Description: Purple and Tan Clayey SAND with Gravel (SC)

Percent of Soil Passing #4 Sieve: **90.0** Material Excluded: **10.0**

LL = 36 PL = 24 PI = 12

	Pycnometer #	105	Balance ID#	Readability	.01 gram
V_p	Pycnometer Volume (V_p)	499.39 ml.		Calibration Date	
PM	Pycnometer Mass	194.27 g.	Balance Verification		
M_p	Ave. Pycnometer Mass (Mp)	194.31 g.		Mass	500 gram
[PM-M_p]	Verify Pycnometer Mass	0.04 g.		Mass Determination	500.00

If [PM-M_p] is greater than .06 grams recalibrate the dry mass of the pycnometer or the balance.

Method A: Moist Specimens

	Initial Moisture Content	Tare #:	
A	Tare Weight		
B	Wet Wt + Tare Wt		
C	Dry Wt. + Tare Wt.		
D	Water Weight	B-C	
E	Dry Weight	C-A	
F	**Moisture Content**	100*D/E	

Target Dry Mass (see Table 1 ASTM D854)	Low Limit	High Limit
Target Wet Mass		

Wet Mass of test specimen _____ grams

Method B: Oven-dried Specimens

Initial Dry Mass of test specimen _____ grams

T-100

$M_{psw;t}$ Mass of the Pycnometer, soil, and water 716.15 grams

Mass of Dry Soil (grams)		Tare #	10
A	Tare Weight		
C	Dry Wt. + Tare Wt.		37.82
M_s	Dry Weight	C-A	37.82

T_t	Test Temperature T_t	23.2 °C
K	Temperature Coefficient at T_t	0.99929
K	Temperature Coefficient at 23°C	0.99933
$p_{w;t}$	Density of Water at T_t	0.99749 g./ml.
	See Table 2 ASTM D 854	

$M_{pw;t}$ Mass of the Pycnometer and water at T_t $M_{pw;t} = M_p + (V_p \times p_{w;t})$ 692.45 grams

G_t Specific Gravity of Soil Solids at the T_t $G_t = M_s / (M_{pw;t} - (M_{psw;t} - M_s))$ 2.679

G Specific Gravity of Soil Solids at the 20°C $G = K \times G_t$ 2.677

Soils containing plus #4 material tested per ASTM C 127:

R % of Soil retained on the #4 sieve _____

P % of Soil passing the #4 sieve _____

Note: Deviation or remove this note

G_{+4} Apparent Specific Gravity of plus #4 material at the 23°C per ASTM C127 _____

Apparent Specific Gravity of plus #4 material corrected to 20°C _____

G_{total} The Average total sample Specific Gravity

$$G_{total} = \frac{1}{\frac{R}{100-G_{+4}} + \frac{P}{100-G}} = 2.677$$

References: ASTM D854 Specific Gravity of Soil Solids by Water Pycnometer ASTM C 127: Specific Gravity and Absorption of Coarse Aggregates
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Technician Name: Chana Savanapridi

Technical Responsibility: Mal Krajan

OCT - 1433
Certification #

Signature

Laboratory Supervisor
Position

Particle Size Analysis of Soils

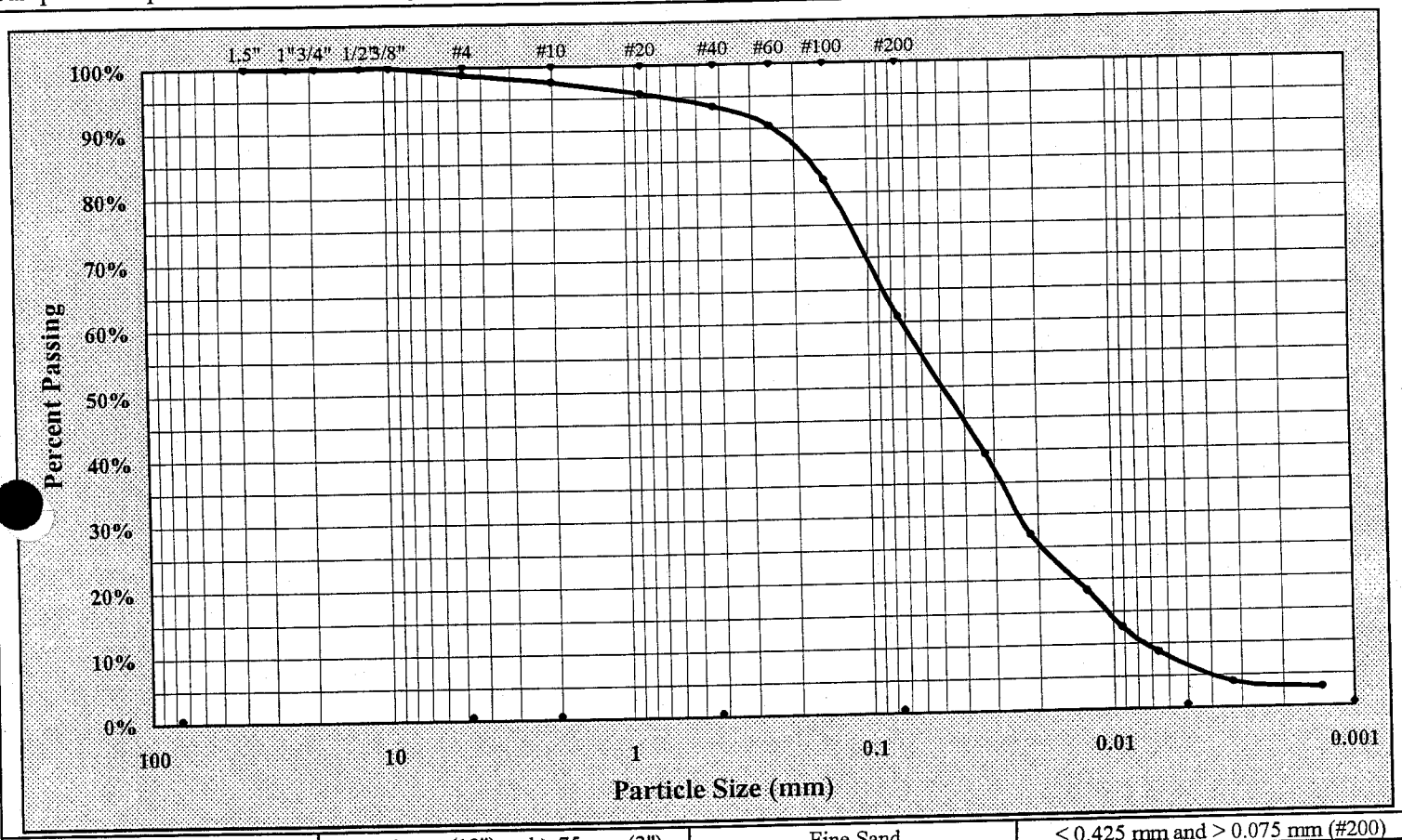
ASTM D 422

S&ME

S[redacted]ME Project #: **1054-04-955**
P[redacted]ject Name: **Belews Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: 09/21/2004
Test Date(s): 09/10 - 09/15/2004

Boring #:	BC-17	Sample #:	SS-3	Sample Date:	9/1/04
Location:	Site Borehole	Offset:	NA	Depth (ft):	13.9'
Sample Description:	Brown Sandy SILT (ML)				



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/8"	Gravel	1.2%	Silt	53.8%
Silt & Clay (% Passing #200)	60.8%	Sand	38.0%	Clay	7.0%
Apparent Relative Density	2.719	Moisture Content		Colloids	2.9%
Liquid Limit	36	Plastic Limit	27	Plastic Index	9

Description of Sand & Gravel Particles Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

[redacted]rences: ASTM D 422: Particle Size Analysis of Soils
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan — Signature — Laboratory Supervisor — Position

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BC-17 SS-3 Classification.xls

Liquid Limit, Plastic Limit, and Plastic Index

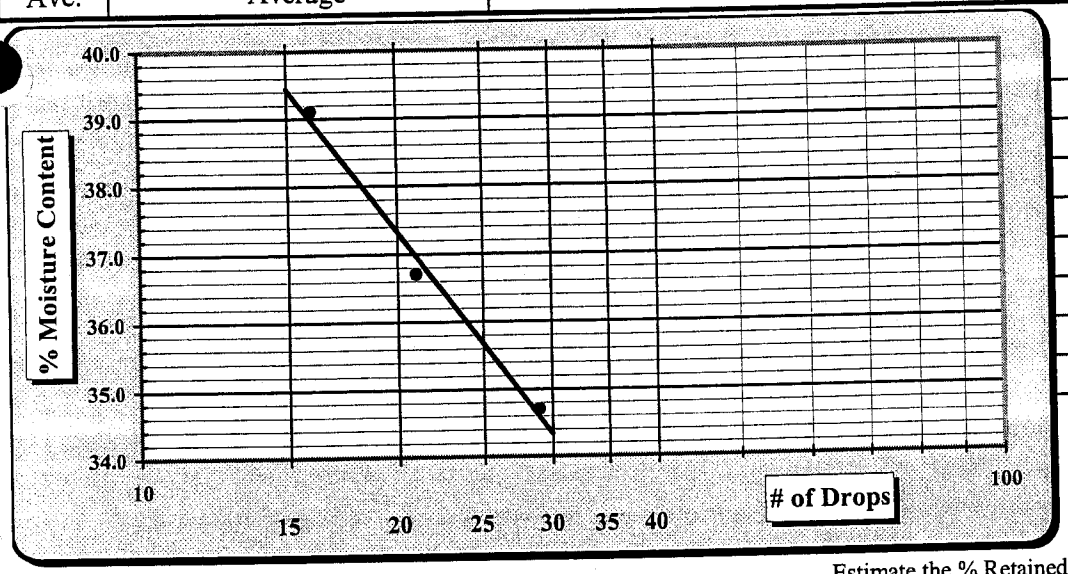
S&ME

Project #: **1054-04-955**
Project Name: Belews Creek Steam Plant
Client Name: Duke Energy
Client Address:

Report Date: 9/21/2004
Test Date(s): 09/13 - 09/17/2004

Boring #: BC-17 Sample #: SS-3 Sample Date: 9/1/2004
Location: Site Borehole Offset: NA Depth (ft): 13.9'
Sample Description: Brown Sandy SILT (ML)

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	48	2	58				39	27	
A	Tare Weight	20.61	15.23	18.44				20.78	20.63	
B	Wet Soil Weight + A	37.86	31.88	31.47				29.90	30.76	
C	Dry Soil Weight + A	33.23	27.59	27.81				27.97	28.66	
D	Water Weight (B-C)	4.63	4.29	3.66				1.93	2.10	
E	Dry Soil Weight (C-A)	12.62	12.36	9.37				7.19	8.03	
F	% Moisture Content (D/E)*100	36.7%	34.7%	39.1%				26.8%	26.2%	
N	# OF DROPS	21	29	16				*Moisture Contents determined by ASTM D 2216*		
LL	LL = F * FACTOR									
Ave.	Average							26.5%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation ☐	Dry Preparation ☐	Air Dried ☒	NP, Non-Plastic	☐
Liquid limit Test:	Multipoint Method ☒	One-point Method ☐		Liquid Limit	36
Classification:	ASTM D 2487 ☒	AASHTO M 145 ☐		Plastic Limit	27
Liquid limit Test:	ASTM D 4318 ☒	AASHTO T 89 ☐		Plastic Index	9
Plastic limit Test:	ASTM D 4318 ☒	AASHTO T 90 ☐		Group Symbol	ML

Technician Name: Chana Savanapridi QCT-1433 (Certification #)

Technical Responsibility: Mal Krajan (Signature) Laboratory Supervisor (Position)

Laboratory Report Version 4.2

Specific Gravity of Soils

S&ME

ASTM D 854 *Method A: Moist Specimens* ☒ *Method B: Oven-dried Specimens* ☐

Project #: **1054-04-955**
Project Name: **Belews Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: September 21, 2004
Test Date(s) 09/13 - 09/16/2004

Boring No.	BC-17	Sample No.	SS-3	Sample Date:	09/01/04
Location:	Site Borehole	Offset:	NA	Depth (ft):	13.9'

Sample Description: Brown Sandy SILT (ML)
Percent of Soil Passing #4 Sieve: **100.0** Material Excluded:
LL = 36 PL = 27 PI = 9

	Pycnometer #	**105**	**Balance ID#**	Readability	**.01 gram**
V_p	Pycnometer Volume (V_p)	**499.39 ml.**		Calibration Date	
PM	Pycnometer Mass	**194.30 g.**	**Balance Verification**		
M_p	Ave. Pycnometer Mass (Mp)	**194.31 g.**		Mass	**500 gram**
[PM-M_p]	Verify Pycnometer Mass	**0.01 g.**		Mass Determination	**500.00**

If [PM-M_p] is greater than .06 grams recalibrate the dry mass of the pycnometer or the balance.

Method A: Moist Specimens

	Initial Moisture Content	Tare #:	
A	Tare Weight		
B	Wet Wt + Tare Wt		
C	Dry Wt. + Tare Wt.		
D	Water Weight	B-C	
E	Dry Weight	C-A	
F	**Moisture Content**	100*D/E	

Target Dry Mass (see Table 1 ASTM D854)	Low Limit	High Limit
Target Wet Mass		

Wet Mass of test specimen _____ grams

Method B: Oven-dried Specimens

Initial Dry Mass of test specimen 27.99 grams

T-100

$M_{psw;t}$ Mass of the Pycnometer, soil, and water 710.15 grams

Mass of Dry Soil (grams)		Tare #	3
A	Tare Weight		
C	Dry Wt. + Tare Wt.		27.99
M_s	Dry Weight	C-A	27.99

T_t	Test Temperature T_t	23.2 °C
K	Temperature Coefficient at T_t	0.99929
K	Temperature Coefficient at 23°C	0.99933
$p_{w;t}$	Density of Water at T_t	0.99749 g./ml.
	See Table 2 ASTM D 854	

$M_{pw;t}$ Mass of the Pycnometer and water at T_t — $M_{pw;t} = M_p + (V_p \times p_{w;t})$ = 692.45 grams

G_t Specific Gravity of Soil Solids at the T_t — $G_t = M_s / (M_{pw;t} - (M_{psw;t} - M_s))$ = 2.721

G Specific Gravity of Soil Solids at the 20°C — $G = K \times G_t$ = 2.719

Soils containing plus #4 material tested per ASTM C 127:

Note: Deviation or remove this note

R % of Soil retained on the #4 sieve _____

P % of Soil passing the #4 sieve _____

G_{+4} Apparent Specific Gravity of plus #4 material at the 23°C per ASTM C127 _____

Apparent Specific Gravity of plus #4 material corrected to 20°C _____

G_{total} The Average total sample Specific Gravity

$$G_{total} = \frac{1}{\frac{R}{100-G_{+4}} + \frac{P}{100-G}} = 2.719$$

References: ASTM D854 Specific Gravity of Soil Solids by Water Pycnometer ASTM C 127: Specific Gravity and Absorption of Coarse Aggregates
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Technician Name: Chana Savanapridi QCT - 1433 (Certification #)

Technical Responsibility: Mal Krajan (Signature) Laboratory Supervisor (Position)

Particle Size Analysis of Soils

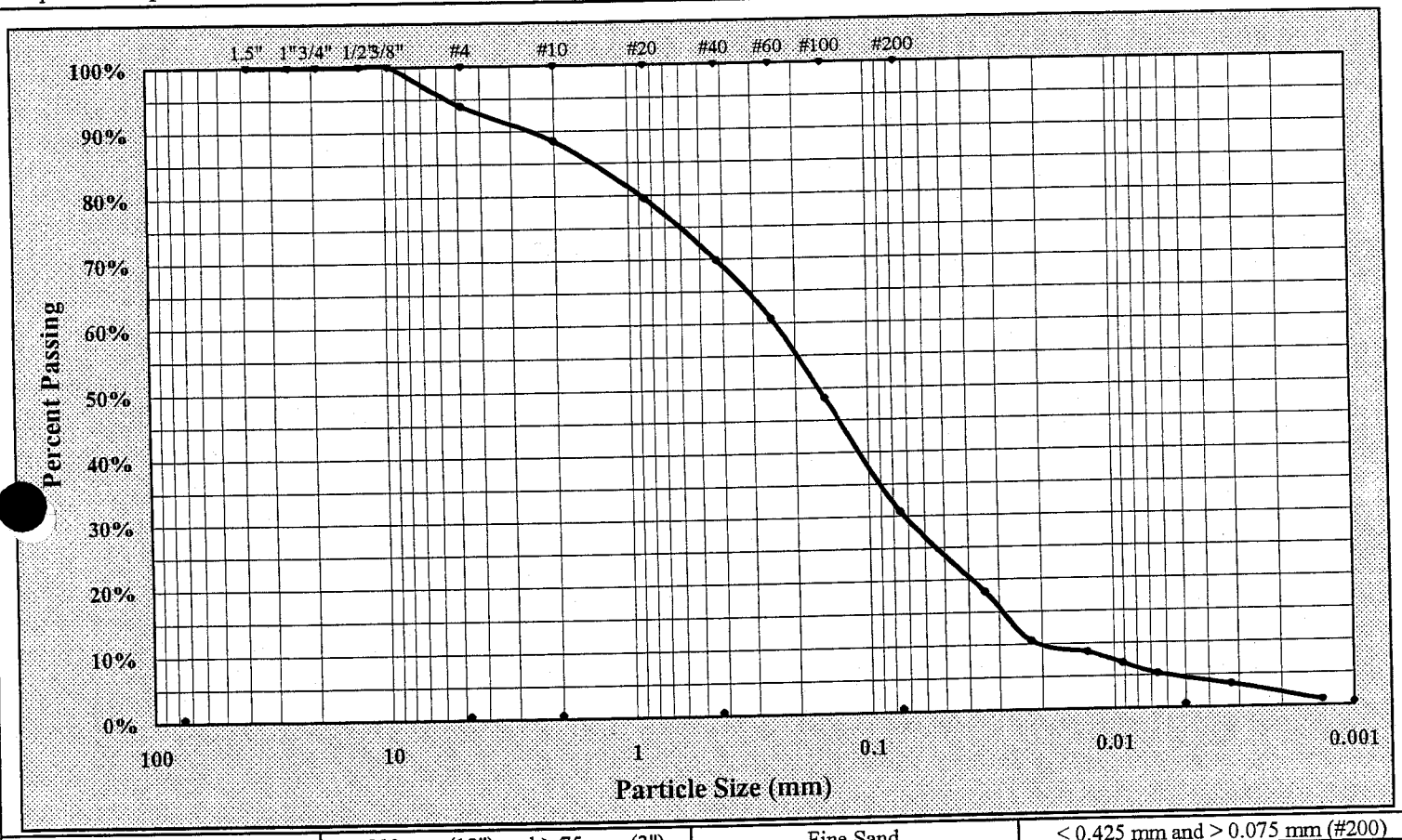
ASTM D 422

S&ME

S&ME Project #: **1054-04-955**
Project Name: **Belews Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: 09/21/2004
Test Date(s): 09/10 - 09/15/2004

Boring #:	BC-18	Sample #:	SS-4	Sample Date:	9/1/04
Location:	Site Borehole	Offset:	NA	Depth (ft):	18.5'
Sample Description:	Brown Clayey SAND (SC)				



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/8"	Gravel	6.2%	Silt	26.0%
Silt & Clay (% Passing #200)	30.7%	Sand	63.1%	Clay	4.7%
Apparent Relative Density	2.759	Moisture Content		Colloids	0.9%
Liquid Limit	32	Plastic Limit	23	Plastic Index	9

Description of Sand & Gravel Particles Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: ASTM D 422: Particle Size Analysis of Soils
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan (Signature) Laboratory Supervisor (Position)

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BC-18 SS-4 Classification.xls

Liquid Limit, Plastic Limit, and Plastic Index

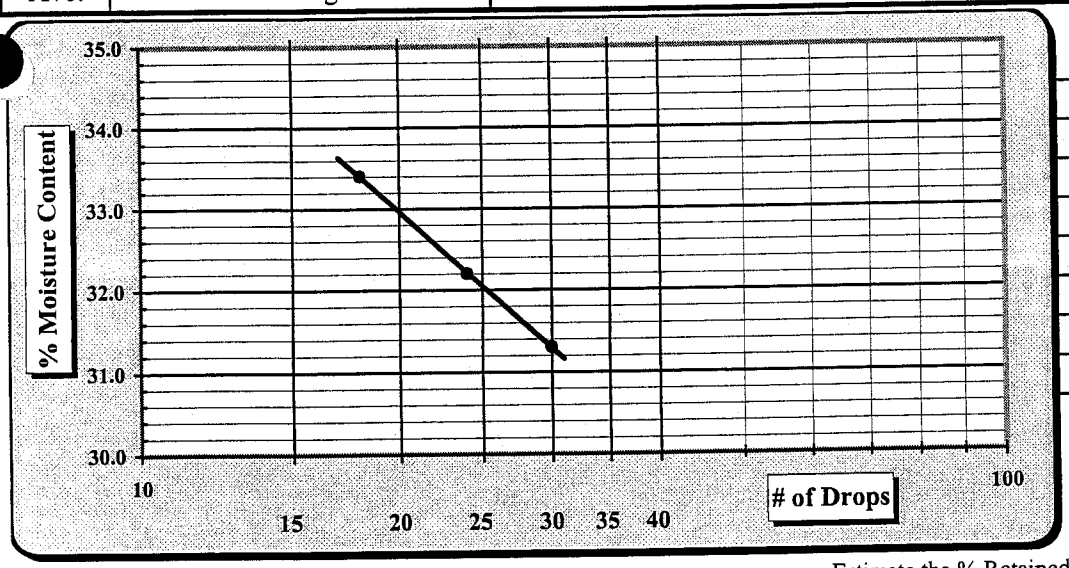
S&ME

Project #: **1054-04-955**
Project Name: Belews Creek Steam Plant
Client Name: Duke Energy
Client Address:

Report Date: 9/21/2004
Test Date(s): 09/10 - 09/15/2004

Boring #: BC-18 Sample #: SS-4 Sample Date: 9/1/2004
Location: Site Borehole Offset: NA Depth (ft): 18.5'
Sample Description: Brown Clayey SAND (SC)

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	32	24	5				42	9	
A	Tare Weight	18.50	18.40	15.34				18.65	17.79	
B	Wet Soil Weight + A	37.12	35.28	31.12				25.74	25.46	
C	Dry Soil Weight + A	32.46	31.17	27.36				24.38	24.05	
D	Water Weight (B-C)	4.66	4.11	3.76				1.36	1.41	
E	Dry Soil Weight (C-A)	13.96	12.77	12.02				5.73	6.26	
F	% Moisture Content (D/E)*100	33.4%	32.2%	31.3%				23.7%	22.5%	
N	# OF DROPS	18	24	30				*Moisture Contents determined by ASTM D 2216*		
LL	LL = F * FACTOR									
Ave.	Average							23.1%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation	☐	Dry Preparation	☐	Air Dried	☒	NP, Non-Plastic ☐
Liquid limit Test:	Multipoint Method	☒	One-point Method	☐			Liquid Limit 32
Classification:	ASTM D 2487	☒	AASHTO M 145	☐			Plastic Limit 23
Liquid limit Test:	ASTM D 4318	☒	AASHTO T 89	☐			Plastic Index 9
Plastic limit Test:	ASTM D 4318	☒	AASHTO T 90	☐			Group Symbol SC

Technician Name: Chana Savanapridi QCT-1433 (Certification #)

Technical Responsibility: Mal Krajan (Signature) Laboratory Supervisor (Position)

Specific Gravity of Soils

S&ME

ASTM D 854 *Method A: Moist Specimens* ☒ *Method B: Oven-dried Specimens* ☐

Project #: **1054-04-955**
Project Name: **Belews Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: September 21, 2004
Test Date(s) 09/10 - 09/15/2004

Boring No.	BC-18	Sample No.	4	Sample Date:	09/01/04
Location:	Site Borehole	Offset:	NA	Depth (ft):	18.5'

Sample Description: Brown Clayey SAND (SC)

Percent of Soil Passing #4 Sieve: **94.0** Material Excluded: **6.0**

LL = 32 PL = 23 PI = 9

	Pycnometer #	**101**	**Balance ID#**	Readability	**.01 gram**
V_p	Pycnometer Volume (V_p)	**499.84 ml.**		Calibration Date	
PM	Pycnometer Mass	**183.78 g.**	**Balance Verification**		
M_p	Ave. Pycnometer Mass (Mp)	**183.73 g.**		Mass	**500 gram**
[PM-M_p]	Verify Pycnometer Mass	**0.05 g.**		Mass Determination	**500.00**

If [PM-M_p] is greater than .06 grams recalibrate the dry mass of the pycnometer or the balance.

Method A: Moist Specimens

	Initial Moisture Content	Tare #:	
A	Tare Weight		
B	Wet Wt + Tare Wt		
C	Dry Wt. + Tare Wt.		
D	Water Weight	**B-C**	
E	Dry Weight	**C-A**	
F	**Moisture Content**	**100*D/E**	

Target Dry Mass (see Table 1 ASTM D854)	Low Limit	High Limit
Target Wet Mass		

Wet Mass of test specimen grams

Method B: Oven-dried Specimens

Initial Dry Mass of test specimen **29.01** grams

T-100

$M_{psw;t}$ Mass of the Pycnometer, soil, and water **700.82** grams

	Mass of Dry Soil (grams)					
		Tare #	3	T_t	Test Temperature T_t	**23.2** °C
A	Tare Weight			**K**	Temperature Coefficient at T_t	**0.99929**
C	Dry Wt. + Tare Wt.		29.01	**K**	Temperature Coefficient at 23°C	**0.99933**
M_s	Dry Weight	**C-A**	**29.01**	$p_{w;t}$	Density of Water at T_t	**0.99749** g./ml.
					See Table 2 ASTM D 854	

$M_{pw;t}$ Mass of the Pycnometer and water at T_t — $M_{pw;t} = M_p + (V_p \times p_{w;t})$ **682.32** grams

G_t Specific Gravity of Soil Solids at the T_t — $G_t = M_s / (M_{pw;t} - (M_{psw;t} - M_s))$ **2.761**

G Specific Gravity of Soil Solids at the 20°C — $G = K \times G_t$ **2.759**

Soils containing plus #4 material tested per ASTM C 127:

Note: Deviation or remove this note

R % of Soil retained on the #4 sieve

P % of Soil passing the #4 sieve

G_{+4} Apparent Specific Gravity of plus #4 material at the 23°C per ASTM C127

Apparent Specific Gravity of plus #4 material corrected to 20°C

G_{total} The Average total sample Specific Gravity

$$G_{total} \quad \frac{1}{\frac{R}{100-G_{+4}} + \frac{P}{100-G}} = 2.759$$

References: ASTM D854 Specific Gravity of Soil Solids by Water Pycnometer ASTM C 127: Specific Gravity and Absorption of Coarse Aggregates
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Technician Name: Chana Savanapridi QCT - 1433 (Certification #)

Technical Responsibility: Mal Krajan (Signature) Laboratory Supervisor (Position)

Laboratory Report Version 4.2

Particle Size Analysis of Soils

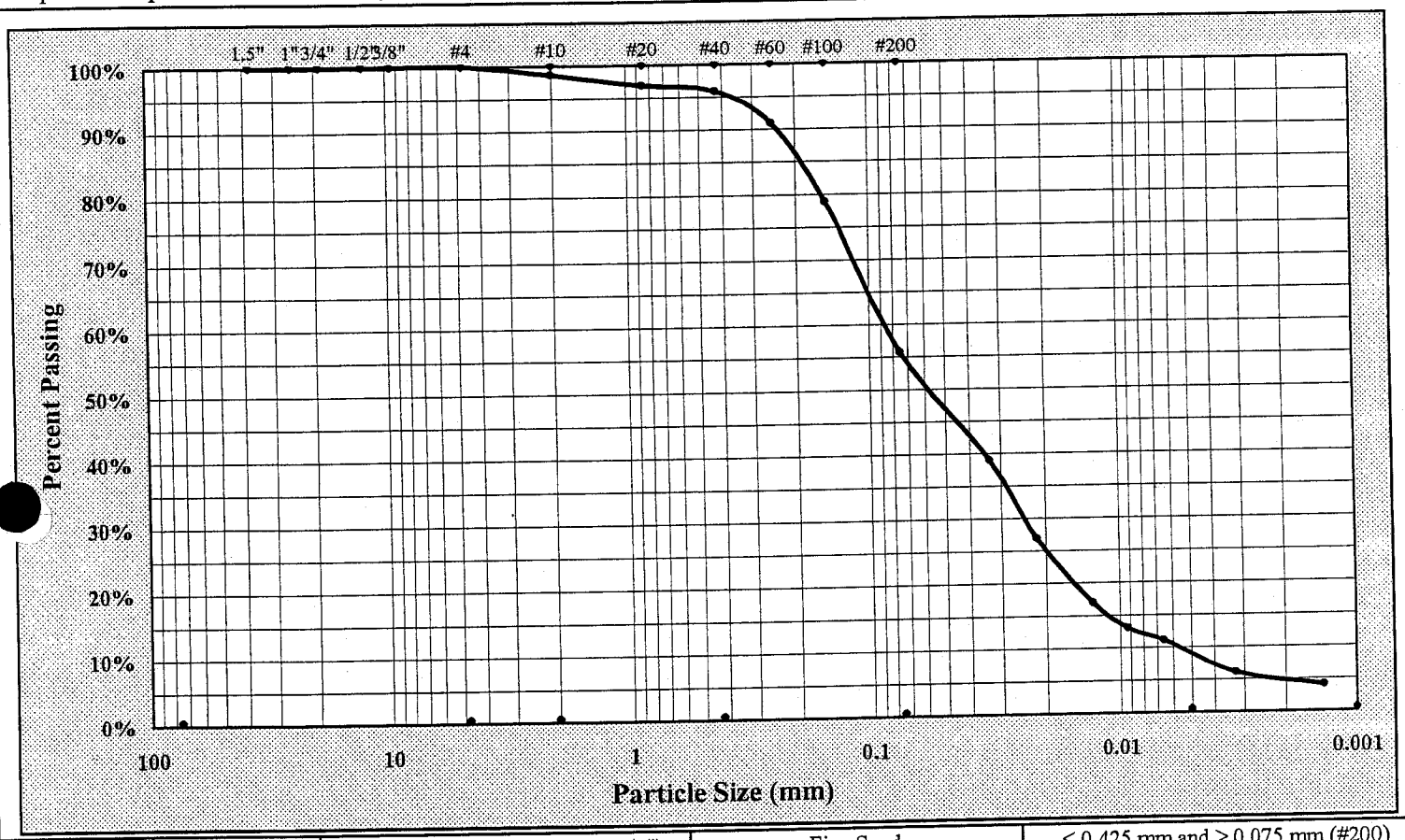
ASTM D 422

S&ME

S&ME Project #: **1054-04-955**
Project Name: **Belews Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: 10/08/2004
Test Date(s): 09/28 - 10/07/2004

Boring #:	BC-19	Sample #:	SS-4	Sample Date:	9/1/04
Location:	Site Borehole	Offset:	NA	Depth (ft):	18.5 - 20'
Sample Description:	Tan Sandy SILT (ML)				



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#4	Gravel	0.0%	Silt	46.9%
Silt & Clay (% Passing #200)	55.7%	Sand	44.3%	Clay	8.8%
Apparent Relative Density	2.670	Moisture Content		Colloids	4.0%
Liquid Limit	38	Plastic Limit	29	Plastic Index	9

Description of Sand & Gravel Particles Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: ASTM D 422: Particle Size Analysis of Soils
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan — Signature — Laboratory Supervisor — Position

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BC-19 SS-4 Classification.xls

Laboratory Report Version 4.2

Specific Gravity of Soils

S&ME

ASTM D 854 *Method A: Moist Specimens* ☒ *Method B: Oven-dried Specimens* ☐

Project #: **1054-04-955**
Project Name: **Belews Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: October 1, 2004
Test Date(s) 09/28 - 10/01/2004

Boring No.	BC-19	Sample No.	SS-4	Sample Date:	09/01/04
Location:	Site Borehole	Offset:	NA	Depth (ft):	18.5- 20'

Sample Description: Tan Sandy SILT (ML)
Percent of Soil Passing #4 Sieve: **100.0** Material Excluded:
LL = 38 PL = 29 PI = 9

	Pycnometer #	**109**	**Balance ID#**	Readability	**.01 gram**
V_p	Pycnometer Volume (V_p)	**499.54 ml.**		Calibration Date	
PM	Pycnometer Mass	**182.84 g.**	**Balance Verification**		
M_p	Ave. Pycnometer Mass (Mp)	**182.86 g.**		Mass	**500 gram**
[PM-M_p]	Verify Pycnometer Mass	**0.02 g.**		Mass Determination	**500.00**

If [PM-M_p] is greater than .06 grams recalibrate the dry mass of the pycnometer or the balance.

Method A: Moist Specimens

	Initial Moisture Content	Tare #:	
A	Tare Weight		
B	Wet Wt + Tare Wt		
C	Dry Wt. + Tare Wt.		
D	Water Weight	B-C	
E	Dry Weight	C-A	
F	**Moisture Content**	100*D/E	

Target Dry Mass (see Table 1 ASTM D854)	Low Limit	High Limit
Target Wet Mass		

Wet Mass of test specimen _____ grams

Method B: Oven-dried Specimens

Initial Dry Mass of test specimen _____ grams

T-100

$M_{psw;t}$ Mass of the Pycnometer, soil, and water **701.09** grams

Mass of Dry Soil (grams)			
		Tare #	8
A	Tare Weight		
C	Dry Wt. + Tare Wt.		31.93
M_s	Dry Weight	C-A	**31.93**

T_t	Test Temperature T_t	**23.5** °C
K	Temperature Coefficient at T_t	**0.99923**
K	Temperature Coefficient at 23°C	**0.99933**
$p_{w;t}$	Density of Water at T_t	**0.99742** g./ml.
	See Table 2 ASTM D 854	

$M_{pw;t}$ Mass of the Pycnometer and water at T_t — $M_{pw;t} = M_p + (V_p \times p_{w;t})$ **681.11** grams
G_t Specific Gravity of Soil Solids at the T_t — $G_t = M_s / (M_{pw;t} - (M_{psw;t} - M_s))$ **2.672**
G Specific Gravity of Soil Solids at the 20°C — $G = K \times G_t$ **2.670**

Soils containing plus #4 material tested per ASTM C 127:
Note: Deviation or remove this note

R % of Soil retained on the #4 sieve _____
P % of Soil passing the #4 sieve _____

G_{+4} Apparent Specific Gravity of plus #4 material at the 23°C per ASTM C127 _____
Apparent Specific Gravity of plus #4 material corrected to 20°C _____

G_{total} The Average total sample Specific Gravity

$$G_{total} = \frac{1}{\frac{R}{100-G_{+4}} + \frac{P}{100-G}} = 2.670$$

References: ASTM D854 Specific Gravity of Soil Solids by Water Pycnometer
ASTM C 127: Specific Gravity and Absorption of Coarse Aggregates
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Technician Name: Chana Savanapridi
OCT - 1433 (Certification #)
Technical Responsibility: Mal Krajan (Signature)
Laboratory Supervisor (Position)

Liquid Limit, Plastic Limit, and Plastic Index

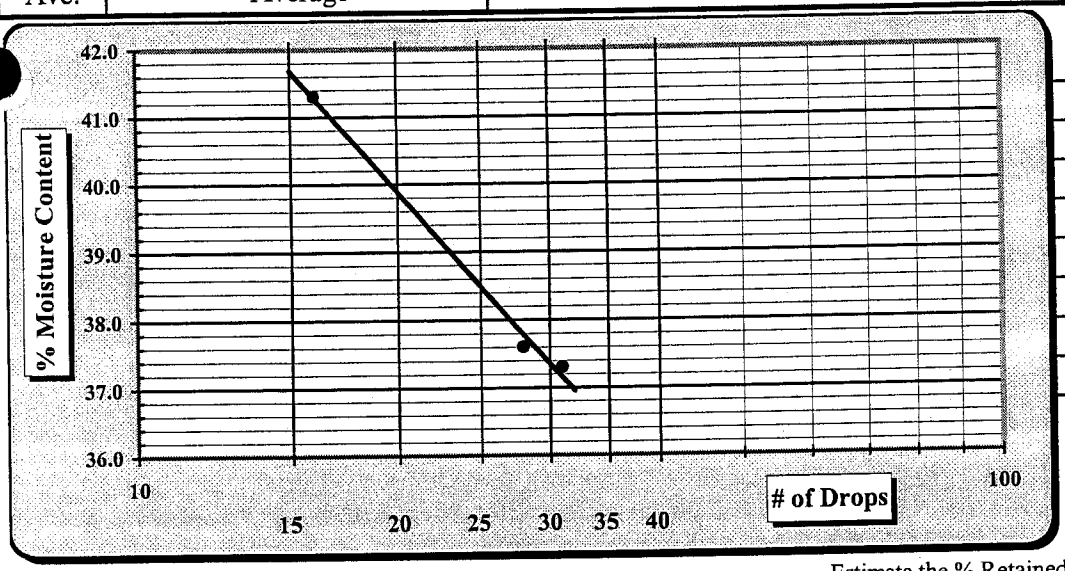
S&ME

Project #: **1054-04-955**
Project Name: Belews Creek Steam Plant
Client Name: Duke Energy
Client Address:

Report Date: 10/08/204
Test Date(s): 09/28 - 10/07/2004

Boring #: BC-19 Sample #: SS-4 Sample Date: 9/1/2004
Location: Site Borehole Offset: NA Depth (ft): 18.5 - 20'
Sample Description: Tan Sandy SILT (ML)

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	34	49	26				57	18	
A	Tare Weight	20.91	20.94	21.00				21.00	20.81	
B	Wet Soil Weight + A	40.41	32.84	37.48				28.09	29.46	
C	Dry Soil Weight + A	34.71	29.59	33.00				26.47	27.53	
D	Water Weight (B-C)	5.70	3.25	4.48				1.62	1.93	
E	Dry Soil Weight (C-A)	13.80	8.65	12.00				5.47	6.72	
F	% Moisture Content (D/E)*100	41.3%	37.6%	37.3%				29.6%	28.7%	
N	# OF DROPS	16	28	31				*Moisture Contents determined by ASTM D 2216*		
LL	LL = F * FACTOR									
Ave.	Average							29.2%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation ☐	Dry Preparation ☐	Air Dried ☒	NP, Non-Plastic	☐
Liquid limit Test:	Multipoint Method ☒	One-point Method ☐		Liquid Limit	38
Classification:	ASTM D 2487 ☒	AASHTO M 145 ☐		Plastic Limit	29
Liquid limit Test:	ASTM D 4318 ☒	AASHTO T 89 ☐		Plastic Index	9
Plastic limit Test:	ASTM D 4318 ☒	AASHTO T 90 ☐		Group Symbol	ML

Technician Name: Chana Savanapridi — OCT-1433 (Certification #)

Technical Responsibility: Mal Krajan (Signature) — Laboratory Supervisor (Position)

Laboratory Report Version 4.2

Particle Size Analysis of Soils

ASTM D 422

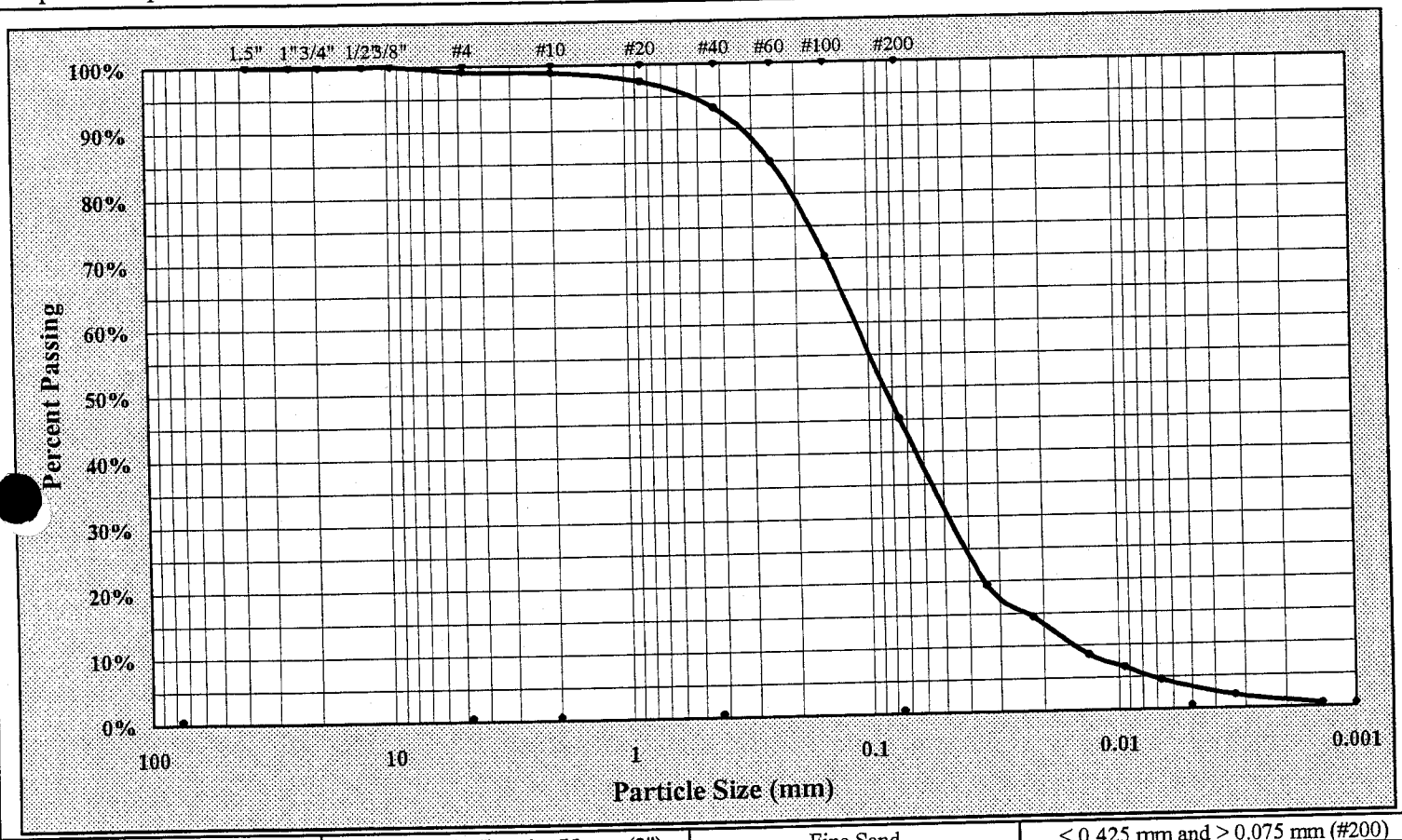
S&ME

S&ME Project #: **1054-04-955**
Project Name: **Belews Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: 09/27/2004
Test Date(s): 09/20 -09/24/2004

Boring #:	BC-20	Sample #:	SS-2	Sample Date:	9/1/04
Location:	Site Borehole	Offset:	NA	Depth (ft):	8.5'

Sample Description: Tan Silty SAND (SM)



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/8"	Gravel	0.9%	Silt	41.6%
Silt & Clay (% Passing #200)	45.1%	Sand	54.0%	Clay	3.5%
Apparent Relative Density	2.655	Moisture Content		Colloids	0.5%
Liquid Limit	36	Plastic Limit	25	Plastic Index	11

Description of Sand & Gravel Particles Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: ASTM D 422: Particle Size Analysis of Soils
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan — Laboratory Supervisor
Signature — Position
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BC-20 SS-2 Classification.xls

S&ME

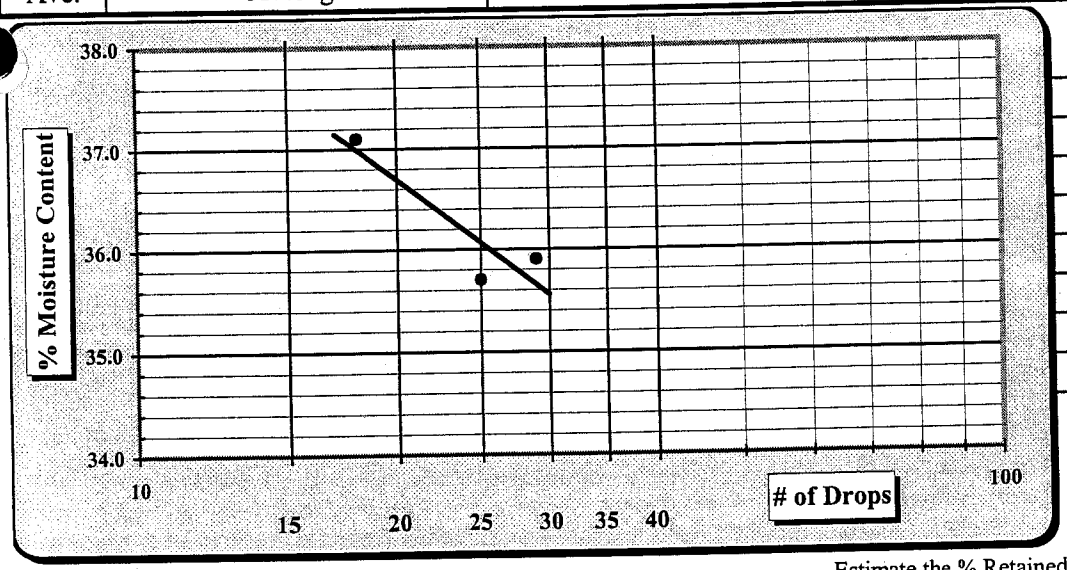
Liquid Limit, Plastic Limit, and Plastic Index

Project #: **1054-04-955**
Project Name: Belews Creek Steam Plant
Client Name: Duke Energy
Client Address:

Report Date: 9/24/2004
Test Date(s): 09/10 - 09/15/2004

Boring #: BC-20 Sample #: SS-2 Sample Date: 9/1/2004
Location: Site Borehole Offset: NA Depth (ft): 8.5'
Sample Description: Tan Silty SAND (SM)

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	58	31	52				50	48	
A	Tare Weight	18.45	18.48	18.55				20.88	20.61	
B	Wet Soil Weight + A	38.76	34.86	32.59				29.09	29.60	
C	Dry Soil Weight + A	33.40	30.43	28.90				27.38	27.88	
D	Water Weight (B-C)	5.36	4.43	3.69				1.71	1.72	
E	Dry Soil Weight (C-A)	14.95	11.95	10.35				6.50	7.27	
F	% Moisture Content (D/E)*100	35.9%	37.1%	35.7%				26.3%	23.7%	
N	# OF DROPS	29	18	25				*Moisture Contents determined by ASTM D 2216*		
LL	LL = F * FACTOR									
Ave.	Average							25.0%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation ☐	Dry Preparation ☐	Air Dried ☒	NP, Non-Plastic	☐
Liquid limit Test:	Multipoint Method ☒	One-point Method ☐		Liquid Limit	36
Classification:	ASTM D 2487 ☒	AASHTO M 145 ☐		Plastic Limit	25
Liquid limit Test:	ASTM D 4318 ☒	AASHTO T 89 ☐		Plastic Index	11
Plastic limit Test:	ASTM D 4318 ☒	AASHTO T 90 ☐		Group Symbol	SM

Technician Name: Chana Savanapridi OCT-1433 (Certification #)

Technical Responsibility: Mal Krajan (Signature) Laboratory Supervisor (Position)

Laboratory Report Version 4.2

Specific Gravity of Soils

S&ME

ASTM D 854 *Method A: Moist Specimens* ☒ *Method B: Oven-dried Specimens* ☐

Project #: **1054-04-955**
Project Name: **Belews Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: September 27, 2004
Test Date(s) 09/20 - 09/23/2004

Boring No. BC-20 Sample No. 2 Sample Date: 09/01/04
Location: Site Borehole Offset: NA Depth (ft): 8.5'
Sample Description: Tan Silty SAND (SM)
Percent of Soil Passing #4 Sieve: **100.0** Material Excluded:
LL = 36 PL = 25 PI = 11

	Pycnometer #	**103**	**Balance ID#**	Readability	**.01 gram**
V_p	Pycnometer Volume (V_p)	**499.67 ml.**		Calibration Date	
PM	Pycnometer Mass	**179.59 g.**	**Balance Verification**		
M_p	Ave. Pycnometer Mass (Mp)	**179.59 g.**		Mass	**500 gram**
[PM-M_p]	Verify Pycnometer Mass	**g.**		Mass Determination	**500.00**

If [PM-M_p] is greater than .06 grams recalibrate the dry mass of the pycnometer or the balance.

Method A: Moist Specimens

	Initial Moisture Content	Tare #:	
A	Tare Weight		
B	Wet Wt + Tare Wt		
C	Dry Wt. + Tare Wt.		
D	Water Weight	B-C	
E	Dry Weight	C-A	
F	**Moisture Content**	100*D/E	

Target Dry Mass (see Table 1 ASTM D854)	Low Limit	High Limit
Target Wet Mass		

Wet Mass of test specimen grams

Method B: Oven-dried Specimens Initial Dry Mass of test specimen **50.17** grams

T-100

$M_{psw;t}$ Mass of the Pycnometer, soil, and water **709.67** grams

Mass of Dry Soil (grams)			
		Tare #	0
A	Tare Weight		
C	Dry Wt. + Tare Wt.		50.17
M_s	Dry Weight	C-A	**50.17**

T_t	Test Temperature T_t	**23.6** °C
K	Temperature Coefficient at T_t	**0.99921**
K	Temperature Coefficient at 23°C	**0.99933**
$p_{w;t}$	Density of Water at T_t	**0.99740** g./ml.
	See Table 2 ASTM D 854	

$M_{pw;t}$ Mass of the Pycnometer and water at T_t $M_{pw;t} = M_p + (V_p \times p_{w;t})$ **677.96** grams
G_t Specific Gravity of Soil Solids at the T_t $G_t = M_s / (M_{pw;t} - (M_{psw;t} - M_s))$ **2.718**
G Specific Gravity of Soil Solids at the 20°C $G = K \times G_t$ **2.715**

Soils containing plus #4 material tested per ASTM C 127:
Note: Deviation or remove this note

R % of Soil retained on the #4 sieve
P % of Soil passing the #4 sieve

G_{+4} Apparent Specific Gravity of plus #4 material at the 23°C per ASTM C127
Apparent Specific Gravity of plus #4 material corrected to 20°C

G_{total} The Average total sample Specific Gravity

$$G_{total} = \frac{1}{\frac{R}{100-G_{+4}} + \frac{P}{100-G}} = 2.715$$

References: ASTM D854 Specific Gravity of Soil Solids by Water Pycnometer
ASTM C 127: Specific Gravity and Absorption of Coarse Aggregates
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Technician Name: Chana Savanapridi QCT - 1433 (Certification #)
Technical Responsibility: Mal Krajan (Signature) Laboratory Supervisor (Position)

Laboratory Report Version 4.2

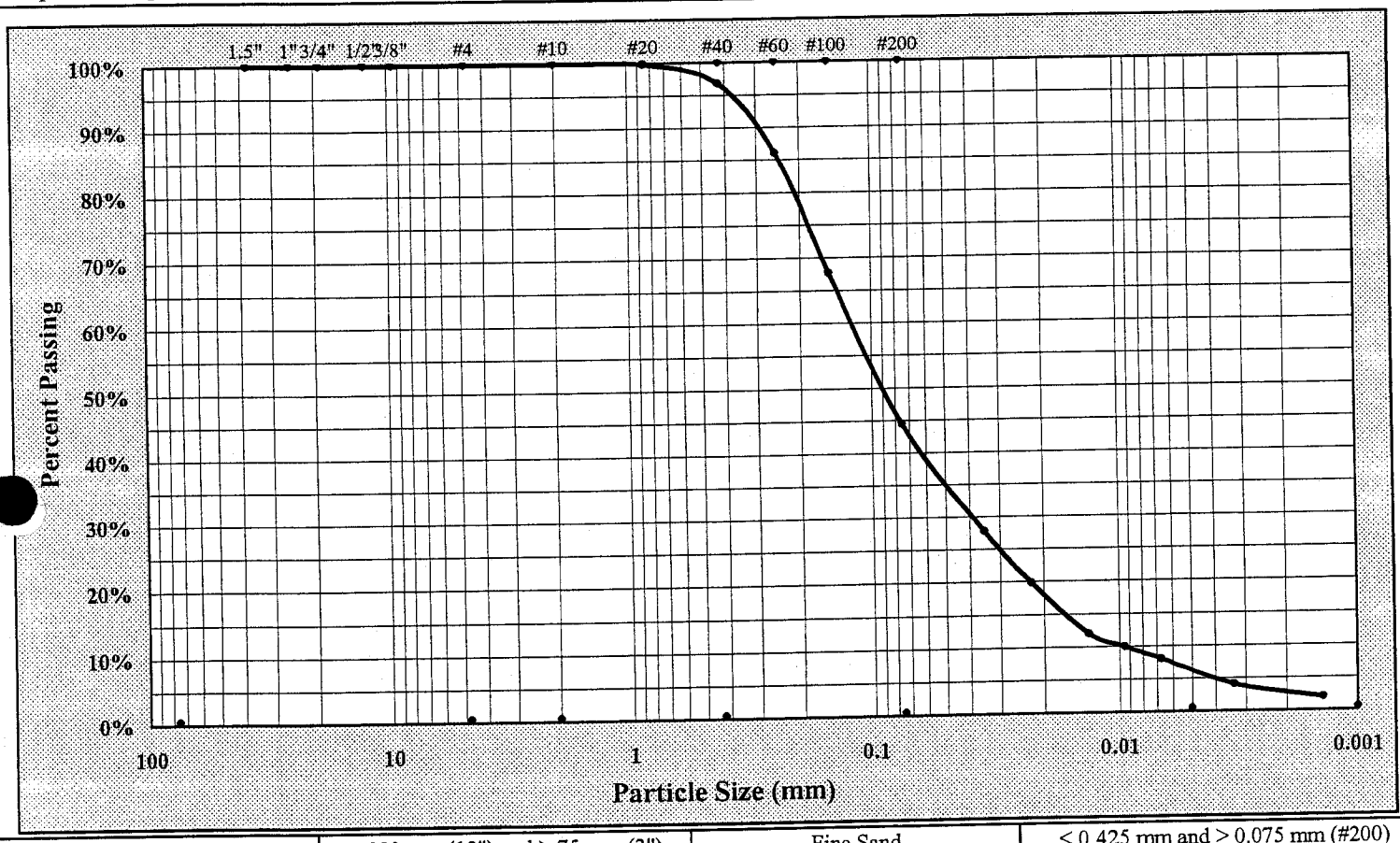
Particle Size Analysis of Soils

ASTM D 422

S&ME

S&ME Project #:	**1054-04-955**	Report Date:	09/21/2004
Project Name:	**Belews Creek Steam Plant**	Test Date(s):	09/13 - 09/17/2004
Client Name:	Duke Energy		
Client Address:			

Boring #:	BC-21	Sample #:	SS-1	Sample Date:	9/1/04
Location:	Site Borehole	Offset:	NA	Depth (ft):	3.5'
Sample Description:	Tan Silty Clayey SAND (SM)				



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#10	Gravel	0.0%	Silt	37.8%
Silt & Clay (% Passing #200)	44.3%	Sand	55.7%	Clay	6.5%
Apparent Relative Density	2.655	Moisture Content		Colloids	2.0%
Liquid Limit	29	Plastic Limit	22	Plastic Index	7

Description of Sand & Gravel Particles Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: ASTM D 422: Particle Size Analysis of Soils; ASTM D 421: Dry Preparation of Soil Samples; ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils; ASTM D 854: Specific Gravity of Soils; ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan — Signature — Laboratory Supervisor (Position)

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BC-21 SS-1 Classification.xls

Laboratory Record Version 4.2

Liquid Limit, Plastic Limit, and Plastic Index

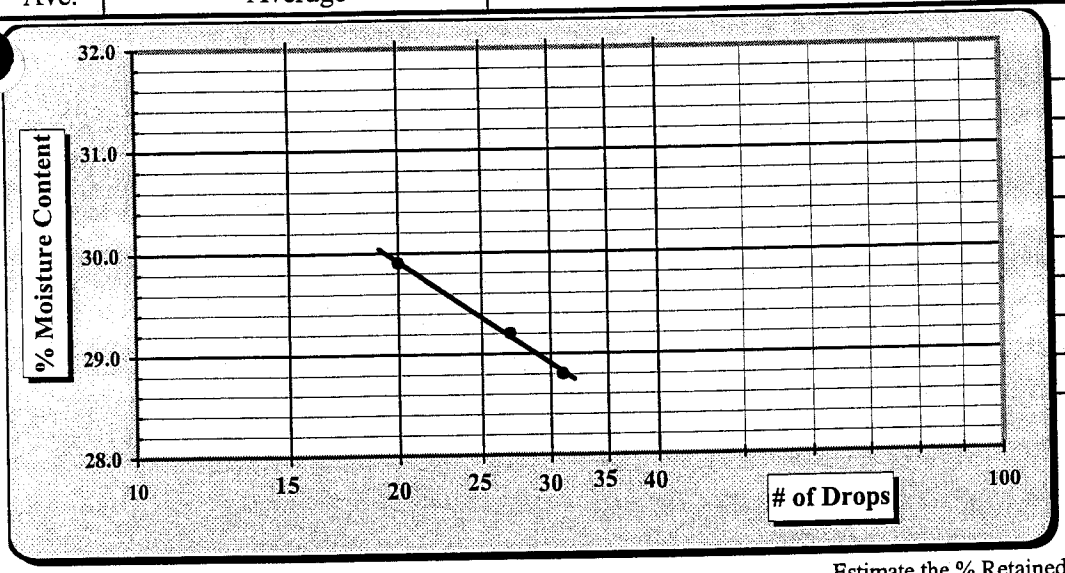
S&ME

Project #: 1054-04-955
Project Name: Belews Creek Steam Plant
Client Name: Duke Energy
Client Address:

Report Date: 9/21/2004
Test Date(s): 09/10 - 09/15/2004

Boring #: BC-21 Sample #: SS-1 Sample Date: 9/1/2004
Location: Site Borehole Offset: NA Depth (ft): 3.5'
Sample Description: Tan Silty Clayey SAND (SM)

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	21	4	31				33	49	
A	Tare Weight	18.53	15.34	18.46				20.78	20.85	
B	Wet Soil Weight + A	39.16	29.78	35.31				29.45	31.08	
C	Dry Soil Weight + A	34.41	26.52	31.54				27.88	29.21	
D	Water Weight (B-C)	4.75	3.26	3.77				1.57	1.87	
E	Dry Soil Weight (C-A)	15.88	11.18	13.08				7.10	8.36	
F	% Moisture Content (D/E)*100	29.9%	29.2%	28.8%				22.1%	22.4%	
N	# OF DROPS	20	27	31				*Moisture Contents determined by ASTM D 2216*		
LL	LL = F * FACTOR									
Ave.	Average							22.3%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation ☐	Dry Preparation ☐	Air Dried ☒	NP, Non-Plastic	☐
Liquid limit Test:	Multipoint Method ☒	One-point Method ☐		Liquid Limit	29
Classification:	ASTM D 2487 ☒	AASHTO M 145 ☐		Plastic Limit	22
Liquid limit Test:	ASTM D 4318 ☒	AASHTO T 89 ☐		Plastic Index	7
Plastic limit Test:	ASTM D 4318 ☒	AASHTO T 90 ☐		Group Symbol	SM

Technician Name: Chana Savanapridi QCT-1433 (Certification #)

Technical Responsibility: Mal Krajan (Signature) Laboratory Supervisor (Position)

Laboratory Report Version 4.2

Specific Gravity of Soils

S&ME

ASTM D 854 *Method A: Moist Specimens* ☐ *Method B: Oven-dried Specimens* ☒

Project #: **1054-04-955**
Project Name: **Belews Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: September 21, 2004
Test Date(s) 09/10 - 09/15/2004

Boring No.	BC-21	Sample No.	SS-1	Sample Date:	09/01/04
Location:	Site Borehole	Offset:	NA	Depth (ft):	3.5'

Sample Description: Tan Silty Clayey SAND (SM)

Percent of Soil Passing #4 Sieve: **100.0** Material Excluded:

LL = 29 PL = 22 PI = 7

	Pycnometer #	**103**	**Balance ID#**	Readability	**.01 gram**
V_p	Pycnometer Volume (V_p)	**499.67 ml.**		Calibration Date	
PM	Pycnometer Mass	**179.59 g.**	**Balance Verification**		
M_p	Ave. Pycnometer Mass (Mp)	**179.59 g.**		Mass	**500 gram**
[PM-M_p]	Verify Pycnometer Mass	**g.**		Mass Determination	**500.00**

If [PM-M_p] is greater than .06 grams recalibrate the dry mass of the pycnometer or the balance.

Method A: Moist Specimens

	Initial Moisture Content	Tare #:	
A	Tare Weight		
B	Wet Wt + Tare Wt		
C	Dry Wt. + Tare Wt.		
D	Water Weight	B-C	
E	Dry Weight	C-A	
F	**Moisture Content**	100*D/E	

Target Dry Mass (see Table 1 ASTM D854)	Low Limit	High Limit
Target Wet Mass		

Wet Mass of test specimen _____ grams

Method B: Oven-dried Specimens Initial Dry Mass of test specimen **28.15** grams

Per T-100

$M_{psw;t}$ Mass of the Pycnometer, soil, and water **695.56** grams

Mass of Dry Soil (grams)			
		Tare #	3
A	Tare Weight		
C	Dry Wt. + Tare Wt.		28.15
M_s	Dry Weight	C-A	**28.15**

T_t	Test Temperature T_t	**23.2** °C
K	Temperature Coefficient at T_t	**0.99929**
K	Temperature Coefficient at 23°C	**0.99933**
$p_{w;t}$	Density of Water at T_t	**0.99749** g./ml.
	See Table 2 ASTM D 854	

$M_{pw;t}$ Mass of the Pycnometer and water at T_t $M_{pw;t} = M_p + (V_p \times p_{w;t})$ **678.01** grams

G_t Specific Gravity of Soil Solids at the T_t $G_t = M_s / (M_{pw;t} - (M_{psw;t} - M_s))$ **2.657**

G Specific Gravity of Soil Solids at the 20°C $G = K \times G_t$ **2.655**

Soils containing plus #4 material tested per ASTM C 127:

Note: Deviation or remove this note

R % of Soil retained on the #4 sieve _____

P % of Soil passing the #4 sieve _____

G_{+4} Apparent Specific Gravity of plus #4 material at the 23°C per ASTM C127 _____

Apparent Specific Gravity of plus #4 material corrected to 20°C _____

G_{total} The Average total sample Specific Gravity

$$G_{total} = \frac{1}{\frac{R}{100-G_{+4}} + \frac{P}{100-G}} = 2.655$$

References: ASTM D854 Specific Gravity of Soil Solids by Water Pycnometer ASTM C 127: Specific Gravity and Absorption of Coarse Aggregates
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Technician Name: Chana Savanapridi QCT - 1433 (Certification #)

Technical Responsibility: Mal Krajan (Signature) Laboratory Supervisor (Position)

Laboratory Report Version 4.2

Particle Size Analysis of Soils

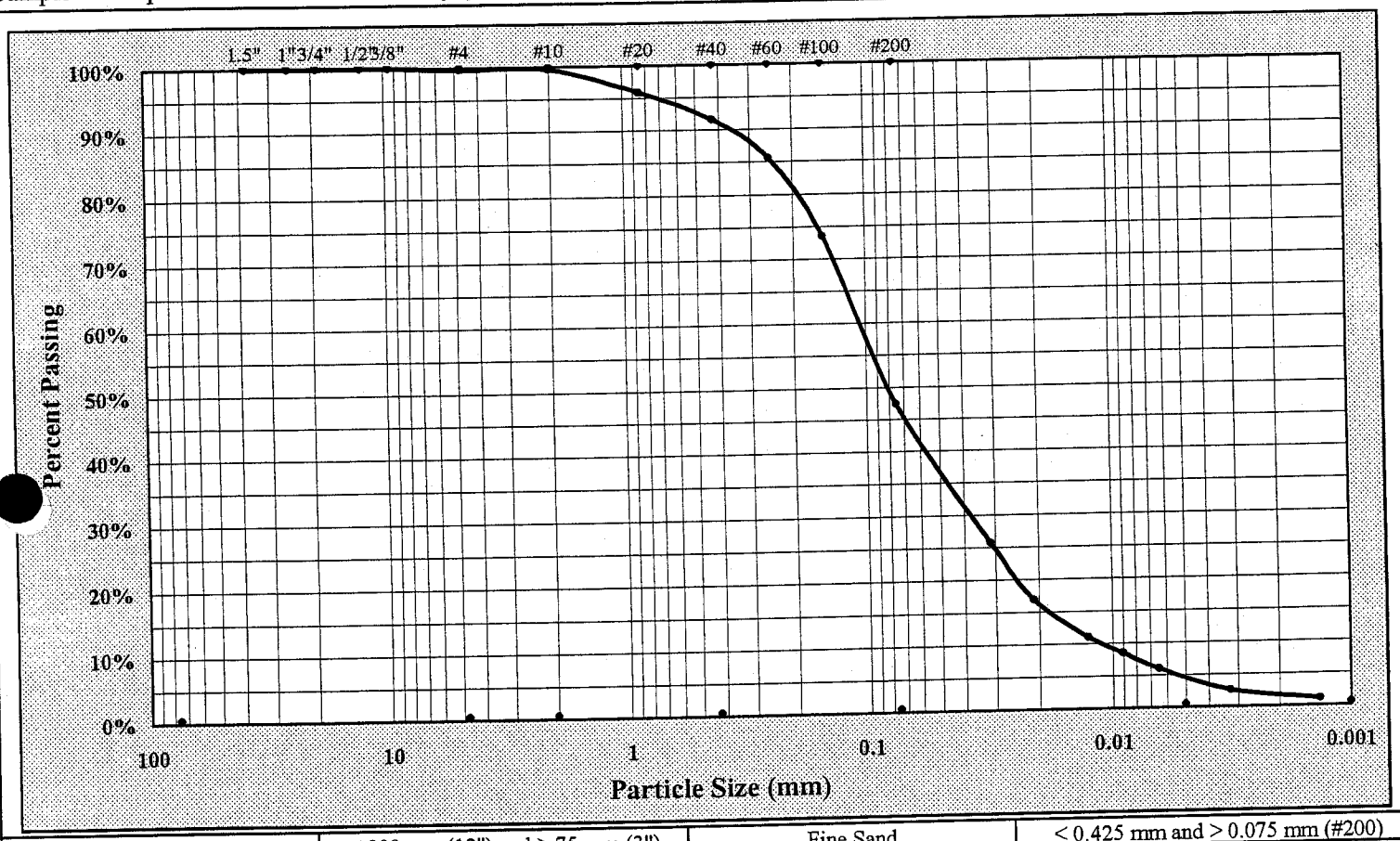
ASTM D 422

S&ME

[redacted]E Project #: **1054-04-955**
Project Name: **Belew Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: 10/08/2004
Test Date(s): 09/28 - 10/07/2004

Boring #:	BC-23	Sample #:	SS-13	Sample Date:	9/1/04
Location:	Site Borehole	Offset:	NA	Depth (ft):	63.5 - 65'
Sample Description:	Tan-Brown Clayey SAND (SC)				



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/8"	Gravel	0.4%	Silt	42.5%
Silt & Clay (% Passing #200)	47.3%	Sand	52.3%	Clay	4.8%
Apparent Relative Density	2.702	Moisture Content		Colloids	1.0%
Liquid Limit	45	Plastic Limit	23	Plastic Index	22

Description of Sand & Gravel Particles Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: ASTM D 422: Particle Size Analysis of Soils
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan (Signature) Laboratory Supervisor (Position)

Liquid Limit, Plastic Limit, and Plastic Index

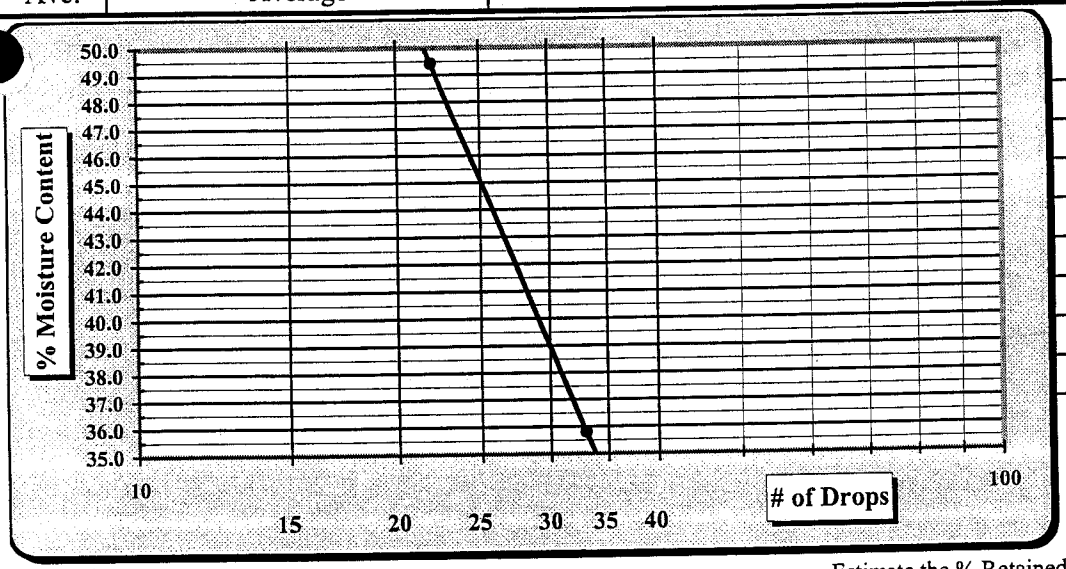
S&ME

Project #: **1054-04-955**
Project Name: Belews Creek Steam Plant
Client Name: Duke Energy
Client Address:

Report Date: 10/08/204
Test Date(s): 09/28 - 10/07/2004

Boring #: BC-23 Sample #: SS-13 Sample Date: 09/01 - 09/24/2004
Location: Site Borehole Offset: Depth (ft): 63.5 - 65'
Sample Description: Tan-Brown Clayey SAND (SC)

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	33	28					34	47	
A	Tare Weight	20.79	21.06					20.91	20.92	
B	Wet Soil Weight + A	34.95	34.75					30.43	28.28	
C	Dry Soil Weight + A	30.27	31.14					28.63	26.93	
D	Water Weight (B-C)	4.68	3.61					1.80	1.35	
E	Dry Soil Weight (C-A)	9.48	10.08					7.72	6.01	
F	% Moisture Content (D/E)*100	49.4%	35.8%					23.3%	22.5%	
N	# OF DROPS	22	33					*Moisture Contents determined by ASTM D 2216*		
LL	LL = F * FACTOR									
Ave.	Average							22.9%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation	☐	Dry Preparation	☐	Air Dried	☒	NP, Non-Plastic ☐
Liquid limit Test:	Multipoint Method	☒	One-point Method	☐			Liquid Limit 45
Classification:	ASTM D 2487	☒	AASHTO M 145	☐			Plastic Limit 23
Liquid limit Test:	ASTM D 4318	☒	AASHTO T 89	☐			Plastic Index 22
Plastic limit Test:	ASTM D 4318	☒	AASHTO T 90	☐			Group Symbol SC

Technician Name: Chana Savanapridi QCT-1433 (Certification #)

Technical Responsibility: Mal Krajan (Signature) Laboratory Supervisor (Position)

Laboratory Report Version 4.2

Specific Gravity of Soils

S&ME

ASTM D 854 *Method A: Moist Specimens* ☒ *Method B: Oven-dried Specimens* ☐

Project #: **1054-04-955**
Project Name: **Belews Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: October 8, 2004
Test Date(s) 09/28 - 10/05/2004

Boring No.	BC-23	Sample No.	SS-13	Sample Date:	09/01/04
Location:	Site Borehole	Offset:	NA	Depth (ft):	63.5 - 65'

Sample Description: Tan-Brown Clayey SAND (SC)
Percent of Soil Passing #4 Sieve: Material Excluded:
LL = 44 PL = 23 PI = 21

	Pycnometer #	**101**	**Balance ID#**	Readability	**.01 gram**
V_p	Pycnometer Volume (V_p)	**499.84 ml.**		Calibration Date	
PM	Pycnometer Mass	**183.76 g.**	**Balance Verification**		
M_p	Ave. Pycnometer Mass (Mp)	**183.73 g.**		Mass	**500 gram**
[PM-M_p]	Verify Pycnometer Mass	**0.03 g.**		Mass Determination	**500.00**

If [PM-M_p] is greater than .06 grams recalibrate the dry mass of the pycnometer or the balance.

Method A: Moist Specimens

	Initial Moisture Content	Tare #:	
A	Tare Weight		
B	Wet Wt + Tare Wt		
C	Dry Wt. + Tare Wt.		
D	Water Weight	B-C	
E	Dry Weight	C-A	
F	**Moisture Content**	100*D/E	

Target Dry Mass (see Table 1 ASTM D854)	Low Limit	High Limit
Target Wet Mass		

Wet Mass of test specimen _____ grams

Method B: Oven-dried Specimens

Per T-100

Initial Dry Mass of test specimen _____ grams

$M_{psw;t}$ Mass of the Pycnometer, soil, and water **713.29** grams

Mass of Dry Soil (grams)			
	Tare #	6	
A Tare Weight			
C Dry Wt. + Tare Wt.		49.21	
M_s Dry Weight	C-A	**49.21**	

T_t	Test Temperature T_t	**23.5** °C
K	Temperature Coefficient at T_t	**0.99923**
K	Temperature Coefficient at 23°C	**0.99933**
$p_{w;t}$	Density of Water at T_t	**0.99742** g./ml.
	See Table 2 ASTM D 854	

$M_{pw;t}$ Mass of the Pycnometer and water at T_t — $M_{pw;t} = M_p + (V_p \times p_{w;t})$ **682.28** grams
G_t Specific Gravity of Soil Solids at the T_t — $G_t = M_s / (M_{pw;t} - (M_{psw;t} - M_s))$ **2.704**
G Specific Gravity of Soil Solids at the 20°C — $G = K \times G_t$ **2.702**

Soils containing plus #4 material tested per ASTM C 127:
Note: Deviation or remove this note

R % of Soil retained on the #4 sieve _____
P % of Soil passing the #4 sieve _____

G_{+4} Apparent Specific Gravity of plus #4 material at the 23°C per ASTM C127 _____
Apparent Specific Gravity of plus #4 material corrected to 20°C _____

G_{total} The Average total sample Specific Gravity

$$G_{total} = \frac{1}{\frac{R}{100-G_{+4}} + \frac{P}{100-G}} = 2.702$$

References: ASTM D854 Specific Gravity of Soil Solids by Water Pycnometer
ASTM C 127: Specific Gravity and Absorption of Coarse Aggregates
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Technician Name: Chana Savanapridi
QCT - 1433 (Certification #)

Technical Responsibility: Mal Krajan (Signature)
Laboratory Supervisor (Position)

APPENDIX VII

LABORATORY TEST RESULTS
BULK SAMPLES

S&ME Moisture - Density Relationship

		Test Date(s):	1/2 -1/4/03
S&ME Project #:	**1264-02-576**	Report Date:	January 5, 2003
Project Name:	**Duke Power - Belows Creek Landfill**		
Client Name:	Duke Energy Corp.		
Client Address:	526 South Church Street, Chartlotte, NC 28202		
Boring #: BC-2	Sample #: Bag-1	Sample Date:	NA
Location: Scrubber Waste Landfill	Offset:	Depth (ft):	0.0 -10.0
Sample Description:	Tan-Brown Fine Sandy Clayey SILT		

Liquid Limit:	31	Specific Gravity:	2.677
Plastic Limit:	25	Plastic Index:	6

Natural Moisture Content (Total Sample): 7.5%

Moisture Content of the Oversize Fraction:

NOTES:

MDD: 107.0 **Opt. MC %: 16.4**

Sieve Size	% Passing

Water Content

Water Content requires GP 2 Balance (0.1 gram Readability).

ASTM D2216 ☒ AASHTO T265 ☐ ASTM D4959 ☐ ASTM D4643 ☐

	Sample #:	1	2		4		
	Water Added:	150	100	50			
	Tare #:	a	b	c	d		
A. Tare Weight	A.						
B. Wet Wt + Tare Wt	B.	500	500	500	500		
C. Dry Wt. + Tare Wt.	C.	409.7	420.1	425.9	442.1		
D. Water Weight	B-C	90.3	79.9	74.1	57.9		
E. Dry Weight	C-A	409.7	420.1	425.9	442.1		
F. Moisture Content	100*D/E	**22.0%**	**19.0%**	**17.4%**	**13.1%**		

Compaction Data

The Compaction Test requires a GP 5 Balance for ASTM (1 gram or .0022 Lb. readability).

G. Wt of Soil + Mold	G.	13.124	13.244	13.312	13.139		
H. Wt. of Mold	H.	9.175	9.175	9.175	9.175		
I. Wt. of Soil (g. or lbs.)	G-H	3.949	4.069	4.137	3.964		
J. Wt of Soil (Lbs.)	I/453.6 or I	3.949	4.069	4.137	3.964		
K. Mold Volume Factor	K.	30.03	30.03	30.03	30.03		
L. Wet Density	J*K	118.6	122.2	124.2	119.0		
M. Dry Density	L/(1+F)	**97.2**	**102.7**	**105.8**	**105.3**		

ASTM D558 ☐ ASTM D 698 ☒ ASTM D1557 ☐ AASHTO T99 ☐ AASHTO T180 ☐

Method A ☒ Method B ☐ Method C ☐ Method D (ASTM 1978) ☐ AASHTO Method D ☐

Moisture-Density Relation of: Fine Fraction ☒ Corrected for Coarse Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐

Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

Soil Plasticity: ASTM D 4318 ☒ AASHTO T 89 ☐ AASHTO T 90 ☐

Sieve Analysis / Particle Size Analysis: ASTM C136 ☐ AASHTO T 27 ☐ ASTM D 422 AASHTO T 88 ☐

Specific Gravity of Soil: ASTM D 854 ☒ AASHTO T 100 ☐

Bulk Gravity of Oversize Fraction: ASTM C 127 ☐ AASHTO T 85 ☐

Soil Classification: ASTM D 2487 ☐ ASTM D 2488 ☒ AASHTO M 145 ☐

Technician Name / Certification #: Chi Lam

Technical Responsibility: Mal Krajan Quality System Coordinator

Moisture - Density Report

S&ME

S&ME Project #: 1264-02-576
Project Name: Duke Power - Belows Creek Landfill
Client Name: Duke Energy Corp.
Client Address: 526 South Church Street, Chartlotte, NC 28202

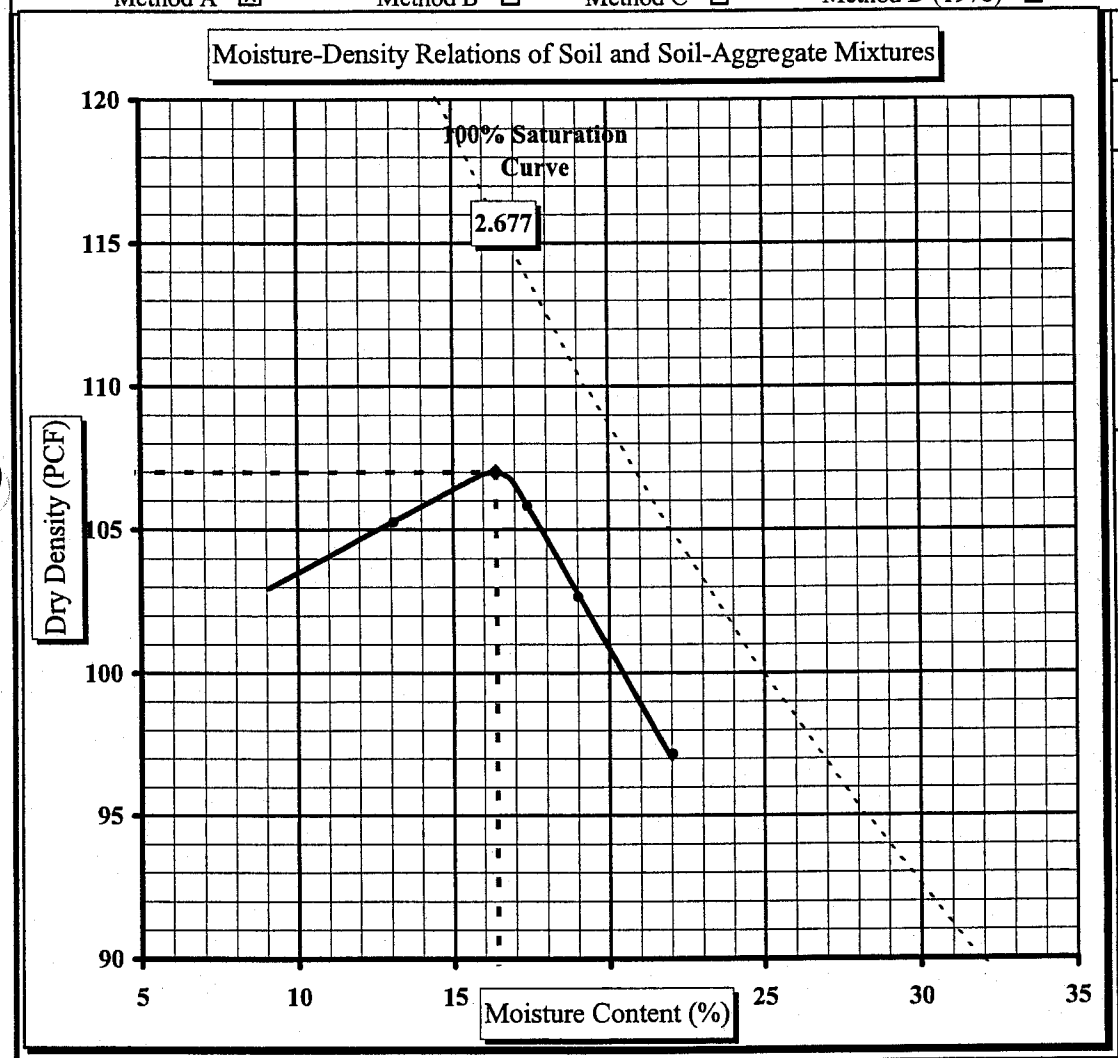
Report Date: January 5, 2003
Test Date(s): 1/2 -1/4/03

Boring #:	BC-2	Sample #:	Bag-1	Sample Date:	NA
Location:	Scrubber Waste Landfill	Offset:		Depth (ft):	0.0 -10.0

Sample Description: Tan-Brown Fine Sandy Clayey SILT

Maximum Dry Density 107.0 PCF. **Optimum Moisture Content** 16.4 %

ASTM D558 ☐ ASTM D 698 ☒ ASTM D1557 ☐ AASHTO T99 ☐ AASHTO T180 ☐
Method A ☒ Method B ☐ Method C ☐ Method D (1978) ☐ AASHTO Method D ☐



Soil Properties	
Natural Moisture Content	7.5%
Liquid Limit:	31
Plastic Limit:	25
Plastic Index:	6
Specific Gravity:	2.677

% Passing

Oversize Fraction
Bulk Sp. Gravity
% Moisture
Oversize Fraction

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐
Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐
Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

References: ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of
ASTM D 422: Particle Size Analysis of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 2488: Description and Identification of Soils (Visual-Manual Procedure)
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Technical Responsibility: Mal Krajan — Quality System Coordinator

S&ME

Specific Gravity of Soils

ASTM D 854

Project #:	1264-02-576	Report Date:	1/8/03
Project Name:	Duke Power - Belows Creek Landfill	Test Date(s)	1/2 - 1/8/03
Client Name:	Duke Energy Corp.		
Client Address:	526 South Church Street, Chartlotte, NC 28202		

Boring No.	BC-2	Sample No.	Bag-1	Sample Date:	NA
Location:	Scrubber Waste Landfill	Offset:		Depth (ft):	0.0 -10.0

Sample Description: Tan-Brown Fine Sandy Clayey SILT

Percent of Soil Passing the #4 Sieve: Material Excluded: Plus # 4 Material (%)

LL = PL = PI =

	Pychnometer #	**108**	**Balance ID#:**	**01001**	Radability: **.01 gram**
V_p	Pychnometer Volume (V_p)	**499.54 ml.**			Calibration Date: **9/17/02**
PM	Pychnometer Mass	**182.47 g.**	**Balance Verification**		
M_p	Ave. Pychnometer Mass (Mp)	**182.47 g.**			Mass **500 gram**
[PM-M_p]	Verify Pychnometer Mass	**g.**			Mass Determination **500.00**

If [PM-M_p] is greater than .06 grams recalibrate the dry mass of the pychnometer

Method A: Moist Specimens ☒ Method B: Oven-dried Specimens ☐

Method A: Moist Specimens

	Initial Moisture Content	Tare #:	#x
A	Tare Weight		9.28
B	Wet Wt + Tare Wt		79
C	Dry Wt. + Tare Wt.		74.12
D	Water Weight	B-C	4.88
E	Dry Weight	C-A	64.84
	Moisture Content	**100*D/E**	**7.5%**

Target Dry Mass (see Table 1 ASTM D854)	Low Limit	High Limit
	90.00	110.00
Target Wet Mass	**96.77**	**118.28**

Note: Deviation

Wet Mass of test specimen _____ grams

Method B: Oven-dried Specimens

Initial Dry Mass of test specimen _____ grams

Note: Deviation

$M_{psw;t}$ Mass of the Pychnometer, soil, and water **711.35** grams

Mass of Dry Soil (grams)			
		Tare #	60
A	Tare Weight		222.05
C	Dry Wt. + Tare Wt.		270.14
M_s	Dry Weight	C-A	**48.09**

T_t	Test Temperature T_t	**18.9 °C**
K	Temperature Coefficient at T_t	**1.00022**
K	Temperature Coefficient at 23°C	**0.99933**
$p_{w;t}$	Density of Water at T_t	**0.99843** g./ml.
	See Table 2 ASTM D 854	

$M_{pw;t}$	Mass of the Pychnometer and water at T_t	$M_{pw;t} = M_p + (V_p \times p_{w;t})$	**681.23** grams
G_t	Specific Gravity of tSoil Solids at the T_t	$G_t = M_s / (M_{pw;t} - (M_{psw;t} - M_s))$	**2.677**
G	Specific Gravity of Soil Solids at the 20°C	$G = K \times G_t$	**2.677**

Soils containing plus #4 material tested per ASTM C 127:

Note: Deviation

R % of Soil retained on the #4 sieve _____

P % of Soil passing the #4 sieve **100.0%**

G_{+4} Apparent Specific Gravity of plus #4 material at the 23°C per ASTM C127 _____

Apparent Specific Gravity of plus #4 material corrected to 20°C _____

G_{total} The Average total sample Specific Gravity

$$G_{total} = \frac{1}{\frac{R}{100-G_{+4}} + \frac{P}{100-G}} = \textbf{2.677}$$

References: ASTM D854 Specific Gravity of Soil Solids by Water Pychnometer
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM C 127: Specific Gravity and Absorption of Coarse Aggregates

Technician Name / Certification #: Tom Savanapridi

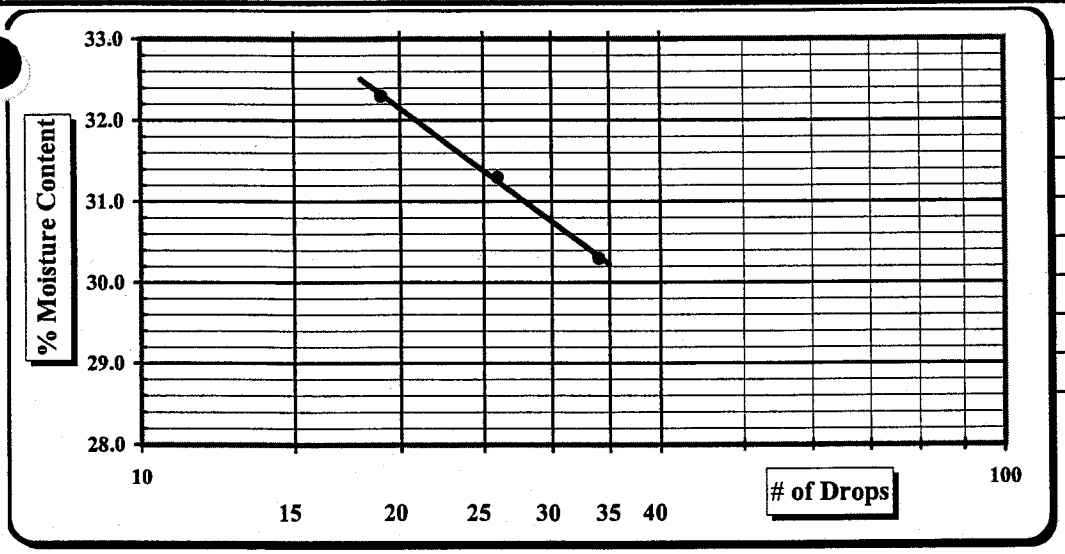
Technical Responsibility / Position: Mal Krajan Quality System Coordinator

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

Project #:	1264-02-576	Report Date:	January 8, 2003
Project Name:	Duke Power-Belows Cr. Landfill	Test Date(s):	1/02/03-1/08/03
Client Name:	Duke Energy Corp.		
Client Address:	526 South Church Street, Charlotte, NC 28202		
Boring #:	BC-2	Sample #: Bag-1	Sample Date: NA
Location:	Scrubber Waste L.F.	Offset:	Depth (ft): 0.0 - 10.0
Sample Description:	Tan-Brown Fine Sandy Clayey SILT		

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	6	90	2				34	716	
A	Tare Weight	8.19	8.23	8.00				6.29	6.51	
B	Wet Soil Weight + A	27.68	30.48	28.98				15.30	14.37	
C	Dry Soil Weight + A	22.92	25.18	24.10				13.48	12.79	
D	Water Weight (B-C)	4.76	5.30	4.88				1.82	1.58	
E	Dry Soil Weight (C-A)	14.73	16.95	16.10				7.19	6.28	
F	% Moisture Content (D/E)*100	32.3	31.3	30.3				25.3	25.2	
N	# OF DROPS	19	26	34						
LL	LL = F * FACTOR									
Ave.	Average							25.2		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation ☐	Dry Preparation ☐	Air Dried ☒	NP, Non-Plastic	☐
Liquid limit Test:	Multipoint Method ☒	One-point Method ☐		Liquid Limit	31
Classification:	ASTM D 2487 ☒	AASHTO M 145 ☐		Plastic Limit	25
Liquid limit Test:	ASTM D 4318 ☒	AASHTO T 89 ☐		Plastic Index	6
Plastic limit Test:	ASTM D 4318 ☒	AASHTO T 90 ☐		Group Symbol	ML

Technician Name / Certification #: Tom Savanpridi

Technical Responsibility / Position: Mal Krajan — Quality System Coordinator

S&ME Moisture - Density Relationship

Test Date(s): 1/2 -1/4/03
Report Date: January 5, 2003

S&ME Project #: 1264-02-576
Project Name: Duke Power - Belows Creek Landfill
Client Name: Duke Energy Corp.
Client Address: 526 South Church Street, Chartlotte, NC 28202
Boring #: BC-3 Sample #: Bag-1 Sample Date: NA
Location: Scrubber Waste Landfill Offset: Depth (ft): 0.0 -10.0
Sample Description: Brown Fine Sandy Silty CLAY (CL)

Sieve Size	% Passing

Liquid Limit: 37 Specific Gravity: 2.761
Plastic Limit: 20 Plastic Index: 17

Natural Moisture Content (Total Sample): 5.8%
Moisture Content of the Oversize Fraction:

NOTES:

MDD: 103.3 **Opt. MC %: 18.2**

Water Content

Water Content requires GP 2 Balance (0.1 gram Readability).

ASTM D2216 ☒ AASHTO T265 ☐ ASTM D4959 ☐ ASTM D4643 ☐

	Sample #:	1	2		4		
	Water Added:	150	100	50			
	Tare #:	a	b	c	d		
A. Tare Weight	A.						
B. Wet Wt + Tare Wt	B.	500	500	500	500		
C. Dry Wt. + Tare Wt.	C.	417	425.9	434.7	452.6		
D. Water Weight	B-C	83	74.1	65.3	47.4		
E. Dry Weight	C-A	417	425.9	434.7	452.6		
F. Moisture Content	100*D/E	**19.9%**	**17.4%**	**15.0%**	**10.5%**		

Compaction Data

The Compaction Test requires a GP 5 Balance for ASTM (1 gram or .0022 Lb. readability).

G. Wt of Soil + Mold	G.	13.237	13.205	13.070	12.780		
H. Wt. of Mold	H.	9.175	9.175	9.175	9.175		
I. Wt. of Soil (g. or lbs.)	G-H	4.062	4.030	3.895	3.605		
J. Wt of Soil (Lbs.)	I/453.6 or I	4.062	4.030	3.895	3.605		
K. Mold Volume Factor	K	30.03	30.03	30.03	30.03		
L. Wet Density	J*K	122.0	121.0	117.0	108.3		
M. Dry Density	L/(1+F)	**101.7**	**103.1**	**101.7**	**98.0**		

ASTM D558 ☐ ASTM D 698 ☒ ASTM D1557 ☐ AASHTO T99 ☐ AASHTO T180 ☐
Method A ☒ Method B ☐ Method C ☐ Method D (ASTM 1978) ☐ AASHTO Method D ☐

Moisture-Density Relation of: Fine Fraction ☒ Corrected for Coarse Fraction (ASTM D 4718) ☐
Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐

Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

Soil Plasticity:	ASTM D 4318 ☒	AASHTO T 89 ☐		AASHTO T 90 ☐
Sieve Analysis / Particle Size Analysis:	ASTM C136 ☐	AASHTO T 27 ☐	ASTM D 422 ☒	AASHTO T 88 ☐
Specific Gravity of Soil:		ASTM D 854 ☒		AASHTO T 100 ☐
Bulk Gravity of Oversize Fraction:		ASTM C 127 ☐		AASHTO T 85 ☐
Soil Classification:	ASTM D 2487 ☒	ASTM D 2488 ☐		AASHTO M 145 ☐

Technician Name / Certification #: Chi Lam
Technical Responsibility: Mal Krajan Quality System Coordinator

Moisture - Density Report

S&ME

S&ME Project #: 1264-02-576
Project Name: Duke Power - Belows Creek Landfill
Client Name: Duke Energy Corp.
Client Address: 526 South Church Street, Chartlotte, NC 28202

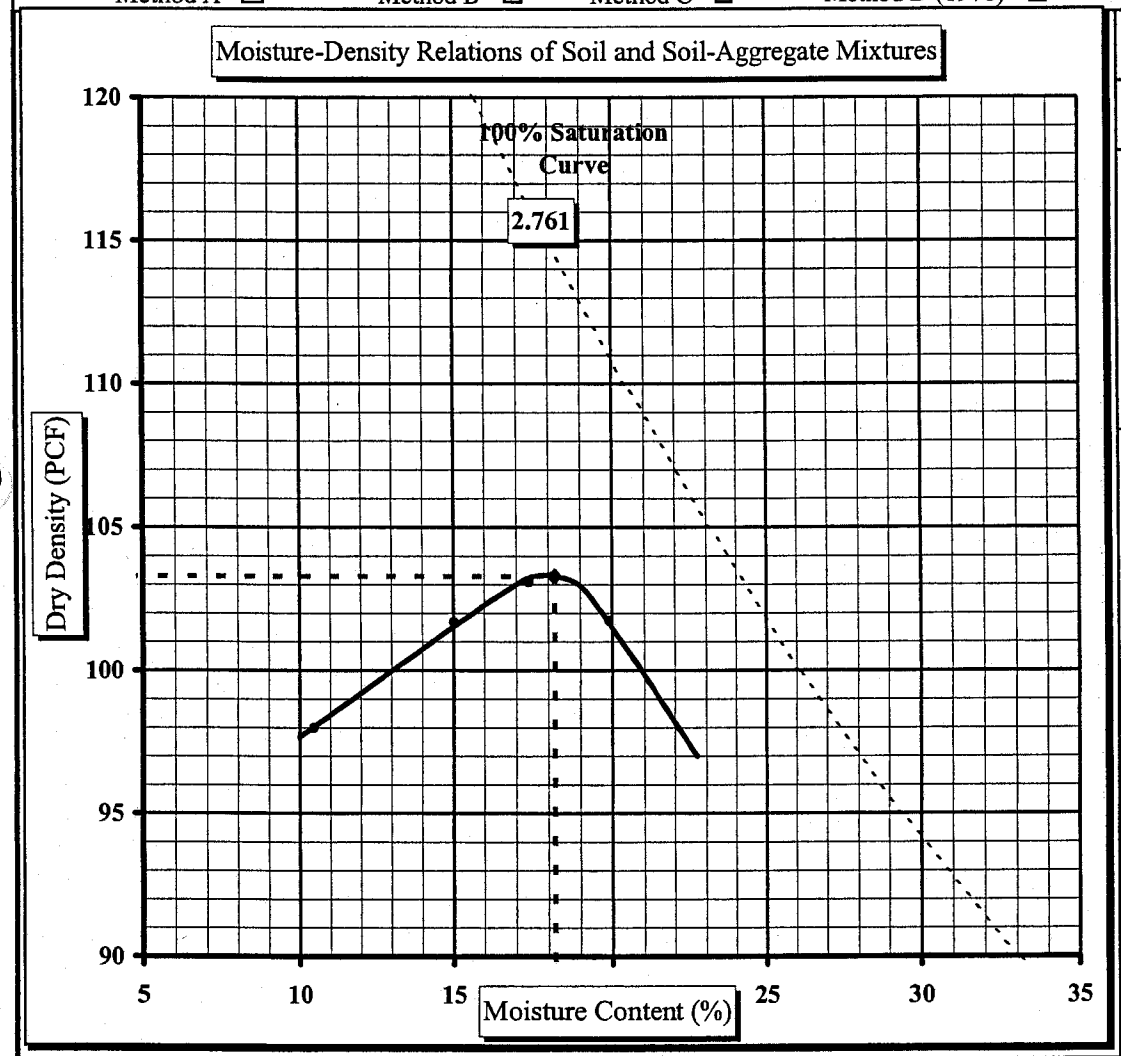
Report Date: January 5, 2003
Test Date(s): 1/2 -1/4/03

Boring #:	BC-3	Sample #:	Bag-1	Sample Date:	NA
Location:	Scrubber Waste Landfill	Offset:		Depth (ft):	0.0 -10.0

Sample Description: Brown Fine Sandy Silty CLAY (CL)

Maximum Dry Density 103.3 PCF. **Optimum Moisture Content 18.2 %**

ASTM D558 ☐ ASTM D 698 ☒ ASTM D1557 ☐ AASHTO T99 ☐ AASHTO T180 ☐
Method A ☒ Method B ☐ Method C ☐ Method D (1978) ☐ AASHTO Method D ☐



Soil Properties	
Natural Moisture Content	5.8%
Liquid Limit:	37
Plastic Limit:	20
Plastic Index:	17
Specific Gravity:	2.761

% Passing

Oversize Fraction
Bulk Sp. Gravity
% Moisture
Oversize Fraction

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐
Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐
Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

References: ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of
ASTM D 422: Particle Size Analysis of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Technical Responsibility: Mal Krajan Quality System Coordinator

S&ME

Specific Gravity of Soils

ASTM D 854

Project #:	1264-02-576	Report Date:	1/8/03
Project Name:	Duke Power - Belows Creek Landfill	Test Date(s)	1/2 - 1/8/03
Client Name:	Duke Energy Corp.		
Client Address:	526 South Church Street, Chartlotte, NC 28202		

Boring No.	BC-3	Sample No.	Bag-1	Sample Date:	NA
Location:	Scrubber Waste Landfill	Offset:		Depth (ft):	0.0 -10.0

Sample Description: Brown Fine Sandy Silty CLAY (CL)

Percent of Soil Passing the #4 Sieve: Material Excluded: Plus # 4 Material (%)

LL = PL = PI =

	Pychnometer #	109	Balance ID#: 01001	Radability:	.01 gram
V_p	Pychnometer Volume (V_p)	499.28 ml.		Calibration Date:	9/17/02
PM	Pychnometer Mass	188.17 g.	Balance Verification		
M_p	Ave. Pychnometer Mass (Mp)	188.17 g.		Mass	500 gram
[PM-M_p]	Verify Pychnometer Mass	g.		Mass Determination	500.00

If [PM-M_p] is greater than .06 grams recalibrate the dry mass of the pychnometer

Method A: Moist Specimens ☒ Method B: Oven-dried Specimens ☐

Method A: Moist Specimens

	Initial Moisture Content	Tare #:	S-14
A	Tare Weight		7.87
B	Wet Wt + Tare Wt		55.99
C	Dry Wt. + Tare Wt.		53.37
D	Water Weight	B-C	2.62
E	Dry Weight	C-A	45.5
	Moisture Content	100*D/E	**5.8%**

Target Dry Mass (see Table 1 ASTM D854)	Low Limit	High Limit
Target Wet Mass	95.18	116.33

Note: Deviation

Wet Mass of test specimen _____ grams

Method B: Oven-dried Specimens

Initial Dry Mass of test specimen _____ grams

Note: Deviation

$M_{psw;t}$ Mass of the Pychnometer, soil, and water 705.83 grams

	Mass of Dry Soil (grams)		
		Tare #	E
A	Tare Weight		171.11
C	Dry Wt. + Tare Wt.		210.75
M_s	Dry Weight	C-A	39.64

T_t	Test Temperature T_t	18.9 °C
K	Temperature Coefficient at T_t	1.00022
K	Temperature Coefficient at 23°C	0.99933
$p_{w;t}$	Density of Water at T_t	0.99843 g./ml.
	See Table 2 ASTM D 854	

$M_{pw;t}$	Mass of the Pychnometer and water at T_t	$M_{pw;t} = M_p + (V_p \times p_{w;t})$	686.67 grams
G_t	Specific Gravity of tSoil Solids at the T_t	$G_t = M_s / (M_{pw;t} - (M_{psw;t} - M_s))$	1.936
G	Specific Gravity of Soil Solids at the 20°C	$G = K \times G_t$	1.936

Soils containing plus #4 material tested per ASTM C 127:

Note: Deviation

R % of Soil retained on the #4 sieve _____

P % of Soil passing the #4 sieve 100.0%

G_{+4} Apparent Specific Gravity of plus #4 material at the 23°C per ASTM C127 _____

Apparent Specific Gravity of plus #4 material corrected to 20°C _____

G_{total} The Average total sample Specific Gravity

$$G_{total} = \frac{1}{\frac{R}{100-G_{+4}} + \frac{P}{100-G}} = 1.936$$

References: ASTM D854 Specific Gravity of Soil Solids by Water Pychnometer
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM C 127: Specific Gravity and Absorption of Coarse Aggregates

Technician Name / Certification #: Tom Savanapridi

Technical Responsibility / Position: Mal Krajan Quality System Coordinator

Particle Size Analysis of Soils

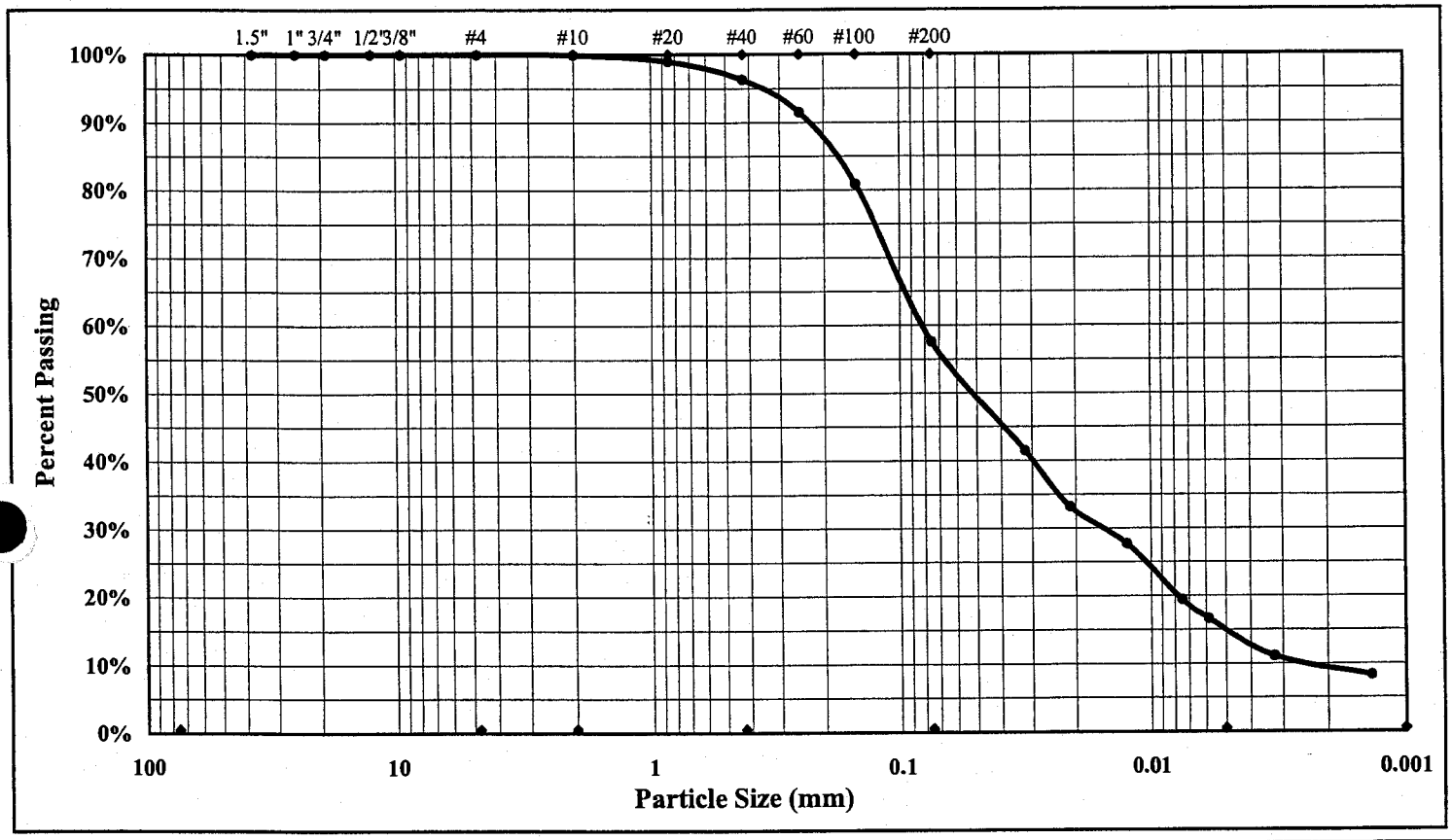
ASTM D 422

S&ME

S&ME Project #: 1264-02-576
Project Name: **Duke Power - Belews Creek Landfill**
Client Name: Duke Energy Corp.
Client Address: 526 South Church S, Charlotte, NC 28202

Report Date: January 9, 2003
Test Date(s): 1/2 - 1/9/03

Boring #:	BC-3	Sample #:		Sample Date:	NA
Location:	Scrubber Waste L.F.	Offset:		Depth (ft):	0.0 - 10.0
Sample Description:	Brown Fine Sandy Silty CLAY (CL)				



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Moisture Content	5.8%	Gravel	0.0%	Liquid Limit	37
Silt & Clay (% Passing #200)	57.6%	Sand	42.4%	Plastic Limit	20
Maximum Particle Size	#10	Silt	42.7%	Plastic Index	17
Specific Gravity	2.761	Clay	14.9%	Colloids	8.3%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

ASTM D 422: Particle Size Analysis of Soils
Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter
Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min.

References: ASTM D 854: Specific Gravity of Soils
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

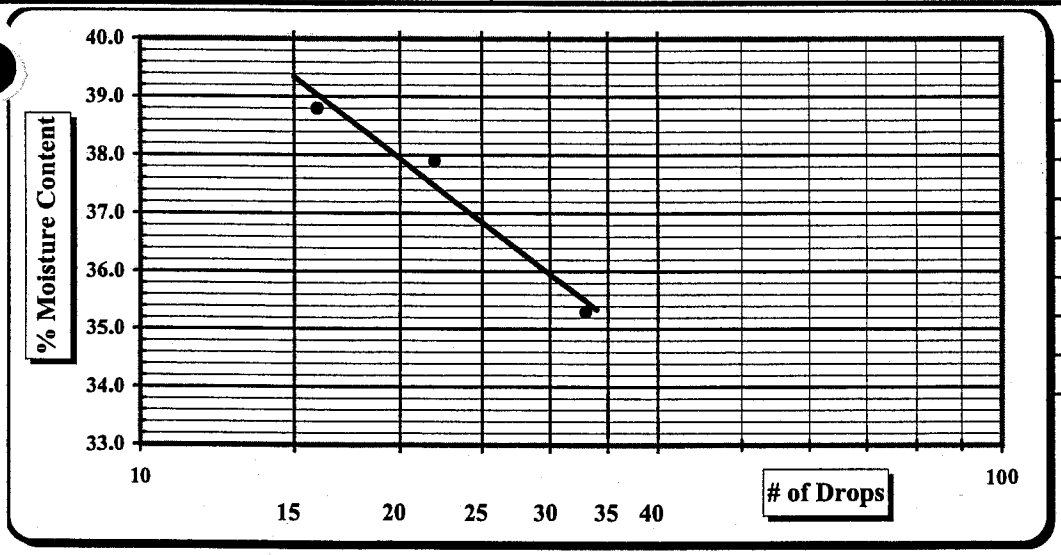
Technical Responsibility / Position: Mal Krajan — Laboratory Supervisor

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

Project #:	1264-02-576	Report Date:	January 7, 2002
Project Name:	Duke Power - Belews Creek Landfill	Test Date(s):	1/2 - 1/7/03
Client Name:	Duke Energy Corp.		
Client Address:	526 South Church S, Charlotte, NC 28202		
Boring #:	BC-3	Sample #:	Sample Date: NA
Location:	Scrubber Waste L.F.	Offset:	Depth (ft): 0.0 - 10.0
Sample Description:	Brown Fine Sandy Silty CLAY (CL)		

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	MB	A38	A23				A-12	Z-19	
A	Tare Weight	8.29	8.05	8.01				6.48	6.36	
B	Wet Soil Weight + A	26.68	26.39	27.40				15.02	13.92	
C	Dry Soil Weight + A	21.54	21.35	22.34				14.13	12.25	
D	Water Weight (B-C)	5.14	5.04	5.06				0.89	1.67	
E	Dry Soil Weight (C-A)	13.25	13.30	14.33				7.65	5.89	
F	% Moisture Content (D/E)*100	38.8	37.9	35.3				11.6	28.4	
N	# OF DROPS	16	22	33						
LL	LL = F * FACTOR									
Ave.	Average							20.0		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation ☐	Dry Preparation ☐	Air Dried ☒	NP, Non-Plastic	☐
Liquid limit Test:	Multipoint Method ☒	One-point Method ☐		Liquid Limit	37
Classification:	ASTM D 2487 ☒	AASHTO M 145 ☐		Plastic Limit	20
Liquid limit Test:	ASTM D 4318 ☒	AASHTO T 89 ☐		Plastic Index	17
Plastic limit Test:	ASTM D 4318 ☒	AASHTO T 90 ☐		Group Symbol	CL

Technician Name / Certification #: Tom Savanpridi

Technical Responsibility / Position: Mal Krajan Laboratory Supervisor

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method "C")

Project #: 1264-02-576 | Test Date(s): 01/02/03 - 01/08/03

Project Name: Duke Power - Belews County Landfill | Report Date: 01/09/03

Client Name: Duke Energy Corp.

Client Address: 526 South Church Street, Charlotte, NC 28202

Boring #: BC-3 | Sample #: Bag-1 | Depth/Elevation: 0.0 - 10.0 | Sample Date: NA

Location: Scrubber Waste | Offset: | Sample Description: Brown Fine Sandy Silty CLAY (CL)

Liquid Limit: 37 | Specific Gravity: 2.761 | Sample Type: Lab-compacted | Sampled By: Sam Watts

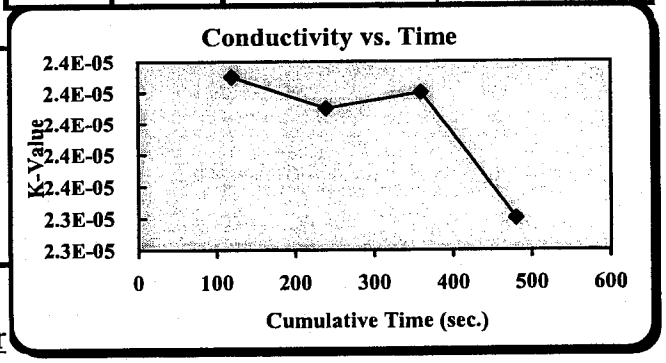
Plastic Limit: 20 | Plasticity Index: 17 | Percent Passing #200: 57.6 | Maximum Particle Size:

Initial Sample Conditions				Final Sample Conditions			
Length (cm):	7.56	Wet Density (PCF):	118.7	Length (cm):	7.72	Wet Density (PCF):	118.3
Diameter (cm):	7.34	Dry Density (PCF):	98.5	Diameter (cm):	7.49	Dry Density (PCF):	92.6
Area (cm^2)	42.31	Percent Saturation:	75.6	Area (cm^2)	44.06	Percent Saturation:	88.9
Volume (cm^3)	319.86			Volume (cm^3)	340.17	B-value:	0.95
Wet weight (grams)	608.4	Void Ratio:	0.749	Wet weight (grams)	644.8	Void Ratio:	0.860
Dry Weight (grams)	504.9	Porosity:	0.428	Dry Weight (grams)	504.9	Porosity:	0.462
Percent Moisture:	20.5			Percent Moisture:	27.7		
Test Parameters:	Effective Consolidation Stress (psi):		2.0	Permeant Liquid Used:		Deaired Demineralized water	
Burette Area (cm^2):	0.196	Cell Pressure (psi):	92.0	Back Pressure (psi):	90.0	Pore Pressure (psi)	90.0

Time (24-hr)			Temperature (°C)				Measurements						Ratio	Gradient	K-Value (cm/sec)	
Start	End	Time (sec)	Initial	Final	Ave.	Factor	$h_{out}1$	$h_{in}1$	$h_{out}2$	$h_{in}2$	h1	h2			Uncorrected K-Value	Corrected K-Value
9:35	9:37	120	21.4	21.4	21.4	0.9669	9.49	2.90	8.92	3.40	33.6	28.2	1.14	3.65	2.51E-05	2.43E-05
9:37	9:39	120	21.4	21.4	21.4	0.9669	8.92	3.40	8.49	3.84	28.2	23.7	0.98	3.07	2.49E-05	2.41E-05
9:39	9:41	120	21.4	21.4	21.4	0.9669	8.49	3.84	8.12	4.22	23.7	19.9	0.97	2.58	2.50E-05	2.42E-05
9:41	9:43	120	21.4	21.4	21.4	0.9669	8.12	4.22	7.82	4.53	19.9	16.8	0.97	2.18	2.42E-05	2.34E-05
												Averages:	*1.02*	*2.87*	*2.48E-05*	*2.40E-05*

Notes:

Sample was compacted to 95.3% @ 3.5% wet of optimum moisture content.



References:

ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

ASTM D2216: Laboratory Determination of Water Content of Soils

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soil

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D 854: Specific Gravity of Soils

ASTM D 422: Particle Size Analysis of Soils

Technician / Certification #: John Dailly | Certification #:

Technical Responsibility: Mal Krajan | Position: Quality System Coordinator

S&ME Moisture - Density Relationship

Test Date(s): 1/2 -1/4/03

S&ME Project #: 1264-02-576 Report Date: January 5, 2003

Project Name: Duke Power - Belows Creek Landfill

Client Name: Duke Energy Corp.

Client Address: 526 South Church Street, Chartlotte, NC 28202

Boring #: BC-6 Sample #: 1 Sample Date: 12/4/02

Location: Scrubber Waste Landfill Offset: Depth (ft): 0.0 -10.0

Sample Description: Tan-Brown Silty Clayey SAND

Liquid Limit: 54 Specific Gravity: 2.692

Plastic Limit: 36 Plastic Index: 18

Natural Moisture Content (Total Sample): 27.6%

Moisture Content of the Oversize Fraction:

NOTES:

Sieve Size	% Passing

MDD: 96.3 **Opt. MC %: 23.4**

Water Content

Water Content requires GP 2 Balance (0.1 gram Readability).

ASTM D2216 ☒ AASHTO T265 ☐ ASTM D4959 ☐ ASTM D4643 ☐

	Sample #:	1	2		4		
	Water Added:	150	100	50			
	Tare #:	a	b	c	d		
A. Tare Weight	A.						
B. Wet Wt + Tare Wt	B.	500	500	500	500		
C. Dry Wt. + Tare Wt.	C.	394.7	399.3	408	424.5		
D. Water Weight	B-C	105.3	100.7	92	75.5		
E. Dry Weight	C-A	394.7	399.3	408	424.5		
F. Moisture Content	100*D/E	**26.7%**	**25.2%**	**22.5%**	**17.8%**		

Compaction Data

The Compaction Test requires a GP 5 Balance for ASTM (1 gram or .0022 Lb. readability).

G. Wt of Soil + Mold	G.	13.078	13.110	13.092	12.784		
H. Wt. of Mold	H.	9.175	9.175	9.175	9.175		
I. Wt. of Soil (g. or lbs.)	G-H	3.903	3.935	3.917	3.609		
J. Wt of Soil (Lbs.)	I/453.6 or I	3.903	3.935	3.917	3.609		
K. Mold Volume Factor	K.	30.03	30.03	30.03	30.03		
L. Wet Density	J*K	117.2	118.2	117.6	108.4		
M. Dry Density	L/(1+F)	**92.5**	**94.4**	**96.0**	**92.0**		

ASTM D558 ☐ ASTM D 698 ☒ ASTM D1557 ☐ AASHTO T99 ☐ AASHTO T180 ☐

Method A ☒ Method B ☐ Method C ☐ Method D (ASTM 1978) ☐ AASHTO Method D ☐

Moisture-Density Relation of: Fine Fraction ☒ Corrected for Coarse Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐

Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

Soil Plasticity: ASTM D 4318 ☒ AASHTO T 89 ☐ AASHTO T 90 ☐

Sieve Analysis / Particle Size Analysis: ASTM C136 ☐ AASHTO T 27 ☐ ASTM D 422 ☐ AASHTO T 88 ☐

Specific Gravity of Soil: ASTM D 854 ☒ AASHTO T 100 ☐

Bulk Gravity of Oversize Fraction: ASTM C 127 ☐ AASHTO T 85 ☐

Soil Classification: ASTM D 2487 ☐ ASTM D 2488 ☒ AASHTO M 145 ☐

Technician Name / Certification #: Chi Lam

Technical Responsibility: Mal Krajan Quality System Coordinator

Moisture - Density Report

S&ME

S&ME Project #:	**1264-02-576**	Report Date:	January 5, 2003
Project Name:	**Duke Power - Belows Creek Landfill**	Test Date(s):	1/2 -1/4/03
Client Name:	Duke Energy Corp.		
Client Address:	526 South Church Street, Chartlotte, NC 28202		

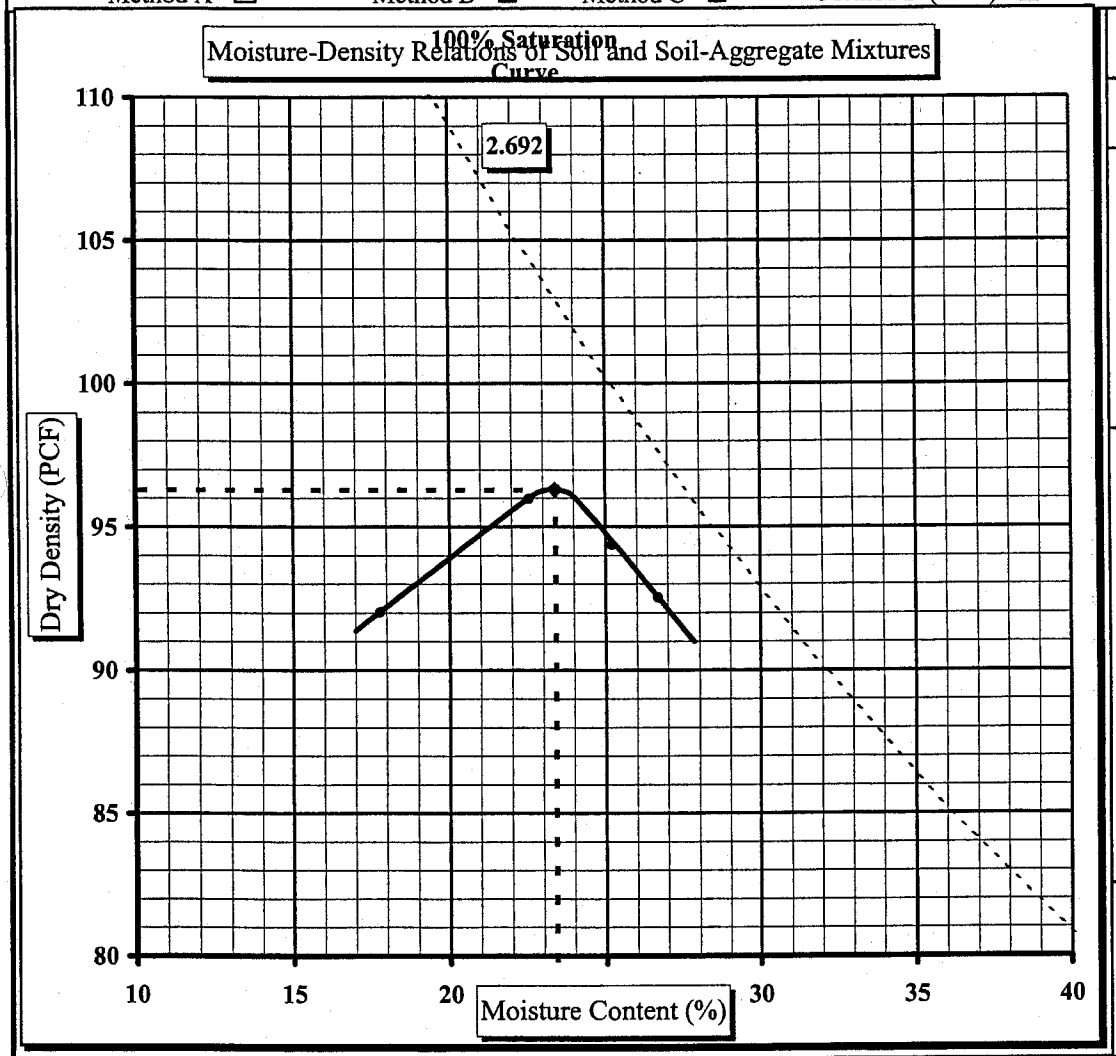
Boring #:	BC-6	Sample #:	1	Sample Date:	12/4/02
Location:	Scrubber Waste Landfill	Offset:		Depth (ft):	0.0 -10.0

Sample Description: Tan-Brown Silty Clayey SAND

Maximum Dry Density **96.3** **PCF.** **Optimum Moisture Content** **23.4** **%**

ASTM D558 ☐ ASTM D 698 ☒ ASTM D1557 ☐ AASHTO T99 ☐ AASHTO T180 ☐

Method A ☒ Method B ☐ Method C ☐ Method D (1978) ☐ AASHTO Method D ☐



Soil Properties	
Natural Moisture Content	27.6%
Liquid Limit:	54
Plastic Limit:	36
Plastic Index:	18
Specific Gravity:	2.692

% Passing

Oversize Fraction

Bulk Sp. Gravity

% Moisture

Oversize Fraction

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐

Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

References: ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of

ASTM D 854: Specific Gravity of Soils

ASTM D 2488: Description and Identification of Soils (Visual-Manual Procedure)

ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Technical Responsibility: Mal Krajan Quality System Coordinator

S&ME

Specific Gravity of Soils

ASTM D 854

Project #: **1264-02-576** Report Date: 1/8/03

Project Name: **Duke Power - Belows Creek Landfill** Test Date(s) 1/2 1/8/03

Client Name: Duke Energy Corp.

Client Address: 526 South Church Street, Chartlotte, NC 28202

Boring No.	BC-6	Sample No.	1	Sample Date:	12/4/02
Location:	Scrubber Waste Landfill	Offset:		Depth (ft):	0.0 -10.0

Sample Description: Tan-Brown Silty Clayey SAND

Percent of Soil Passing the #4 Sieve: 1 Material Excluded: Plus # 4 Material (%)

LL = PL = PI =

	Pychnometer #	**104**	**Balance ID#:**	**01001** Radability:	**.01 gram**
V_p	Pychnometer Volume (V_p)	**499.58 ml.**		Calibration Date:	**9/17/02**
PM	Pychnometer Mass	**182.12 g.**	**Balance Verification**		
M_p	Ave. Pychnometer Mass (Mp)	**182.12 g.**		Mass	**500 gram**
[PM-M_p]	Verify Pychnometer Mass	**g.**		Mass Determination	**500.00**

If [PM-M_p] is greater than .06 grams recalibrate the dry mass of the pychnometer

Method A: Moist Specimens ☒ Method B: Oven-dried Specimens ☐

Method A: Moist Specimens

	Initial Moisture Content	Tare #:	11
A	Tare Weight		9.43
B	Wet Wt + Tare Wt		65.03
C	Dry Wt. + Tare Wt.		52.99
D	Water Weight	B-C	12.04
E	Dry Weight	C-A	43.56
	Moisture Content	100*D/E	**27.6%**

Target Dry Mass (see Table 1 ASTM D854)	Low Limit	High Limit
	90.00	110.00
Target Wet Mass	**114.88**	**140.40**

Note: Deviation

Wet Mass of test specimen _____ grams

Method B: Oven-dried Specimens

Initial Dry Mass of test specimen _____ grams

Note: Deviation

$M_{psw;t}$ Mass of the Pychnometer, soil, and water **705.83** grams

Mass of Dry Soil (grams)			
		Tare #	E
A	Tare Weight		171.11
C	Dry Wt. + Tare Wt.		210.75
M_s	Dry Weight	C-A	**39.64**

T_t	Test Temperature T_t	**18.9 °C**
K	Temperature Coefficient at T_t	**1.00022**
K	Temperature Coefficient at 23°C	**0.99933**
$p_{w;t}$	Density of Water at T_t	**0.99843** g./ml.
	See Table 2 ASTM D 854	

$M_{pw;t}$	Mass of the Pychnometer and water at T_t	$M_{pw;t} = M_p + (V_p \times p_{w;t})$	**680.92** grams
G_t	Specific Gravity of tSoil Solids at the T_t	$G_t = M_s / (M_{pw;t} - (M_{psw;t} - M_s))$	**2.692**
G	Specific Gravity of Soil Solids at the 20°C	$G = K \times G_t$	**2.692**

Soils containing plus #4 material tested per ASTM C 127: R % of Soil retained on the #4 sieve _____

Note: Deviation P % of Soil passing the #4 sieve **100.0%**

G_{+4} Apparent Specific Gravity of plus #4 material at the 23°C per ASTM C127 _____

Apparent Specific Gravity of plus #4 material corrected to 20°C _____

G_{total} The Average total sample Specific Gravity

$$G_{total} = \frac{1}{\frac{R}{100-G_{+4}} + \frac{P}{100-G}} = \textbf{2.692}$$

References: ASTM D854 Specific Gravity of Soil Solids by Water Pychnometer

ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

ASTM C 127: Specific Gravity and Absorption of Coarse Aggregates

Technician Name / Certification #: Tom Savanapridi

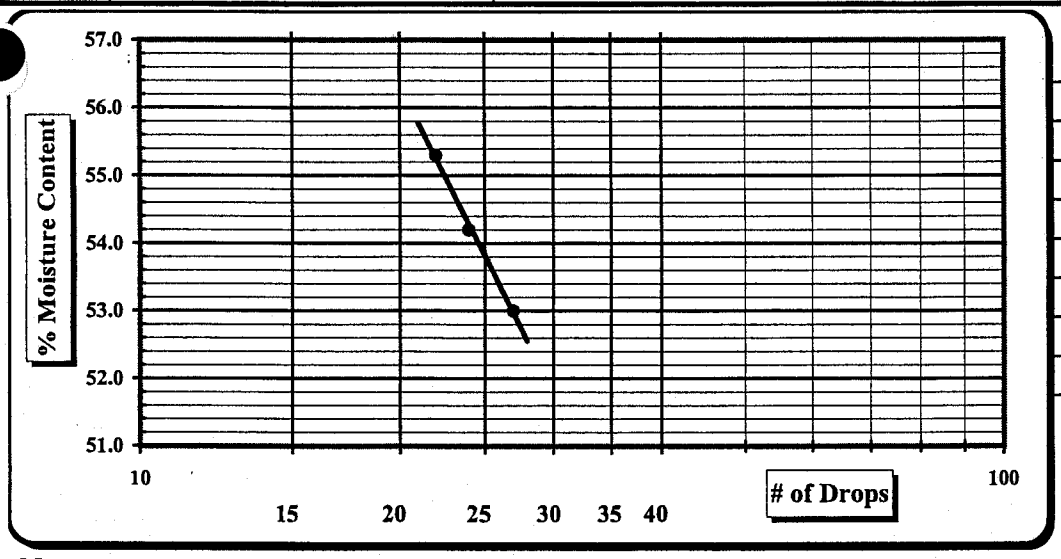
Technical Responsibility / Position: Mal Krajan Laboratory Supervisor

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

Project #:	1264-02-576	Report Date:	January 8, 2003
Project Name:	Duke Power-Belows Cr. Landfill	Test Date(s):	1/02/03-1/08/03
Client Name:	Duke Energy Corp.		
Client Address:	526 South Church St.		
Boring #:	BC-6	Sample #: NA	Sample Date: Na
Location:		Offset:	Depth (ft): 0-10'
Sample Description:	Red Silty Sandy Clay		

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	14	31	14				10	59	
A	Tare Weight	8.42	8.02	7.98				6.35	6.48	
B	Wet Soil Weight + A	20.83	20.91	19.24				14.36	15.51	
C	Dry Soil Weight + A	16.53	16.32	15.28				12.25	13.09	
D	Water Weight (B-C)	4.30	4.59	3.96				2.11	2.42	
E	Dry Soil Weight (C-A)	8.11	8.30	7.30				5.90	6.61	
F	% Moisture Content (D/E)*100	53.0	55.3	54.2				35.8	36.6	
N	# OF DROPS	27	22	24						
LL	LL = F * FACTOR									
Ave.	Average							36.2		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation ☐	Dry Preparation ☐	Air Dried ☒	NP, Non-Plastic	☐
Liquid limit Test:	Multipoint Method ☒	One-point Method ☐		Liquid Limit	54
Classification:	ASTM D 2487 ☒	AASHTO M 145 ☐		Plastic Limit	36
Liquid limit Test:	ASTM D 4318 ☒	AASHTO T 89 ☐		Plastic Index	18
Plastic limit Test:	ASTM D 4318 ☒	AASHTO T 90 ☐		Group Symbol	MH

Technician Name / Certification #: Tom Savanpridi

Technical Responsibility / Position: Mal Krajan Laboratory Supervisor

S&ME

Moisture - Density Relationship

Test Date(s): 1/2 -1/4/03
Report Date: January 5, 2003

S&ME Project #: 1264-02-576
Project Name: Duke Power - Belows Creek Landfill
Client Name: Duke Energy Corp.
Client Address: 526 South Church Street, Chartlotte, NC 28202
Boring #: BC-7 Sample #: Bag-1 Sample Date: NA
Location: Scrubber Waste Landfill Offset: Depth (ft): 0.0 -10.0
Sample Description: Tan-Brown Sandy Clayey SILT (ML)

Sieve Size	% Passing

Liquid Limit: 44 Specific Gravity: 2.726
Plastic Limit: 31 Plastic Index: 11

Natural Moisture Content (Total Sample): 24.3%
Moisture Content of the Oversize Fraction:

NOTES:

MDD: 98.2 **Opt. MC %: 22.3**

Water Content

Water Content requires GP 2 Balance (0.1 gram Readability).

ASTM D2216 ☒ AASHTO T265 ☐ ASTM D4959 ☐ ASTM D4643 ☐

	Sample #:	1	2		4		
	Water Added:	150	100	50			
	Tare #:	a	b	c	d		
A. Tare Weight	A.						
B. Wet Wt + Tare Wt	B.	500	500	500	500		
C. Dry Wt. + Tare Wt.	C.	400.1	405.8	414.4	433.3		
D. Water Weight	B-C	99.9	94.2	85.6	66.7		
E. Dry Weight	C-A	400.1	405.8	414.4	433.3		
F. Moisture Content	100*D/E	**25.0%**	**23.2%**	**20.7%**	**15.4%**		

Compaction Data

The Compaction Test requires a GP 5 Balance for ASTM (1 gram or .0022 Lb. readability).

G. Wt of Soil + Mold	G.	13.139	13.165	13.090	12.815		
H. Wt. of Mold	H.	9.175	9.175	9.175	9.175		
I. Wt. of Soil (g. or lbs.)	G-H	3.964	3.990	3.915	3.640		
J. Wt of Soil (Lbs.)	I/453.6 or I	3.964	3.990	3.915	3.640		
K. Mold Volume Factor	K.	30.03	30.03	30.03	30.03		
L. Wet Density	J*K	119.0	119.8	117.6	109.3		
M. Dry Density	L/(1+F)	**95.3**	**97.2**	**97.4**	**94.7**		

ASTM D558 ☐ ASTM D 698 ☒ ASTM D1557 ☐ AASHTO T99 ☐ AASHTO T180 ☐
Method A ☒ Method B ☐ Method C ☐ Method D (ASTM 1978) ☐ AASHTO Method D ☐
Moisture-Density Relation of: Fine Fraction ☒ Corrected for Coarse Fraction (ASTM D 4718) ☐
Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐
Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

Soil Plasticity:	ASTM D 4318 ☒	AASHTO T 89 ☐		AASHTO T 90 ☐
Sieve Analysis / Particle Size Analysis:	ASTM C136 ☐	AASHTO T 27 ☐	ASTM D 422 ☒	AASHTO T 88 ☐
Specific Gravity of Soil:		ASTM D 854 ☒		AASHTO T 100 ☐
Bulk Gravity of Oversize Fraction:		ASTM C 127 ☐		AASHTO T 85 ☐
Soil Classification:	ASTM D 2487 ☒	ASTM D 2488 ☐		AASHTO M 145 ☐

Technician Name / Certification #: Chi Lam
Technical Responsibility: Mal Krajan Quality System Coordinator

Moisture - Density Report

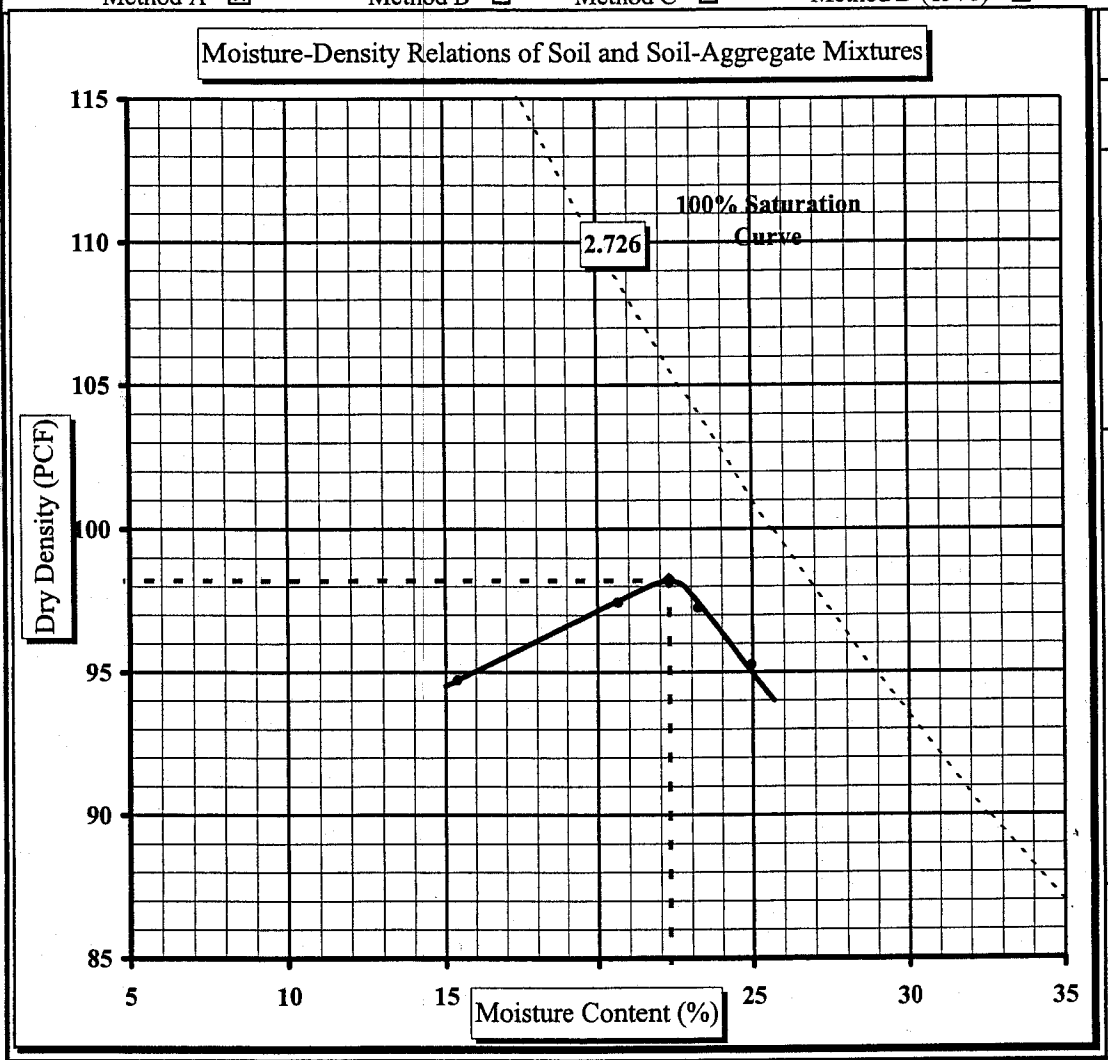
S&ME

S&ME Project #: 1264-02-576 | Report Date: January 5, 2003
Project Name: Duke Power - Belows Creek Landfill | Test Date(s): 1/2 -1/4/03
Client Name: Duke Energy Corp.
Client Address: 526 South Church Street, Chartlotte, NC 28202

Boring #: BC-7 | Sample #: Bag-1 | Sample Date: NA
Location: Scrubber Waste Landfill | Offset: | Depth (ft): 0.0 -10.0
Sample Description: Tan-Brown Sandy Clayey SILT (ML)

Maximum Dry Density 98.2 **PCF.** **Optimum Moisture Content** 22.3 %

ASTM D558 ☐ ASTM D 698 ☒ ASTM D1557 ☐ AASHTO T99 ☐ AASHTO T180 ☐
Method A ☒ Method B ☐ Method C ☐ Method D (1978) ☐ AASHTO Method D ☐



Soil Properties	
Natural Moisture Content	24.3%
Liquid Limit:	44
Plastic Limit:	31
Plastic Index:	11
Specific Gravity:	2.726

% Passing

Oversize Fraction
Bulk Sp. Gravity
% Moisture
Oversize Fraction

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐
Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐
Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

References: ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of
ASTM D 422: Particle Size Analysis of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Technical Responsibility: Mal Krajan — Quality System Coordinator

S&ME

Specific Gravity of Soils

ASTM D 854

Project #:	1264-02-576	Report Date:	1/8/03
Project Name:	**Duke Power - Belows Creek Landfill**	Test Date(s)	1/2 1/8/03
Client Name:	Duke Energy Corp.		
Client Address:	526 South Church Street, Chartlotte, NC 28202		

Boring No.	BC-7	Sample No.	Bag-1	Sample Date:	NA
Location:	Scrubber Waste Landfill	Offset:		Depth (ft):	0.0 -10.0

Sample Description: Tan-Brown Sandy Clayey SILT (ML)

Percent of Soil Passing the #4 Sieve: Material Excluded: Plus # 4 Material (%)

LL = PL = PI =

	Pychnometer #	**105**	**Balance ID#:** 01001	Radability:	**.01 gram**
V_p	Pychnometer Volume (V_p)	**499.04 ml.**		Calibration Date:	**9/17/02**
PM	Pychnometer Mass	**194.26 g.**	**Balance Verification**		
M_p	Ave. Pychnometer Mass (Mp)	**194.26 g.**		Mass	**500 gram**
[PM-M_p]	Verify Pychnometer Mass	**g.**		Mass Determination	**500.00**

If [PM-M_p] is greater than .06 grams recalibrate the dry mass of the pychnometer

Method A: Moist Specimens ☒ Method B: Oven-dried Specimens ☐

Method A: Moist Specimens

Initial Moisture Content		Tare #:	S-11
A	Tare Weight		7.95
B	Wet Wt + Tare Wt		65.58
C	Dry Wt. + Tare Wt.		54.31
D	Water Weight	B-C	11.27
E	Dry Weight	C-A	46.36
	Moisture Content	100*D/E	**24.3%**

Target Dry Mass (see Table 1 ASTM D854)	Low Limit	High Limit
	90.00	110.00
Target Wet Mass	**111.88**	**136.74**

Note: Deviation

Wet Mass of test specimen _____ grams

Method B: Oven-dried Specimens

Initial Dry Mass of test specimen _____ grams

Note: Deviation

$M_{psw;t}$ Mass of the Pychnometer, soil, and water **726.55** grams

Mass of Dry Soil (grams)			
		Tare #	X-42
A	Tare Weight		186.59
C	Dry Wt. + Tare Wt.		240.35
M_s	Dry Weight	C-A	**53.76**

T_t	Test Temperature T_t	**18.9** °C
K	Temperature Coefficient at T_t	**1.00022**
K	Temperature Coefficient at 23°C	**0.99933**
$p_{w;t}$	Density of Water at T_t	**0.99843** g./ml.
	See Table 2 ASTM D 854	

$M_{pw;t}$	Mass of the Pychnometer and water at T_t	$M_{pw;t} = M_p + (V_p \times p_{w;t})$	**692.52** grams
G_t	Specific Gravity of tSoil Solids at the T_t	$G_t = M_s / (M_{pw;t} - (M_{psw;t} - M_s))$	**2.725**
G	Specific Gravity of Soil Solids at the 20°C	$G = K \times G_t$	**2.726**

Soils containing plus #4 material tested per ASTM C 127:

Note: Deviation

R % of Soil retained on the #4 sieve _____

P % of Soil passing the #4 sieve **100.0%**

G_{+4} Apparent Specific Gravity of plus #4 material at the 23°C per ASTM C127 _____

Apparent Specific Gravity of plus #4 material corrected to 20°C _____

G_{total} The Average total sample Specific Gravity

$$G_{total} = \frac{1}{\frac{R}{100-G_{+4}} + \frac{P}{100-G}} = \textbf{2.726}$$

References: ASTM D854 Specific Gravity of Soil Solids by Water Pychnometer

ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

ASTM C 127: Specific Gravity and Absorption of Coarse Aggregates

Technician Name / Certification #: Tom Savanapridi

Technical Responsibility / Position: Mal Krajan Quality System Coordinator

Laboratory Report Version 4.0

Particle Size Analysis of Soils

ASTM D 422

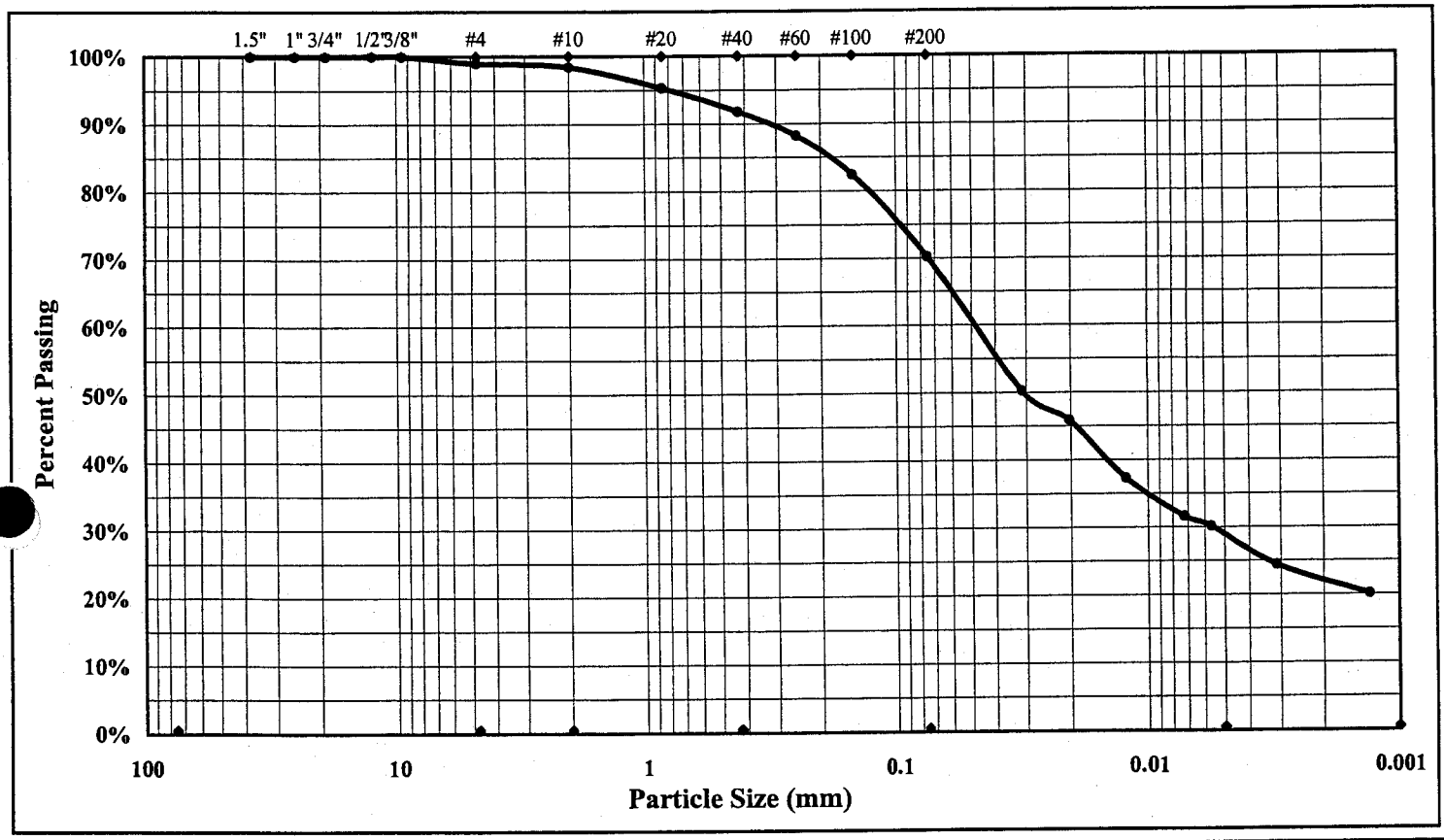
S&ME

S&ME Project #: **1264-02-576**
Project Name: **Duke Power - Belews Creek Landfill**
Client Name: Duke Energy Corp.
Client Address: 526 South Church Street, Charlotte, NC 28202

Report Date: January 9, 2003
Test Date(s): 1/2 - 1/9/03

Boring #:	BC-7	Sample #:	Bag - 1	Sample Date:	NA
Location:	Scrubber Waste L.F.	Offset:		Depth (ft):	0.0 - 10.0

Sample Description: Tan-Brown Sandy Clayey SILT with a trace of Gravel



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Moisture Content	24.3%	Gravel	1.0%	Liquid Limit	44
Silt & Clay (% Passing #200)	70.2%	Sand	28.8%	Plastic Limit	31
Maximum Particle Size	3/8"	Silt	43.2%	Plastic Index	13
Specific Gravity	2.726	Clay	27.0%	Colloids	20.1%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

ASTM D 422: Particle Size Analysis of Soils Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter
Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min.

References: ASTM D 854: Specific Gravity of Soils
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility / Position: Mal Krajan — Quality System Coordinator

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

Project #: 1264-02-576 Report Date: January 7, 2002

Project Name: Duke Power - Belews Creek Landfill Test Date(s): 1/2/ - 1/07/03

Client Name: Duke Energy Corp.

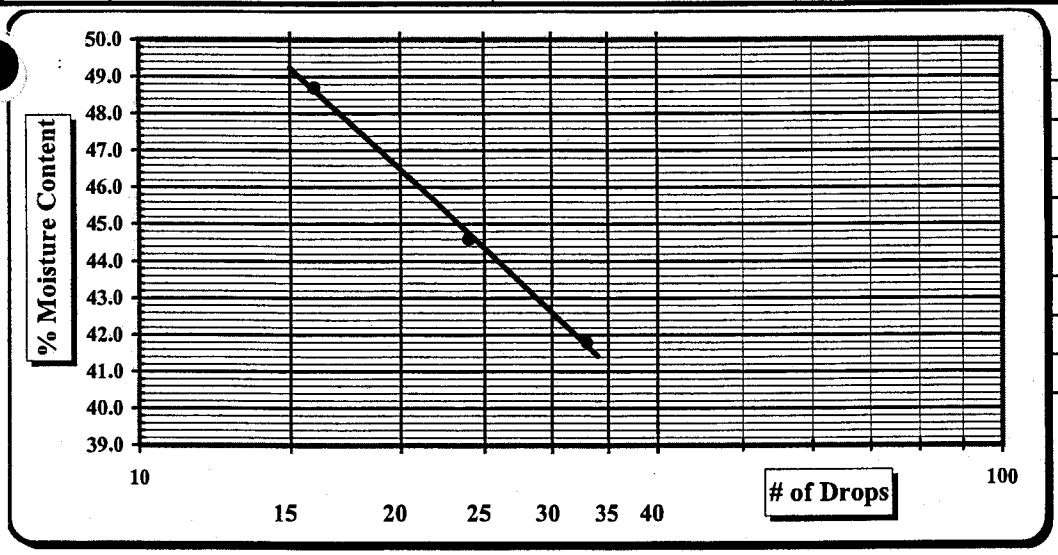
Client Address: 526 South Church Street, Charlotte, NC 28202

Boring #: BC-7 Sample #: Bag - 1 Sample Date: NA

Location: Scrubber Waste L.F. Offset: Depth (ft): 0.0 - 10.0

Sample Description: Tan-Brown Sandy Clayey SILT with a trace of Gravel

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	101	A-8	A33				15	A-59	
A	Tare Weight	8.06	8.24	8.04				6.48	6.47	
B	Wet Soil Weight + A	23.28	20.50	19.00				16.81	14.41	
C	Dry Soil Weight + A	18.79	16.72	15.41				14.40	12.52	
D	Water Weight (B-C)	4.49	3.78	3.59				2.41	1.89	
E	Dry Soil Weight (C-A)	10.73	8.48	7.37				7.92	6.05	
F	% Moisture Content (D/E)*100	41.8	44.6	48.7				30.4	31.2	
N	# OF DROPS	33	24	16						
LL	LL = F * FACTOR									
Ave.	Average							30.8		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation ☐	Dry Preparation ☐	Air Dried ☒	NP, Non-Plastic	☐
Liquid limit Test:	Multipoint Method ☒	One-point Method ☐		Liquid Limit	44
Classification:	ASTM D 2487 ☒	AASHTO M 145 ☐		Plastic Limit	31
Liquid limit Test:	ASTM D 4318 ☒	AASHTO T 89 ☐		Plastic Index	13
Plastic limit Test:	ASTM D 4318 ☒	AASHTO T 90 ☐		Group Symbol	ML

Technician Name / Certification #: Tom Savanpridi

Technical Responsibility / Position: Mal Krajan Laboratory Supervisor

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method "C")

Project #: 1264-02-576 — Test Date(s): 01/02/03 - 01/08/03
Project Name: Duke Power - Belews County Landfill — Report Date: 01/09/03
Client Name: Duke Energy Corp.
Client Address: 526 South Church Street
Boring #: BC-7 Sample #: Bag-1 Depth/Elevation: 0-10' Sample Date: not reported
Location: Scrubber Waste Offset: Sample Description: Tan-Brown Sandy Clayey SILT with a trace of Gravel
Liquid Limit: 44 Specific Gravity: 2.726 Sample Type: Lab-compacted Sampled By: Sam Watts
Plastic Limit: 31 Plasticity Index: 13 Percent Passing #200: 70.2 Maximum Particle Size:

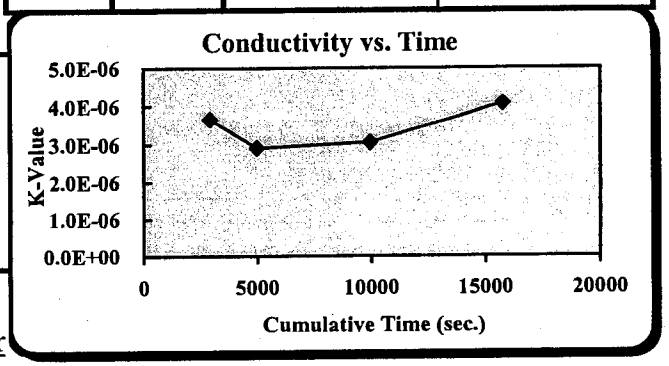
Initial Sample Conditions				Final Sample Conditions			
Length (cm):	7.49	Wet Density (PCF):	116.5	Length (cm):	7.53	Wet Density (PCF):	120.5
Diameter (cm):	7.33	Dry Density (PCF):	92.9	Diameter (cm):	7.37	Dry Density (PCF):	91.4
Area (cm^2)	42.20	Percent Saturation:	83.2	Area (cm^2)	42.65	Percent Saturation:	100.0
Volume (cm^3)	316.08			Volume (cm^3)	321.14	B-value:	0.98
Wet weight (grams)	589.8	Void Ratio:	0.832	Wet weight (grams)	619.9	Void Ratio:	0.861
Dry Weight (grams)	470.3	Porosity:	0.454	Dry Weight (grams)	470.3	Porosity:	0.463
Percent Moisture:	25.4			Percent Moisture:	31.8		
Test Parameters:	Effective Consolidation Stress (psi):		2.0	Permeant Liquid Used:		Deaired Demineralized water	
Burette Area (cm^2):	0.720	Cell Pressure (psi):	72.0	Back Pressure (psi):	70.0	Pore Pressure (psi)	70.0

Time (24-hr)			Temperature (°C)				Measurements						Ratio	Grad-ient	K-Value (cm/sec)	
Start	End	Time (sec)	Initial	Final	Ave.	Factor	$h_{out}1$	$h_{in}1$	$h_{out}2$	$h_{in}2$	h1	h2			Uncorrected K-Value	Corrected K-Value
9:44	10:33	2940	21.4	21.4	21.4	0.9669	40.10	23.30	38.75	24.65	16.8	14.1	1.00	1.87	3.79E-06	3.66E-06
10:33	11:07	2040	21.4	21.4	21.4	0.9669	38.75	24.65	38.15	25.35	14.1	12.8	0.86	1.70	3.01E-06	2.91E-06
11:07	12:30	4980	21.4	21.3	21.4	0.9669	38.15	25.35	36.75	26.80	12.8	10.0	0.97	1.33	3.15E-06	3.05E-06
12:30	14:07	5820	21.3	21.3	21.3	0.9669	36.75	26.80	35.20	28.40	10.0	6.8	0.97	0.90	4.21E-06	4.07E-06
													0.95	*1.45*	*3.54E-06*	*3.42E-06*

Averages:

Notes:

Sample was compacted to 94.7% @ 3.1% wet of optimum moisture content.



References:
ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D2216: Laboratory Determination of Water Content of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soil
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 854: Specific Gravity of Soils
ASTM D 422: Particle Size Analysis of Soils

Technician / Certification #: John Dailly — Certification #:
Technical Responsibility: Mal Krajan — Position: Quality System Coordinator

S&ME Moisture - Density Relationship

		Test Date(s):	1/2 -1/4/03
S&ME Project #:	**1264-02-576**	Report Date:	January 5, 2003
Project Name:	**Duke Power - Belows Creek Landfill**		
Client Name:	Duke Energy Corp.		
Client Address:	526 South Church Street, Chartlotte, NC 28202		
Boring #: BC-8	Sample #: 1	Sample Date:	NA
Location: Scrubber Waste Landfill	Offset:	Depth (ft):	0.0 -10.0
Sample Description:	Tan-Brown Sandy Clayey SILT		

Liquid Limit:	45	Specific Gravity:	2.784
Plastic Limit:	38	Plastic Index:	7

Natural Moisture Content (Total Sample): 13.5%

Moisture Content of the Oversize Fraction:

NOTES:

MDD: 100.9 **Opt. MC %: 19.6**

Sieve Size	% Passing

Water Content

Water Content requires GP 2 Balance (0.1 gram Readability).

ASTM D2216 ☒ AASHTO T265 ☐ ASTM D4959 ☐ ASTM D4643 ☐

	Sample #:	1	2		4		
	Water Added:	150	100	50			
	Tare #:	a	b	c	d		
A. Tare Weight	A.						
B. Wet Wt + Tare Wt	B.	500	500	500	500		
C. Dry Wt. + Tare Wt.	C.	406.7	414.5	423.4	441.5		
D. Water Weight	B-C	93.3	85.5	76.6	58.5		
E. Dry Weight	C-A	406.7	414.5	423.4	441.5		
F. Moisture Content	100*D/E	**22.9%**	**20.6%**	**18.1%**	**13.3%**		

Compaction Data

The Compaction Test requires a GP 5 Balance for ASTM (1 gram or .0022 Lb. readability).

G. Wt of Soil + Mold	G.	13.204	13.204	13.107	12.804		
H. Wt. of Mold	H.	9.175	9.175	9.175	9.175		
I. Wt. of Soil (g. or lbs.)	G-H	4.029	4.029	3.932	3.629		
J. Wt of Soil (Lbs.)	I/453.6 or I	4.029	4.029	3.932	3.629		
K. Mold Volume Factor	K.	30.03	30.03	30.03	30.03		
L. Wet Density	J*K	121.0	121.0	118.1	109.0		
M. Dry Density	L/(1+F)	**98.4**	**100.3**	**100.0**	**96.2**		

ASTM D558 ☐ ASTM D 698 ☒ ASTM D1557 ☐ AASHTO T99 ☐ AASHTO T180 ☐

Method A ☒ Method B ☐ Method C ☐ Method D (ASTM 1978) ☐ AASHTO Method D ☐

Moisture-Density Relation of: Fine Fraction ☒ Corrected for Coarse Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐

Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

Soil Plasticity: ASTM D 4318 ☒ AASHTO T 89 ☐ AASHTO T 90 ☐

Sieve Analysis / Particle Size Analysis: ASTM C136 ☐ AASHTO T 27 ☐ ASTM D 422 ☐ AASHTO T 88 ☐

Specific Gravity of Soil: ASTM D 854 ☒ AASHTO T 100 ☐

Bulk Gravity of Oversize Fraction: ASTM C 127 ☐ AASHTO T 85 ☐

Soil Classification: ASTM D 2487 ASTM D 2488 ☒ AASHTO M 145 ☐

Technician Name / Certification #: Chi Lam

Technical Responsibility: Mal Krajan Quality System Coordinator

Moisture - Density Report

S&ME

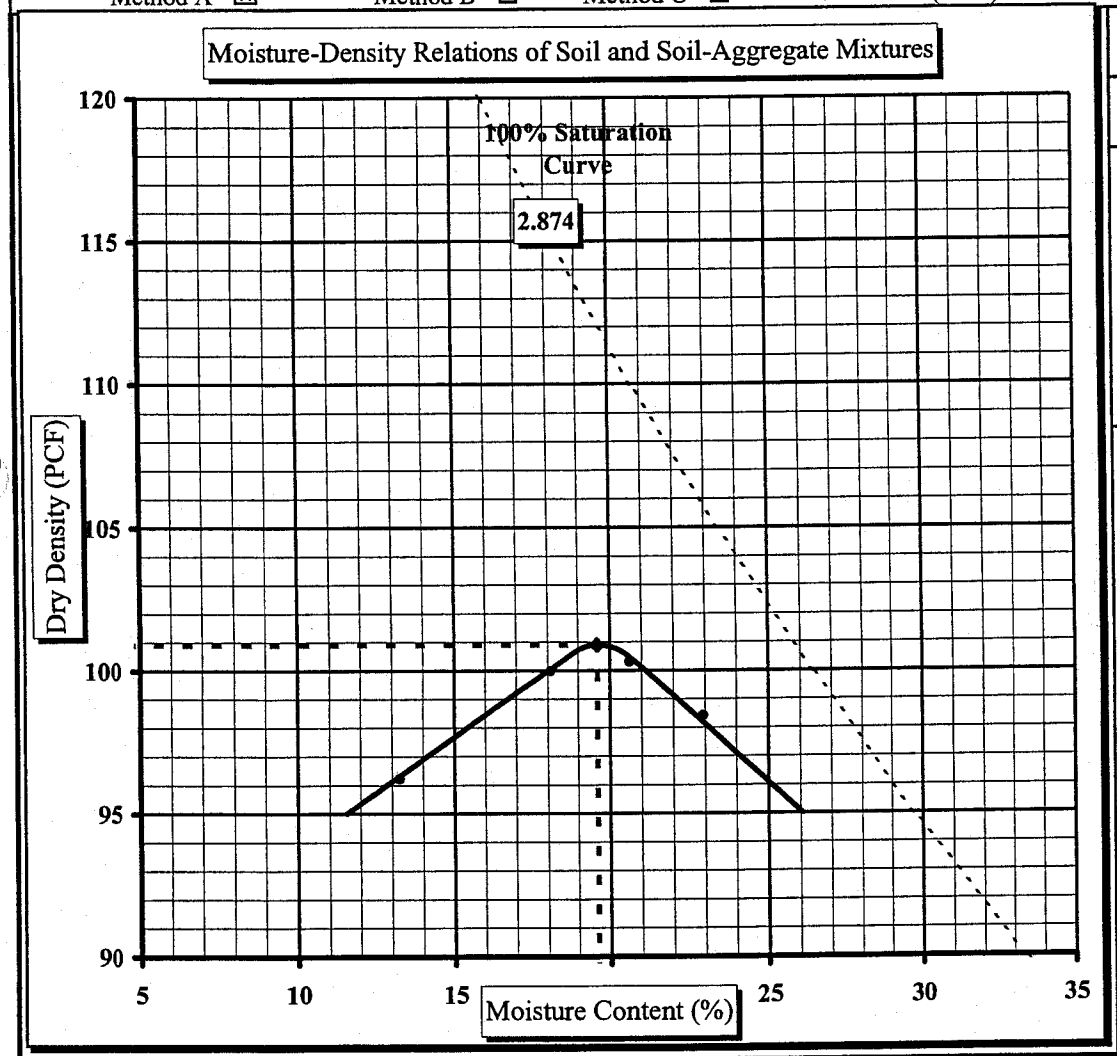
S&ME Project #: **1264-02-576**
Project Name: **Duke Power - Belows Creek Landfill**
Client Name: Duke Energy Corp.
Client Address: 526 South Church Street, Chartlotte, NC 28202

Report Date: January 5, 2003
Test Date(s): 1/2 -1/4/03

Boring #: BC-8 Sample #: 1 Sample Date: NA
Location: Scrubber Waste Landfill Offset: Depth (ft): 0.0 -10.0
Sample Description: Tan-Brown Sandy Clayey SILT

Maximum Dry Density **100.9 PCF.** **Optimum Moisture Content** **19.6 %**

ASTM D558 ☐ ASTM D 698 ☒ ASTM D1557 ☐ AASHTO T99 ☐ AASHTO T180 ☐
Method A ☒ Method B ☐ Method C ☐ Method D (1978) ☐ AASHTO Method D ☐



Soil Properties	
Natural Moisture Content	13.5%
Liquid Limit:	45
Plastic Limit:	38
Plastic Index:	7
Specific Gravity:	2.784

% Passing

Oversize Fraction
Bulk Sp. Gravity
% Moisture
Oversize Fraction

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐
Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐
Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

References: ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of
ASTM D 854: Specific Gravity of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Technical Responsibility: Mal Krajan Quality System Coordinator

S&ME

Specific Gravity of Soils

ASTM D 854

Project #: 1264-02-576 Report Date: 1/8/03
Project Name: Duke Power - Belows Creek Landfill Test Date(s) 1/2 1/8/03
Client Name: Duke Energy Corp.
Client Address: 526 South Church Street, Chartlotte, NC 28202

Boring No. BC-8 Sample No. 1 Sample Date: NA
Location: Scrubber Waste Landfill Offset: Depth (ft): 0.0 -10.0
Sample Description: Tan-Brown Sandy Clayey SILT
Percent of Soil Passing the #4 Sieve: 1 Material Excluded: Plus # 4 Material (%)
LL = PL = PI =

	Pychnometer #	**106**	**Balance ID#:**	**01001** Radability:	**.01 gram**
V_p	Pychnometer Volume (V_p)	**499.63 ml.**		Calibration Date:	**9/17/02**
PM	Pychnometer Mass	**187.22 g.**	**Balance Verification**		
M_p	Ave. Pychnometer Mass (Mp)	**187.22 g.**		Mass	**500 gram**
[PM-M_p]	Verify Pychnometer Mass	**g.**		Mass Determination	**500.00**

If [PM-M_p] is greater than .06 grams recalibrate the dry mass of the pychnometer

Method A: Moist Specimens ☒ Method B: Oven-dried Specimens ☐

Method A: Moist Specimens

Initial Moisture Content		Tare #:	G4
A	Tare Weight		9.12
B	Wet Wt + Tare Wt		67.38
C	Dry Wt. + Tare Wt.		60.47
D	Water Weight	B-C	6.91
E	Dry Weight	C-A	51.35
	Moisture Content	**100*D/E**	**13.5%**

Target Dry Mass (see Table 1 ASTM D854)	Low Limit	High Limit
Target Wet Mass	**102.11**	**124.80**

Note: Deviation

Wet Mass of test specimen _____ grams

Method B: Oven-dried Specimens
Note: Deviation

Initial Dry Mass of test specimen _____ grams

$M_{psw;t}$ Mass of the Pychnometer, soil, and water **719.38** grams

Mass of Dry Soil (grams)			
		Tare #	98
A	Tare Weight		161.36
C	Dry Wt. + Tare Wt.		213.35
M_s	Dry Weight	C-A	**51.99**

T_t	Test Temperature T_t	**18.9** °C
K	Temperature Coefficient at T_t	**1.00022**
K	Temperature Coefficient at 23°C	**0.99933**
$p_{w;t}$	Density of Water at T_t	**0.99843** g./ml.
	See Table 2 ASTM D 854	

$M_{pw;t}$	Mass of the Pychnometer and water at T_t	$M_{pw;t} = M_p + (V_p \times p_{w;t})$	**686.07** grams
G_t	Specific Gravity of tSoil Solids at the T_t	$G_t = M_s / (M_{pw;t} - (M_{psw;t} - M_s))$	**2.784**
G	Specific Gravity of Soil Solids at the 20°C	$G = K \times G_t$	**2.784**

Soils containing plus #4 material tested per ASTM C 127:
Note: Deviation

R % of Soil retained on the #4 sieve _____
P % of Soil passing the #4 sieve **100.0%**

G_{+4} Apparent Specific Gravity of plus #4 material at the 23°C per ASTM C127 _____
Apparent Specific Gravity of plus #4 material corrected to 20°C _____

G_{total} The Average total sample Specific Gravity

$$G_{total} = \frac{1}{\frac{R}{100-G_{+4}} + \frac{P}{100-G}} = \textbf{2.784}$$

References: ASTM D854 Specific Gravity of Soil Solids by Water Pychnometer
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM C 127: Specific Gravity and Absorption of Coarse Aggregates

Technician Name / Certification #: Tom Savanapridi
Technical Responsibility / Position: Mal Krajan Laboratory Supervisor

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

Project #: 1264-02-576 Report Date: January 8, 2003

Project Name: Duke Power-Belows Cr. Landfill Test Date(s): 1/02/03-1/08/03

Client Name: Duke Energy Corp.

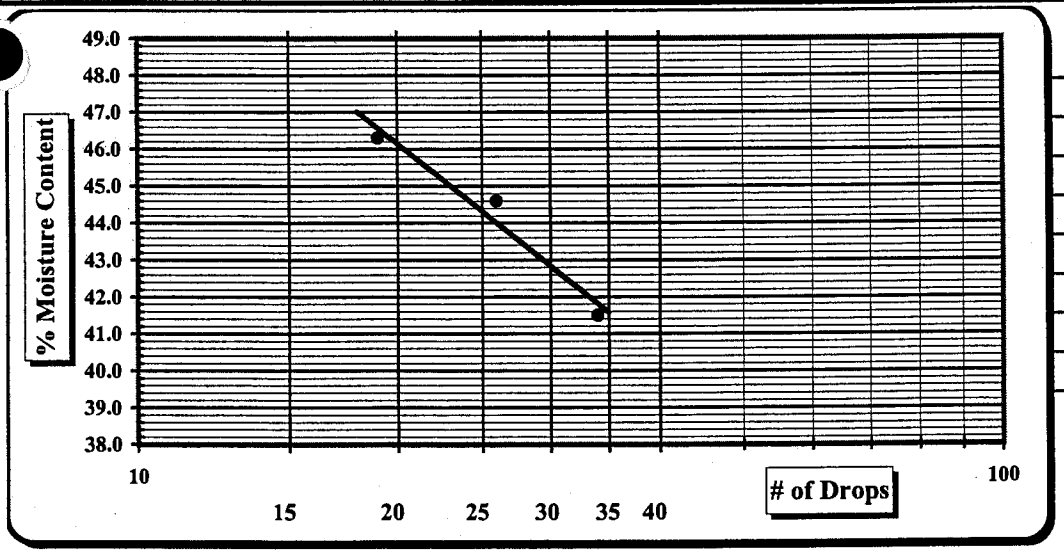
Client Address: 526 South Church St.

Boring #: BC-8 Sample #: 1 Sample Date: NA

Location: Scrubber Waste L.F. Offset: Depth (ft): 0.0 - 10.0

Sample Description: Tan-Brown Sandy Clayey SILT

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	MB	193	8				19	15	
A	Tare Weight	8.29	8.06	8.23				6.36	6.45	
B	Wet Soil Weight + A	25.53	23.87	22.71				15.74	14.28	
C	Dry Soil Weight + A	20.47	18.99	18.13				13.18	12.10	
D	Water Weight (B-C)	5.06	4.88	4.58				2.56	2.18	
E	Dry Soil Weight (C-A)	12.18	10.93	9.90				6.82	5.65	
F	% Moisture Content (D/E)*100	41.5	44.6	46.3				37.5	38.6	
N	# OF DROPS	34	26	19						
LL	LL = F * FACTOR									
Ave.	Average							38.1		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation	☐	Dry Preparation	☐	Air Dried	☒	NP, Non-Plastic ☐
Liquid limit Test:	Multipoint Method	☒	One-point Method	☐			Liquid Limit 45
Classification:	ASTM D 2487	☒	AASHTO M 145	☐			Plastic Limit 38
Liquid limit Test:	ASTM D 4318	☒	AASHTO T 89	☐			Plastic Index 7
Plastic limit Test:	ASTM D 4318	☒	AASHTO T 90	☐			Group Symbol ML

Technician Name / Certification #: Tom Savanpridi

Technical Responsibility / Position: Mal Krajan Laboratory Supervisor

S&ME Moisture - Density Relationship

		Test Date(s):	1/2 -1/4/03
S&ME Project #:	**1264-02-576**	Report Date:	January 5, 2003
Project Name:	**Duke Power - Belows Creek Landfill**		
Client Name:	Duke Energy Corp.		
Client Address:	526 South Church Street, Chartlotte, NC 28202		
Boring #: BC-9	Sample #: Bag-1	Sample Date:	NA
Location: Scrubber Waste Landfill	Offset:	Depth (ft):	0.0 -10.0
Sample Description:	Tan Sandy Clayey SILT		

Liquid Limit:	25	Specific Gravity:	2.691
Plastic Limit:	24	Plastic Index:	4

Natural Moisture Content (Total Sample): 6.6%

Moisture Content of the Oversize Fraction:

NOTES:

MDD: 110.8 **Opt. MC %: 13.0**

Sieve Size	% Passing

Water Content

Water Content requires GP 2 Balance (0.1 gram Readability).

ASTM D2216 ☒ AASHTO T265 ☐ ASTM D4959 ☐ ASTM D4643 ☐

	Sample #:	1	2		4		
	Water Added:	150	100	50			
	Tare #:	a	b	c	d		
A. Tare Weight	A.						
B. Wet Wt + Tare Wt	B.	500	500	500	500		
C. Dry Wt. + Tare Wt.	C.	424.6	432.3	438.9	458.2		
D. Water Weight	B-C	75.4	67.7	61.1	41.8		
E. Dry Weight	C-A	424.6	432.3	438.9	458.2		
F. Moisture Content	100*D/E	**17.8%**	**15.7%**	**13.9%**	**9.1%**		

Compaction Data

The Compaction Test requires a GP 5 Balance for ASTM (1 gram or .0022 Lb. readability).

G. Wt of Soil + Mold	G.	13.273	13.333	13.358	13.074		
H. Wt. of Mold	H.	9.175	9.175	9.175	9.175		
I. Wt. of Soil (g. or lbs.)	G-H	4.098	4.158	4.183	3.899		
J. Wt of Soil (Lbs.)	I/453.6 or I	4.098	4.158	4.183	3.899		
K. Mold Volume Factor	K.	30.03	30.03	30.03	30.03		
L. Wet Density	J*K	123.1	124.9	125.6	117.1		
M. Dry Density	L/(1+F)	**104.5**	**108.0**	**110.3**	**107.3**		

ASTM D558 ☐ ASTM D 698 ☒ ASTM D1557 ☐ AASHTO T99 ☐ AASHTO T180 ☐

Method A ☒ Method B ☐ Method C ☐ Method D (ASTM 1978) ☐ AASHTO Method D ☐

Moisture-Density Relation of: Fine Fraction ☒ Corrected for Coarse Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐

Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

Soil Plasticity:	ASTM D 4318 ☒	AASHTO T 89 ☐		AASHTO T 90 ☐
Sieve Analysis / Particle Size Analysis:	ASTM C136 ☐	AASHTO T 27 ☐	ASTM D 422 ☒	AASHTO T 88 ☐
Specific Gravity of Soil:		ASTM D 854 ☒		AASHTO T 100 ☐
Bulk Gravity of Oversize Fraction:		ASTM C 127 ☐		AASHTO T 85 ☐
Soil Classification:	ASTM D 2487 ☒	ASTM D 2488 ☐		AASHTO M 145 ☐

Technician Name / Certification #: Chi Lam

Technical Responsibility: Mal Krajan Quality System Coordinator

Moisture - Density Report

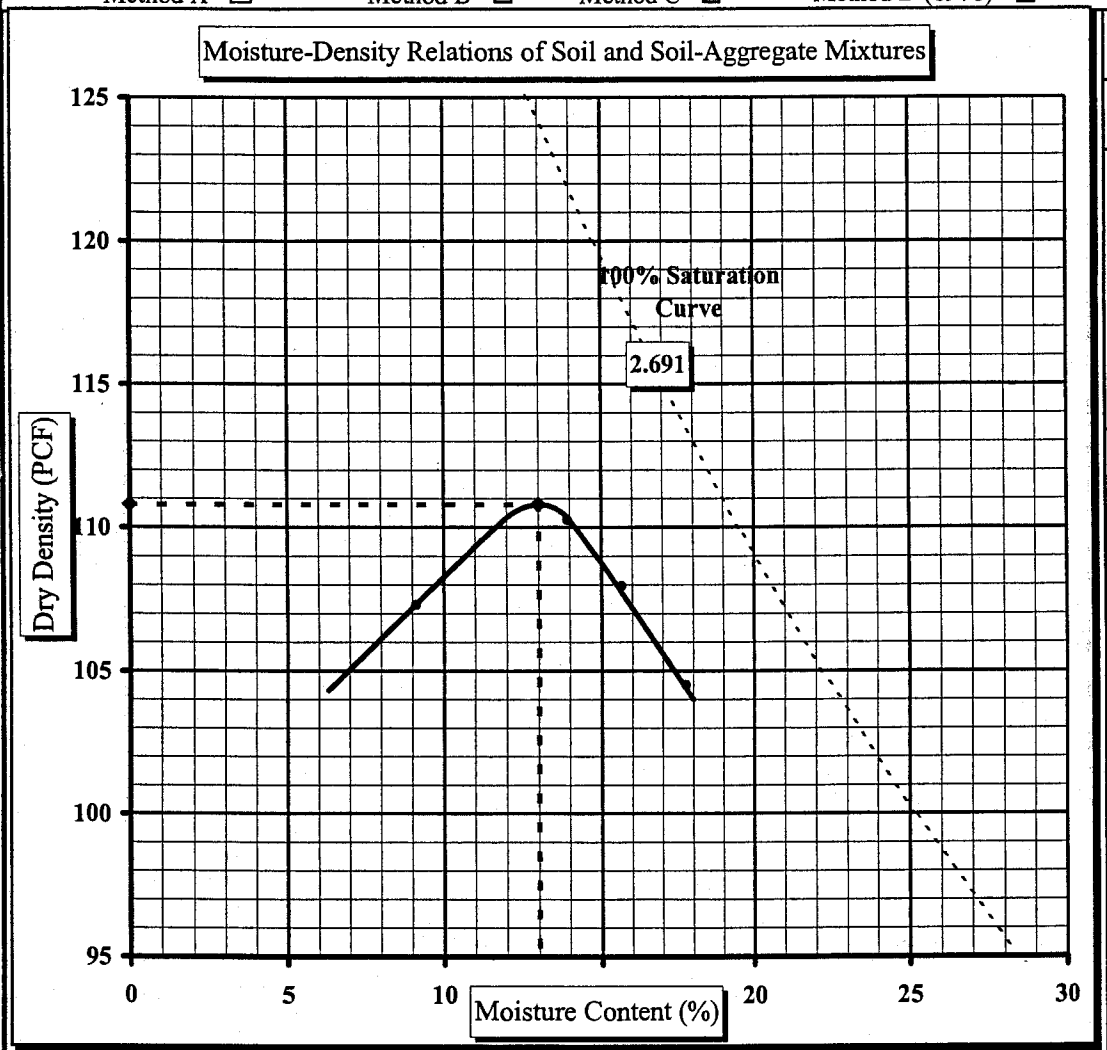
S&ME Project #: 1264-02-576
Project Name: Duke Power - Belows Creek Landfill
Client Name: Duke Energy Corp.
Client Address: 526 South Church Street, Chartlotte, NC 28202

Report Date: January 5, 2003
Test Date(s): 1/2 -1/4/03

Boring #: BC-9 Sample #: Bag-1 Sample Date: NA
Location: Scrubber Waste Landfill Offset: Depth (ft): 0.0 -10.0
Sample Description: Tan Sandy Clayey SILT

Maximum Dry Density 110.8 PCF. **Optimum Moisture Content** 13.0 %

ASTM D558 ☐ ASTM D 698 ☒ ASTM D1557 ☐ AASHTO T99 ☐ AASHTO T180 ☐
Method A ☒ Method B ☐ Method C ☐ Method D (1978) ☐ AASHTO Method D ☐



Soil Properties	
Natural Moisture Content	6.6%
Liquid Limit:	25
Plastic Limit:	24
Plastic Index:	4
Specific Gravity:	2.691

% Passing

Oversize Fraction
Bulk Sp. Gravity
% Moisture
Oversize Fraction

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐
Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐
Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

References: ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of
ASTM D 422: Particle Size Analysis of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Technical Responsibility: Mal Krajan Quality System Coordinator

S&ME

Specific Gravity of Soils

ASTM D 854

Project #: 1264-02-576 — Report Date: 1/8/03
Project Name: Duke Power - Belows Creek Landfill — Test Date(s) 1/2 1/8/03
Client Name: Duke Energy Corp.
Client Address: 526 South Church Street, Chartlotte, NC 28202

Boring No. BC-9 Sample No. Bag-1 Sample Date: NA
Location: Scrubber Waste Landfill Offset: Depth (ft): 0.0 -10.0
Sample Description: Tan Sandy Clayey SILT
Percent of Soil Passing the #4 Sieve: Material Excluded: Plus # 4 Material (%)
LL = PL = PI =

	Pychnometer #	**105**	**Balance ID#:**	**01001** Radability:	**.01 gram**
V_p	Pychnometer Volume (V_p)	**499.04 ml.**		Calibration Date:	**9/17/02**
PM	Pychnometer Mass	**194.28 g.**	**Balance Verification**		
M_p	Ave. Pychnometer Mass (Mp)	**194.28 g.**		Mass	**500 gram**
[PM-M_p]	Verify Pychnometer Mass	**g.**		Mass Determination	**500.00**

If [PM-M_p] is greater than .06 grams recalibrate the dry mass of the pychnometer

Method A: Moist Specimens ☒ Method B: Oven-dried Specimens ☐

Method A: Moist Specimens

	Initial Moisture Content	Tare #:	K-81
A	Tare Weight		8.59
B	Wet Wt + Tare Wt		119.79
C	Dry Wt. + Tare Wt.		112.89
D	Water Weight	B-C	6.9
E	Dry Weight	C-A	104.3
	Moisture Content	**100*D/E**	**6.6%**

Target Dry Mass (see Table 1 ASTM D854)	Low Limit	High Limit
Target Wet Mass	**90.00**	**110.00**
	95.95	**117.28**

Note: Deviation

Wet Mass of test specimen _____ grams

Method B: Oven-dried Specimens Initial Dry Mass of test specimen _____ grams
Note: Deviation

$M_{psw;t}$ Mass of the Pychnometer, soil, and water **727.67** grams

Mass of Dry Soil (grams)			
		Tare #	999
A	Tare Weight		226.74
C	Dry Wt. + Tare Wt.		282.81
M_s	Dry Weight	C-A	**56.07**

T_t	Test Temperature T_t	**19.9 °C**
K	Temperature Coefficient at T_t	**1.00002**
K	Temperature Coefficient at 23°C	**0.99933**
$p_{w;t}$	Density of Water at T_t	**0.99823** g./ml.
	See Table 2 ASTM D 854	

$M_{pw;t}$	Mass of the Pychnometer and water at T_t	$M_{pw;t} = M_p + (V_p \times p_{w;t})$	**692.44** grams
G_t	Specific Gravity of tSoil Solids at the T_t	$G_t = M_s / (M_{pw;t} - (M_{psw;t} - M_s))$	**2.691**
G	Specific Gravity of Soil Solids at the 20°C	$G = K \times G_t$	**2.691**

Soils containing plus #4 material tested per ASTM C 127:
Note: Deviation

R % of Soil retained on the #4 sieve _____
P % of Soil passing the #4 sieve **100.0%**

G_{+4} Apparent Specific Gravity of plus #4 material at the 23°C per ASTM C127 _____
Apparent Specific Gravity of plus #4 material corrected to 20°C _____

G_{total} The Average total sample Specific Gravity

$$G_{total} = \frac{1}{\frac{R}{100-G_{+4}} + \frac{P}{100-G}} = \textbf{2.691}$$

References: ASTM D854 Specific Gravity of Soil Solids by Water Pychnometer
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM C 127: Specific Gravity and Absorption of Coarse Aggregates

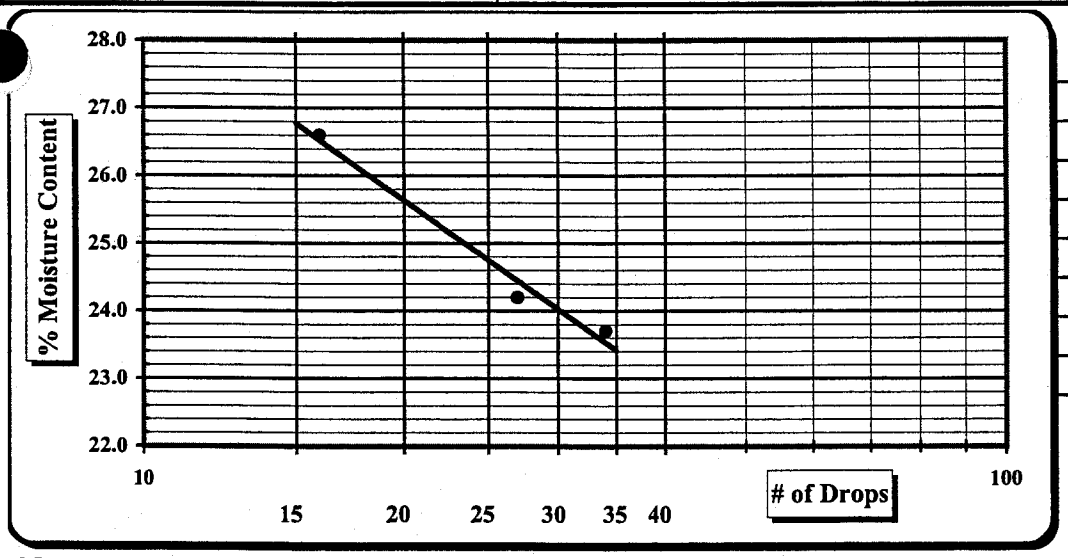
Technician Name / Certification #: Tom Savanapridi
Technical Responsibility / Position: Mal Krajan Quality System Coordinator

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

Project #:	1264-02-576	Report Date:	January 8, 2003
Project Name:	Duke Power-Belows Cr. Landfill	Test Date(s):	1/02/03-1/08/03
Client Name:	Duke Energy Corp.		
Client Address:	526 South Church Street, Charlotte, NC 28202		
Boring #:	BC-9	Sample #: Bag-1	Sample Date: NA
Location:	Scrubber Waste L.F.	Offset:	Depth (ft): 0.0 - 10.0
Sample Description:	Tan Sandy Clayey SILT		

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	15	101	98				49	67	
A	Tare Weight	8.08	8.06	8.08				6.19	6.18	
B	Wet Soil Weight + A	23.97	29.42	27.77				13.22	14.62	
C	Dry Soil Weight + A	20.93	25.26	23.63				11.99	13.15	
D	Water Weight (B-C)	3.04	4.16	4.14				1.23	1.47	
E	Dry Soil Weight (C-A)	12.85	17.20	15.55				5.80	6.97	
F	% Moisture Content (D/E)*100	23.7	24.2	26.6				21.2	21.1	
N	# OF DROPS	34	27	16						
LL	LL = F * FACTOR									
Ave.	Average							21.2		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation ☐	Dry Preparation ☐	Air Dried ☒	NP, Non-Plastic	☐
Liquid limit Test:	Multipoint Method ☒	One-point Method ☐		Liquid Limit	25
Classification:	ASTM D 2487 ☒	AASHTO M 145 ☐		Plastic Limit	21
Liquid limit Test:	ASTM D 4318 ☒	AASHTO T 89 ☐		Plastic Index	4
Plastic limit Test:	ASTM D 4318 ☒	AASHTO T 90 ☐		Group Symbol	ML

Technician Name / Certification #: Tom Savanapridi

Technical Responsibility / Position: Mal Krajan — Quality System Coordinator

S&ME Moisture - Density Relationship

Test Date(s): 1/2 -1/4/03
Report Date: January 5, 2003

S&ME Project #: 1264-02-576
Project Name: Duke Power - Belows Creek Landfill
Client Name: Duke Energy Corp.
Client Address: 526 South Church Street, Chartlotte, NC 28202
Boring #: BC-10 Sample #: Bag-1 Sample Date: NA
Location: Scrubber Waste Landfill Offset: Depth (ft): 0.0 -10.0
Sample Description: Yellow Clayey Silty SAND with a Trace of Gravel (SM)

Sieve Size	% Passing

Liquid Limit: 24 Specific Gravity: 2.652
Plastic Limit: 21 Plastic Index: 3

Natural Moisture Content (Total Sample): 9.3%
Moisture Content of the Oversize Fraction:

NOTES:

MDD: 109.1 **Opt. MC %: 14.9**

Water Content

Water Content requires GP 2 Balance (0.1 gram Readability).

ASTM D2216 ☒ AASHTO T265 ☐ ASTM D4959 ☐ ASTM D4643 ☐

	Sample #:	1	2		4		
	Water Added:	150	100	50			
	Tare #:	a	b	c	d		
A. Tare Weight	A.						
B. Wet Wt + Tare Wt	B.	500	500	500	500		
C. Dry Wt. + Tare Wt.	C.	425	435	441.6	463.7		
D. Water Weight	B-C	75	65	58.4	36.3		
E. Dry Weight	C-A	425	435	441.6	463.7		
F. Moisture Content	100*D/E	**17.6%**	**14.9%**	**13.2%**	**7.8%**		

Compaction Data

The Compaction Test requires a GP 5 Balance for ASTM (1 gram or .0022 Lb. readability).

G. Wt of Soil + Mold	G.	13.270	13.351	13.258	12.968		
H. Wt. of Mold	H.	9.175	9.175	9.175	9.175		
I. Wt. of Soil (g. or lbs.)	G-H	4.095	4.176	4.083	3.793		
J. Wt of Soil (Lbs.)	I/453.6 or I	4.095	4.176	4.083	3.793		
K. Mold Volume Factor	K.	30.03	30.03	30.03	30.03		
L. Wet Density	J*K	123.0	125.4	122.6	113.9		
M. Dry Density	L/(1+F)	**104.5**	**109.1**	**108.3**	**105.6**		

ASTM D558 ☐ ASTM D 698 ☒ ASTM D1557 ☐ AASHTO T99 ☐ AASHTO T180 ☐
Method A ☒ Method B ☐ Method C ☐ Method D (ASTM 1978) ☐ AASHTO Method D ☐
Moisture-Density Relation of: Fine Fraction ☒ Corrected for Coarse Fraction (ASTM D 4718) ☐
Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐
Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐
Soil Plasticity: ASTM D 4318 ☒ AASHTO T 89 ☐ AASHTO T 90 ☐
Sieve Analysis / Particle Size Analysis: ASTM C136 ☐ AASHTO T 27 ☐ ASTM D 422 ☒ AASHTO T 88 ☐
Specific Gravity of Soil: ASTM D 854 ☒ AASHTO T 100 ☐
Bulk Gravity of Oversize Fraction: ASTM C 127 ☐ AASHTO T 85 ☐
Soil Classification: ASTM D 2487 ☒ ASTM D 2488 ☐ AASHTO M 145 ☐

Technician Name / Certification #: Chi Lam
Technical Responsibility: Mal Krajan Quality System Coordinator

Moisture - Density Report

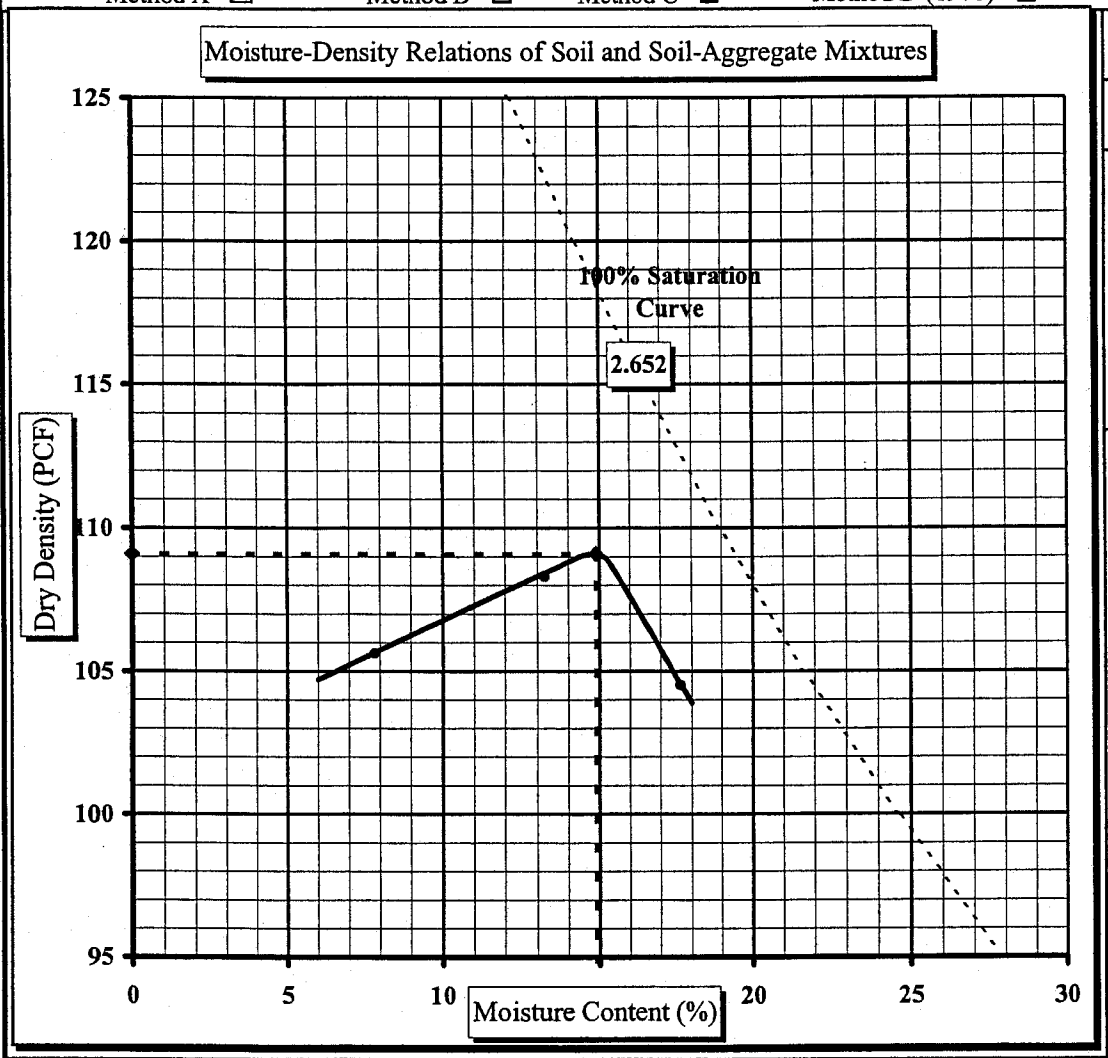
S&ME

S&ME Project #: 1264-02-576 Report Date: January 5, 2003
Project Name: Duke Power - Belows Creek Landfill Test Date(s): 1/2 -1/4/03
Client Name: Duke Energy Corp.
Client Address: 526 South Church Street, Chartlotte, NC 28202

Boring #: BC-10 Sample #: Bag-1 Sample Date: NA
Location: Scrubber Waste Landfill Offset: Depth (ft): 0.0 -10.0
Sample Description: Yellow Clayey Silty SAND with a Trace of Gravel (SM)

Maximum Dry Density 109.1 PCF. **Optimum Moisture Content 14.9 %**

ASTM D558 ☐ ASTM D 698 ☒ ASTM D1557 ☐ AASHTO T99 ☐ AASHTO T180 ☐
Method A ☒ Method B ☐ Method C ☐ Method D (1978) ☐ AASHTO Method D ☐



Soil Properties	
Natural Moisture Content	9.3%
Liquid Limit:	24
Plastic Limit:	21
Plastic Index:	3
Specific Gravity:	2.652

% Passing

Oversize Fraction
Bulk Sp. Gravity
% Moisture
Oversize Fraction

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐
Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐
Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

References: ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of
ASTM D 422: Particle Size Analysis of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Technical Responsibility: Mal Krajan Quality System Coordinator

S&ME

Specific Gravity of Soils

ASTM D 854

Project #: 1264-02-576 — Report Date: 1/8/03
Project Name: Duke Power - Belows Creek Landfill — Test Date(s) 1/2 1/8/03
Client Name: Duke Energy Corp.
Client Address: 526 South Church Street, Chartlotte, NC 28202

Boring No. BC-10 Sample No. Bag-1 Sample Date: NA
Location: Scrubber Waste Landfill Offset: Depth (ft): 0.0 -10.0
Sample Description: Yellow Clayey Silty SAND with a Trace of Gravel (SM)
Percent of Soil Passing the #4 Sieve: Material Excluded: Plus # 4 Material (%)
LL = PL = PI =

	Pychnometer #	**106**	**Balance ID#:**	**01001** Radability:	**.01 gram**
V_p	Pychnometer Volume (V_p)	**499.63 ml.**		Calibration Date:	**9/17/02**
PM	Pychnometer Mass	**187.19 g.**	**Balance Verification**		
M_p	Ave. Pychnometer Mass (Mp)	**187.19 g.**		Mass	**500 gram**
[PM-M_p]	Verify Pychnometer Mass	**g.**		Mass Determination	**500.00**

If [PM-M_p] is greater than .06 grams recalibrate the dry mass of the pychnometer

Method A: Moist Specimens ☒ Method B: Oven-dried Specimens ☐

Method A: Moist Specimens

	Initial Moisture Content	Tare #:	C-18
A	Tare Weight		9.25
B	Wet Wt + Tare Wt		118.44
C	Dry Wt. + Tare Wt.		109.19
D	Water Weight	B-C	9.25
E	Dry Weight	C-A	99.94
	Moisture Content	100*D/E	**9.3%**

Target Dry Mass (see Table 1 ASTM D854)	Low Limit	High Limit
	90.00	110.00
Target Wet Mass	**98.33**	**120.18**

Note: Deviation

Wet Mass of test specimen _____ grams

Method B: Oven-dried Specimens

Initial Dry Mass of test specimen _____ grams

Note: Deviation

$M_{psw;t}$ Mass of the Pychnometer, soil, and water **721.16** grams

Mass of Dry Soil (grams)			
		Tare #	LR-2
A	Tare Weight		198.08
C	Dry Wt. + Tare Wt.		254.63
M_s	Dry Weight	C-A	**56.55**

T_t	Test Temperature T_t	**19.9 °C**
K	Temperature Coefficient at T_t	**1.00002**
K	Temperature Coefficient at 23°C	**0.99933**
$p_{w;t}$	Density of Water at T_t	**0.99823** g./ml.
	See Table 2 ASTM D 854	

$M_{pw;t}$	Mass of the Pychnometer and water at T_t	$M_{pw;t} = M_p + (V_p \times p_{w;t})$	**685.94** grams
G_t	Specific Gravity of tSoil Solids at the T_t	$G_t = M_s / (M_{pw;t} - (M_{psw;t} - M_s))$	**2.652**
G	Specific Gravity of Soil Solids at the 20°C	$G = K \times G_t$	**2.652**

Soils containing plus #4 material tested per ASTM C 127:
Note: Deviation

R % of Soil retained on the #4 sieve _____
P % of Soil passing the #4 sieve **100.0%**

G_{+4} Apparent Specific Gravity of plus #4 material at the 23°C per ASTM C127 _____
Apparent Specific Gravity of plus #4 material corrected to 20°C _____

G_{total} The Average total sample Specific Gravity

$$G_{total} = \frac{1}{\frac{R}{100-G_{+4}} + \frac{P}{100-G}} = \textbf{2.652}$$

References: ASTM D854 Specific Gravity of Soil Solids by Water Pychnometer
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM C 127: Specific Gravity and Absorption of Coarse Aggregates

Technician Name / Certification #: Tom Savanapridi
Technical Responsibility / Position: Mal Krajan — Quality System Coordinator

Laboratory Report Version 4.0

Particle Size Analysis of Soils

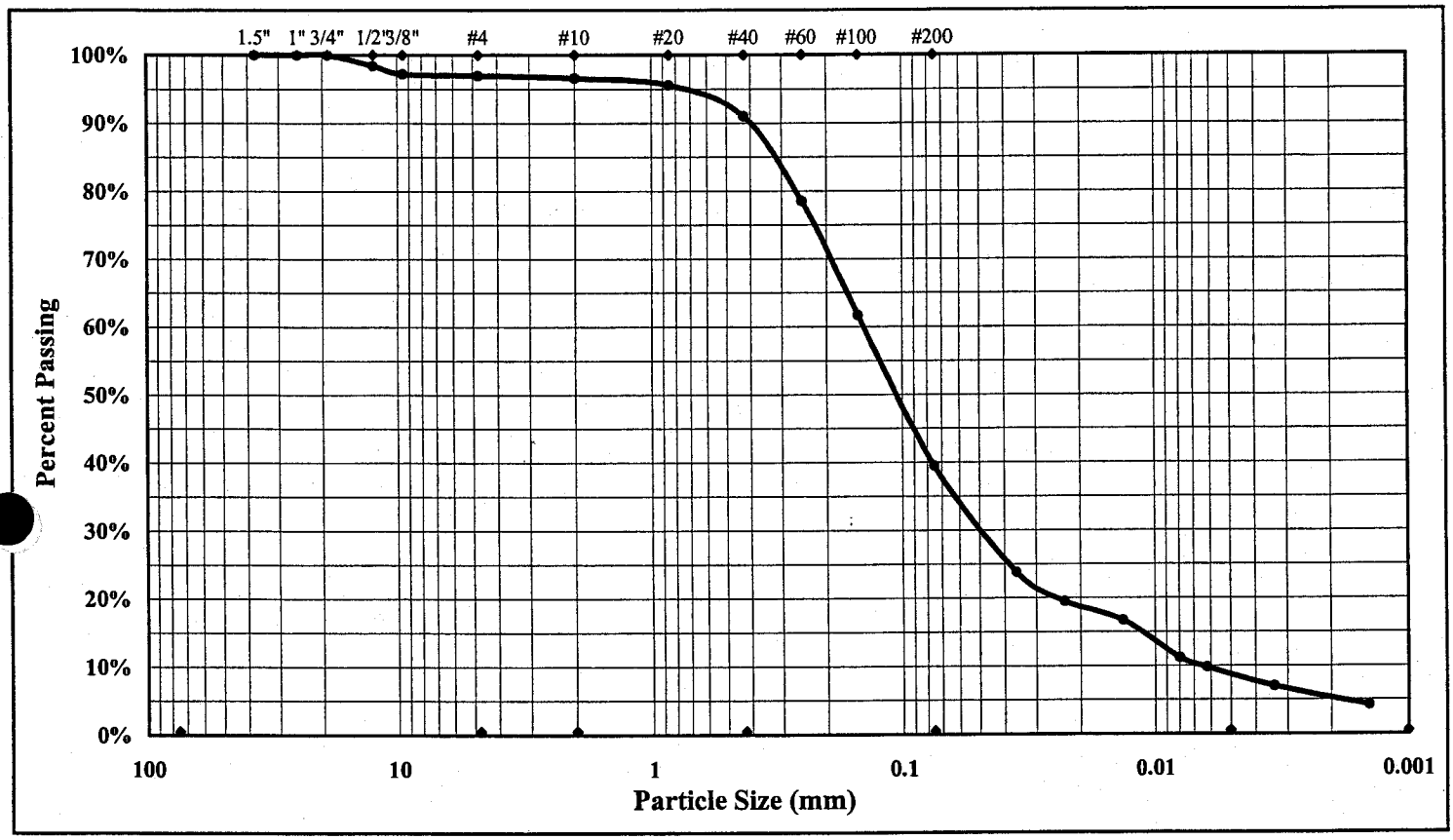
ASTM D 422

S&ME

S&ME Project #: **1264-02-576**
Project Name: **Duke Power - Belews Creek Landfill**
Client Name: Duke Energy Corp.
Client Address: 526 South Church Street, Charlotte, NC 28202

Report Date: January 9, 2003
Test Date(s): 1/2 - 1/7/03

Boring #:	BC-10	Sample #:		Sample Date:	NA
Location:	Scrubber Waste L.F.	Offset:		Depth (ft):	0.0 - 10.0
Sample Description:	Yellow Clayey Silty Fine SAND with a trace of Gravel				



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Moisture Content	9.3%	Gravel	3.0%	Liquid Limit	24
Silt & Clay (% Passing #200)	39.5%	Sand	57.5%	Plastic Limit	21
Maximum Particle Size	3/4"	Silt	31.6%	Plastic Index	3
Specific Gravity	2.652	Clay	7.9%	Colloids	4.2%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☒

ASTM D 422: Particle Size Analysis of Soils — Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter; Mechanical Stirring Apparatus (A); Length of Dispersion Period: 1 min.

References: ASTM D 854: Specific Gravity of Soils
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

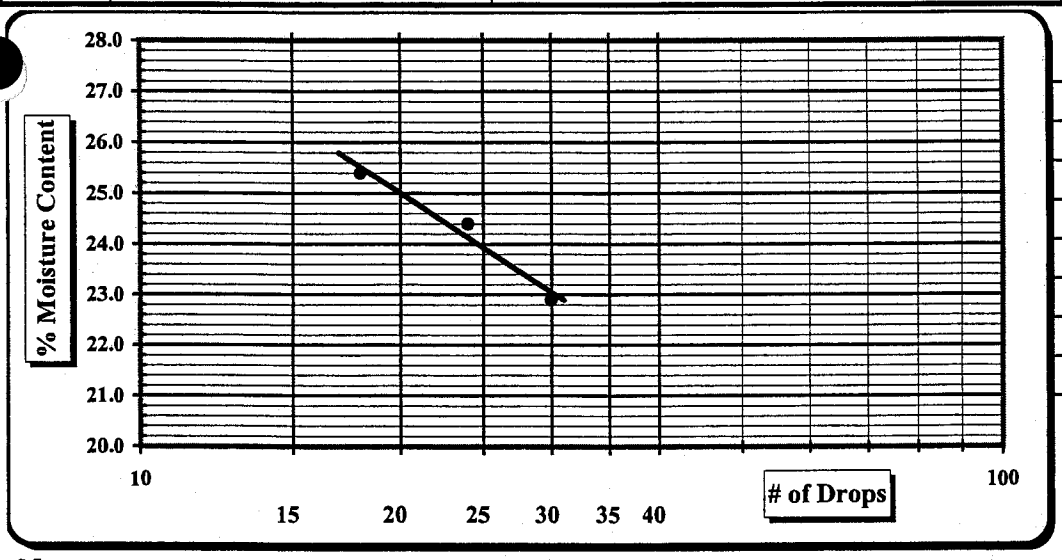
Technical Responsibility / Position: Mal Krajan — Laboratory Supervisor

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

Project #:	1264-02-576	Report Date:	January 7, 2002
Project Name:	Duke Power - Belews Creek Landfill	Test Date(s):	January 2, 2002
Client Name:	Duke Energy Corp.		
Client Address:	526 South Church Street, Charlotte, NC 28202		
Boring #:	BC-10	Sample #:	Sample Date: NA
Location:	Scrubber Waste L.F.	Offset:	Depth (ft): 0.0 - 10.0
Sample Description:	Yellow Clayey Silty Fine SAND with a trace of Gravel		

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	MB	25	A-21				A-10	67	
A	Tare Weight	8.45	7.99	8.27				6.35	6.20	
B	Wet Soil Weight + A	29.75	29.77	25.29				15.63	19.91	
C	Dry Soil Weight + A	25.78	25.50	21.84				14.03	17.59	
D	Water Weight (B-C)	3.97	4.27	3.45				1.60	2.32	
E	Dry Soil Weight (C-A)	17.33	17.51	13.57				7.68	11.39	
F	% Moisture Content (D/E)*100	22.9	24.4	25.4				20.8	20.4	
N	# OF DROPS	30	24	18						
LL	LL = F * FACTOR									
Ave.	Average							20.6		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation ☐	Dry Preparation ☐	Air Dried ☒	NP, Non-Plastic	☐
Liquid limit Test:	Multipoint Method ☒	One-point Method ☐		Liquid Limit	24
Classification:	ASTM D 2487 ☒	AASHTO M 145 ☐		Plastic Limit	21
Liquid limit Test:	ASTM D 4318 ☒	AASHTO T 89 ☐		Plastic Index	3
Plastic limit Test:	ASTM D 4318 ☒	AASHTO T 90 ☐		Group Symbol	SM

Technician Name / Certification #: Tom Savanpridi

Technical Responsibility / Position: Mal Krajan Laboratory Supervisor

S&ME

Labor[illegible]ecord Version 4.1

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method "C")

Project #:	1264-02-576	Test Date(s):	01/02/03 - 01/08/03
Project Name:	Duke Power - Belews County Landfill	Report Date:	01/09/03
Client Name:	Duke Energy Corp.		
Client Address:	526 South Church Street		

Boring #:	BC-10	Sample #:	Bag-1	Depth/Elevation:	0.0 - 10.0	Sample Date:	NA
Location:	Scrubber Waste	Offset:		Sample Description:	Yellow Clayey Silty Fine SAND with a trace of Gravel		
Liquid Limit:	24	Specific Gravity:	2.652	Sample Type:	Lab-compacted	Sampled By:	Sam Watts
Plastic Limit:	21	Plasticity Index:	3	Percent Passing #200:	39.5	Maximum Particle Size:	

Initial Sample Conditions				Final Sample Conditions			
Length (cm):	7.47	Wet Density (PCF):	122.9	Length (cm):	7.48	Wet Density (PCF):	126.7
Diameter (cm):	7.32	Dry Density (PCF):	104.4	Diameter (cm):	7.33	Dry Density (PCF):	104.0
Area (cm^2)	42.08	Percent Saturation:	80.2	Area (cm^2)	42.19	Percent Saturation:	97.8
Volume (cm^3)	314.34			Volume (cm^3)	315.60	B-value:	1.00
Wet weight (grams)	619.1	Void Ratio:	0.585	Wet weight (grams)	640.7	Void Ratio:	0.591
Dry Weight (grams)	526.0	Porosity:	0.369	Dry Weight (grams)	526.0	Porosity:	0.371
Percent Moisture:	17.7			Percent Moisture:	21.8		
Test Parameters:	Effective Consolidation Stress (psi):		2.0	Permeant Liquid Used:		Deaired Demineralized water	
Burette Area (cm^2):	0.720	Cell Pressure (psi):	72.0	Back Pressure (psi):	70.0	Pore Pressure (psi)	70.0

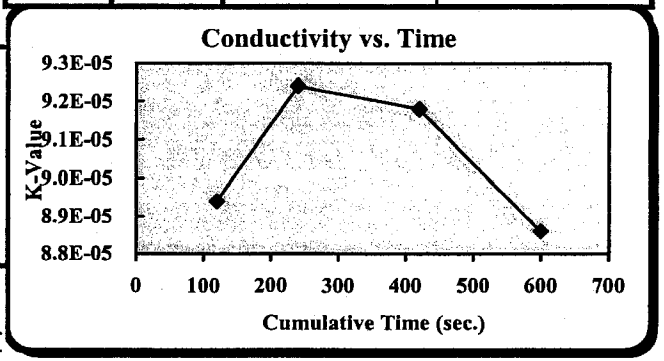
Time (24-hr)			Temperature (°C)				Measurements						Ratio	Grad-ient	K-Value (cm/sec)	
Start	End	Time (sec)	Initial	Final	Ave.	Factor	$h_{out}1$	$h_{in}1$	$h_{out}2$	$h_{in}2$	h1	h2			Uncorrected K-Value	Corrected K-Value
9:38	9:40	120	21.4	21.4	21.4	0.9669	42.80	24.00	41.15	25.35	18.8	15.8	1.22	2.11	9.25E-05	8.94E-05
9:40	9:42	120	21.4	21.4	21.4	0.9669	41.15	25.35	39.80	26.60	15.8	13.2	1.08	1.76	9.56E-05	9.24E-05
9:42	9:45	180	21.4	21.4	21.4	0.9669	39.80	26.60	38.20	28.10	13.2	10.1	1.07	1.35	9.49E-05	9.18E-05
9:45	9:48	180	21.4	21.4	21.4	0.9669	38.20	28.10	37.05	29.25	10.1	7.8	1.00	1.04	9.16E-05	8.86E-05
												Averages:	*1.09*	*1.57*	*9.37E-05*	*9.06E-05*

Notes:

Sample was compacted to 95.7% @ 2.8% wet of optimum moisture content.

References:

ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D2216: Laboratory Determination of Water Content of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soil
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 854: Specific Gravity of Soils
ASTM D 422: Particle Size Analysis of Soils



Technician / Certification #: John Dailly Certification #:

Technical Responsibility: Mal Krajan Position: Quality System Coordinator

S&ME Moisture - Density Relationship

		Test Date(s):	1/2 -1/4/03
S&ME Project #:	**1264-02-576**	Report Date:	January 5, 2003
Project Name:	**Duke Power - Belows Creek Landfill**		
Client Name:	Duke Energy Corp.		
Client Address:	526 South Church Street, Chartlotte, NC 28202		
Boring #: BC-11	Sample #: 1	Sample Date:	NA
Location: Scrubber Waste Landfill	Offset:	Depth (ft):	0.0 -10.0
Sample Description:	Tan-Brown Silty Clayey SAND		

Liquid Limit:	47	Specific Gravity:	2.716
Plastic Limit:	26	Plastic Index:	21

Natural Moisture Content (Total Sample): 27.6%

Moisture Content of the Oversize Fraction:

NOTES:

MDD: 108.4 **Opt. MC %: 17.6**

Sieve Size	% Passing

Water Content

Water Content requires GP 2 Balance (0.1 gram Readability).

ASTM D2216 ☒ AASHTO T265 ☐ ASTM D4959 ☐ ASTM D4643 ☐

	Sample #:	1	2		4		
	Water Added:	150	100	50			
	Tare #:	a	b	c	d		
A. Tare Weight	A.						
B. Wet Wt + Tare Wt	B.	500	500	500	500		
C. Dry Wt. + Tare Wt.	C.	413.9	420.8	429.4	446.1		
D. Water Weight	B-C	86.1	79.2	70.6	53.9		
E. Dry Weight	C-A	413.9	420.8	429.4	446.1		
F. Moisture Content	100*D/E	**20.8%**	**18.8%**	**16.4%**	**12.1%**		

Compaction Data

The Compaction Test requires a GP 5 Balance for ASTM (1 gram or .0022 Lb. readability).

G. Wt of Soil + Mold	G.	13.339	13.437	13.330	12.787		
H. Wt. of Mold	H.	9.175	9.175	9.175	9.175		
I. Wt. of Soil (g. or lbs.)	G-H	4.164	4.262	4.155	3.612		
J. Wt of Soil (Lbs.)	I/453.6 or I	4.164	4.262	4.155	3.612		
K. Mold Volume Factor	K.	30.03	30.03	30.03	30.03		
L. Wet Density	J*K	125.0	128.0	124.8	108.5		
M. Dry Density	L/(1+F)	**103.5**	**107.7**	**107.2**	**96.8**		

ASTM D558 ☐ ASTM D 698 ☒ ASTM D1557 ☐ AASHTO T99 ☐ AASHTO T180 ☐

Method A ☒ Method B ☐ Method C ☐ Method D (ASTM 1978) ☐ AASHTO Method D ☐

Moisture-Density Relation of: Fine Fraction ☒ Corrected for Coarse Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐

Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

Soil Plasticity: ASTM D 4318 ☒ AASHTO T 89 ☐ AASHTO T 90 ☐

Sieve Analysis / Particle Size Analysis: ASTM C136 ☐ AASHTO T 27 ☐ ASTM D 422 ☒ AASHTO T 88 ☐

Specific Gravity of Soil: ASTM D 854 ☒ AASHTO T 100 ☐

Bulk Gravity of Oversize Fraction: ASTM C 127 ☐ AASHTO T 85 ☐

Soil Classification: ASTM D 2487 ☒ ASTM D 2488 ☐ AASHTO M 145 ☐

Technician Name / Certification #: Chi Lam

Technical Responsibility: Mal Krajan Quality System Coordinator

Moisture - Density Report

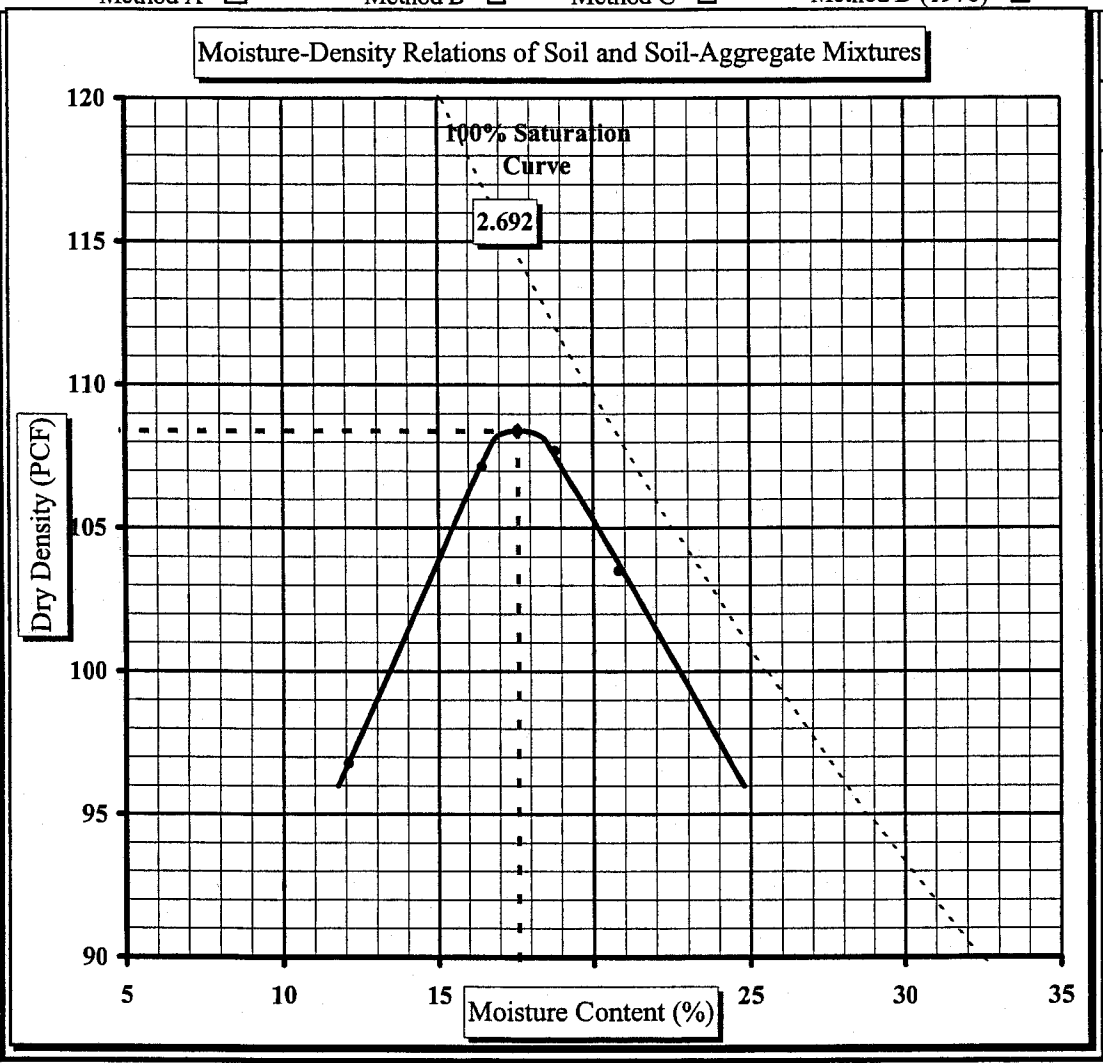
S&ME

S&ME Project #: 1264-02-576 | Report Date: January 5, 2003
Project Name: Duke Power - Belows Creek Landfill | Test Date(s): 1/2 -1/4/03
Client Name: Duke Energy Corp.
Client Address: 526 South Church Street, Chartlotte, NC 28202

Boring #: BC-11 | Sample #: 1 | Sample Date: NA
Location: Scrubber Waste Landfill | Offset: | Depth (ft): 0.0 -10.0
Sample Description: Tan-Brown Silty Clayey SAND

Maximum Dry Density 108.4 PCF. **Optimum Moisture Content 17.6 %**

ASTM D558 ☐ ASTM D 698 ☒ ASTM D1557 ☐ AASHTO T99 ☐ AASHTO T180 ☐
Method A ☒ Method B ☐ Method C ☐ Method D (1978) ☐ AASHTO Method D ☐



Soil Properties	
Natural Moisture Content	27.6%
Liquid Limit:	47
Plastic Limit:	26
Plastic Index:	21
Specific Gravity:	2.716

% Passing

Oversize Fraction
Bulk Sp. Gravity
% Moisture
Oversize Fraction

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐
Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐
Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

References: ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of
ASTM D 422: Particle Size Analysis of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Technical Responsibility: Mal Krajan — Quality System Coordinator

S&ME

Specific Gravity of Soils

ASTM D 854

Project #:	1264-02-576	Report Date:	1/8/03
Project Name:	Duke Power - Belows Creek Landfill	Test Date(s)	1/2 1/8/03
Client Name:	Duke Energy Corp.		
Client Address:	526 South Church Street, Chartlotte, NC 28202		

Boring No.	BC-11	Sample No.	1	Sample Date:	NA
Location:	Scrubber Waste Landfill	Offset:		Depth (ft):	0.0 -10.0

Sample Description: Tan-Brown Silty Clayey SAND

Percent of Soil Passing the #4 Sieve: 1 Material Excluded: Plus # 4 Material (%)

LL = PL = PI =

	Pychnometer #	**104**	**Balance ID#:**	**01001** Radability:	**.01 gram**
V_p	Pychnometer Volume (V_p)	**499.58 ml.**		Calibration Date:	**9/17/02**
PM	Pychnometer Mass	**182.12 g.**	**Balance Verification**		
M_p	Ave. Pychnometer Mass (Mp)	**182.12 g.**		Mass	**500 gram**
[PM-M_p]	Verify Pychnometer Mass	**g.**		Mass Determination	**500.00**

If [PM-M_p] is greater than .06 grams recalibrate the dry mass of the pychnometer

Method A: Moist Specimens ☒ Method B: Oven-dried Specimens ☐

Method A: Moist Specimens

	Initial Moisture Content	Tare #:	11
A	Tare Weight		9.43
B	Wet Wt + Tare Wt		65.03
C	Dry Wt. + Tare Wt.		52.99
D	Water Weight	B-C	12.04
E	Dry Weight	C-A	43.56
	Moisture Content	100*D/E	**27.6%**

Target Dry Mass (see Table 1 ASTM D854)	Low Limit	High Limit
Target Wet Mass	**114.88**	**140.40**

Note: Deviation

Wet Mass of test specimen _____ grams

Method B: Oven-dried Specimens

Initial Dry Mass of test specimen _____ grams

Note: Deviation

$M_{psw;t}$ Mass of the Pychnometer, soil, and water **705.83** grams

Mass of Dry Soil (grams)			
		Tare #	E
A	Tare Weight		171.11
C	Dry Wt. + Tare Wt.		210.75
M_s	Dry Weight	C-A	**39.64**

T_t	Test Temperature T_t	**18.9** °C
K	Temperature Coefficient at T_t	**1.00022**
K	Temperature Coefficient at 23°C	**0.99933**
$p_{w;t}$	Density of Water at T_t	**0.99843** g./ml.
	See Table 2 ASTM D 854	

$M_{pw;t}$	Mass of the Pychnometer and water at T_t	$M_{pw;t} = M_p + (V_p \times p_{w;t})$	**680.92** grams
G_t	Specific Gravity of tSoil Solids at the T_t	$G_t = M_s / (M_{pw;t} - (M_{psw;t} - M_s))$	**2.692**
G	Specific Gravity of Soil Solids at the 20°C	$G = K \times G_t$	**2.692**

Soils containing plus #4 material tested per ASTM C 127:

Note: Deviation

R % of Soil retained on the #4 sieve _____

P % of Soil passing the #4 sieve **100.0%**

G_{+4} Apparent Specific Gravity of plus #4 material at the 23°C per ASTM C127 _____

Apparent Specific Gravity of plus #4 material corrected to 20°C _____

G_{total} The Average total sample Specific Gravity

$$G_{total} = \frac{1}{\frac{R}{100-G_{+4}} + \frac{P}{100-G}} = \textbf{2.692}$$

References: ASTM D854 Specific Gravity of Soil Solids by Water Pychnometer
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM C 127: Specific Gravity and Absorption of Coarse Aggregates

Technician Name / Certification #: Tom Savanapridi

Technical Responsibility / Position: Mal Krajan Laboratory Supervisor

Particle Size Analysis of Soils

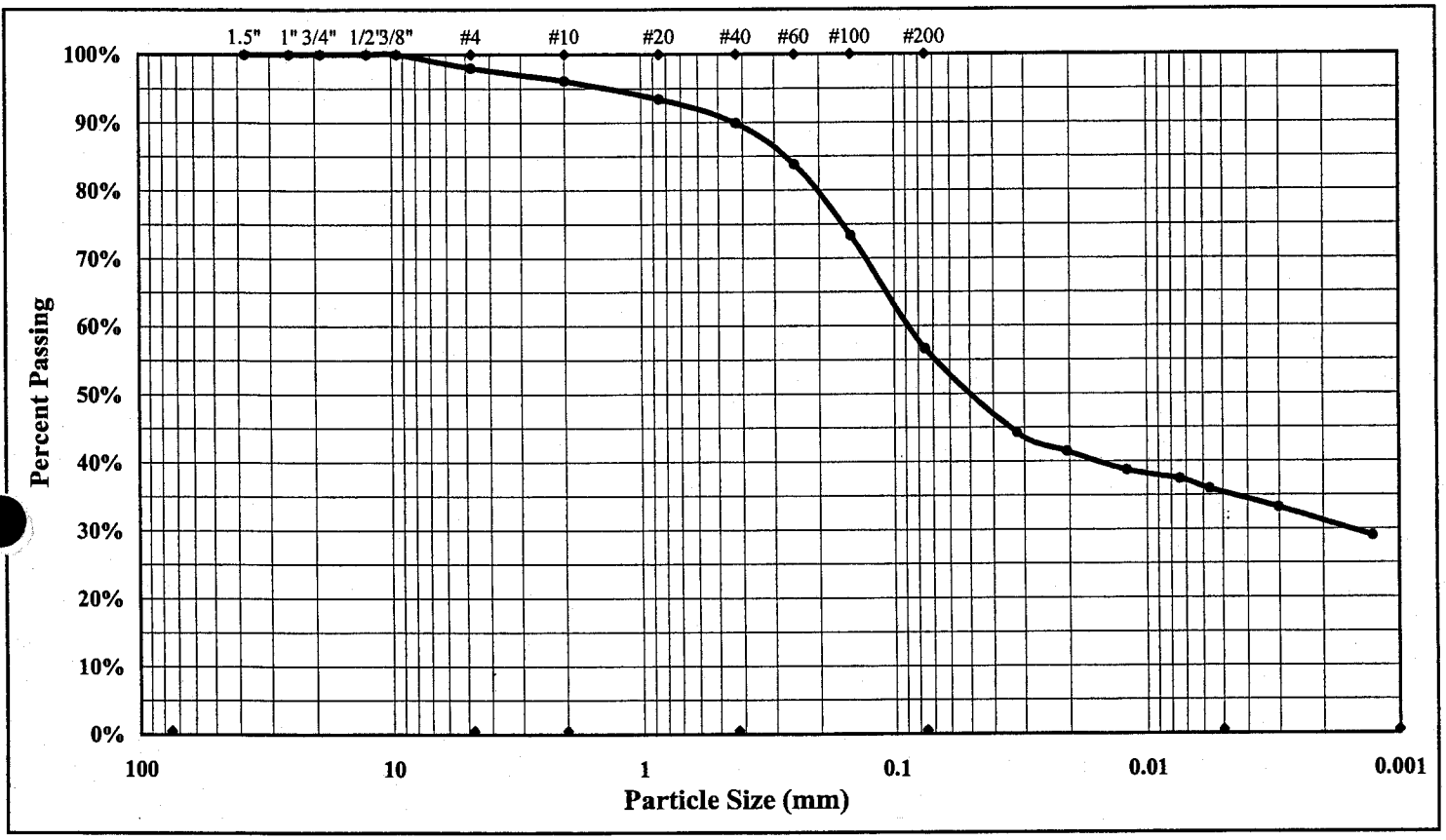
ASTM D 422

S&ME

S&ME Project #: **1264-02-576**
Project Name: **Duke Power - Belews Co. Landfill**
Client Name: Duke Energy Corp.
Client Address: 526 S. Church St.

Report Date: January 9, 2003
Test Date(s): 37623

Boring #:	BC-11	Sample #:		Sample Date:	not reported
Location:	Scrubber Waste	Offset:		Depth (ft):	0-10
Sample Description:	Red Silty Clayey Sand with a trace of Gravel				



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Moisture Content	19.4%	Gravel	2.0%	Liquid Limit	47
Silt & Clay (% Passing #200)	56.6%	Sand	41.4%	Plastic Limit	26
Maximum Particle Size	#4	Silt		Plastic Index	21
Specific Gravity	2.716	Clay		Colloids	29.0%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

ASTM D 422: Particle Size Analysis of Soils Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter
Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min.

References: ASTM D 854: Specific Gravity of Soils
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility / Position: Mal Krajan — Laboratory Supervisor

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

Project #: 1264-02-576 Report Date: January 7, 2002

Project Name: Duke Power - Belews Co. Landfill Test Date(s): January 2, 2002

Client Name: Duke Energy Corp.

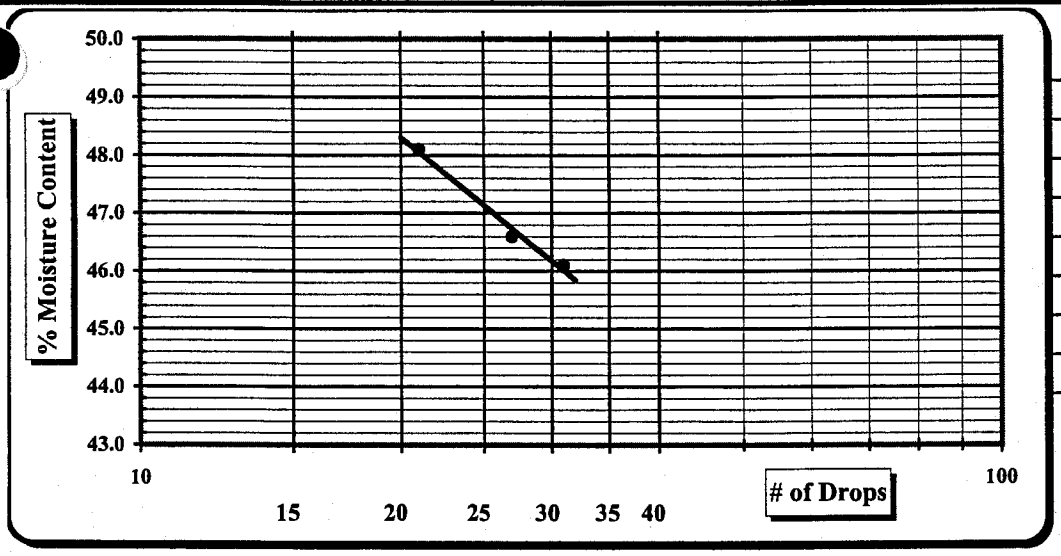
Client Address: 526 S. Church St.

Boring #: BC-11 Sample #: Sample Date: not reported

Location: Scrubber Waste Landfill Offset: Depth (ft): 0-10

Sample Description: Red Silty Clayey Sand with a trace of Gravel

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	14	M-10	A-6				AB	8AM	
A	Tare Weight	7.92	8.16	8.15				6.04	6.22	
B	Wet Soil Weight + A	22.00	18.44	18.71				12.39	15.48	
C	Dry Soil Weight + A	17.56	15.17	15.28				11.10	13.53	
D	Water Weight (B-C)	4.44	3.27	3.43				1.29	1.95	
E	Dry Soil Weight (C-A)	9.64	7.01	7.13				5.06	7.31	
F	% Moisture Content (D/E)*100	46.1	46.6	48.1				25.5	26.7	
N	# OF DROPS	31	27	21						
LL	LL = F * FACTOR									
Ave.	Average								26.1	



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation ☐	Dry Preparation ☐	Air Dried ☒	NP, Non-Plastic	☐
Liquid limit Test:	Multipoint Method ☒	One-point Method ☐		Liquid Limit	47
Classification:	ASTM D 2487 ☒	AASHTO M 145 ☐		Plastic Limit	26
Liquid limit Test:	ASTM D 4318 ☒	AASHTO T 89 ☐		Plastic Index	21
Plastic limit Test:	ASTM D 4318 ☒	AASHTO T 90 ☐		Group Symbol	CL

Technician Name / Certification #: Tom Savanpridi

Technical Responsibility / Position: Mal Krajan Laboratory Supervisor

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method "C")

Project #: 1264-02-576 | Test Date(s): 01/02/03 - 01/08/03

Project Name: Duke Power - Belews County Landfill | Report Date: 01/09/03

Client Name: Duke Energy Corp.

Client Address: 526 South Church Street

Boring #: BC-11 | Sample #: | Depth/Elevation: 0-10' | Sample Date: not reported

Location: Scrubber Waste | Offset: | Sample Description: Red Silty Clayey Sand with a trace of Gravel

Liquid Limit: 47 | Specific Gravity: 2.716 | Sample Type: Lab-compacted | Sampled By: Sam Watts

Plastic Limit: 26 | Plasticity Index: 21 | Percent Passing #200: 56.6 | Maximum Particle Size:

Initial Sample Conditions				Final Sample Conditions			
Length (cm):	7.40	Wet Density (PCF):	124.2	Length (cm):	7.45	Wet Density (PCF):	126.9
Diameter (cm):	7.33	Dry Density (PCF):	103.1	Diameter (cm):	7.38	Dry Density (PCF):	101.0
Area (cm^2)	42.20	Percent Saturation:	86.3	Area (cm^2)	42.77	Percent Saturation:	100.0
Volume (cm^3)	312.28			Volume (cm^3)	318.61	B-value:	0.95
Wet weight (grams)	621.2	Void Ratio:	0.645	Wet weight (grams)	648.0	Void Ratio:	0.679
Dry Weight (grams)	515.5	Porosity:	0.392	Dry Weight (grams)	515.5	Porosity:	0.404
Percent Moisture:	20.5			Percent Moisture:	25.7		
Test Parameters:	Effective Consolidation Stress (psi):		2.0	Permeant Liquid Used:		Deaired Demineralized water	
Burette Area (cm^2):	0.196	Cell Pressure (psi):	92.0	Back Pressure (psi):	90.0	Pore Pressure (psi)	90.0

Time (24-hr)			Temperature (°C)				Measurements						Ratio	Grad-ient	K-Value (cm/sec)	
Start	End	Time (sec)	Initial	Final	Ave.	Factor	$h_{out}1$	$h_{in}1$	$h_{out}2$	$h_{in}2$	h1	h2			Uncorrected K-Value	Corrected K-Value
9:34	10:27	3180	21.4	21.4	21.4	0.9669	9.16	2.63	9.05	2.74	33.3	32.2	1.00	4.32	1.80E-07	1.74E-07
10:27	11:41	4440	21.4	21.4	21.4	0.9669	9.05	2.74	8.92	2.89	32.2	30.8	0.87	4.13	1.71E-07	1.65E-07
11:41	12:59	4680	21.4	21.3	21.4	0.9669	8.92	2.89	8.79	3.04	30.8	29.3	0.87	3.93	1.82E-07	1.76E-07
12:59	14:08	4140	21.3	21.3	21.3	0.9669	8.79	3.04	8.68	3.16	29.3	28.2	0.92	3.79	1.58E-07	1.53E-07
												Averages:	*0.92*	*4.04*	*1.73E-07*	*1.67E-07*

Notes:

Sample was compacted to 95.3% @ 2.7% wet of optimum moisture content.

References:

ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

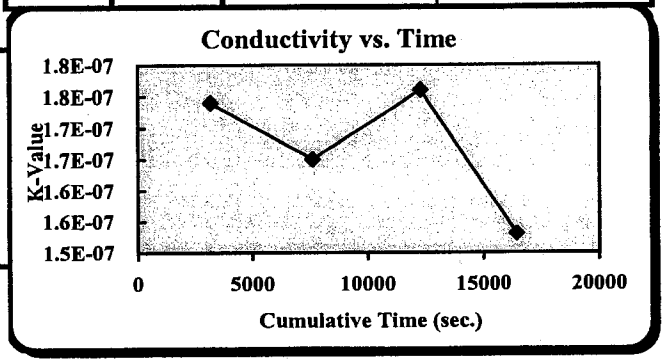
ASTM D2216: Laboratory Determination of Water Content of Soils

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soil

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D 854: Specific Gravity of Soils

ASTM D 422: Particle Size Analysis of Soils



Technician / Certification #: Mal Krajan | Certification #:

Technical Responsibility: Mal Krajan | Position: Laboratory Manager

S&ME Moisture - Density Relationship

Test Date(s): 1/2 -1/4/03

S&ME Project #:	**1264-02-576**	Report Date:	January 5, 2003
Project Name:	**Duke Power - Belows Creek Landfill**		
Client Name:	Duke Energy Corp.		
Client Address:	526 South Church Street, Chartlotte, NC 28202		
Boring #: BC-12	Sample #: 1	Sample Date:	NA
Location: Scrubber Waste Landfill	Offset:	Depth (ft):	5.0 - 10.0
Sample Description:	Brown Fine Sandy Clayey SILT (ML)		

Liquid Limit:	36	Specific Gravity:	2.668
Plastic Limit:	29	Plastic Index:	6

Natural Moisture Content (Total Sample): 14.5%

Moisture Content of the Oversize Fraction:

NOTES:

MDD: 105.0 **Opt. MC %: 18.1**

Sieve Size	% Passing

Water Content

Water Content requires GP 2 Balance (0.1 gram Readability).

ASTM D2216 ☒ AASHTO T265 ☐ ASTM D4959 ☐ ASTM D4643 ☐

	Sample #:	1	2		4		
	Water Added:	150	100	50			
	Tare #:	a	b	c	d		
A. Tare Weight	A.						
B. Wet Wt + Tare Wt	B.	500	500	500	500		
C. Dry Wt. + Tare Wt.	C.	415.5	421.2	429.6	450		
D. Water Weight	B-C	84.5	78.8	70.4	50		
E. Dry Weight	C-A	415.5	421.2	429.6	450		
F. Moisture Content	100*D/E	**20.3%**	**18.7%**	**16.4%**	**11.1%**		

Compaction Data

The Compaction Test requires a GP 5 Balance for ASTM (1 gram or .0022 Lb. readability).

G. Wt of Soil + Mold	G.	13.270	13.308	13.208	12.892		
H. Wt. of Mold	H.	9.175	9.175	9.175	9.175		
I. Wt. of Soil (g. or lbs.)	G-H	4.095	4.133	4.033	3.717		
J. Wt of Soil (Lbs.)	I/453.6 or I	4.095	4.133	4.033	3.717		
K. Mold Volume Factor	K.	30.03	30.03	30.03	30.03		
L. Wet Density	J*K	123.0	124.1	121.1	111.6		
M. Dry Density	L/(1+F)	**102.2**	**104.6**	**104.1**	**100.5**		

ASTM D558 ☐ ASTM D 698 ☒ ASTM D1557 ☐ AASHTO T99 ☐ AASHTO T180 ☐

Method A ☒ Method B ☐ Method C ☐ Method D (ASTM 1978) ☐ AASHTO Method D ☐

Moisture-Density Relation of: Fine Fraction ☒ Corrected for Coarse Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐

Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

Soil Plasticity:	ASTM D 4318 ☒	AASHTO T 89 ☐		AASHTO T 90 ☐
Sieve Analysis / Particle Size Analysis:	ASTM C136 ☐	AASHTO T 27 ☐	ASTM D 422 ☒	AASHTO T 88 ☐
Specific Gravity of Soil:		ASTM D 854 ☒		AASHTO T 100 ☐
Bulk Gravity of Oversize Fraction:		ASTM C 127 ☐		AASHTO T 85 ☐
Soil Classification:	ASTM D 2487 ☒	ASTM D 2488 ☐		AASHTO M 145 ☐

Technician Name / Certification #: Chi Lam

Technical Responsibility: Mal Krajan Quality System Coordinator

Moisture - Density Report

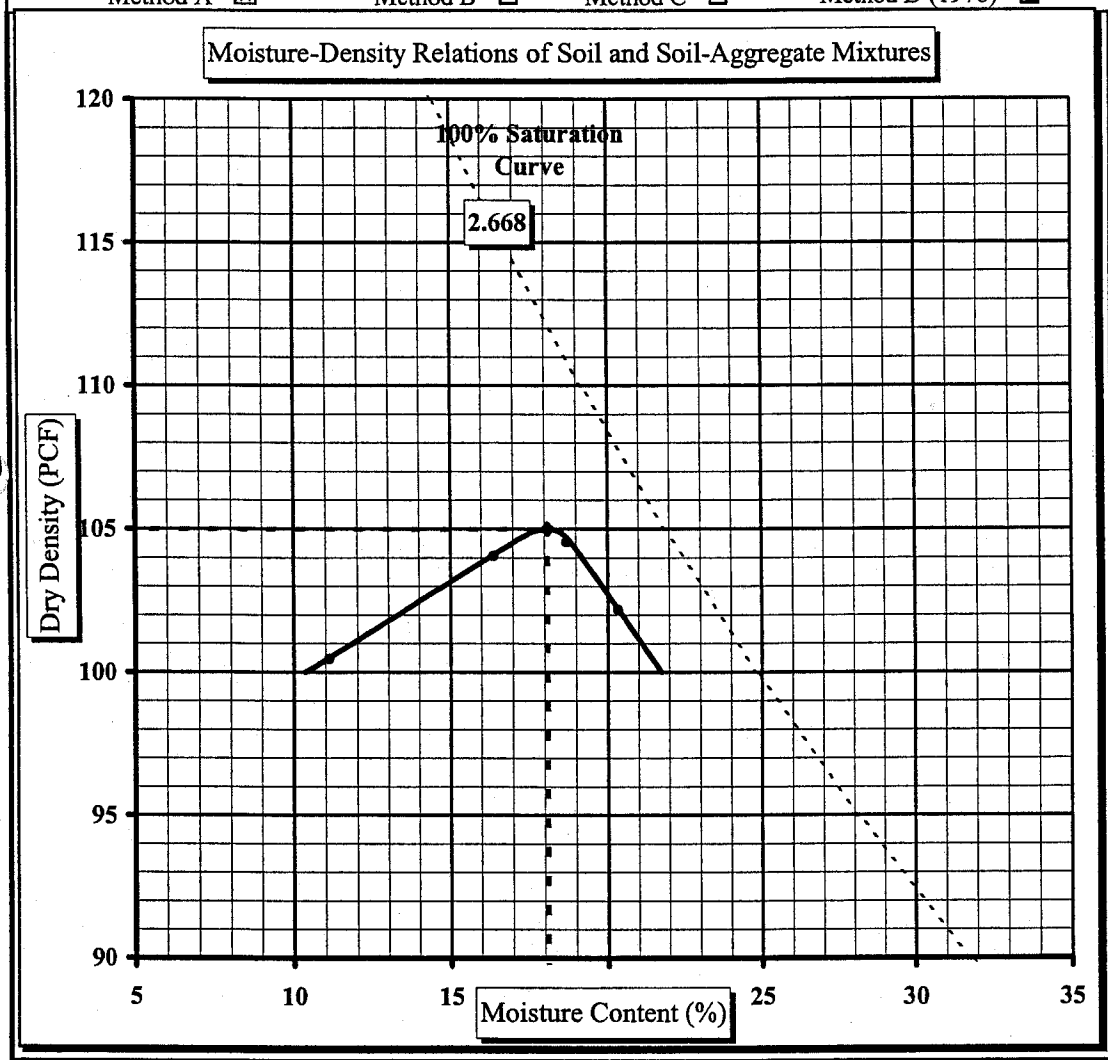
S&ME

S&ME Project #: 1264-02-576 | Report Date: January 5, 2003
Project Name: Duke Power - Belows Creek Landfill | Test Date(s): 1/2 -1/4/03
Client Name: Duke Energy Corp.
Client Address: 526 South Church Street, Chartlotte, NC 28202

Boring #: BC-12 | Sample #: 1 | Sample Date: NA
Location: Scrubber Waste Landfill | Offset: | Depth (ft): 5.0 - 10.0
Sample Description: Brown Fine Sandy Clayey SILT (ML)

Maximum Dry Density 105.0 PCF. **Optimum Moisture Content** 18.1 %

ASTM D558 ☐ ASTM D 698 ☒ ASTM D1557 ☐ AASHTO T99 ☐ AASHTO T180 ☐
Method A ☒ Method B ☐ Method C ☐ Method D (1978) ☐ AASHTO Method D ☐



Soil Properties	
Natural Moisture Content	14.5%
Liquid Limit:	36
Plastic Limit:	29
Plastic Index:	6
Specific Gravity:	2.668

% Passing

Oversize Fraction
Bulk Sp. Gravity
% Moisture
Oversize Fraction

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐
Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐
Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

References: ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of
ASTM D 422: Particle Size Analysis of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Technical Responsibility: Mal Krajan — Quality System Coordinator

S&ME

Specific Gravity of Soils

ASTM D 854

Project #:	1264-02-576	Report Date:	1/8/03
Project Name:	Duke Power - Belows Creek Landfill	Test Date(s)	1/2 1/8/03
Client Name:	Duke Energy Corp.		
Client Address:	526 South Church Street, Chartlotte, NC 28202		

Boring No.	BC-12	Sample No.	1	Sample Date:	NA
Location:	Scrubber Waste Landfill	Offset:		Depth (ft):	5.0 - 10.0

Sample Description: Brown Fine Sandy Clayey SILT (ML)

Percent of Soil Passing the #4 Sieve: Material Excluded: Plus # 4 Material (%)

LL = PL = PI =

	Pychnometer #	**104**	**Balance ID#:**	**01001** Radability:	**.01 gram**
V_p	Pychnometer Volume (V_p)	**499.58 ml.**		Calibration Date:	**9/17/02**
PM	Pychnometer Mass	**181.98 g.**	**Balance Verification**		
M_p	Ave. Pychnometer Mass (Mp)	**181.98 g.**		Mass	**500 gram**
[PM-M_p]	Verify Pychnometer Mass	**g.**		Mass Determination	**500.00**

If [PM-M_p] is greater than .06 grams recalibrate the dry mass of the pychnometer

Method A: Moist Specimens ☒ Method B: Oven-dried Specimens ☐

Method A: Moist Specimens

	Initial Moisture Content	Tare #:	
A	Tare Weight		
B	Wet Wt + Tare Wt		
C	Dry Wt. + Tare Wt.		
D	Water Weight	B-C	
E	Dry Weight	C-A	
	Moisture Content	100*D/E	

Target Dry Mass (see Table 1 ASTM D854)	Low Limit	High Limit
	90.00	110.00
Target Wet Mass		

Note: Deviation

Wet Mass of test specimen _____ grams

Method B: Oven-dried Specimens

Initial Dry Mass of test specimen _____ grams

Note: Deviation

$M_{psw;t}$ Mass of the Pychnometer, soil, and water **711.65** grams

Mass of Dry Soil (grams)				T_t	Test Temperature T_t	**20.3** °C
		Tare #	79	K	Temperature Coefficient at T_t	**0.99994**
A	Tare Weight		177.04	K	Temperature Coefficient at 23°C	**0.99933**
C	Dry Wt. + Tare Wt.		226.65	$p_{w;t}$	Density of Water at T_t	**0.99814** g./ml.
M_s	Dry Weight	C-A	**49.61**		See Table 2 ASTM D 854	

$M_{pw;t}$	Mass of the Pychnometer and water at T_t	$M_{pw;t} = M_p + (V_p \times p_{w;t})$	**680.63** grams
G_t	Specific Gravity of tSoil Solids at the T_t	$G_t = M_s / (M_{pw;t} - (M_{psw;t} - M_s))$	**2.669**
G	Specific Gravity of Soil Solids at the 20°C	$G = K \times G_t$	**2.668**

Soils containing plus #4 material tested per ASTM C 127:

Note: Deviation

R % of Soil retained on the #4 sieve _____

P % of Soil passing the #4 sieve **100.0%**

G_{+4} Apparent Specific Gravity of plus #4 material at the 23°C per ASTM C127 _____

Apparent Specific Gravity of plus #4 material corrected to 20°C _____

G_{total} The Average total sample Specific Gravity

$$G_{total} = \frac{1}{\frac{R}{100-G_{+4}} + \frac{P}{100-G}} = \textbf{2.668}$$

References: ASTM D854 Specific Gravity of Soil Solids by Water Pychnometer
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM C 127: Specific Gravity and Absorption of Coarse Aggregates

Technician Name / Certification #: Tom Savanapridi

Technical Responsibility / Position: Mal Krajan Quality System Coordinator

Particle Size Analysis of Soils

ASTM D 422

S&ME

Project #: 1264-02-576 Test Date(s): 1/15/03-1/21/03

Project Name: Duke Power-Belews Creek Landfill Report Date: January 21, 2003

Client Name: Duke Energy Corp.

Client Address: 526 South Chuch Street, Charlotte, NC 28202

Boring #: BC-12 Sample #: Bag -1 Sample Date: NA

Location: Scrubbler Waste Landfill Offset: Depth (ft): 5.0 - 10.0

Sample Description: Brown Fine Sandy Clayey SILT (ML)

% Moisture Content: 14.5% $Cu = D_{60}/D_{10}$: $Cc = (D_{30})^2/(D_{10}xD_{60})$:

Liquid Limit: 35 Plastic Limit: 29 Plastic Index: 6 Specific Gravity: 2.668

Particle Size Analysis / Without Hydrometer Analysis		
	Tare Number	S-7
A	Tare Weight	7.94
B	Total Sample Dry Wt. + Tare Wt.	70.92
C	Total Sample Dry Weight (B-A)	62.98
D	Total Sample Wt. After #200 Wash	25.58
E	Percent Passing #200 (1-D/C)x100	59.4%

Moisture Content		Natural
	Tare #	S-7
A	Tare Weight	7.94
B	Wet Weight + Tare Wt.	80.08
C	Dry Weight + Tare Wt.	70.92
D	Water Wt. (B-C)	9.16
E	Dry Wt.(C-A)	62.98
	Moisture Content (100 x D/E) (%)	14.5%

Sieve Size (mm)	Sieve Size	Retained Weight	Percent Retained	**Percent Passing Total Sample**
37.50	1.5"	0.0	0.0%	**100.0%**
25.00	1.0"	0.00	0.0%	**100.0%**
19.00	3/4"	0.00	0.0%	**100.0%**
12.50	1/2"	0.00	0.0%	**100.0%**
9.50	3/8"	0.00	0.0%	**100.0%**
4.75	#4	0.25	0.4%	**99.6%**
2.00	#10	1.61	2.6%	**97.4%**
0.85	#20	4.05	6.4%	**93.6%**
0.43	#40	7.06	11.2%	**88.8%**
0.25	#60	10.71	17.0%	**83.0%**
0.15	#100	16.08	25.5%	**74.5%**
0.075	#200	24.90	39.5%	**60.5%**

Notes:	Maximum Particle Size:	**3/8"**	Gravel	< 75 mm and > 4.75 mm (#4)	**0.4%**
	D10		Coarse Sand	< 4.75 mm and >2.00 mm (#10)	**2.2%**
	D30		Medium Sand	< 2.00 mm and > 0.425 mm (#40)	**8.7%**
	D/60		Fine Sand	< 0.425 mm and > 0.075 mm (#200)	**28.3%**
			% Silt and Clay	< 0.075 mm	**60.5%**
			Description of Sand & Gravel	Rounded ☐	Angular ☐
			Hard & Durable ☐	Soft ☐	Weathered & Friable ☒

ASTM D 422: Particle Size Analysis of Soils *Hydrometer portion of test method not utilized.*

ASTM D 421: Dry Preparation of Soil Samples

ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D 854: Specific Gravity of Soils

Technician / Certification #: Tom S.

Technical Responsibility: Mal Krajan Position: Quality System Coordinator

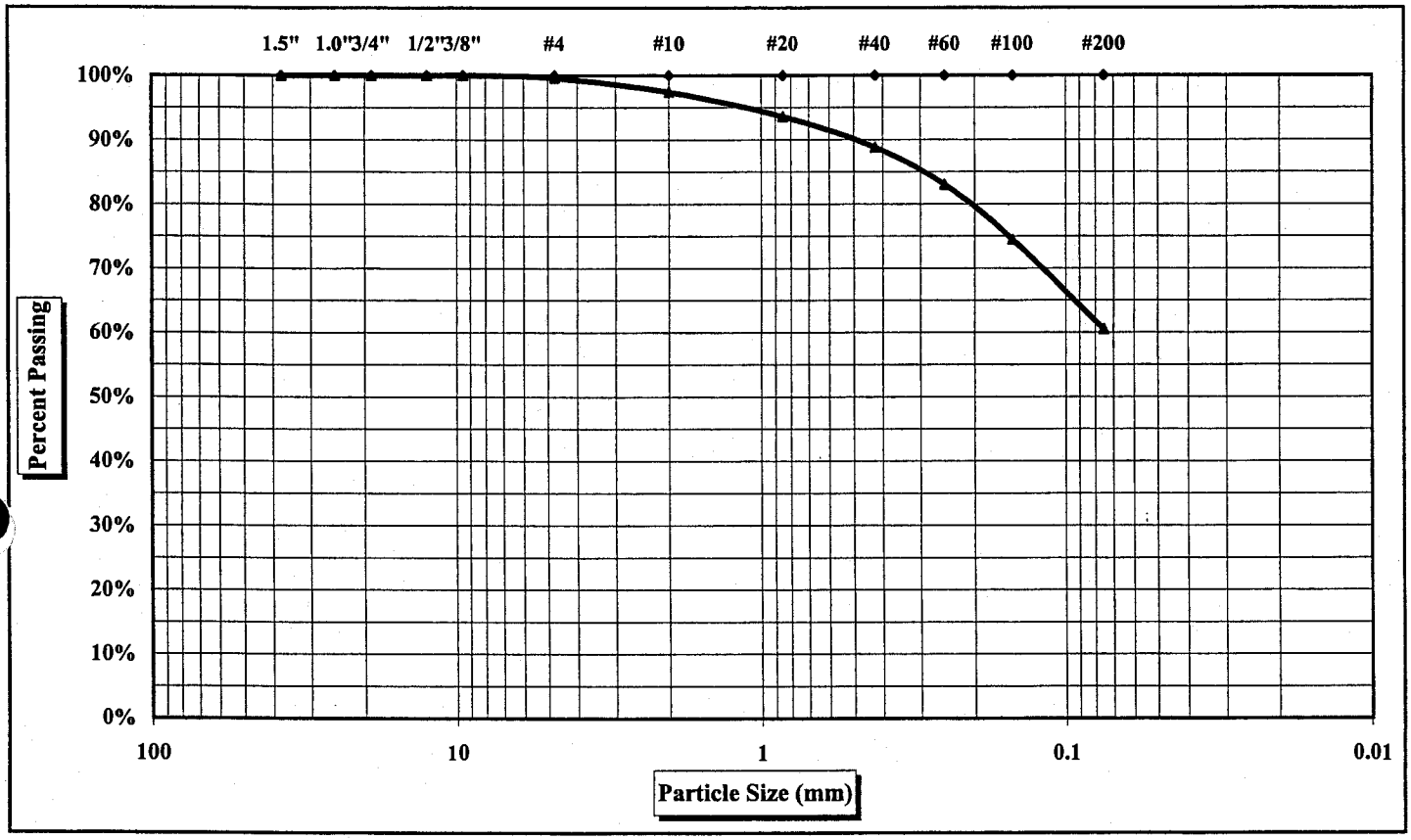
Particle Size Analysis of Soils

ASTM D 422

S&ME

S&ME Project #:	1264-02-576	Report Date:	January 21, 2003
Project Name:	Duke Power-Belews Creek Landfill	Test Date(s):	1/15/03-1/21/03
Client Name:	Duke Energy Corp.		
Client Address:	526 South Chuch Street, Charlotte, NC 28202		

Boring #:	BC-12	Sample #:	Bag -1	Sample Date:	NA
Location:	Scrubbler Waste	Offset:		Depth (ft):	5.0 - 10.0
Sample Description:	Brown Fine Sandy Clayey SILT (ML)				



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Moisture Content	14.5%	Gravel	0%	Liquid Limit	35
Silt & Clay (% Passing #200)	60.5%	Coarse Sand	2%	Plastic Limit	29
Maximum Particle Size	3/8"	Medium Sand	9%	Plastic Index	6
Specific Gravity	2.668	Fine Sand	28%		

Description of Sand & Gravel Particles:

Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☒

References: ASTM D 422: Particle Size Analysis of Soils
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 854: Specific Gravity of Soils

Technical Responsibility: Mal Krajan — Quality System Coordinator

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

Project #: 1264-02-576 Report Date: January 21, 2003

Project Name: Duke Power-Belews Creek Landfill Test Date(s): 1/15/03-1/21/03

Client Name: Duke Energy Corp.

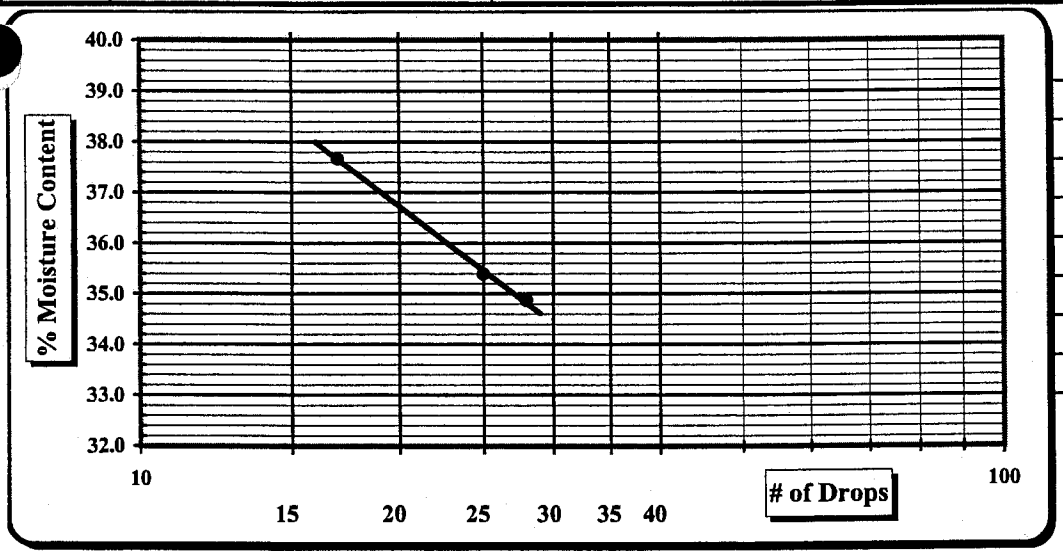
Client Address: 526 South Chuch Street, Charlotte, NC 28202

Boring #: BC-12 Sample #: Bag -1 Sample Date: NA

Location: Scrubbler Waste Offset: Depth (ft): 5.0 - 10.0

Sample Description: Brown Fine Sandy Clayey SILT (ML)

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	6	53	41				15	32	
A	Tare Weight	8.36	8.20	8.22				6.47	6.16	
B	Wet Soil Weight + A	26.78	28.82	26.09				15.36	15.84	
C	Dry Soil Weight + A	21.74	23.43	21.47				13.38	13.64	
D	Water Weight (B-C)	5.04	5.39	4.62				1.98	2.20	
E	Dry Soil Weight (C-A)	13.38	15.23	13.25				6.91	7.48	
F	% Moisture Content (D/E)*100	37.7	35.4	34.9				28.7	29.4	
N	# OF DROPS	17	25	28						
LL	LL = F * FACTOR									
Ave.	Average							29.0		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation	☐	Dry Preparation	☐	Air Dried	☒	NP, Non-Plastic ☐
Liquid limit Test:	Multipoint Method	☒	One-point Method	☐			Liquid Limit 35
Classification:	ASTM D 2487	☒	AASHTO M 145	☐			Plastic Limit 29
Liquid limit Test:	ASTM D 4318	☒	AASHTO T 89	☐			Plastic Index 6
astic limit Test:	ASTM D 4318	☒	AASHTO T 90	☐			Group Symbol ML

Technician Name / Certification #: Tom Savanpridi

Technical Responsibility / Position: Mal Krajan Quality System Coordinator

S&ME

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method "C")

Project #: 1264-02-576 — Test Date(s): 1/15/03 - 01/25/03

Project Name: Duke Power - Belews Creek Landfill — Report Date: 01/26/03

Client Name: Duke Energy Corp.

Client Address:

Boring #: BC-12 Sample #: Bag-1 Depth/Elevation: 5-10' Sample Date: NA

Location: Scrubber Waste Offset: Sample Description: Brown Fine Sandy Clayey SILT (ML)

Liquid Limit: 35 Specific Gravity: 2.668 Sample Type: Lab-compacted Sampled By: Sam Watts

Plastic Limit: 29 Plastic Index: 6 Percent Passing #200: 60.5 Maximum Particle Size:

Initial Sample Conditions				Final Sample Conditions			
Length (cm):	7.559	Wet Density (PCF):	120.5	Length (cm):	7.559	Wet Density (PCF):	125.6
Diameter (cm):	7.315	Dry Density (PCF):	99.6	Diameter (cm):	7.315	Dry Density (PCF):	99.6
Area (cm^2)	42.03	Percent Saturation:	83.4	Area (cm^2)	42.03	Percent Saturation:	100.0
Volume (cm^3)	317.70			Volume (cm^3)	317.70	b value:	0.98
Wet weight (grams)	613.3	Void Ratio:	0.672	Wet weight (grams)	639.2	Void Ratio:	0.672
Dry Weight (grams)	506.9	Porosity:	0.402	Dry Weight (grams)	506.9	Porosity:	0.402
Percent Moisture:	21.0			Percent Moisture:	26.1		
Test Parameters:	Effective Consolidation Stress (psi):		3.0	Permeant Liquid Used:		Deaired Demineralized water	
Burette Area (cm^2):	0.196	Cell Pressure (psi):	83.0	Back Pressure (psi):	80.0	Pore Pressure (psi)	80.0

Time (24-hr)			Temperature (°C)				Measurements						Ratio	Grad-ient	K-Value (cm/sec)	
Start	End	Time (sec)	Initial	Final	Ave.	Factor	$h_{out}1$	$h_{in}1$	$h_{out}2$	$h_{in}2$	h1	h2			Uncorrected K-Value	Corrected K-Value
7:05	7:11	360	25.5	25.5	25.5	0.8774	7.37	3.63	7.15	3.94	19.1	16.4	0.71	2.17	7.46E-06	6.55E-06
7:11	7:19	480	25.5	25.5	25.5	0.8774	7.15	3.94	6.91	4.19	16.4	13.9	0.96	1.84	6.07E-06	5.33E-06
7:19	7:28	540	25.5	25.5	25.5	0.8774	6.91	4.19	6.68	4.42	13.9	11.5	1.00	1.52	6.19E-06	5.43E-06
7:28	7:35	420	25.5	25.5	25.5	0.8774	6.68	4.42	6.53	4.57	11.5	10.0	1.00	1.32	5.87E-06	5.15E-06
													Averages:		***6.40E-06***	***5.61E-06***

Notes:

Sample was compacted to 94.8% @ 2.8% wet of optimum moisture content.

References:

ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

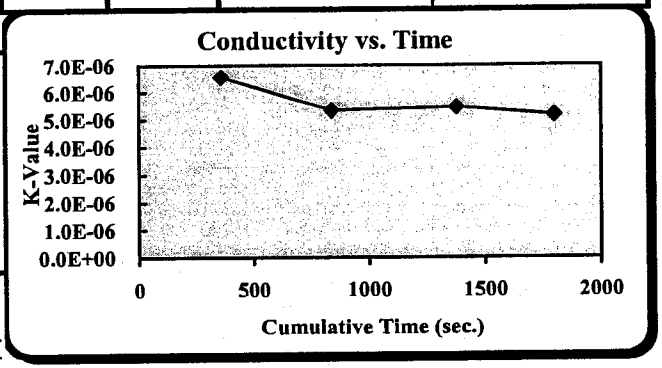
ASTM D2216: Laboratory Determination of Water Content of Soils

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soil

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D 854: Specific Gravity of Soils

ASTM D 422: Particle Size Analysis of Soils



Technician / Certification #: John Dailly — Certification #:

Technical Responsibility: Mal Krajan — Position: Quality System Coordinator

S&ME Moisture - Density Relationship

		Test Date(s):	1/2 -1/4/03
S&ME Project #:	**1264-02-576**	Report Date:	January 5, 2003
Project Name:	**Duke Power - Belows Creek Landfill**		
Client Name:	Duke Energy Corp.		
Client Address:	526 South Church Street, Chartlotte, NC 28202		
Boring #: BC-13	Sample #: Bag-1	Sample Date:	NA
Location: Scrubber Waste Landfill	Offset:	Depth (ft):	0.0 - 10.0
Sample Description:	Tan-Brown Silty Clayey SAND		

Liquid Limit:	38	Specific Gravity:	2.672
Plastic Limit:	28	Plastic Index:	10

Natural Moisture Content (Total Sample): 11.1%

Moisture Content of the Oversize Fraction:

NOTES:

MDD: 98.8 **Opt. MC %: 22.4**

Sieve Size	% Passing

Water Content

Water Content requires GP 2 Balance (0.1 gram Readability).

ASTM D2216 ☒ AASHTO T265 ☐ ASTM D4959 ☐ ASTM D4643 ☐

	Sample #:	1	2		4		
	Water Added:	150	100	50			
	Tare #:	a	b	c	d		
A. Tare Weight	A.						
B. Wet Wt + Tare Wt	B.	500	500	500	500		
C. Dry Wt. + Tare Wt.	C.	400.1	404.8	411.7	432.7		
D. Water Weight	B-C	99.9	95.2	88.3	67.3		
E. Dry Weight	C-A	400.1	404.8	411.7	432.7		
F. Moisture Content	100*D/E	**25.0%**	**23.5%**	**21.4%**	**15.6%**		

Compaction Data

The Compaction Test requires a GP 5 Balance for ASTM (1 gram or .0022 Lb. readability).

G. Wt of Soil + Mold	G.	13.149	13.205	13.156	12.826		
H. Wt. of Mold	H.	9.175	9.175	9.175	9.175		
I. Wt. of Soil (g. or lbs.)	G-H	3.974	4.030	3.981	3.651		
J. Wt of Soil (Lbs.)	I/453.6 or I	3.974	4.030	3.981	3.651		
K. Mold Volume Factor	K.	30.03	30.03	30.03	30.03		
L. Wet Density	J*K	119.3	121.0	119.5	109.6		
M. Dry Density	L/(1+F)	**95.5**	**98.0**	**98.4**	**94.9**		

ASTM D558 ☐ ASTM D 698 ☒ ASTM D1557 ☐ AASHTO T99 ☐ AASHTO T180 ☐

Method A ☒ Method B ☐ Method C ☐ Method D (ASTM 1978) ☐ AASHTO Method D ☐

Moisture-Density Relation of: Fine Fraction ☒ Corrected for Coarse Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐

Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

Soil Plasticity: ASTM D 4318 ☒ AASHTO T 89 ☐ AASHTO T 90 ☐

Sieve Analysis / Particle Size Analysis: ASTM C136 ☐ AASHTO T 27 ☐ ASTM D 422 ☒ AASHTO T 88 ☐

Specific Gravity of Soil: ASTM D 854 ☒ AASHTO T 100 ☐

Bulk Gravity of Oversize Fraction: ASTM C 127 ☐ AASHTO T 85 ☐

Soil Classification: ASTM D 2487 ☒ ASTM D 2488 ☐ AASHTO M 145 ☐

Technician Name / Certification #: Chi Lam

Technical Responsibility: Mal Krajan Quality System Coordinator

Moisture - Density Report

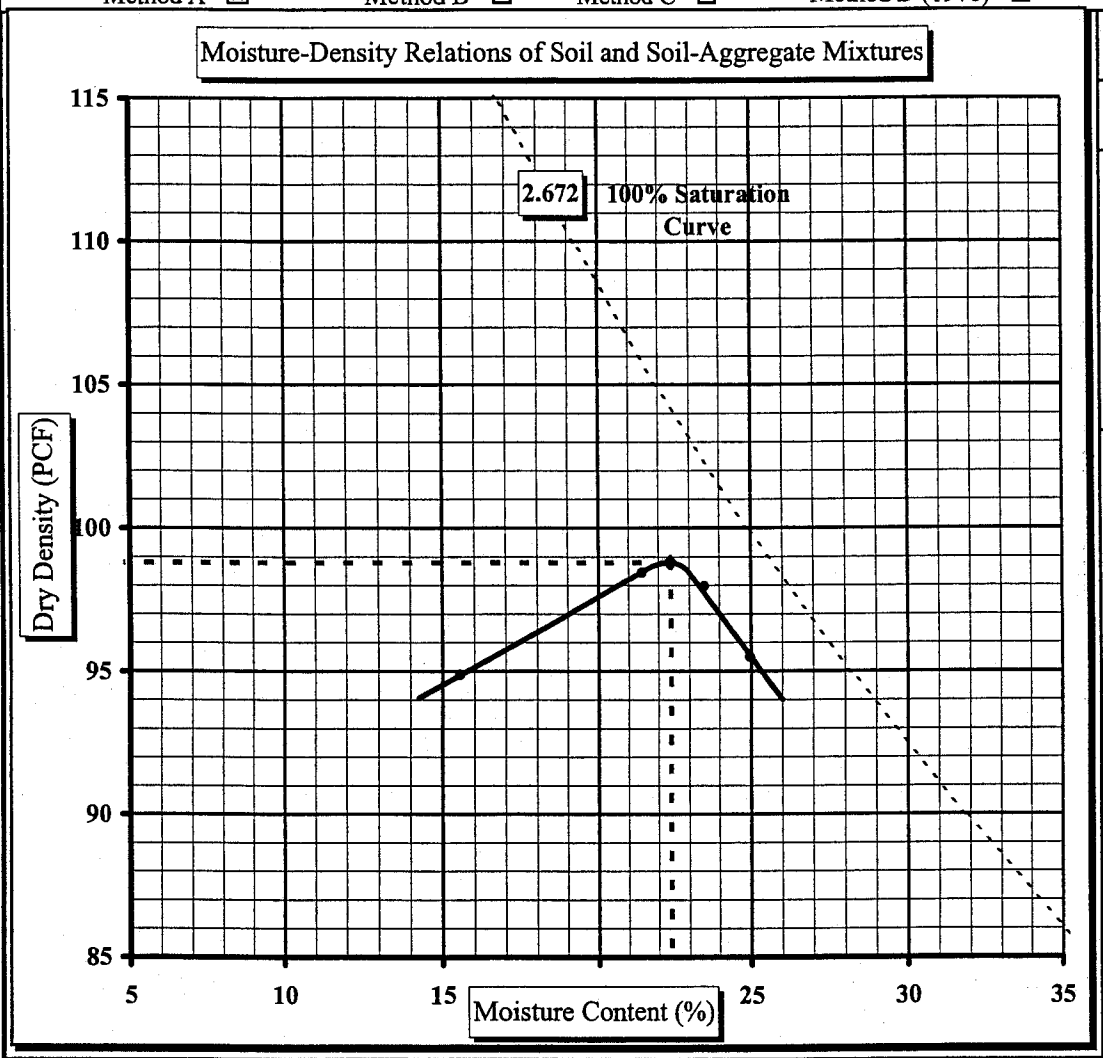
S&ME Project #: 1264-02-576
Project Name: Duke Power - Belows Creek Landfill
Client Name: Duke Energy Corp.
Client Address: 526 South Church Street, Chartlotte, NC 28202

Report Date: January 5, 2003
Test Date(s): 1/2 -1/4/03

Boring #: BC-13 Sample #: Bag-1 Sample Date: NA
Location: Scrubber Waste Landfill Offset: Depth (ft): 0.0 - 10.0
Sample Description: Tan-Brown Silty Clayey SAND

Maximum Dry Density 98.8 **PCF.** **Optimum Moisture Content** 22.4 %

ASTM D558 ☐ ASTM D 698 ☒ ASTM D1557 ☐ AASHTO T99 ☐ AASHTO T180 ☐
Method A ☒ Method B ☐ Method C ☐ Method D (1978) ☐ AASHTO Method D ☐



Soil Properties	
Natural Moisture Content	11.1%
Liquid Limit:	38
Plastic Limit:	28
Plastic Index:	10
Specific Gravity:	2.672

% Passing

Oversize Fraction
Bulk Sp. Gravity
% Moisture
Oversize Fraction

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐
Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐
Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

References: ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of
ASTM D 422: Particle Size Analysis of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Technical Responsibility: Mal Krajan Quality System Coordinator

S&ME

Specific Gravity of Soils

ASTM D 854

Project #: **1264-02-576** Report Date: 1/8/03

Project Name: **Duke Power - Belows Creek Landfill** Test Date(s) 1/2 1/8/03

Client Name: Duke Energy Corp.

Client Address: 526 South Church Street, Chartlotte, NC 28202

Boring No. BC-13 Sample No. Bag-1 Sample Date: NA

Location: Scrubber Waste Landfill Offset: Depth (ft): 0.0 - 10.0

Sample Description: Tan-Brown Silty Clayey SAND

Percent of Soil Passing the #4 Sieve: Material Excluded: Plus # 4 Material (%)

LL = PL = PI =

	Pychnometer #	**108**	**Balance ID#:**	**01001** Radability:	**.01 gram**
V_p	Pychnometer Volume (V_p)	**499.54 ml.**		Calibration Date:	**9/17/02**
PM	Pychnometer Mass	**182.34 g.**	**Balance Verification**		
M_p	Ave. Pychnometer Mass (Mp)	**182.34 g.**		Mass	**500 gram**
[PM-M_p]	Verify Pychnometer Mass	**g.**		Mass Determination	**500.00**

If [PM-M_p] is greater than .06 grams recalibrate the dry mass of the pychnometer

Method A: Moist Specimens ☒ Method B: Oven-dried Specimens ☐

Method A: Moist Specimens

	Initial Moisture Content	Tare #:	S-8
A	Tare Weight		7.91
B	Wet Wt + Tare Wt		101.02
C	Dry Wt. + Tare Wt.		91.74
D	Water Weight	**B-C**	9.28
E	Dry Weight	**C-A**	83.83
	Moisture Content	**100*D/E**	**11.1%**

Target Dry Mass (see Table 1 ASTM D854)	Low Limit	High Limit
Target Wet Mass	**99.96**	**122.18**

Note: Deviation

Wet Mass of test specimen _____ grams

Method B: Oven-dried Specimens

Initial Dry Mass of test specimen _____ grams

Note: Deviation

$M_{psw;t}$ Mass of the Pychnometer, soil, and water **716.23** grams

Mass of Dry Soil (grams)			
		Tare #	64
A	Tare Weight		173.02
C	Dry Wt. + Tare Wt.		229.33
M_s	Dry Weight	**C-A**	**56.31**

T_t	Test Temperature T_t	**19.9** °C
K	Temperature Coefficient at T_t	**1.00002**
K	Temperature Coefficient at 23°C	**0.99933**
$p_{w;t}$	Density of Water at T_t	**0.99823** g./ml.
	See Table 2 ASTM D 854	

$M_{pw;t}$	Mass of the Pychnometer and water at T_t	$M_{pw;t} = M_p + (V_p \times p_{w;t})$	**681.00** grams
G_t	Specific Gravity of tSoil Solids at the T_t	$G_t = M_s / (M_{pw;t} - (M_{psw;t} - M_s))$	**2.672**
G	Specific Gravity of Soil Solids at the 20°C	$G = K \times G_t$	**2.672**

Soils containing plus #4 material tested per ASTM C 127:

Note: Deviation

R % of Soil retained on the #4 sieve _____

P % of Soil passing the #4 sieve **100.0%**

G_{+4} Apparent Specific Gravity of plus #4 material at the 23°C per ASTM C127 _____

Apparent Specific Gravity of plus #4 material corrected to 20°C _____

G_{total} The Average total sample Specific Gravity

$$G_{total} = \frac{1}{\frac{R}{100-G_{+4}} + \frac{P}{100-G}} = \textbf{2.672}$$

References: ASTM D854 Specific Gravity of Soil Solids by Water Pychnometer

ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

ASTM C 127: Specific Gravity and Absorption of Coarse Aggregates

Technician Name / Certification #: Tom Savanapridi

Technical Responsibility / Position: Mal Krajan Quality System Coordinator

Laboratory Report Version 4.0

Particle Size Analysis of Soils

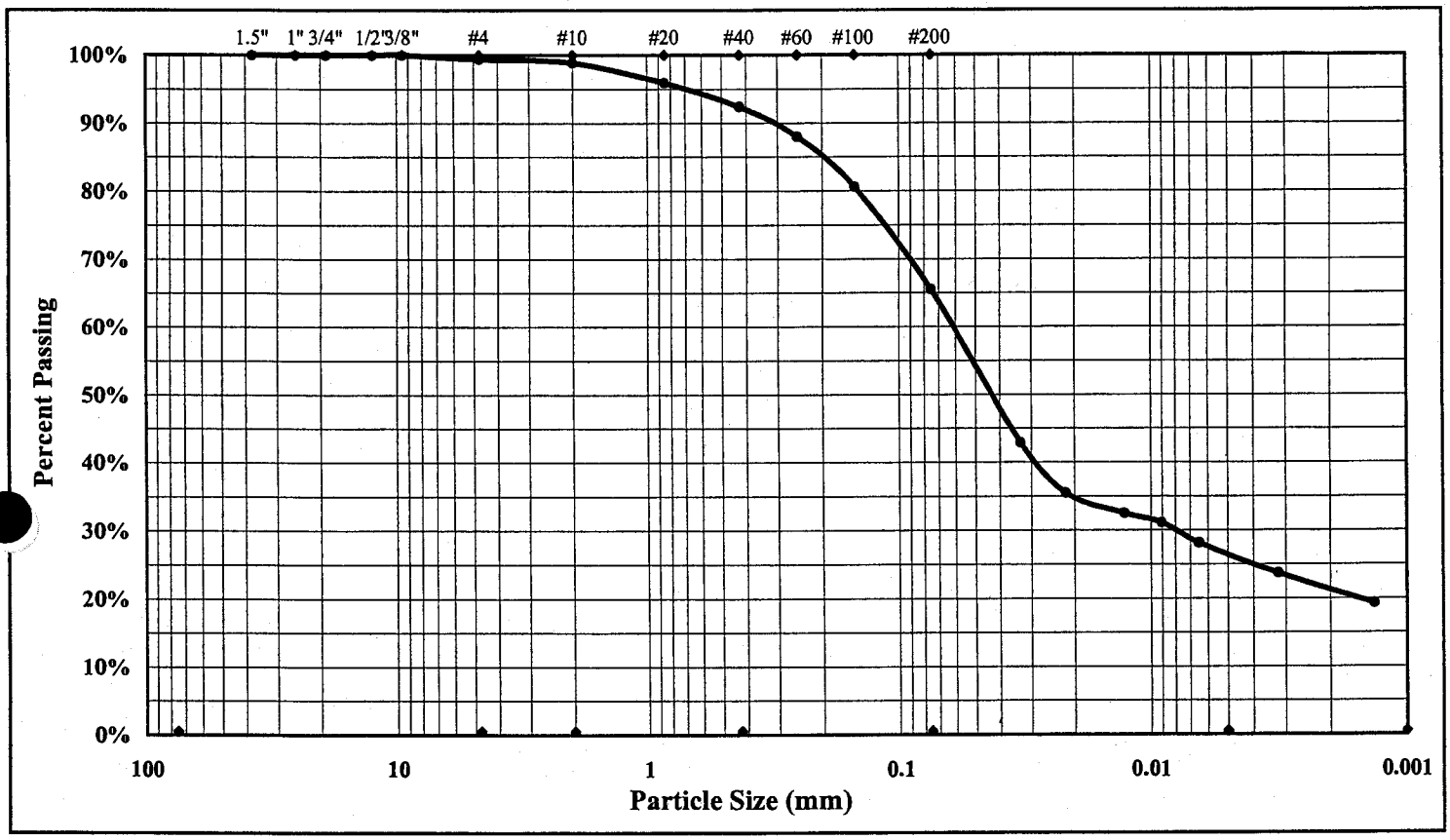
ASTM D 422

S&ME

S&ME Project #: **1264-02-576**
Project Name: **Duke Power - Belews Co. Landfill**
Client Name: Duke Energy Corp.
Client Address: 526 S. Church St.

Report Date: January 9, 2003
Test Date(s): 1/2 - 1/8/03

Boring #:	BC-13	Sample #:	Bag-1	Sample Date:	NA
Location:	Scrubber Waste L.F.	Offset:		Depth (ft):	0.0 - 10.0
Sample Description:	Red Fine Sandy Clayey SILT with a Trace of Gravel (ML)				



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Moisture Content	11.1%	Gravel	0.6%	Liquid Limit	38
Silt & Clay (% Passing #200)	65.5%	Sand	33.9%	Plastic Limit	28
Maximum Particle Size	3/8"	Silt		Plastic Index	10
Specific Gravity	2.672	Clay		Colloids	19.3%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

ASTM D 422: Particle Size Analysis of Soils
Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter
Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min.

References: ASTM D 854: Specific Gravity of Soils
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

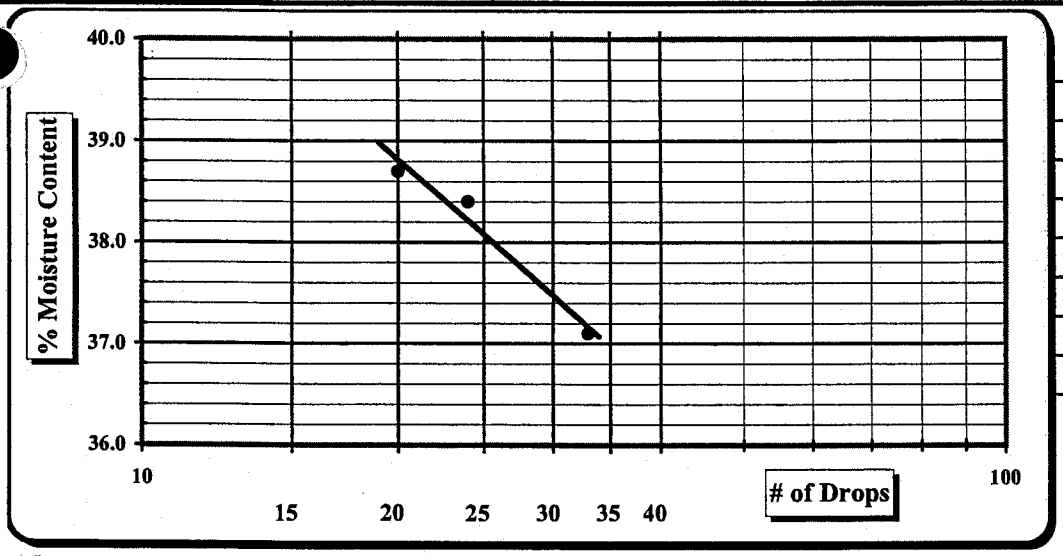
Technical Responsibility / Position: Mal Krajan — Quality System Coordinator

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

Project #:	1264-02-576	Report Date:	January 7, 2002
Project Name:	Duke Power - Belews Co. Landfill	Test Date(s):	1/2 - 1/8/03
Client Name:	Duke Energy Corp.		
Client Address:	526 S. Church St.		
Boring #:	BC-13	Sample #: Bag-1	Sample Date: NA
Location:	Scrubber Waste L.F.	Offset:	Depth (ft): 0.0 - 10.0
Sample Description:	Red Fine Sandy Clayey SILT with a Trace of Gravel (ML)		

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	M-33	104	M-3				416	S9	
A	Tare Weight	8.13	8.08	8.27				6.14	6.28	
B	Wet Soil Weight + A	26.48	24.33	27.80				13.66	14.66	
C	Dry Soil Weight + A	21.36	19.82	22.52				12.03	12.80	
D	Water Weight (B-C)	5.12	4.51	5.28				1.63	1.86	
E	Dry Soil Weight (C-A)	13.23	11.74	14.25				5.89	6.52	
F	% Moisture Content (D/E)*100	38.7	38.4	37.1				27.7	28.5	
N	# OF DROPS	20	24	33						
LL	LL = F * FACTOR									
Ave.	Average							28.1		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation	☐	Dry Preparation	☐	Air Dried	☒	NP, Non-Plastic ☐
Liquid limit Test:	Multipoint Method	☒	One-point Method	☐			Liquid Limit 38
Classification:	ASTM D 2487	☒	AASHTO M 145	☐			Plastic Limit 28
Liquid limit Test:	ASTM D 4318	☒	AASHTO T 89	☐			Plastic Index 10
Plastic limit Test:	ASTM D 4318	☒	AASHTO T 90	☐			Group Symbol ML

Technician Name / Certification #: Tom Savanapridi

Technical Responsibility / Position: Mal Krajan Quality System Coordinator

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method "C")

Project #:	1264-02-576	Test Date(s):	01/02/03 - 01/08/03
Project Name:	Duke Power - Belews County Landfill	Report Date:	01/09/03
Client Name:	Duke Energy Corp.		
Client Address:	526 South Church Street		

Boring #:	BC-13	Sample #:		Depth/Elevation:	0.0 - 10.0	Sample Date:	not reported
Location:	Scrubber Waste	Offset:		Sample Description:	Red Fine Sandy Clayey SILT with a Trace of Gravel (ML)		
Liquid Limit:	38	Specific Gravity:	2.672	Sample Type:	Lab-compacted	Sampled By:	Sam Watts
Plastic Limit:	28	Plasticity Index:	10	Percent Passing #200:	65.5	Maximum Particle Size:	

Initial Sample Conditions				Final Sample Conditions			
Length (cm):	7.48	Wet Density (PCF):	117.9	Length (cm):	7.53	Wet Density (PCF):	119.3
Diameter (cm):	7.33	Dry Density (PCF):	93.6	Diameter (cm):	7.38	Dry Density (PCF):	91.8
Area (cm^2)	42.20	Percent Saturation:	88.8	Area (cm^2)	42.76	Percent Saturation:	98.0
Volume (cm^3)	315.66			Volume (cm^3)	321.99	B-value:	0.96
Wet weight (grams)	596.3	Void Ratio:	0.782	Wet weight (grams)	615.3	Void Ratio:	0.818
Dry Weight (grams)	473.3	Porosity:	0.439	Dry Weight (grams)	473.3	Porosity:	0.450
Percent Moisture:	26.0			Percent Moisture:	30.0		
Test Parameters:	Effective Consolidation Stress (psi):		2.0	Permeant Liquid Used:		Deaired Demineralized water	
Burette Area (cm^2):	0.720	Cell Pressure (psi):	82.0	Back Pressure (psi):	80.0	Pore Pressure (psi)	80.0

Time (24-hr)			Temperature (°C)				Measurements						Ratio	Grad-ient	K-Value (cm/sec)	
Start	End	Time (sec)	Initial	Final	Ave.	Factor	$h_{out}1$	$h_{in}1$	$h_{out}2$	$h_{in}2$	h1	h2			Uncorrected K-Value	Corrected K-Value
9:33	9:46	780	21.4	21.4	21.4	0.9669	43.30	24.35	42.85	24.85	19.0	18.0	0.90	2.39	4.39E-06	4.24E-06
9:46	10:03	1020	21.4	21.4	21.4	0.9669	42.85	24.85	42.20	25.55	18.0	16.7	0.93	2.22	4.66E-06	4.51E-06
10:03	10:25	1320	21.4	21.4	21.4	0.9669	42.20	25.55	41.60	26.25	16.7	15.4	0.86	2.05	3.89E-06	3.76E-06
10:25	10:50	1500	21.4	21.4	21.4	0.9669	41.60	26.25	40.85	27.00	15.4	13.9	1.00	1.85	4.33E-06	4.19E-06
													0.92	*2.13*	*4.32E-06*	*4.18E-06*

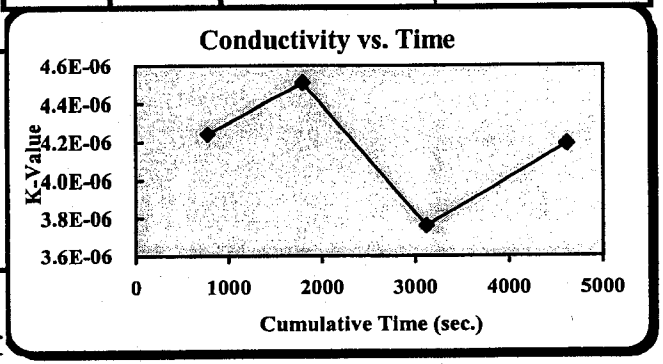
Averages:

Notes:

Sample was compacted to 94.6% @ 3.5% wet of optimum moisture content.

References:

ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D2216: Laboratory Determination of Water Content of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soil
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 854: Specific Gravity of Soils
ASTM D 422: Particle Size Analysis of Soils



Technician / Certification #: John Dailly Certification #:

Technical Responsibility: Mal Krajan Position: Quality System Coordinator

S&ME Moisture - Density Relationship

Test Date(s): 1/2 -1/4/03
Report Date: January 5, 2003

S&ME Project #: 1264-02-576
Project Name: Duke Power - Belows Creek Landfill
Client Name: Duke Energy Corp.
Client Address: 526 South Church Street, Chartlotte, NC 28202
Boring #: BC-13 Sample #: 2 Sample Date: NA
Location: Scrubber Waste Landfill Offset: Depth (ft): 10.0 - 20.0
Sample Description: Brown Fine Sandy Clayey SILT (ML)

Sieve Size	% Passing

Liquid Limit: 34 Specific Gravity: 2.705
Plastic Limit: 27 Plastic Index: 7

Natural Moisture Content (Total Sample): 18.0%
Moisture Content of the Oversize Fraction:

NOTES:

MDD: 103.0 **Opt. MC %: 19.1**

Water Content

Water Content requires GP 2 Balance (0.1 gram Readability).

ASTM D2216 ☒ AASHTO T265 ☐ ASTM D4959 ☐ ASTM D4643 ☐

	Sample #:	1	2		4		
	Water Added:	150	100	50			
	Tare #:	a	b	c	d		
A. Tare Weight	A.						
B. Wet Wt + Tare Wt	B.	500	500	500	500		
C. Dry Wt. + Tare Wt.	C.	415.9	423.9	405.8	439.4		
D. Water Weight	B-C	84.1	76.1	94.2	60.6		
E. Dry Weight	C-A	415.9	423.9	405.8	439.4		
F. Moisture Content	100*D/E	**20.2%**	**18.0%**	**23.2%**	**13.8%**		

Compaction Data

The Compaction Test requires a GP 5 Balance for ASTM (1 gram or .0022 Lb. readability).

G. Wt of Soil + Mold	G.	13.261	13.204	13.157	12.960		
H. Wt. of Mold	H.	9.175	9.175	9.175	9.175		
I. Wt. of Soil (g. or lbs.)	G-H	4.086	4.029	3.982	3.785		
J. Wt of Soil (Lbs.)	I/453.6 or 1	4.086	4.029	3.982	3.785		
K. Mold Volume Factor	K.	30.03	30.03	30.03	30.03		
L. Wet Density	J*K	122.7	121.0	119.6	113.7		
M. Dry Density	L/(1+F)	**102.1**	**102.6**	**97.1**	**99.9**		

ASTM D558 ☐ ASTM D 698 ☒ ASTM D1557 ☐ AASHTO T99 ☐ AASHTO T180 ☐
Method A ☒ Method B ☐ Method C ☐ Method D (ASTM 1978) ☐ AASHTO Method D ☐

Moisture-Density Relation of: Fine Fraction ☒ Corrected for Coarse Fraction (ASTM D 4718) ☐
Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐

Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

Soil Plasticity: ASTM D 4318 ☒ AASHTO T 89 ☐ AASHTO T 90 ☐
Sieve Analysis / Particle Size Analysis: ASTM C136 ☐ AASHTO T 27 ☐ ASTM D 422 ☒ AASHTO T 88 ☐
Specific Gravity of Soil: ASTM D 854 ☒ AASHTO T 100 ☐
Bulk Gravity of Oversize Fraction: ASTM C 127 ☐ AASHTO T 85 ☐
Soil Classification: ASTM D 2487 ☒ ASTM D 2488 ☐ AASHTO M 145 ☐

Technician Name / Certification #: Chi Lam
Technical Responsibility: Mal Krajan Quality System Coordinator

Moisture - Density Report

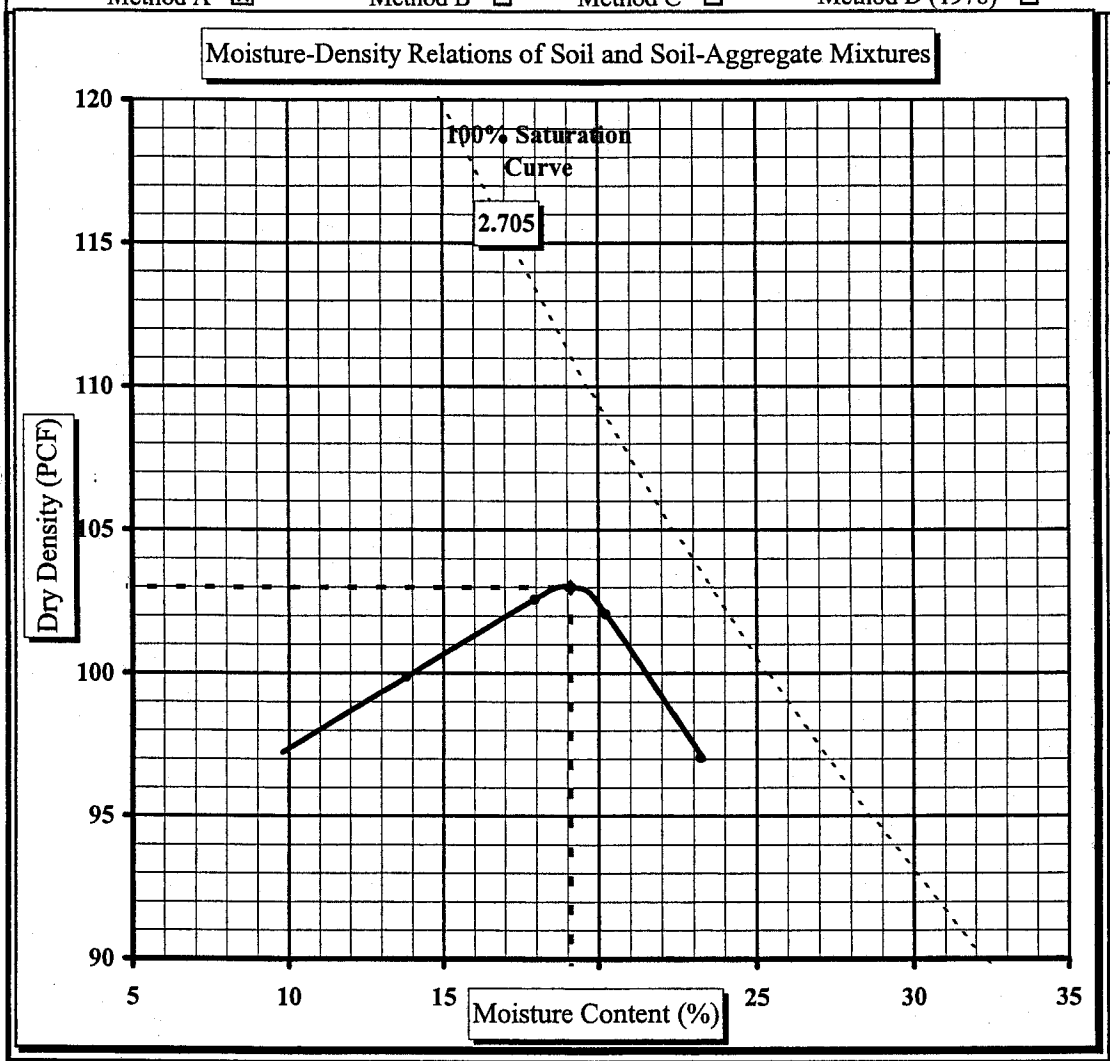
S&ME

S&ME Project #: 1264-02-576 | Report Date: January 5, 2003
Project Name: Duke Power - Belows Creek Landfill | Test Date(s): 1/2 -1/4/03
Client Name: Duke Energy Corp.
Client Address: 526 South Church Street, Chartlotte, NC 28202

Boring #: BC-13 | Sample #: 2 | Sample Date: NA
Location: Scrubber Waste Landfill | Offset: | Depth (ft): 10.0 - 20.0
Sample Description: Brown Fine Sandy Clayey SILT (ML)

Maximum Dry Density 103.0 PCF. | **Optimum Moisture Content** 19.1 %

ASTM D558 ☐ | ASTM D 698 ☒ | ASTM D1557 ☐ | AASHTO T99 ☐ | AASHTO T180 ☐
Method A ☒ | Method B ☐ | Method C ☐ | Method D (1978) ☐ | AASHTO Method D ☐



Soil Properties	
Natural Moisture Content	18.0%
Liquid Limit:	34
Plastic Limit:	27
Plastic Index:	7
Specific Gravity:	2.705

% Passing

Oversize Fraction
Bulk Sp. Gravity
% Moisture
Oversize Fraction

Moisture-Density Curve Displayed: Fine Fraction ☒ | Corrected for Oversize Fraction (ASTM D 4718) ☐
Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ | 3/8 inch Sieve ☐ | 3/4 inch Sieve ☐
Mechanical Hammer ☐ | Manual Hammer ☒ | Moist Preparation ☒ | Dry Preparation ☐

References: ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of
ASTM D 422: Particle Size Analysis of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Technical Responsibility: Mal Krajan — Quality System Coordinator

S&ME

Specific Gravity of Soils

ASTM D 854

Project #:	1264-02-576	Report Date:	1/8/03
Project Name:	**Duke Power - Belows Creek Landfill**	Test Date(s)	1/2 1/8/03
Client Name:	Duke Energy Corp.		
Client Address:	526 South Church Street, Chartlotte, NC 28202		

Boring No.	BC-13	Sample No.	2	Sample Date:	NA
Location:	Scrubber Waste Landfill	Offset:		Depth (ft):	10.0 - 20.0

Sample Description: Brown Fine Sandy Clayey SILT (ML)

Percent of Soil Passing the #4 Sieve: Material Excluded: Plus # 4 Material (%)

LL = PL = PI =

	Pychnometer #	**109**	**Balance ID#:**	**01001**	Radability:	**.01 gram**
V_p	Pychnometer Volume (V_p)	**499.28 ml.**			Calibration Date:	**9/17/02**
PM	Pychnometer Mass	**188.15 g.**	**Balance Verification**			
M_p	Ave. Pychnometer Mass (Mp)	**188.15 g.**			Mass	**500 gram**
[PM-M_p]	Verify Pychnometer Mass	**g.**			Mass Determination	**500.00**

If [PM-M_p] is greater than .06 grams recalibrate the dry mass of the pychnometer

Method A: Moist Specimens ☒ Method B: Oven-dried Specimens ☐

Method A: Moist Specimens

	Initial Moisture Content	Tare #:	11
A	Tare Weight		9.43
B	Wet Wt + Tare Wt		65.03
C	Dry Wt. + Tare Wt.		52.99
D	Water Weight	B-C	12.04
E	Dry Weight	C-A	43.56
	Moisture Content	100*D/E	**27.6%**

Target Dry Mass (see Table 1 ASTM D854)	Low Limit	High Limit
Target Wet Mass	**114.88**	**140.40**

Note: Deviation

Wet Mass of test specimen _____ grams

Method B: Oven-dried Specimens

Initial Dry Mass of test specimen _____ grams

Note: Deviation

$M_{psw;t}$ Mass of the Pychnometer, soil, and water 717.69 grams

Mass of Dry Soil (grams)			
		Tare #	60
A	Tare Weight		222.12
C	Dry Wt. + Tare Wt.		271.60
M_s	Dry Weight	C-A	**49.48**

T_t	Test Temperature T_t	**20.3** °C
K	Temperature Coefficient at T_t	**0.99994**
K	Temperature Coefficient at 23°C	**0.99933**
$p_{w;t}$	Density of Water at T_t	**0.99814** g./ml.
	See Table 2 ASTM D 854	

$M_{pw;t}$	Mass of the Pychnometer and water at T_t	$M_{pw;t} = M_p + (V_p \times p_{w;t})$	**686.50** grams
G_t	Specific Gravity of tSoil Solids at the T_t	$G_t = M_s / (M_{pw;t} - (M_{psw;t} - M_s))$	**2.705**
G	Specific Gravity of Soil Solids at the 20°C	$G = K \times G_t$	**2.705**

Soils containing plus #4 material tested per ASTM C 127:

Note: Deviation

R % of Soil retained on the #4 sieve _____

P % of Soil passing the #4 sieve **100.0%**

G_{+4} Apparent Specific Gravity of plus #4 material at the 23°C per ASTM C127 _____

Apparent Specific Gravity of plus #4 material corrected to 20°C _____

G_{total} The Average total sample Specific Gravity

$$G_{total} = \frac{1}{\frac{R}{100-G_{+4}} + \frac{P}{100-G}} = \textbf{2.705}$$

References: ASTM D854 Specific Gravity of Soil Solids by Water Pychnometer
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM C 127: Specific Gravity and Absorption of Coarse Aggregates

Technician Name / Certification #: Tom Savanapridi

Technical Responsibility / Position: Mal Krajan Quality System Coordinator

Particle Size Analysis of Soils

ASTM D 422

S&ME

Project #: 1264-02-576 Test Date(s): 1/15/03-1/21/03

Project Name: Duke Power-Belews Creek Landfill Report Date: January 21, 2003

Client Name: Duke Energy Corp.

Client Address: 526 South Chuch Street, Charlotte, NC 28202

Boring #: BC-13 Sample #: Bag - 2 Sample Date: NA

Location: Scrubber Waste L.F. Offset: Depth (ft): 10.0 - 20.0

Sample Description: Brown Fine Sandy Clayey SILT (ML)

% Moisture Content: 18.0% Cu = D_{60}/D_{10}: Cc = $(D_{30})^2/(D_{10}xD_{60})$:

Liquid Limit: 34 Plastic Limit: 27 Plastic Index: 7 Specific Gravity: 2.705

Particle Size Analysis / Without Hydrometer Analysis		
	Tare Number	12.00
A	Tare Weight	9.23
B	Total Sample Dry Wt. + Tare Wt.	61.59
C	Total Sample Dry Weight (B-A)	52.36
D	Total Sample Wt. After #200 Wash	21.58
E	Percent Passing #200 (1-D/C)x100	58.8%

Moisture Content		Natural
	Tare #	12
A	Tare Weight	9.23
B	Wet Weight + Tare Wt.	71.03
C	Dry Weight + Tare Wt.	61.59
D	Water Wt. (B-C)	9.44
E	Dry Wt.(C-A)	52.36
Moisture Content (100 x D/E) (%)		18.0%

Sieve Size (mm)	Sieve Size	Retained Weight	Percent Retained	**Percent Passing Total Sample**
37.50	1.5"	0.0	0.0%	**100.0%**
25.00	1.0"	0.00	0.0%	**100.0%**
19.00	3/4"	0.00	0.0%	**100.0%**
12.50	1/2"	0.00	0.0%	**100.0%**
9.50	3/8"	0.00	0.0%	**100.0%**
4.75	#4	0.00	0.0%	**100.0%**
2.00	#10	0.83	1.6%	**98.4%**
0.85	#20	1.72	3.3%	**96.7%**
0.43	#40	2.94	5.6%	**94.4%**
0.25	#60	5.06	9.7%	**90.3%**
0.15	#100	9.93	19.0%	**81.0%**
0.075	#200	20.52	39.2%	**60.8%**

Notes:	Maximum Particle Size:	#4	Gravel	< 75 mm and > 4.75 mm (#4)	**0.0%**
	D10		Coarse Sand	< 4.75 mm and >2.00 mm (#10)	**1.6%**
	D30		Medium Sand	< 2.00 mm and > 0.425 mm (#40)	**4.0%**
	D/60		Fine Sand	< 0.425 mm and > 0.075 mm (#200)	**33.6%**
			% Silt and Clay	< 0.075 mm	**60.8%**
			Description of Sand & Gravel	Rounded ☐	Angular ☐
			Hard & Durable ☐	Soft ☐	Weathered & Friable ☐

ASTM D 422: Particle Size Analysis of Soils *Hydrometer portion of test method not utilized.*

ASTM D 421: Dry Preparation of Soil Samples

ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D 854: Specific Gravity of Soils

Technician / Certification #: Tom S.

Technical Responsibility: Mal Krajan Position: Quality System Coordinator

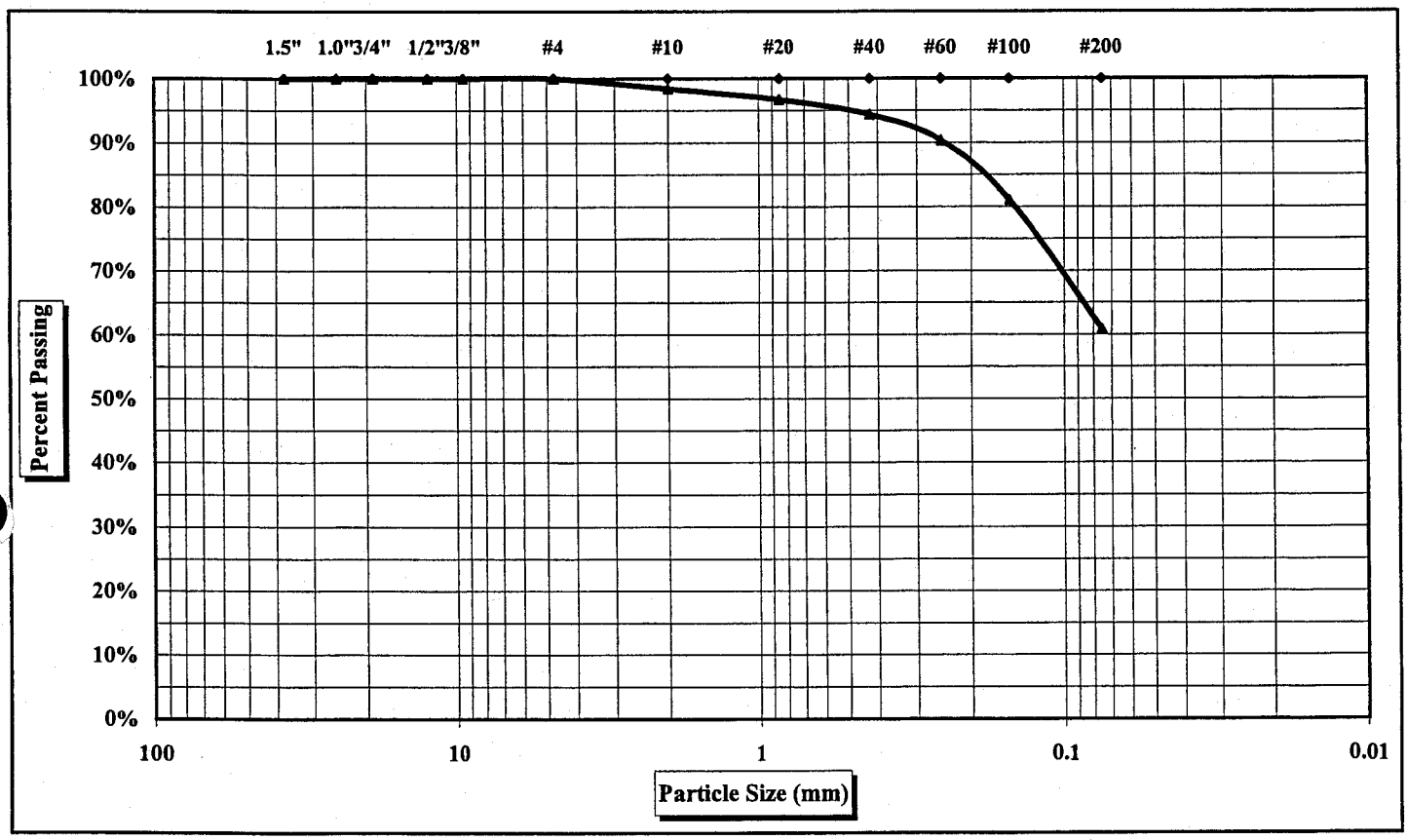
Particle Size Analysis of Soils

ASTM D 422

S&ME

S&ME Project #:	**1264-02-576**	Report Date:	January 21, 2003
Project Name:	**Duke Power-Belews Creek Landfill**	Test Date(s):	1/15/03-1/21/03
Client Name:	Duke Energy Corp.		
Client Address:	526 South Chuch Street, Charlotte, NC 28202		

Boring #:	BC-13	Sample #:	Bag - 2	Sample Date:	NA
Location:	Scrubber Waste L.F.	Offset:		Depth (ft):	10.0 - 20.0
Sample Description:	Brown Fine Sandy Clayey SILT (ML)				



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Moisture Content	18.0%	Gravel	0%	Liquid Limit	34
Silt & Clay (% Passing #200)	60.8%	Coarse Sand	2%	Plastic Limit	27
Maximum Particle Size	#4	Medium Sand	4%	Plastic Index	7
Specific Gravity	2.705	Fine Sand	34%		

Description of Sand & Gravel Particles:

Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

References: ASTM D 422: Particle Size Analysis of Soils
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 854: Specific Gravity of Soils

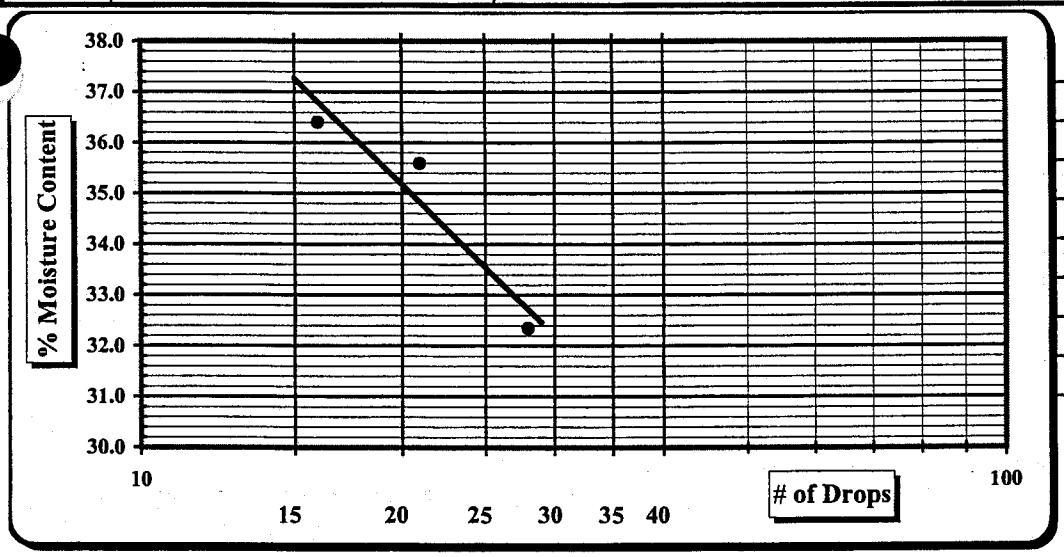
Technical Responsibility: Mal Krajan — Quality System Coordinator

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

Project #:	1264-02-576	Report Date:	January 21, 2003
Project Name:	Duke Power-Belews Creek Landfill	Test Date(s):	1/15/03-1/21/03
Client Name:	Duke Energy Corp.		
Client Address:	526 South Chuch Street, Charlotte, NC 28202		
Boring #:	BC-13	Sample #: Bag - 2	Sample Date: NA
Location:	Scrubber Waste L.F.	Offset:	Depth (ft): 10.0 - 20.0
Sample Description:	Brown Fine Sandy Clayey SILT (ML)		

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	75	104	2				641	967	
A	Tare Weight	8.09	8.08	8.00				6.59	6.04	
B	Wet Soil Weight + A	27.01	25.30	25.39				13.06	13.63	
C	Dry Soil Weight + A	21.96	20.78	21.14				11.68	11.98	
D	Water Weight (B-C)	5.05	4.52	4.25				1.38	1.65	
E	Dry Soil Weight (C-A)	13.87	12.70	13.14				5.09	5.94	
F	% Moisture Content (D/E)*100	36.4	35.6	32.3				27.1	27.8	
N	# OF DROPS	16	21	28						
LL	LL = F * FACTOR									
Ave.	Average							27.4		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation ☐	Dry Preparation ☐	Air Dried ☒	NP, Non-Plastic	☐
Liquid limit Test:	Multipoint Method ☒	One-point Method ☐		Liquid Limit	34
Classification:	ASTM D 2487 ☒	AASHTO M 145 ☐		Plastic Limit	27
Liquid limit Test:	ASTM D 4318 ☒	AASHTO T 89 ☐		Plastic Index	7
Plastic limit Test:	ASTM D 4318 ☒	AASHTO T 90 ☐		Group Symbol	ML

Technician Name / Certification #: Tom Savanpridi

Technical Responsibility / Position: Mal Krajan — Quality System Coordinator

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method "C")

Project #: 1264-02-576 | Test Date(s): 1/21/03 - 01/25/03

Project Name: Duke Power - Belews Creek Landfill | Report Date: 01/26/03

Client Name: Duke Energy Corp.

Client Address:

Boring #: BC-13 | Sample #: Bag-2 | Depth/Elevation: 10-20' | Sample Date: NA

Location: Scrubber Waste | Offset: | Sample Description: Brown Fine Sandy Clayey SILT (ML)

Liquid Limit: 34 | Specific Gravity: 2.705 | Sample Type: Lab-compacted | Sampled By: Sam Watts

Plastic Limit: 27 | Plastic Index: 7 | Percent Passing #200: 60.8 | Maximum Particle Size:

Initial Sample Conditions				Final Sample Conditions			
Length (cm):	7.366	Wet Density (PCF):	120.2	Length (cm):	7.366	Wet Density (PCF):	124.4
Diameter (cm):	7.328	Dry Density (PCF):	98.3	Diameter (cm):	7.328	Dry Density (PCF):	98.3
Area (cm^2)	42.18	Percent Saturation:	84.0	Area (cm^2)	42.18	Percent Saturation:	100.0
Volume (cm^3)	310.70			Volume (cm^3)	310.70	b value:	0.96
Wet weight (grams)	598.3	Void Ratio:	0.718	Wet weight (grams)	619.3	Void Ratio:	0.718
Dry Weight (grams)	489.2	Porosity:	0.418	Dry Weight (grams)	489.2	Porosity:	0.418
Percent Moisture:	22.3			Percent Moisture:	26.6		
Test Parameters:	Effective Consolidation Stress (psi):		3.0	Permeant Liquid Used:		Deaired Demineralized water	
Burette Area (cm^2):	0.720	Cell Pressure (psi):	73.0	Back Pressure (psi):	73.0	Pore Pressure (psi)	73.0

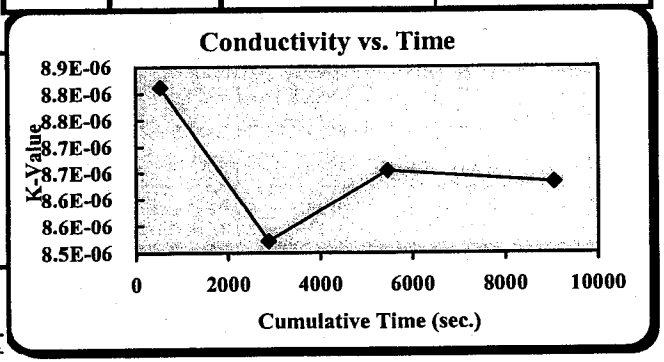
Time (24-hr)			Temperature (°C)				Measurements						Ratio	Gradient	K-Value (cm/sec)	
Start	End	Time (sec)	Initial	Final	Ave.	Factor	$h_{out}1$	$h_{in}1$	$h_{out}2$	$h_{in}2$	h1	h2			Uncorrected K-Value	Corrected K-Value
9:48	9:57	540	24.0	24.0	24.0	0.9077	40.80	12.05	39.65	13.20	28.8	26.5	1.00	3.59	9.71E-06	8.81E-06
9:57	10:36	2340	24.0	24.0	24.0	0.9077	39.65	13.20	35.90	17.25	26.5	18.7	0.93	2.53	9.39E-06	8.52E-06
10:36	11:19	2580	24.0	24.1	24.1	0.9056	35.90	17.25	32.95	20.35	18.7	12.6	0.95	1.71	9.56E-06	8.65E-06
11:19	12:19	3600	24.1	24.1	24.1	0.9056	32.95	20.35	30.40	23.10	12.6	7.3	0.93	0.99	9.53E-06	8.63E-06
												Averages:	*0.95*	*2.21*	*9.55E-06*	*8.65E-06*

Notes:

Sample was compacted to 95.2% @ 2.9% wet of optimum moisture content.

References:

ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D2216: Laboratory Determination of Water Content of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soil
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 854: Specific Gravity of Soils
ASTM D 422: Particle Size Analysis of Soils



Technician / Certification #: John Dailly | Certification #:

Technical Responsibility: Mal Krajan | Position: Quality System Coordinator

S&ME Moisture - Density Relationship

Test Date(s): 1/2 -1/4/03

S&ME Project #: 1264-02-576 Report Date: January 5, 2003

Project Name: Duke Power - Belows Creek Landfill

Client Name: Duke Energy Corp.

Client Address: 526 South Church Street, Chartlotte, NC 28202

Boring #: BC-14 Sample #: Bag-1 Sample Date: NA

Location: Scrubber Waste Landfill Offset: Depth (ft): 0.0 - 10.0

Sample Description: Tan-Brown Fine Sandy Silty CLAY

Liquid Limit:	40	Specific Gravity:	2.839
Plastic Limit:	23	Plastic Index:	17

Natural Moisture Content (Total Sample): 27.6%

Moisture Content of the Oversize Fraction:

NOTES:

Sieve Size	% Passing

MDD: 108.3 **Opt. MC %:** 17.6

Water Content

Water Content requires GP 2 Balance (0.1 gram Readability).

ASTM D2216 ☒ AASHTO T265 ☐ ASTM D4959 ☐ ASTM D4643 ☐

	Sample #:	1	2		4		
	Water Added:	150	100	50			
	Tare #:	a	b	c	d		
A. Tare Weight	A.						
B. Wet Wt + Tare Wt	B.	500	500	500	500		
C. Dry Wt. + Tare Wt.	C.	413.7	420.8	428.1	447.3		
D. Water Weight	B-C	86.3	79.2	71.9	52.7		
E. Dry Weight	C-A	413.7	420.8	428.1	447.3		
F. Moisture Content	100*D/E	**20.9%**	**18.8%**	**16.8%**	**11.8%**		

Compaction Data

The Compaction Test requires a GP 5 Balance for ASTM (1 gram or .0022 Lb. readability).

G. Wt of Soil + Mold	G.	13.314	13.412	13.370	12.955		
H. Wt. of Mold	H.	9.175	9.175	9.175	9.175		
I. Wt. of Soil (g. or lbs.)	G-H	4.139	4.237	4.195	3.780		
J. Wt of Soil (Lbs.)	I/453.6 or I	4.139	4.237	4.195	3.780		
K. Mold Volume Factor	K.	30.03	30.03	30.03	30.03		
L. Wet Density	J*K	124.3	127.2	126.0	113.5		
M. Dry Density	L/(1+F)	**102.8**	**107.1**	**107.9**	**101.5**		

ASTM D558 ☐ ASTM D 698 ☒ ASTM D1557 ☐ AASHTO T99 ☐ AASHTO T180 ☐

Method A ☒ Method B ☐ Method C ☐ Method D (ASTM 1978) ☐ AASHTO Method D ☐

Moisture-Density Relation of: Fine Fraction ☒ Corrected for Coarse Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐

Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

Soil Plasticity: ASTM D 4318 ☒ AASHTO T 89 ☐ AASHTO T 90 ☐

Sieve Analysis / Particle Size Analysis: ASTM C136 ☐ AASHTO T 27 ☐ ASTM D 422 ☐ AASHTO T 88 ☐

Specific Gravity of Soil: ASTM D 854 ☒ AASHTO T 100 ☐

Bulk Gravity of Oversize Fraction: ASTM C 127 ☐ AASHTO T 85 ☐

Soil Classification: ASTM D 2487 ☐ ASTM D 2488 ☒ AASHTO M 145 ☐

Technician Name / Certification #: Chi Lam

Technical Responsibility: Mal Krajan Quality System Coordinator

Moisture - Density Report

S&ME

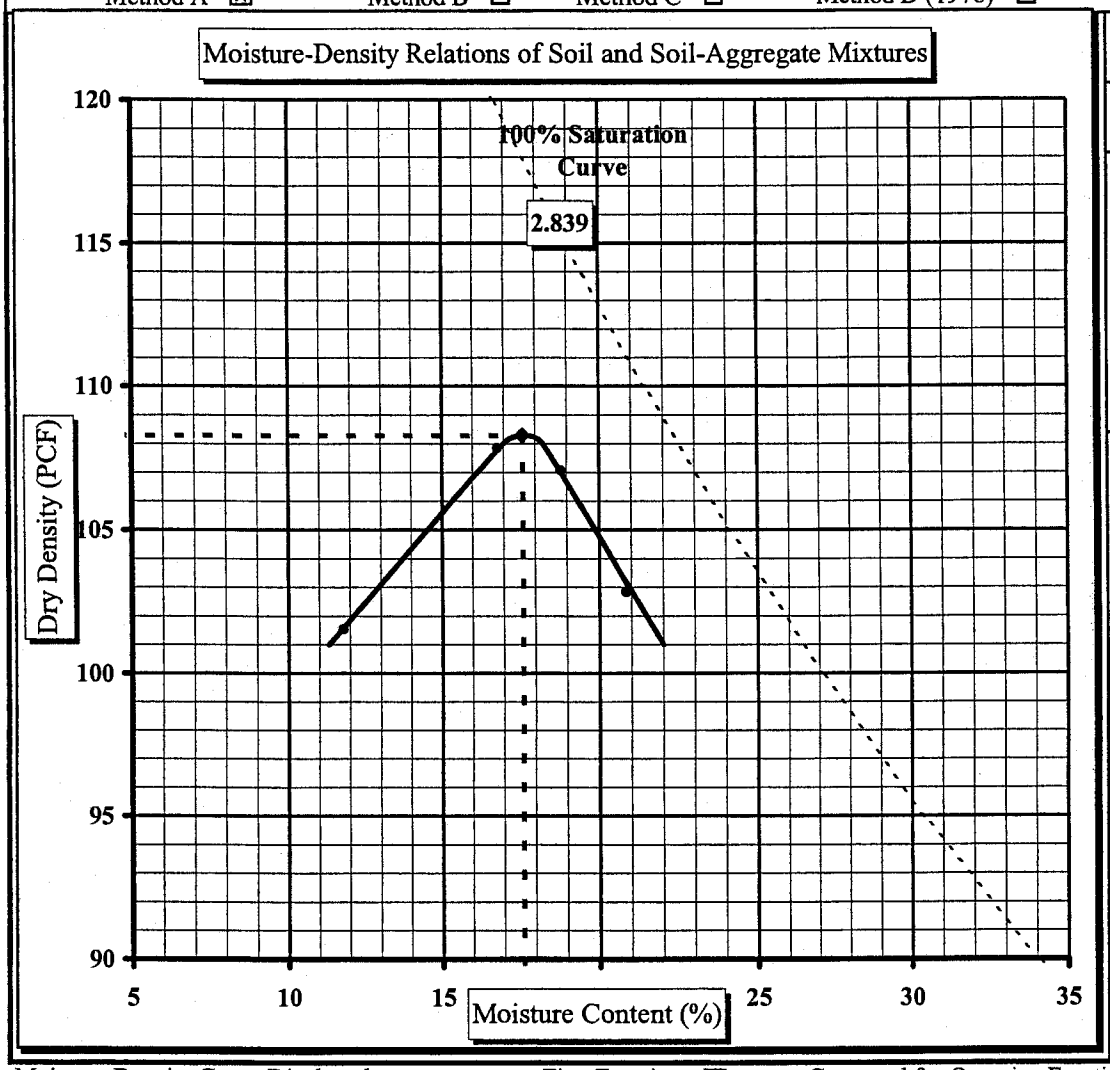
S&ME Project #: 1264-02-576
Project Name: Duke Power - Belows Creek Landfill
Client Name: Duke Energy Corp.
Client Address: 526 South Church Street, Chartlotte, NC 28202

Report Date: January 5, 2003
Test Date(s): 1/2 -1/4/03

Boring #: BC-14 Sample #: Bag-1 Sample Date: NA
Location: Scrubber Waste Landfill Offset: Depth (ft): 0.0 - 10.0
Sample Description: Tan-Brown Fine Sandy Silty CLAY

Maximum Dry Density 108.3 PCF. **Optimum Moisture Content** 17.6 %

ASTM D558 ☐ ASTM D 698 ☒ ASTM D1557 ☐ AASHTO T99 ☐ AASHTO T180 ☐
Method A ☒ Method B ☐ Method C ☐ Method D (1978) ☐ AASHTO Method D ☐



Soil Properties	
Natural Moisture Content	27.6%
Liquid Limit:	40
Plastic Limit:	23
Plastic Index:	17
Specific Gravity:	2.839

% Passing

Oversize Fraction
Bulk Sp. Gravity
% Moisture
Oversize Fraction

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐
Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐
Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

References: ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of
ASTM D 854: Specific Gravity of Soils
ASTM D 2488: Description and Identification of Soils (Visual-Manual Procedure)
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Technical Responsibility: Mal Krajan Quality System Coordinator

S&ME

Specific Gravity of Soils

ASTM D 854

Project #:	1264-02-576	Report Date:	1/8/03
Project Name:	**Duke Power - Belows Creek Landfill**	Test Date(s)	1/2 1/8/03
Client Name:	Duke Energy Corp.		
Client Address:	526 South Church Street, Chartlotte, NC 28202		

Boring No.	BC-14	Sample No.	Bag-1	Sample Date:	NA
Location:	Scrubber Waste Landfill	Offset:		Depth (ft):	0.0 - 10.0

Sample Description: Tan-Brown Fine Sandy Silty CLAY

Percent of Soil Passing the #4 Sieve: Material Excluded: Plus # 4 Material (%)

LL = PL = PI =

	Pychnometer #	**109**	**Balance ID#:**	**01001** Radability:	**.01 gram**
V_p	Pychnometer Volume (V_p)	**499.28 ml.**		Calibration Date:	**9/17/02**
PM	Pychnometer Mass	**188.17 g.**	**Balance Verification**		
M_p	Ave. Pychnometer Mass (Mp)	**188.17 g.**		Mass	**500 gram**
[PM-M_p]	Verify Pychnometer Mass	**g.**		Mass Determination	**500.00**

If [PM-M_p] is greater than .06 grams recalibrate the dry mass of the pychnometer

Method A: Moist Specimens ☒ Method B: Oven-dried Specimens ☐

Method A: Moist Specimens

	Initial Moisture Content	Tare #:	S-13
A	Tare Weight		7.9
B	Wet Wt + Tare Wt		244.85
C	Dry Wt. + Tare Wt.		236.73
D	Water Weight	B-C	8.12
E	Dry Weight	C-A	228.83
	Moisture Content	100*D/E	**3.5%**

Target Dry Mass (see Table 1 ASTM D854)	Low Limit	High Limit
	90.00	110.00
Target Wet Mass	**93.19**	**113.90**

Note: Deviation

Wet Mass of test specimen _____ grams

Method B: Oven-dried Specimens

Initial Dry Mass of test specimen _____ grams

Note: Deviation

$M_{psw;t}$ Mass of the Pychnometer, soil, and water **722.90** grams

Mass of Dry Soil (grams)			
		Tare #	9
A	Tare Weight		138.88
C	Dry Wt. + Tare Wt.		194.97
M_s	Dry Weight	C-A	**56.09**

T_t	Test Temperature T_t	19.9 °C
K	Temperature Coefficient at T_t	**1.00002**
K	Temperature Coefficient at 23°C	**0.99933**
$p_{w;t}$	Density of Water at T_t	**0.99823** g./ml.
	See Table 2 ASTM D 854	

$M_{pw;t}$	Mass of the Pychnometer and water at T_t	$M_{pw;t} = M_p + (V_p \times p_{w;t})$	**686.57** grams
G_t	Specific Gravity of tSoil Solids at the T_t	$G_t = M_s / (M_{pw;t} - (M_{psw;t} - M_s))$	**2.839**
G	Specific Gravity of Soil Solids at the 20°C	$G = K \times G_t$	**2.839**

Soils containing plus #4 material tested per ASTM C 127:

Note: Deviation

R % of Soil retained on the #4 sieve _____

P % of Soil passing the #4 sieve **100.0%**

G_{+4} Apparent Specific Gravity of plus #4 material at the 23°C per ASTM C127 _____

Apparent Specific Gravity of plus #4 material corrected to 20°C _____

G_{total} The Average total sample Specific Gravity

$$G_{total} = \frac{1}{\frac{R}{100-G_{+4}} + \frac{P}{100-G}} = \textbf{2.839}$$

References: ASTM D854 Specific Gravity of Soil Solids by Water Pychnometer
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM C 127: Specific Gravity and Absorption of Coarse Aggregates

Technician Name / Certification #: Tom Savanapridi

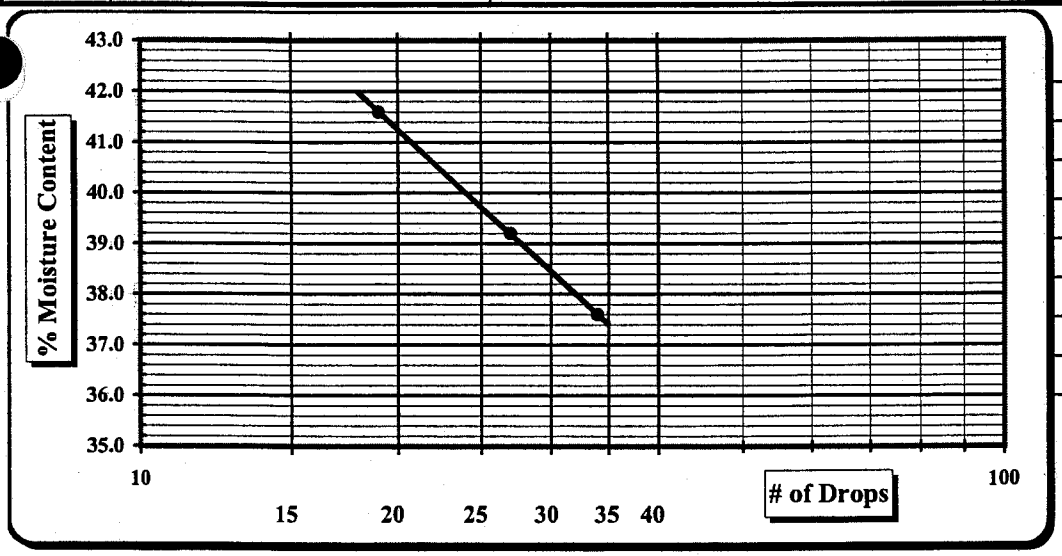
Technical Responsibility / Position: Mal Krajan Quality System Coordinator

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

Project #:	1264-02-576	Report Date:	January 8, 2003
Project Name:	Duke Power-Belows Cr. Landfill	Test Date(s):	1/02/03-1/08/03
Client Name:	Duke Energy Corp.		
Client Address:	526 South Church St.		
Boring #:	BC-14	Sample #: NA	Sample Date: NA
Location:		Offset:	Depth (ft): 0-10'
Sample Description:	Yellow-Tan Silty Sandy Clay		

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	31	37	6				716	6	
A	Tare Weight	8.01	8.08	8.35				6.50	6.22	
B	Wet Soil Weight + A	18.52	22.28	21.49				14.63	13.79	
C	Dry Soil Weight + A	15.43	18.28	17.90				13.10	12.36	
D	Water Weight (B-C)	3.09	4.00	3.59				1.53	1.43	
E	Dry Soil Weight (C-A)	7.42	10.20	9.55				6.60	6.14	
F	% Moisture Content (D/E)*100	41.6	39.2	37.6				23.2	23.3	
N	# OF DROPS	19	27	34						
LL	LL = F * FACTOR									
Ave.	Average							23.3		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation ☐	Dry Preparation ☐	Air Dried ☒	NP, Non-Plastic	☐
Liquid limit Test:	Multipoint Method ☒	One-point Method ☐		Liquid Limit	40
Classification:	ASTM D 2487 ☒	AASHTO M 145 ☐		Plastic Limit	23
Liquid limit Test:	ASTM D 4318 ☒	AASHTO T 89 ☐		Plastic Index	17
Plastic limit Test:	ASTM D 4318 ☒	AASHTO T 90 ☐		Group Symbol	CL

Technician Name / Certification #: Tom Savanpridi

Technical Responsibility / Position: Mal Krajan Laboratory Supervisor

Particle Size Analysis of Soils

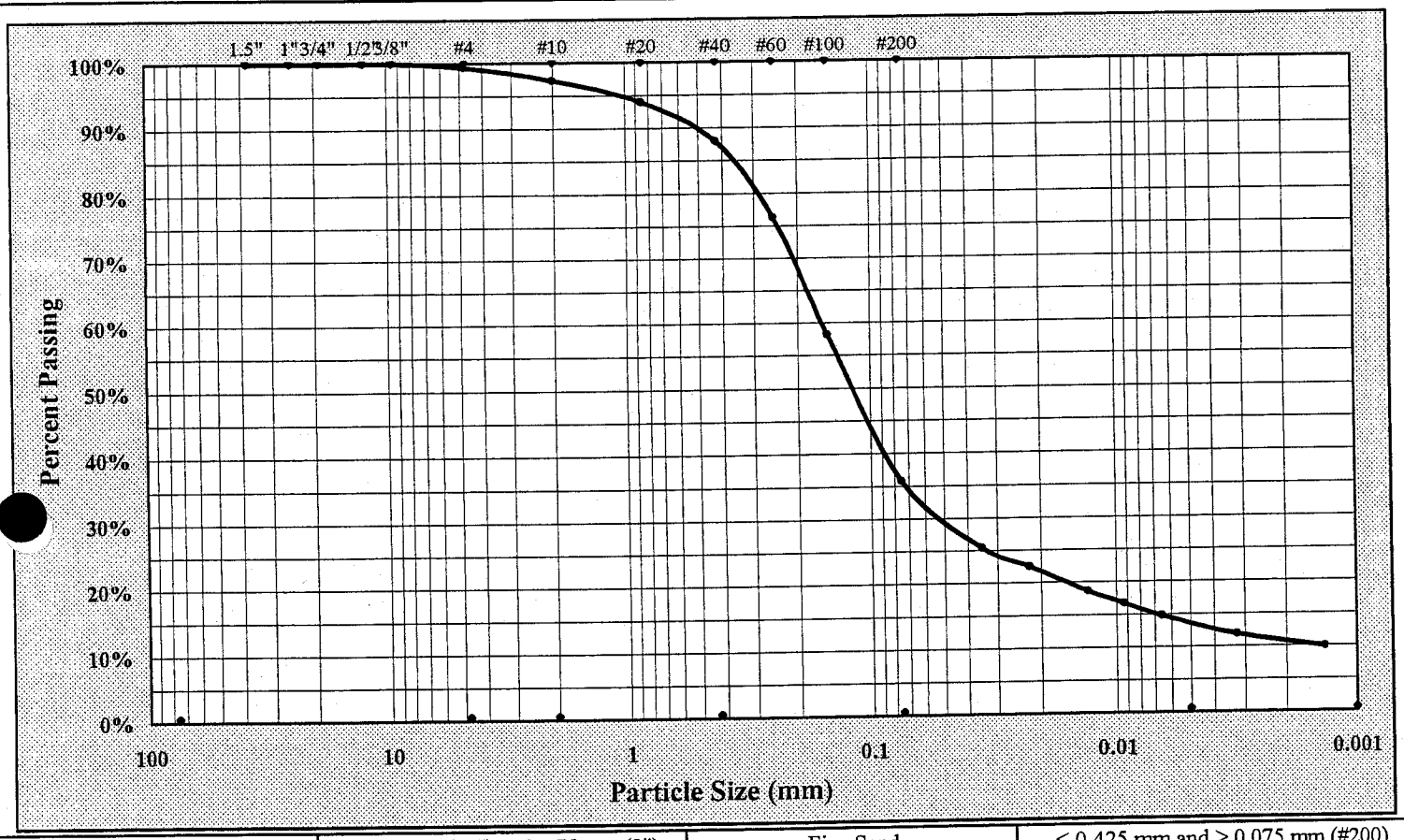
ASTM D 422

S&ME

S&ME Project #: **1054-04-955**
Project Name: **Belew Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: 10/08/2004
Test Date(s): 09/28 - 10/07/2004

Boring #:	BC-15	Sample #:	Bag-1	Sample Date:	9/1/04
Location:	Site Borehole	Offset:	NA	Depth (ft):	0 - 5'
Sample Description:	Tan Silty SAND (SM)				



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/8"	Gravel	0.7%	Silt	21.9%
Silt & Clay (% Passing #200)	35.7%	Sand	63.6%	Clay	13.8%
Apparent Relative Density	2.635	Moisture Content	26.8%	Colloids	9.8%
Liquid Limit	27	Plastic Limit	22	Plastic Index	5

Description of Sand & Gravel Particles Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: ASTM D 422: Particle Size Analysis of Soils
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan — Laboratory Supervisor
(Signature) (Position)
S&ME, INC. 3109 Spring Forest Road, Raleigh, N.C. 27616
BC-15 Bag-1 Classification.xls

Liquid Limit, Plastic Limit, and Plastic Index

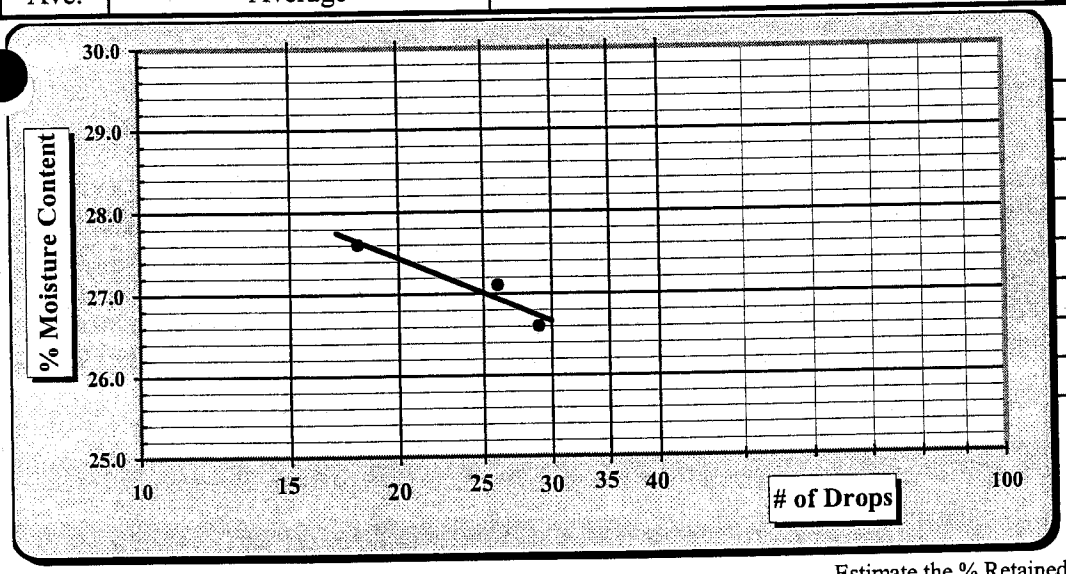
S&ME

Project #: **1054-04-955**
Project Name: Belews Creek Steam Plant
Client Name: Duke Energy
Client Address:

Report Date: 10/08/204
Test Date(s): 09/28 - 10/07/2004

Boring #: BC-15 Sample #: Bag-1 Sample Date: 09/01 - 09/24/2004
Location: Site Borehole Offset: NA Depth (ft): 0 - 5'
Sample Description: Tan Silty SAND (SM)

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	11	8	48				56	23	
A	Tare Weight	21.00	17.67	20.63				20.93	20.95	
B	Wet Soil Weight + A	37.17	33.17	38.51				29.77	30.19	
C	Dry Soil Weight + A	33.67	29.91	34.70				28.20	28.51	
D	Water Weight (B-C)	3.50	3.26	3.81				1.57	1.68	
E	Dry Soil Weight (C-A)	12.67	12.24	14.07				7.27	7.56	
F	% Moisture Content (D/E)*100	27.6%	26.6%	27.1%				21.6%	22.2%	
N	# OF DROPS	18	29	26				*Moisture Contents determined by ASTM D 2216*		
LL	LL = F * FACTOR									
Ave.	Average							21.9%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation	☐	Dry Preparation	☐	Air Dried	☒	NP, Non-Plastic ☐
Liquid limit Test:	Multipoint Method	☒	One-point Method	☐			Liquid Limit 27
Classification:	ASTM D 2487	☒	AASHTO M 145	☐			Plastic Limit 22
Liquid limit Test:	ASTM D 4318	☒	AASHTO T 89	☐			Plastic Index 5
Plastic limit Test:	ASTM D 4318	☒	AASHTO T 90	☐			Group Symbol SM

Technician Name: Chana Savanapridi QCT-1433 *Certification #*

Technical Responsibility: Mal Krajan *Signature* Laboratory Supervisor *Position*

Moisture - Density Report

S&ME

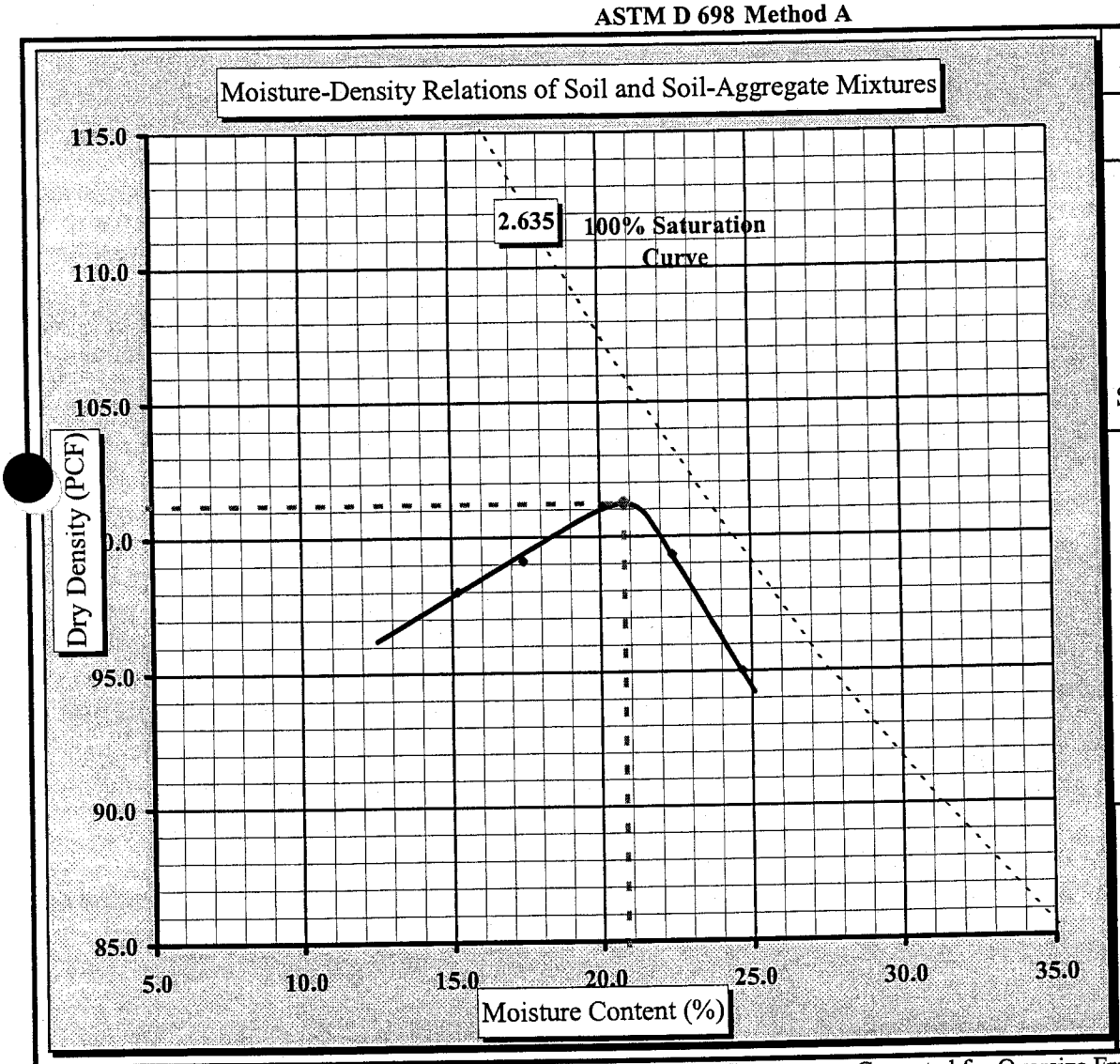
S&ME Project #: **1054-04-955**
Project Name: **Belews Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: October 8, 2004
Test Date(s): 09/29 - 09/30/2004

Boring #:	BC-15	Sample #:	Bag-1	Sample Date:	September 1, 2004
Location:	Site Borehole	Offset:	NA	Depth (ft):	0 - 5'
Sample Description:	Tan Silty SAND (SM)				

Maximum Dry Density **101.2** **PCF.** **Optimum Moisture Content** **20.8** **%**

ASTM D 698 Method A



Soil Properties

Natural Moisture Content:	26.8%
Liquid Limit:	27
Plastic Limit:	22
Plastic Index:	5
Specific Gravity:	2.635

% Passing
#4 100.0

Oversize Fraction

Bulk Sp. Gravity
% Moisture
Oversize Fraction
MDD
Opt. MC

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐
Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐
Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

References: ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 422: Particle Size Analysis of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan Signature Laboratory Supervisor Position

Laboratory Report Version 4.2

Specific Gravity of Soils

S&ME

ASTM D 854 *Method A: Moist Specimens* ☐ *Method B: Oven-dried Specimens* ☒

Project #: **1054-04-955**
Project Name: **Belews Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: October 8, 2004
Test Date(s) 09/29 - 09/30/2004

Boring No.	BC-15	Sample No.	Bag-1	Sample Date:	09/01/04
Location:	Site Borehole	Offset:	NA	Depth (ft):	0 - 5'

Sample Description: Tan Silty SAND (SM)

Percent of Soil Passing #4 Sieve: **100.0** Material Excluded:

LL = 27 PL = 22 PI = 5

	Pycnometer #	102	Balance ID#	Readability	.01 gram
V_p	Pycnometer Volume (V_p)	499.99 ml.		Calibration Date	
PM	Pycnometer Mass	179.13 g.	Balance Verification		
M_p	Ave. Pycnometer Mass (Mp)	179.15 g.		Mass	500 gram
[PM-M_p]	Verify Pycnometer Mass	0.02 g.		Mass Determination	500.00

If [PM-M_p] is greater than .06 grams recalibrate the dry mass of the pycnometer or the balance.

Method A: Moist Specimens

	Initial Moisture Content	Tare #:	
A	Tare Weight		7.99
B	Wet Wt + Tare Wt		70.60
C	Dry Wt. + Tare Wt.		57.37
D	Water Weight	B-C	13.23
E	Dry Weight	C-A	49.38
F	**Moisture Content**	100*D/E	**26.8%**

Target Dry Mass (see Table 1 ASTM D854)	Low Limit	High Limit
Target Wet Mass		

Wet Mass of test specimen _____ grams

Method B: Oven-dried Specimens

Initial Dry Mass of test specimen _____ grams

Per T-100

$M_{psw;t}$ Mass of the Pycnometer, soil, and water **701.20** grams

	Mass of Dry Soil (grams)		
		Tare #	7
A	Tare Weight		
C	Dry Wt. + Tare Wt.		37.61
M_s	Dry Weight	C-A	**37.61**

T_t	Test Temperature T_t	23.5 °C
K	Temperature Coefficient at T_t	0.99923
K	Temperature Coefficient at 23°C	0.99933
$p_{w;t}$	Density of Water at T_t	0.99742 g./ml.
	See Table 2 ASTM D 854	

$M_{pw;t}$ Mass of the Pycnometer and water at T_t $M_{pw;t} = M_p + (V_p \times p_{w;t})$ **677.85** grams

G_t Specific Gravity of Soil Solids at the T_t $G_t = M_s / (M_{pw;t} - (M_{psw;t} - M_s))$ **2.637**

G Specific Gravity of Soil Solids at the 20°C $G = K \times G_t$ **2.635**

Soils containing plus #4 material tested per ASTM C 127:

Note: Deviation or remove this note

R % of Soil retained on the #4 sieve _____

P % of Soil passing the #4 sieve _____

G_{+4} Apparent Specific Gravity of plus #4 material at the 23°C per ASTM C127 _____

Apparent Specific Gravity of plus #4 material corrected to 20°C _____

G_{total} The Average total sample Specific Gravity

$$G_{total} = \frac{1}{\frac{R}{100-G_{+4}} + \frac{P}{100-G}} = 2.635$$

References: ASTM D854 Specific Gravity of Soil Solids by Water Pycnometer ASTM C 127: Specific Gravity and Absorption of Coarse Aggregates
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Technician Name: Chana Savanapridi

QCT - 1433
Certification #

Technical Responsibility: Mal Krajan

Signature

Laboratory Supervisor
Position

S&ME

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method "C")

Project #: 1054-04-955 Test Date(s): 10/11 - 10/13/04

Project Name: Belews Creek Steam Plant Report Date: 10/13/04

Client Name:

Client Address:

Boring #: BC-15 Sample #: Bag-1 Depth/Elevation: 0-5 ft. Sample Date: 09/01/04

Location: Project Site Offset: NA Sample Description: Tan Silty SAND (SM)

Liquid Limit: 27 Specific Gravity: 2.635 Sample Type: lab-compacted Sampled By: S&ME

Plastic Limit: 22 Plasticity Index: 5 Percent Passing #200: 35.7 Maximum Particle Size: 3/8"

Initial Sample Conditions			
Height (cm):	9.642	Wet Unit Weight (lbs/ft^3):	115.1
Diameter (cm):	7.315	Dry Unit Weight (lbs/ft^3):	95.6
Area (cm^2):	42.03	Percent Saturation:	77.7
Volume (cm^3):	405.25	Void Ratio:	0.7193
Wet weight (grams):	747.0	Porosity:	0.4184
Dry Weight (grams):	620.8	Station Corrections (cm)	
Percent Moisture:	21.2	Influent: -2.962	Effluent: -2.962

Final Sample Conditions			
Height (cm):	9.642	Dry Unit Weight (lbs/ft^3):	95.6
Diameter (cm):	7.315	Percent Saturation:	100.0
Area (cm^2)	42.03	Void Ratio:	0.7193
Volume (cm^3)	405.25	Porosity:	0.4184
Wet weight (grams)	805.4		
Dry Weight (grams)	620.8		
Percent Moisture:	29.7		

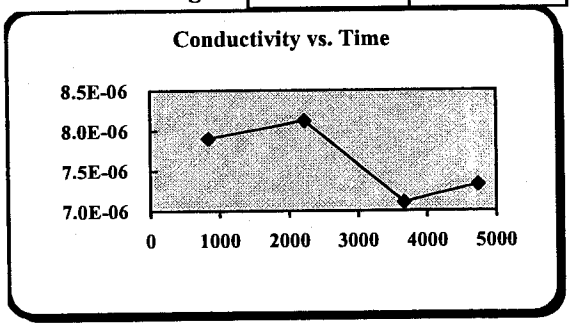
Measured ***B*** coefficient: 0.98

MDD (pcf): 101.2 Optimum (%): 20.8

Testing Station	Burette Areas (cm^2):			Effective Consolidation Stress (psi):	7.0	Permeant Liquid Used:	Deaired Demineralized water
3	Influent:	0.720	Influent: 0.720	Cell Pressure (psi):	87.0	Influent Pressure (psi):	80.0	Effluent Pressure (psi)	80.0

Start Date	Start Time	End Date	End Time	Time (seconds)	Temperature (°C) Initial	Final	Avg.	Corr. Factor	Initial INF.	Initial EFF.	Final INF.	Final EFF.	h_1 (cm)	h_2 (cm)	Gradient	K-Value (cm/sec) Uncorrected	Corrected
10/13/04	5:36:00 AM	10/13/04	5:50:00 AM	840	24.0	24.0	24.0	0.908	18.60	37.50	19.40	36.70	18.90	17.30	1.9	8.70E-06	7.90E-06
10/13/04	5:50:00 AM	10/13/04	6:13:00 AM	1380	24.0	24.0	24.0	0.908	19.40	36.70	20.70	35.60	17.30	14.90	1.7	8.94E-06	8.12E-06
10/13/04	6:13:00 AM	10/13/04	6:37:00 AM	1440	24.0	24.0	24.0	0.908	20.70	35.60	21.60	34.60	14.90	13.00	1.4	7.82E-06	7.10E-06
10/13/04	6:37:00 AM	10/13/04	6:55:00 AM	1080	24.0	24.0	24.0	0.908	21.60	34.60	22.30	34.00	13.00	11.70	1.3	8.06E-06	7.32E-06
															Averages:	**8.38E-06**	**7.61E-06**

Remarks: Test specimen compacted to 95% at optimum moisture content.



References:
ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D 2216: Laboratory Determination of Water Content of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plasticity Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 854: Specific Gravity of Soils
ASTM D 422: Particle Size Analysis of Soils

Technician / Certification #: David Duffy/Mal Krajan Certification #:

Technical Responsibility: Mal Krajan Position: Laboratory Supervisor

Laboratory Report Version 4.2

Particle Size Analysis of Soils

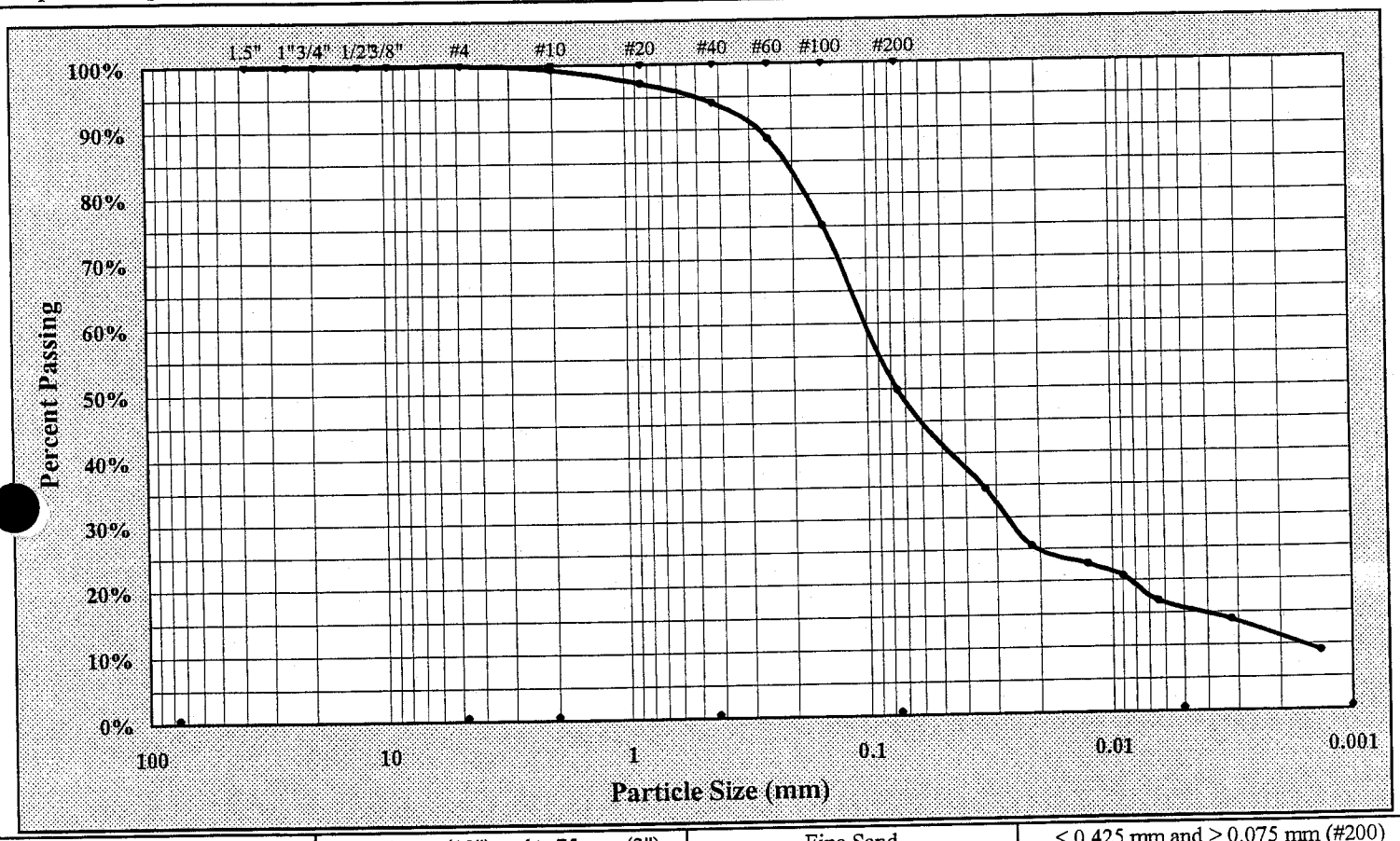
ASTM D 422

S&ME

S&ME Project #: **1054-04-955**
Project Name: **Belews Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: 09/21/2004
Test Date(s): 09/13 - 09/17/2004

Boring #:	BC-16	Sample #:	Bag-1	Sample Date:	9/1/04
Location:	Site Borehole	Offset:	NA	Depth (ft):	0 - 5'
Sample Description:	Tan-Brown Silty SAND (SM)				



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#4	Gravel	0.0%	Silt	34.1%
Silt & Clay (% Passing #200)	49.7%	Sand	50.3%	Clay	15.6%
Apparent Relative Density	2.708	Moisture Content	42.1%	Colloids	8.8%
Liquid Limit	30	Plastic Limit	22	Plastic Index	8

Description of Sand & Gravel Particles Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: ASTM D 422: Particle Size Analysis of Soils
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan — Signature — Laboratory Supervisor — Position

S&ME, INC. 3109 Spring Forest Road, Raleigh, N.C. 27616

Liquid Limit, Plastic Limit, and Plastic Index

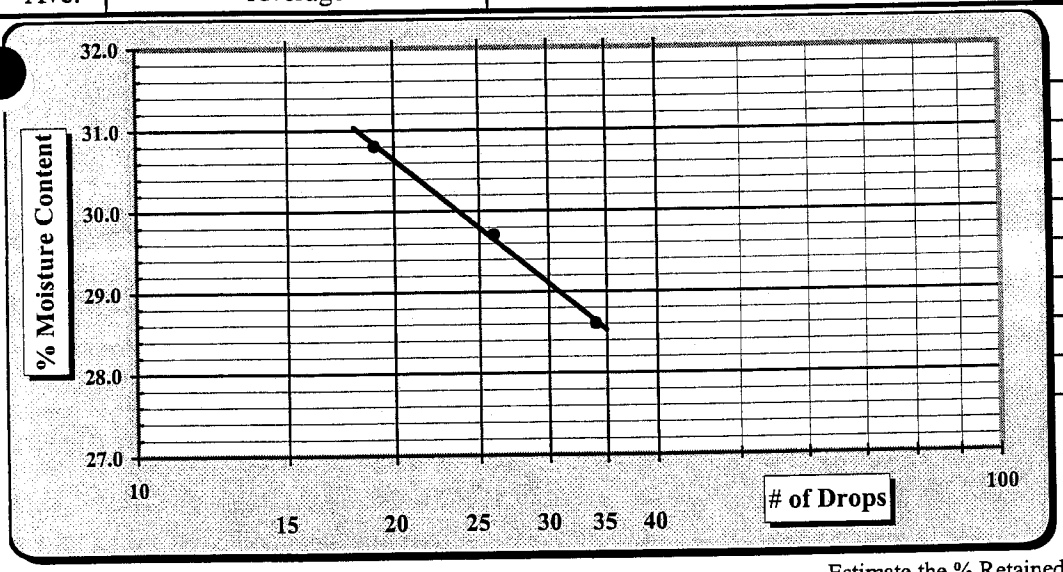
S&ME

Project #: 1054-04-955
Project Name: Belews Creek Steam Plant
Client Name: Duke Energy
Client Address:

Report Date: 9/21/2004
Test Date(s): 09/13 - 09/17/2004

Boring #: BC-16 Sample #: Bag-1 Sample Date: 9/1/2004
Location: Site Borehole Offset: NA Depth (ft): 0 - 5'
Sample Description: Tan-Brown Silty SAND (SM)

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	40	56	54				34	57	
A	Tare Weight	21.00	20.93	21.04				20.91	20.97	
B	Wet Soil Weight + A	34.05	37.33	38.92				31.38	30.99	
C	Dry Soil Weight + A	30.98	33.57	34.94				29.48	29.14	
D	Water Weight (B-C)	3.07	3.76	3.98				1.90	1.85	
E	Dry Soil Weight (C-A)	9.98	12.64	13.90				8.57	8.17	
F	% Moisture Content (D/E)*100	30.8%	29.7%	28.6%				22.2%	22.6%	
N	# OF DROPS	19	26	34				*Moisture Contents determined by ASTM D 2216*		
LL	LL = F * FACTOR									
Ave.	Average							22.4%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation ☐	Dry Preparation ☐	Air Dried ☒	NP, Non-Plastic	☐
Liquid limit Test:	Multipoint Method ☒	One-point Method ☐		Liquid Limit	30
Classification:	ASTM D 2487 ☒	AASHTO M 145 ☐		Plastic Limit	22
Liquid limit Test:	ASTM D 4318 ☒	AASHTO T 89 ☐		Plastic Index	8
Plastic limit Test:	ASTM D 4318 ☒	AASHTO T 90 ☐		Group Symbol	SM

Technician Name: Chana Savanapridi — QCT-1433 (Certification #)

Technical Responsibility: Mal Krajan (Signature) — Laboratory Supervisor (Position)

Moisture - Density Report

S&ME

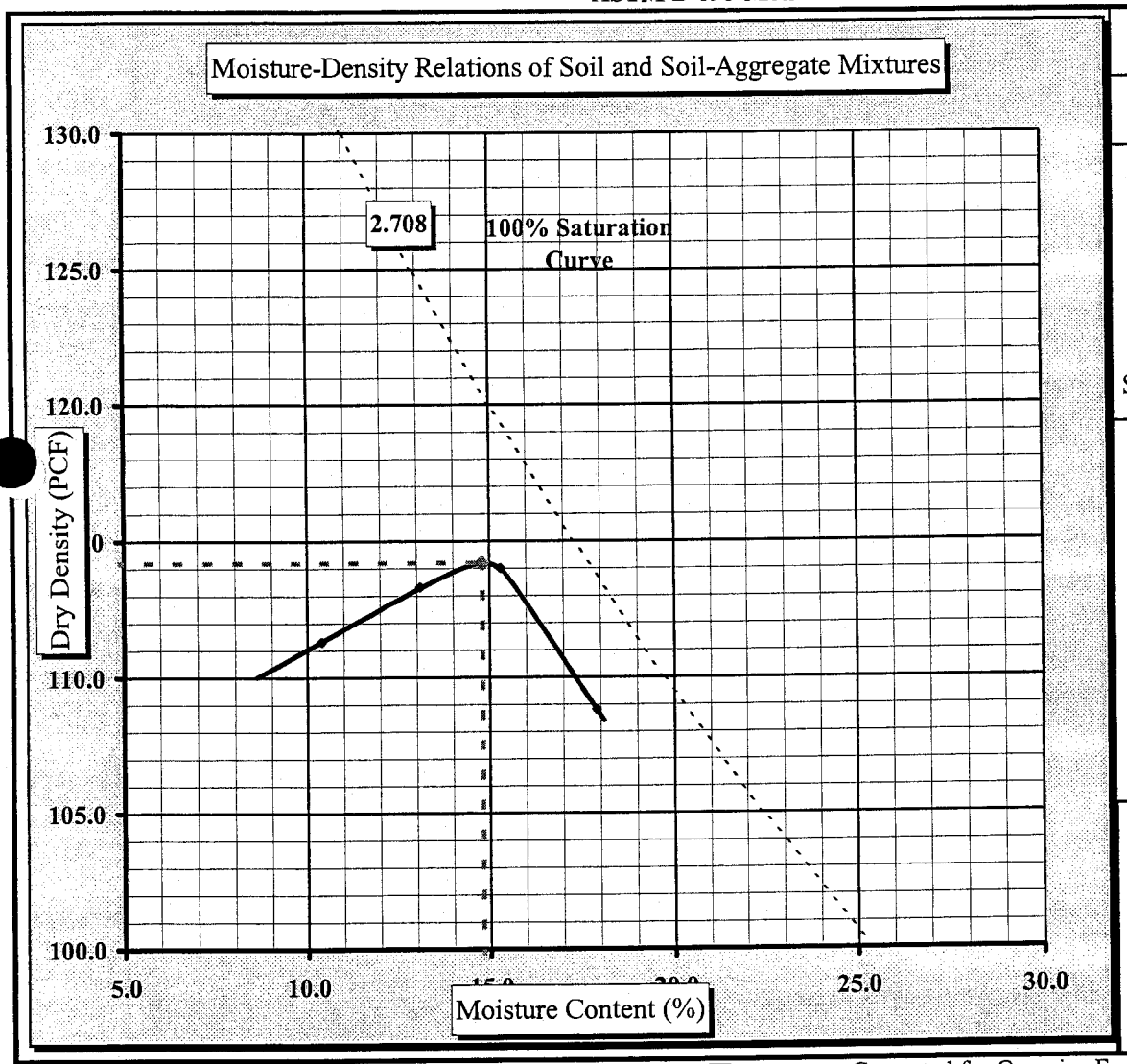
S&ME Project #: 1054-04-955
Project Name: Belews Creek Steam Plant
Client Name: Duke Energy
Client Address:

Report Date: September 14, 2004
Test Date(s): 09/13 - 09/14/2004

Boring #:	BC-16	Sample #:	Bag-1	Sample Date:	September 1, 2004
Location:	Site-Borehole	Offset:	NA	Depth (ft):	0 - 5'
Sample Description:	Tan-Brown Silty SAND (SM)				

Maximum Dry Density 114.2 **PCF.** **Optimum Moisture Content** 14.8 %

ASTM D 698 Method A



Soil Properties

Natural Moisture Content:	42.1%
Liquid Limit:	30
Plastic Limit:	22
Plastic Index:	8
Specific Gravity:	2.708
% Passing #4	100.0

Oversize Fraction

Bulk Sp. Gravity
% Moisture
Oversize Fraction
MDD
Opt. MC

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐
Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐
Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

References: ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 422: Particle Size Analysis of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan *Signature* Laboratory Supervisor *Position*

Laboratory Report Version 4.2

Specific Gravity of Soils

S&ME

ASTM D 854 *Method A: Moist Specimens* ☒ *Method B: Oven-dried Specimens* ☐

Project #: **1054-04-955**
Project Name: **Belews Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: September 21, 2004
Test Date(s) 09/13 - 09/16/2004

Boring No. BC-16 Sample No. Bag-1 Sample Date: 09/01/04
Location: Site Borehole Offset: Depth (ft): 0 - 5'
Sample Description: Pink Silty SAND (SM)
Percent of Soil Passing #4 Sieve: **100.0** Material Excluded:
LL = 30 PL = 22 PI = 8

	Pycnometer #	101	Balance ID#	Readability	.01 gram
V_p	Pycnometer Volume (V_p)	499.84 ml.		Calibration Date	
PM	Pycnometer Mass	183.76 g.	Balance Verification		
M_p	Ave. Pycnometer Mass (Mp)	183.73 g.		Mass	500 gram
[PM-M_p]	Verify Pycnometer Mass	0.03 g.		Mass Determination	500.00

If [PM-M_p] is greater than .06 grams recalibrate the dry mass of the pycnometer or the balance.

Method A: Moist Specimens

Initial Moisture Content		Tare #:	
A	Tare Weight		
B	Wet Wt + Tare Wt		
C	Dry Wt. + Tare Wt.		
D	Water Weight	B-C	
E	Dry Weight	C-A	
F	**Moisture Content**	100*D/E	

Target Dry Mass (see Table 1 ASTM D854)	Low Limit	High Limit
Target Wet Mass		

Wet Mass of test specimen grams

Method B: Oven-dried Specimens

Initial Dry Mass of test specimen 29.89 grams

Per T-100

$M_{psw;t}$ Mass of the Pycnometer, soil, and water 701.14 grams

Mass of Dry Soil (grams)			
		Tare #	3
A	Tare Weight		
C	Dry Wt. + Tare Wt.		29.89
M_s	Dry Weight	C-A	29.89

T_t	Test Temperature T_t	23.5 °C
K	Temperature Coefficient at T_t	0.99923
K	Temperature Coefficient at 23°C	0.99933
$p_{w;t}$	Density of Water at T_t	0.99742 g./ml.
	See Table 2 ASTM D 854	

$M_{pw;t}$ Mass of the Pycnometer and water at T_t $M_{pw;t} = M_p + (V_p \times p_{w;t})$ 682.28 grams
G_t Specific Gravity of Soil Solids at the T_t $G_t = M_s / (M_{pw;t} - (M_{psw;t} - M_s))$ 2.710
G Specific Gravity of Soil Solids at the 20°C $G = K \times G_t$ 2.708

Soils containing plus #4 material tested per ASTM C 127:
Note: Deviation or remove this note

R % of Soil retained on the #4 sieve
P % of Soil passing the #4 sieve

G_{+4} Apparent Specific Gravity of plus #4 material at the 23°C per ASTM C127
Apparent Specific Gravity of plus #4 material corrected to 20°C

G_{total} The Average total sample Specific Gravity

$$G_{total} = \frac{1}{\frac{R}{100-G_{+4}} + \frac{P}{100-G}} = 2.708$$

References: ASTM D854 Specific Gravity of Soil Solids by Water Pycnometer ASTM C 127: Specific Gravity and Absorption of Coarse Aggregates
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Technician Name: Chana Savanapridi QCT - 1433 (Certification #)
Technical Responsibility: Mal Krajan (Signature) Laboratory Supervisor (Position)

S&ME

Hydraulic Conductivity of S[illegible]ated Porous Materials
Using a Flexible Wall Permeameter (Method "C")

Project #: 1054-04-955 — Test Date(s): 9/23 - 9/28/04

Project Name: Belews Creek Steam Plant — Report Date: 09/29/04

Client Name:

Client Address:

Boring #: BC-16 | Sample #: Bag-1 | Depth/Elevation: 0-5 ft. | Sample Date: 09/01/04

Location: Project Site | Offset: NA | Sample Description: Tan-Brown Silty SAND (SM)

Liquid Limit: 30 | Specific Gravity: 2.708 | Sample Type: lab-compacted | Sampled By: S&ME

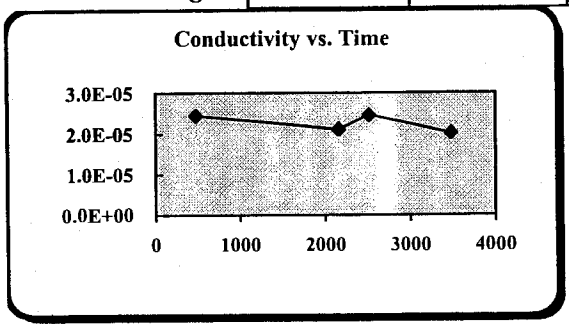
Plastic Limit: 22 | Plasticity Index: 8 | Percent Passing #200: 49.7 | Maximum Particle Size: #4

Initial Sample Conditions				Final Sample Conditions			
Height (cm):	9.540	Wet Unit Weight (lbs/ft^3):	121.5	Height (cm):	9.533	Dry Unit Weight (lbs/ft^3):	106.6
Diameter (cm):	7.417	Dry Unit Weight (lbs/ft^3):	106.6	Diameter (cm):	7.414	Percent Saturation:	100.0
Area (cm^2):	43.21	Percent Saturation:	66.1	Area (cm^2)	43.17	Void Ratio:	0.5845
Volume (cm^3):	412.22	Void Ratio:	0.5857	Volume (cm^3)	411.54	Porosity:	0.3689
Wet weight (grams):	802.3	Porosity:	0.3694	Wet weight (grams)	859.6	Measured ***B*** coefficient: 1.00	
Dry Weight (grams):	703.6	Station Corrections (cm)		Dry Weight (grams)	703.6	MDD (pcf): 114.2	Optimum (%): 14.8
Percent Moisture:	14.3	Influent: 4.012	Effluent: 3.535	Percent Moisture:	22.2		

Testing Station	Burette Areas (cm^2):				Effective Consolidation Stress (psi):	7.0	Permeant Liquid Used:	Deaired Demineralized water
11	Influent:	0.720	Influent:	0.720	Cell Pressure (psi):	87.0	Influent Pressure (psi):	80.0	Effluent Pressure (psi)	80.0

Start		End		Time	Temperature (°C)			Corr.	Initial		Final		h_1	h_2	Grad-	K-Value (cm/sec)	
Date	Time	Date	Time	(seconds)	Initial	Final	Avg.	Factor	INF.	EFF.	INF.	EFF.	(cm)	(cm)	ient	Uncorrected	Corrected
09/28/04	2:47:00 PM	09/28/04	2:55:00 PM	480	24.5	24.5	24.5	0.898	13.50	48.00	16.20	45.40	34.98	29.68	3.4	2.72E-05	2.44E-05
09/28/04	2:55:00 PM	09/28/04	3:23:00 PM	1680	24.5	24.5	24.5	0.898	16.20	45.40	22.20	39.80	29.68	18.08	2.5	2.35E-05	2.11E-05
09/28/04	3:23:00 PM	09/28/04	3:29:00 PM	360	24.5	24.5	24.5	0.898	22.20	39.80	23.30	38.80	18.08	15.98	1.8	2.73E-05	2.45E-05
09/28/04	3:29:00 PM	09/28/04	3:45:00 PM	960	24.5	24.5	24.5	0.898	23.30	38.80	25.30	37.00	15.98	12.18	1.5	2.25E-05	2.02E-05
															Averages:	**2.51E-05**	**2.26E-05**

Remarks: Specimen was compacted to 95% at opt. moisture content.



References:
ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D 2216: Laboratory Determination of Water Content of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plasticity Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 854: Specific Gravity of Soils
ASTM D 422: Particle Size Analysis of Soils

Technician / Certification #: David Duffy — Certification #:

Technical Responsibility: Mal Krajan — Position: Laboratory Supervisor

Laboratory Report Version 4.2

Particle Size Analysis of Soils

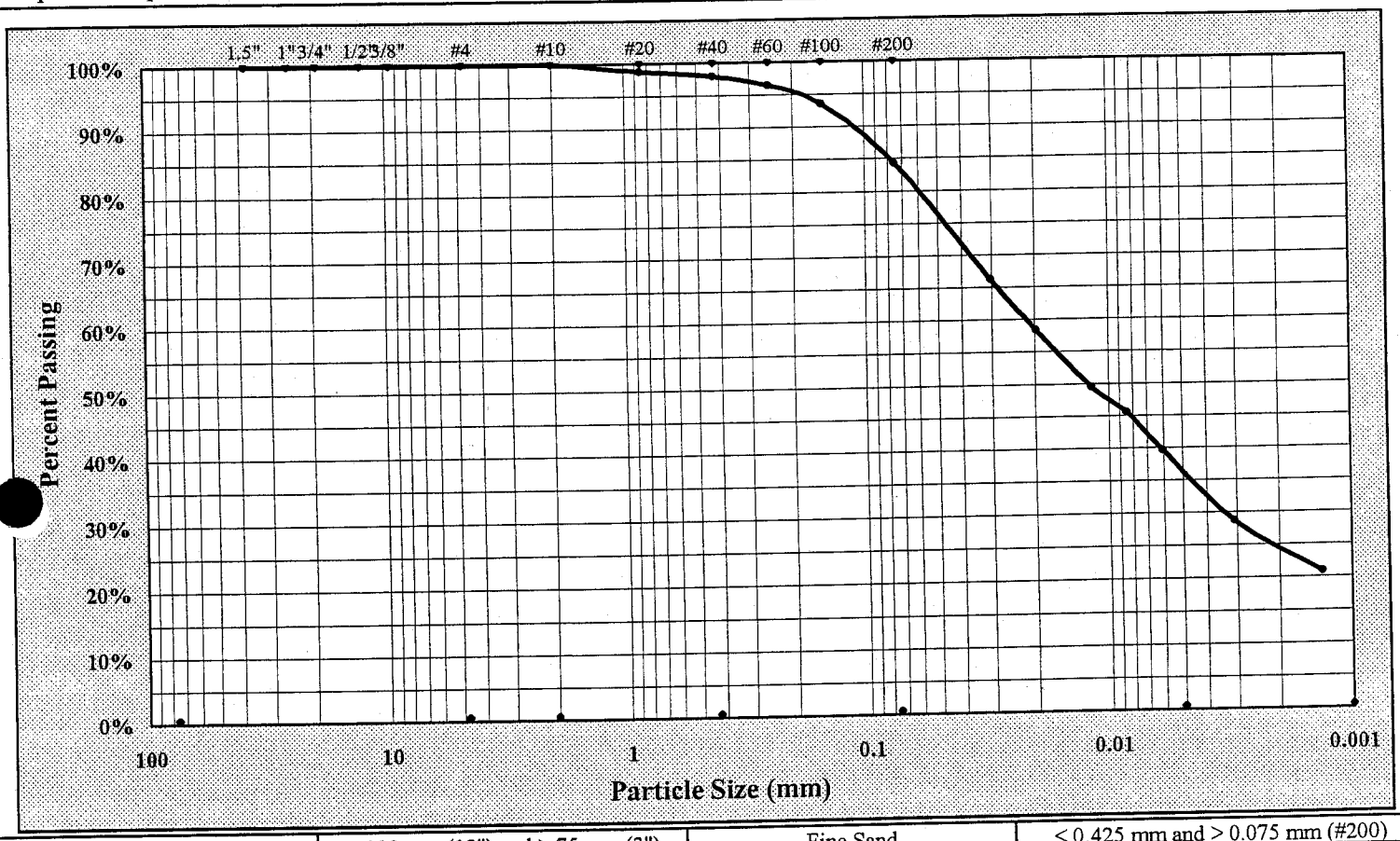
ASTM D 422

S&ME

S[redacted]ME Project #: **1054-04-955**
Project Name: **Belews Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: 09/21/2004
Test Date(s): 09/13 - 09/17/2004

Boring #:	BC-17	Sample #:	Bag-1	Sample Date:	9/1/04
Location:	Site Borehole	Offset:	NA	Depth (ft):	0 - 6'
Sample Description:	Red-Brown Sandy Clayey SILT (MH)				



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	4"	Gravel	0.0%	Silt	48.2%
Silt & Clay (% Passing #200)	84.2%	Sand	15.8%	Clay	36.0%
Apparent Relative Density	2.654	Moisture Content	21.3%	Colloids	20.7%
Liquid Limit	55	Plastic Limit	31	Plastic Index	24

Description of Sand & Gravel Particles Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

[redacted]rences: ASTM D 422: Particle Size Analysis of Soils
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan — Laboratory Supervisor
(Signature) (Position)

S&ME, INC. 3109 Spring Forest Road, Raleigh, N.C. 27616

BC-17 Bag-1 Classification.xls

Laboratory Record Version 4.2

Liquid Limit, Plastic Limit, and Plastic Index

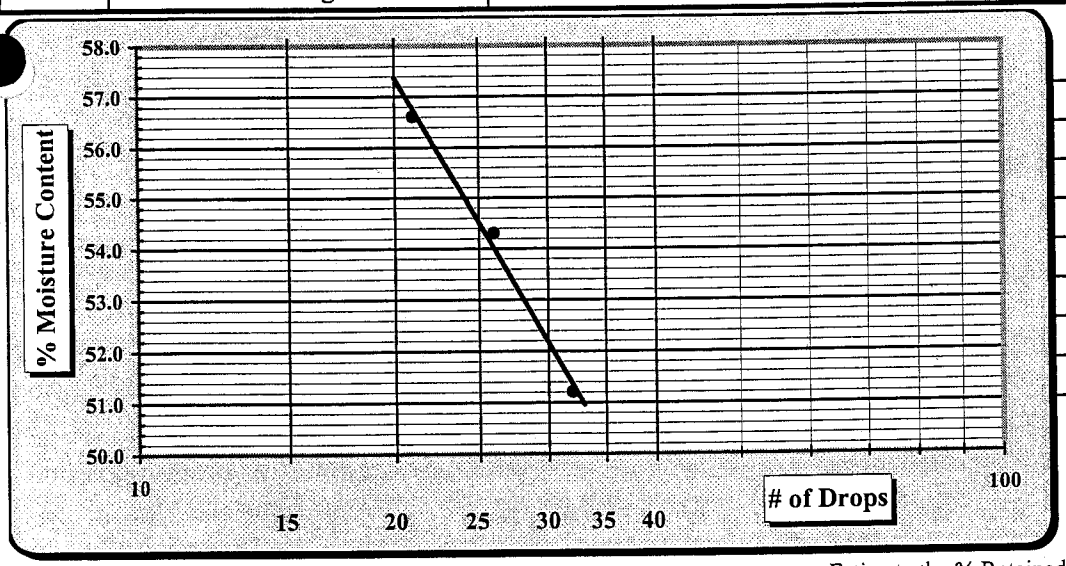
S&ME

Project #: **1054-04-955**
Project Name: Belews Creek Steam Plant
Client Name: Duke Energy
Client Address:

Report Date: 9/21/2004
Test Date(s): 09/13 - 09/17/2004

Boring #: BC-17 Sample #: Bag-1 Sample Date: 9/1/2004
Location: Site Borehole Offset: NA Depth (ft): 0 - 6'
Sample Description: Red-Brown Sandy Clayey SILT (MH)

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	42	2	5				16	11	
A	Tare Weight	18.66	15.25	15.36				20.97	21.01	
B	Wet Soil Weight + A	29.15	24.86	26.34				29.28	28.10	
C	Dry Soil Weight + A	25.60	21.48	22.37				27.29	26.45	
D	Water Weight (B-C)	3.55	3.38	3.97				1.99	1.65	
E	Dry Soil Weight (C-A)	6.94	6.23	7.01				6.32	5.44	
F	% Moisture Content (D/E)*100	51.2%	54.3%	56.6%				31.5%	30.3%	
N	# OF DROPS	32	26	21				*Moisture Contents determined by ASTM D 2216*		
LL	LL = F * FACTOR									
Ave.	Average							30.9%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation	☐	Dry Preparation	☐	Air Dried	☒	NP, Non-Plastic ☐
Liquid limit Test:	Multipoint Method	☒	One-point Method	☐			Liquid Limit 55
Classification:	ASTM D 2487	☒	AASHTO M 145	☐			Plastic Limit 31
Liquid limit Test:	ASTM D 4318	☒	AASHTO T 89	☐			Plastic Index 24
Plastic limit Test:	ASTM D 4318	☒	AASHTO T 90	☐			Group Symbol MH

Technician Name: Chana Savanapridi OCT-1433 (Certification #)

Technical Responsibility: Mal Krajan (Signature) Laboratory Supervisor (Position)

Laboratory Report Version 4.2

Specific Gravity of Soils

S&ME

ASTM D 854 *Method A: Moist Specimens* ☒ *Method B: Oven-dried Specimens* ☐

Project #: **1054-04-955**
Project Name: **Belews Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: September 21, 2004
Test Date(s) 09/13 - 09/16/2004

Boring No. BC-17 Sample No. Bag-1 Sample Date: 09/01/04
Location: Site Borehole Offset: NA Depth (ft): 0 - 6'
Sample Description: Red-Brown Sandy Clayey SILT (MH)
Percent of Soil Passing #4 Sieve: **100.0** Material Excluded:
LL = 55 PL = 31 PI = 24

	Pycnometer #	**109**	**Balance ID#**	Readability	**.01 gram**
V_p	Pycnometer Volume (V_p)	**499.54 ml.**		Calibration Date	
PM	Pycnometer Mass	**182.85 g.**	**Balance Verification**		
M_p	Ave. Pycnometer Mass (Mp)	**182.86 g.**		Mass	**500 gram**
[PM-M_p]	Verify Pycnometer Mass	**0.01 g.**		Mass Determination	**500.00**

If [PM-M_p] is greater than .06 grams recalibrate the dry mass of the pycnometer or the balance.

Method A: Moist Specimens

	Initial Moisture Content	Tare #:	
A	Tare Weight		
B	Wet Wt + Tare Wt		
C	Dry Wt. + Tare Wt.		
D	Water Weight	B-C	
E	Dry Weight	C-A	
F	**Moisture Content**	100*D/E	

Target Dry Mass (see Table 1 ASTM D854)	Low Limit	High Limit
Target Wet Mass		

Wet Mass of test specimen grams

Method B: Oven-dried Specimens

Initial Dry Mass of test specimen 29.89 grams

T-100

$M_{psw;t}$ Mass of the Pycnometer, soil, and water 713.46 grams

Mass of Dry Soil (grams)			
	Tare #	3	
A	Tare Weight		
C	Dry Wt. + Tare Wt.	51.83	
M_s	Dry Weight C-A	**51.83**	

T_t	Test Temperature T_t	23.2 °C
K	Temperature Coefficient at T_t	0.99929
K	Temperature Coefficient at 23°C	0.99933
$p_{w;t}$	Density of Water at T_t	0.99749 g./ml.
	See Table 2 ASTM D 854	

$M_{pw;t}$ Mass of the Pycnometer and water at T_t $M_{pw;t} = M_p + (V_p \times p_{w;t})$ 681.15 grams
G_t Specific Gravity of Soil Solids at the T_t $G_t = M_s / (M_{pw;t} - (M_{psw;t} - M_s))$ 2.656
G Specific Gravity of Soil Solids at the 20°C $G = K \times G_t$ 2.654

Soils containing plus #4 material tested per ASTM C 127: R % of Soil retained on the #4 sieve
Note: Deviation or remove this note P % of Soil passing the #4 sieve

G_{+4} Apparent Specific Gravity of plus #4 material at the 23°C per ASTM C127
Apparent Specific Gravity of plus #4 material corrected to 20°C

G_{total} The Average total sample Specific Gravity $G_{total} = \dfrac{1}{\dfrac{R}{100-G_{+4}} + \dfrac{P}{100-G}} =$ 2.654

References: ASTM D854 Specific Gravity of Soil Solids by Water Pycnometer ASTM C 127: Specific Gravity and Absorption of Coarse Aggregates
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Technician Name: Chana Savanapridi OCT - 1433 (Certification #)
Technical Responsibility: Mal Krajan (Signature) Laboratory Supervisor (Position)

Laboratory Report Version 4.2

Moisture - Density Report

S&ME

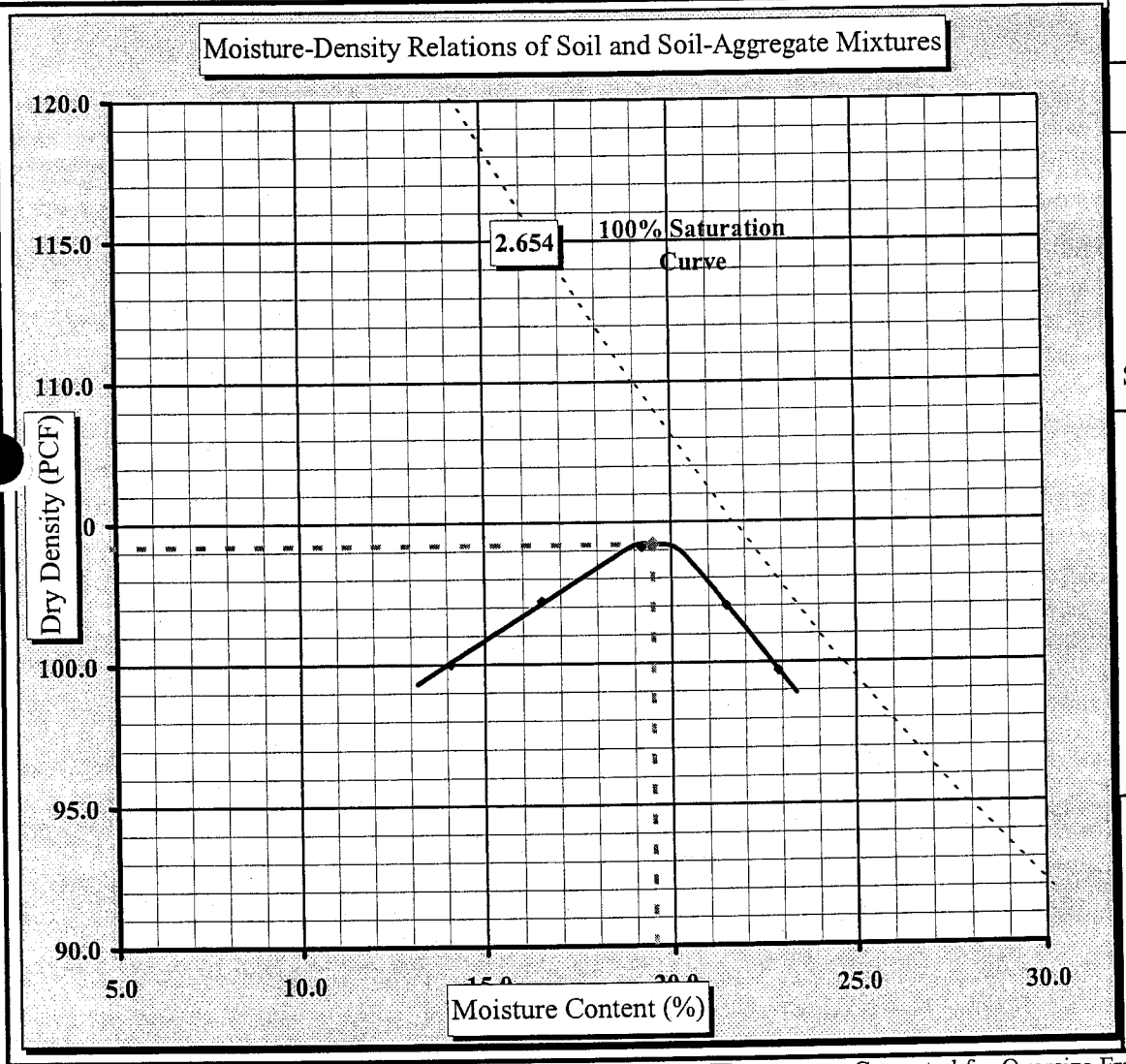
S&ME Project #: 1054-04-955
Project Name: Belews Creek Steam Plant
Client Name: Duke Energy
Client Address:

Report Date: September 14, 2004
Test Date(s): 09/13 - 09/14/2004

Boring #:	BC-17	Sample #:	Bag-1	Sample Date:	9/1 - 9/8/04
Location:	Site-Borehole	Offset:	NA	Depth (ft):	0 - 6'
Sample Description:	Red-Brown Sandy Clayey SILT (MH)				

Maximum Dry Density 104.2 **PCF.** **Optimum Moisture Content** 19.5 %

ASTM D 698 Method A



Soil Properties

Natural Moisture Content:	21.2%
Liquid Limit:	55
Plastic Limit:	31
Plastic Index:	24
Specific Gravity:	2.654

% Passing
#4 100.0

Oversize Fraction

Bulk Sp. Gravity
% Moisture
Oversize Fraction
MDD
Opt. MC

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐
Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐
Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

References: ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 422: Particle Size Analysis of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan *Signature* Laboratory Supervisor *Position*

S&ME

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method "C")

Test Date(s): 9/23 - 9/28/04

Report Date: 09/29/04

Project #: 1054-04-955

Project Name: Belews Creek Steam Plant

Client Name:

Client Address:

Boring #: BC-17 | Sample #: Bag-1 | Depth/Elevation: 0-6 ft. | Sample Date: 09/01/04

Location: Project Site | Offset: NA | Sample Description: Red-Brown Sandy Clayey SILT (MH)

Liquid Limit: 55 | Specific Gravity: 2.654 | Sample Type: lab-compacted | Sampled By: S&ME

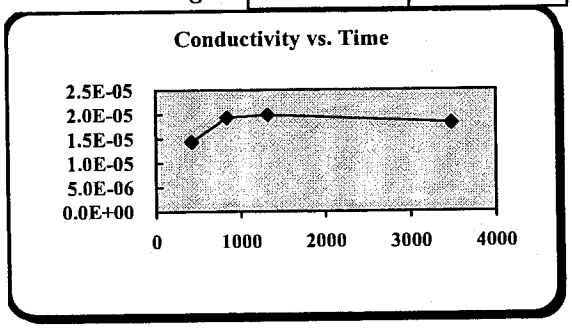
Plastic Limit: 31 | Plasticity Index: 24 | Percent Passing #200: 84.2 | Maximum Particle Size: #4

Initial Sample Conditions				Final Sample Conditions			
Height (cm):	9.642	Wet Unit Weight (lbs/ft^3):	115.6	Height (cm):	9.642	Dry Unit Weight (lbs/ft^3):	98.4
Diameter (cm):	7.361	Dry Unit Weight (lbs/ft^3):	98.4	Diameter (cm):	7.361	Percent Saturation:	100.0
Area (cm^2):	42.56	Percent Saturation:	75.1	Area (cm^2)	42.56	Void Ratio:	0.6823
Volume (cm^3):	410.36	Void Ratio:	0.6823	Volume (cm^3)	410.36	Porosity:	0.4056
Wet weight (grams):	759.8	Porosity:	0.4056	Wet weight (grams)	832.4	Measured ***B*** coefficient: 0.98	
Dry Weight (grams):	647.0	Station Corrections (cm)		Dry Weight (grams)	647.0	MDD (pcf): 104.2	Optimum (%): 19.5
Percent Moisture:	19.3	Influent: 3.174	Effluent: 3.174	Percent Moisture:	28.7		

Testing Station	Burette Areas (cm^2):			Effective Consolidation Stress (psi):	7.0	Permeant Liquid Used:	Deaired Demineralized water
10	Influent: 0.720	Influent:	0.720	Cell Pressure (psi):	87.0	Influent Pressure (psi):	80.0	Effluent Pressure (psi):	80.0

Start		End		Time	Temperature (°C)			Corr.	Initial		Final		h_1	h_2	Grad-	K-Value (cm/sec)	
Date	Time	Date	Time	(seconds)	Initial	Final	Avg.	Factor	INF.	EFF.	INF.	EFF.	(cm)	(cm)	ient	Uncorrected	Corrected
09/28/04	2:48:00 PM	09/28/04	2:55:00 PM	420	24.5	24.5	24.5	0.898	0.00	28.00	1.00	26.80	28.00	25.80	2.8	1.59E-05	1.43E-05
09/28/04	2:55:00 PM	09/28/04	3:02:00 PM	420	24.5	24.5	24.5	0.898	1.00	26.80	2.30	25.40	25.80	23.10	2.5	2.15E-05	1.93E-05
09/28/04	3:02:00 PM	09/28/04	3:10:00 PM	480	24.5	24.5	24.5	0.898	2.30	25.40	3.60	23.90	23.10	20.30	2.3	2.20E-05	1.98E-05
09/28/04	3:10:00 PM	09/28/04	3:46:00 PM	2160	24.5	24.5	24.5	0.898	3.60	23.90	7.50	19.40	20.30	11.90	1.7	2.02E-05	1.81E-05
															Averages:	**1.99E-05**	**1.79E-05**

Remarks: Specimen was compacted to 95% at opt. moisture content.



References:

ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

ASTM D 2216: Laboratory Determination of Water Content of Soils

ASTM D 4318: Liquid Limit, Plastic Limit, & Plasticity Index of Soils

ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D 854: Specific Gravity of Soils

ASTM D 422: Particle Size Analysis of Soils

Technician / Certification #: David Duffy Certification #:

Technical Responsibility: Mal Krajan Position: Laboratory Supervisor

Laboratory Report Version 4.2

Particle Size Analysis of Soils

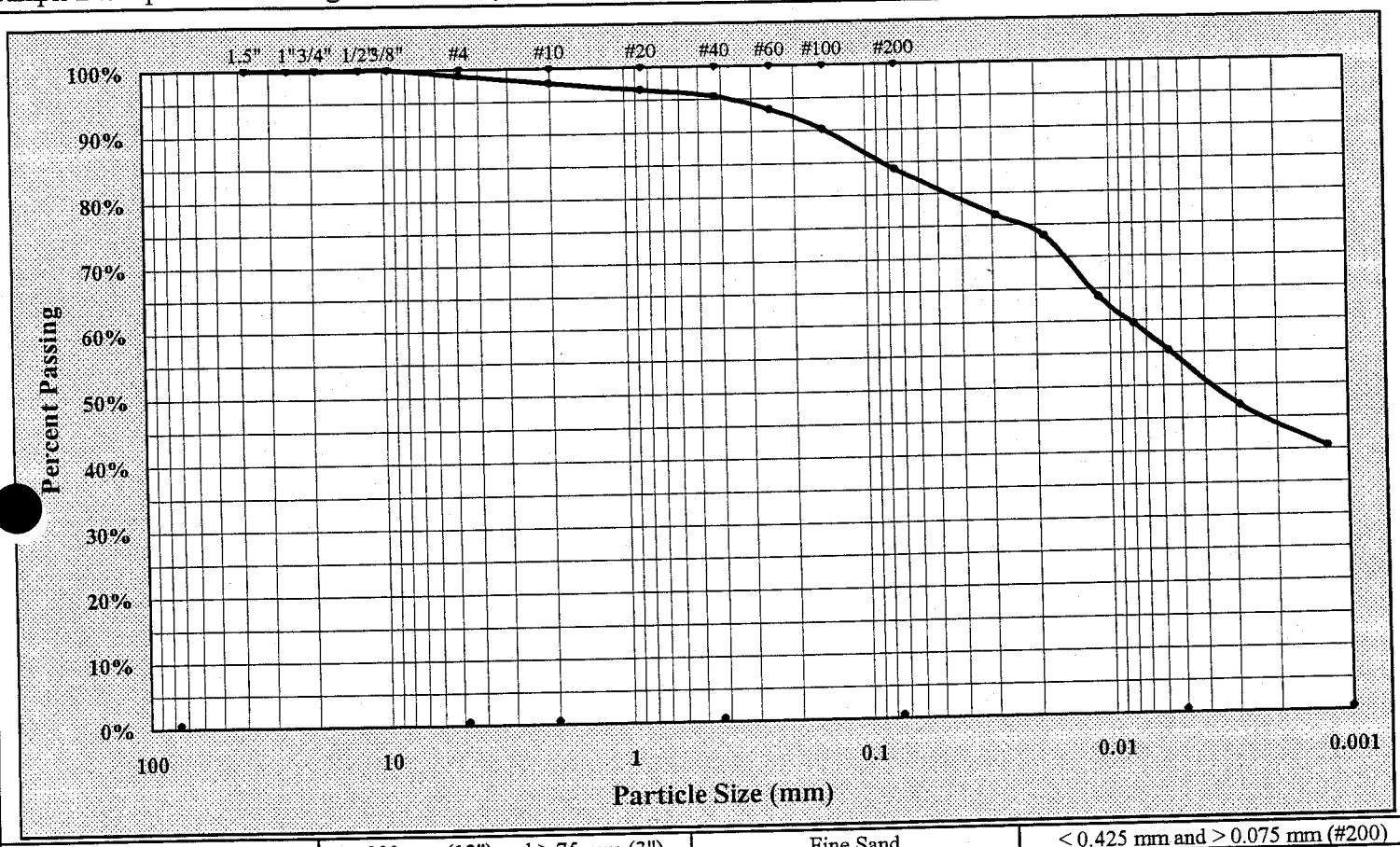
ASTM D 422

S&ME

S&ME Project #: **1054-04-955**
Project Name: **Belew Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: 10/08/2004
Test Date(s): 09/28 - 10/07/2004

Boring #:	BC-19	Sample #:	Bag-1	Sample Date:	9/1/04
Location:	Site Borehole	Offset:	NA	Depth (ft):	2 - 7'
Sample Description:	Orange-Brown Sandy SILT (MH)				



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/8"	Gravel	1.0%	Silt	30.8%
Silt & Clay (% Passing #200)	83.8%	Sand	15.2%	Clay	53.0%
Apparent Relative Density	2.735	Moisture Content	37.1%	Colloids	40.3%
Liquid Limit	72	Plastic Limit	44	Plastic Index	28

Description of Sand & Gravel Particles Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: ASTM D 422: Particle Size Analysis of Soils
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan — Laboratory Supervisor
(Signature) (Position)

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3109 Spring Forest Road, Raleigh, N.C. 27616

Laboratory Record Version 4.2

Liquid Limit, Plastic Limit, and Plastic Index

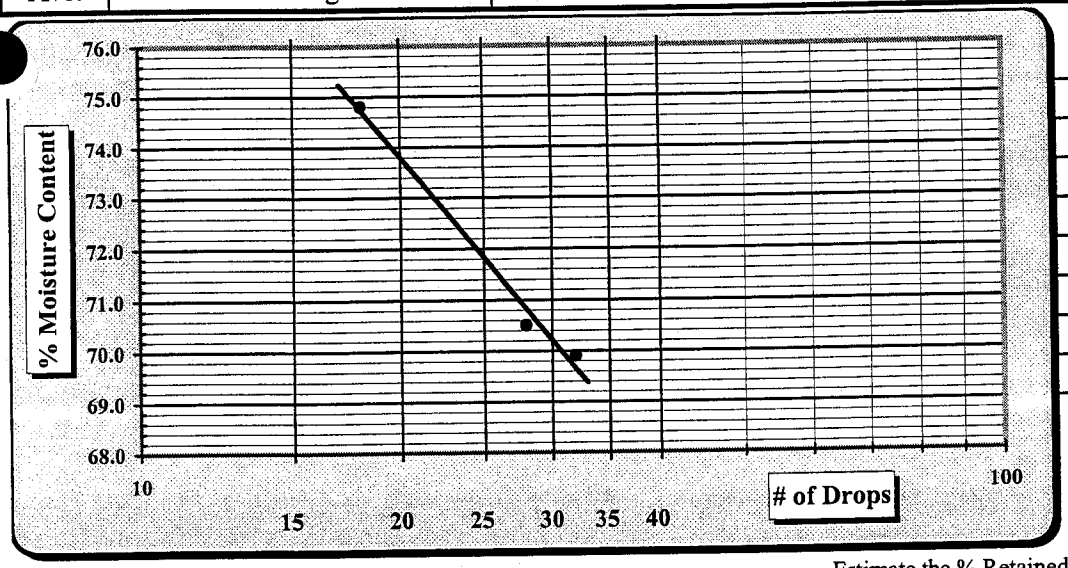
S&ME

Project #: **1054-04-955**
Project Name: Belews Creek Steam Plant
Client Name: Duke Energy
Client Address:

Report Date: 10/08/204
Test Date(s): 09/30 - 10/07/2004

Boring #: BC-19 Sample #: Bag-1 Sample Date: 9/1/2004
Location: Site Borehole Offset: NA Depth (ft): 2 - 7'
Sample Description: Orange-Brown Sandy SILT (MH)

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	52	2	37				47	28	
A	Tare Weight	18.57	15.25	18.56				20.92	21.04	
B	Wet Soil Weight + A	27.64	24.97	25.12				29.61	30.46	
C	Dry Soil Weight + A	23.89	20.81	22.42				26.98	27.59	
D	Water Weight (B-C)	3.75	4.16	2.70				2.63	2.87	
E	Dry Soil Weight (C-A)	5.32	5.56	3.86				6.06	6.55	
F	% Moisture Content (D/E)*100	70.5%	74.8%	69.9%				43.4%	43.8%	
N	# OF DROPS	28	18	32				*Moisture Contents determined by ASTM D 2216*		
LL	LL = F * FACTOR									
Ave.	Average							43.6%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation	☐	Dry Preparation	☐	Air Dried	☒	NP, Non-Plastic ☐
Liquid limit Test:	Multipoint Method	☒	One-point Method	☐			Liquid Limit 72
Classification:	ASTM D 2487	☒	AASHTO M 145	☐			Plastic Limit 44
Liquid limit Test:	ASTM D 4318	☒	AASHTO T 89	☐			Plastic Index 28
Plastic limit Test:	ASTM D 4318	☒	AASHTO T 90	☐			Group Symbol MH

Technician Name: Chana Savanapridi OCT-1433 (Certification #)

Technical Responsibility: Mal Krajan (Signature) Laboratory Supervisor (Position)

Laboratory Report Version 4.2

Moisture - Density Report

S&ME

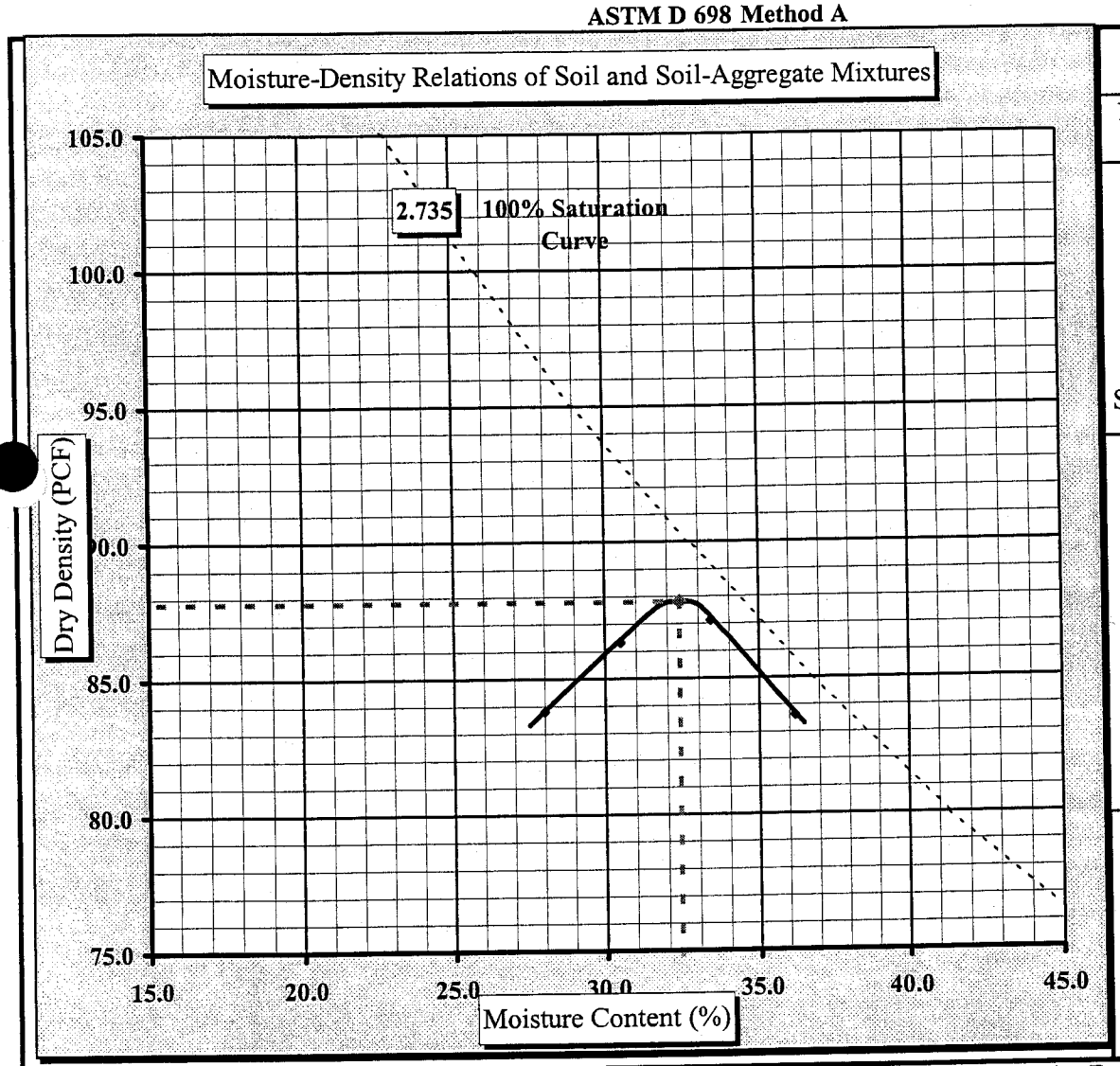
S&ME Project #:	1054-04-955	Report Date:	October 8, 2004
Project Name:	Belews Creek Steam Plant	Test Date(s):	09/29 - 09/30/2004
Client Name:	Duke Energy		
Client Address:			

Boring #:	BC-19	Sample #:	Bag-1	Sample Date:	September 1, 2004
Location:	Site Borehole	Offset:	NA	Depth (ft):	2 - 7'

Sample Description: Orange-Brown Sandy SILT (MH)

Maximum Dry Density **87.8** **PCF.** **Optimum Moisture Content** **32.4** **%**

ASTM D 698 Method A



Soil Properties	
Natural Moisture Content:	37.1%
Liquid Limit:	72
Plastic Limit:	44
Plastic Index:	28
Specific Gravity:	2.735
% Passing #4	100.0

Oversize Fraction

Bulk Sp. Gravity
% Moisture
Oversize Fraction
MDD
Opt. MC

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐

Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

References: ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 422: Particle Size Analysis of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan *Signature* Laboratory Supervisor *Position*

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Laboratory Report Version 4.2

Specific Gravity of Soils

S&ME

ASTM D 854 *Method A: Moist Specimens* ☐ *Method B: Oven-dried Specimens* ☒

Project #: **1054-04-955**
Project Name: **Belews Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: October 8, 2004
Test Date(s) 09/29 - 09/30/2004

Boring No. BC-19 Sample No. Bag-1 Sample Date: 09/01/04
Location: Site Borehole Offset: NA Depth (ft): 2 - 7'
Sample Description: Orange-Brown Sandy SILT (MH)
Percent of Soil Passing #4 Sieve: **100.0** Material Excluded:
LL = 72 PL = 44 PI = 28

	Pycnometer #	**105**	**Balance ID#**	Readability	**.01 gram**
V_p	Pycnometer Volume (V_p)	**499.39 ml.**		Calibration Date	
PM	Pycnometer Mass	**194.34 g.**	**Balance Verification**		
M_p	Ave. Pycnometer Mass (Mp)	**194.34 g.**		Mass	**500 gram**
[PM-M_p]	Verify Pycnometer Mass	**g.**		Mass Determination	**500.00**

If [PM-M_p] is greater than .06 grams recalibrate the dry mass of the pycnometer or the balance.

Method A: Moist Specimens

	Initial Moisture Content	Tare #:	20
A	Tare Weight		7.93
B	Wet Wt + Tare Wt		56.78
C	Dry Wt. + Tare Wt.		43.55
D	Water Weight	B-C	13.23
E	Dry Weight	C-A	35.62
F	**Moisture Content**	100*D/E	**37.1%**

Target Dry Mass (see Table 1 ASTM D854)	Low Limit	High Limit
Target Wet Mass		

Wet Mass of test specimen _____ grams

Method B: Oven-dried Specimens

Initial Dry Mass of test specimen **33.66** grams

T-100

$M_{psw;t}$ Mass of the Pycnometer, soil, and water **713.80** grams

	Mass of Dry Soil (grams)		
		Tare #	1
A	Tare Weight		
C	Dry Wt. + Tare Wt.		33.66
M_s	Dry Weight	C-A	**33.66**

T_t	Test Temperature T_t	**23.5** °C
K	Temperature Coefficient at T_t	**0.99923**
K	Temperature Coefficient at 23°C	**0.99933**
$p_{w;t}$	Density of Water at T_t	**0.99742** g./ml.
	See Table 2 ASTM D 854	

$M_{pw;t}$ Mass of the Pycnometer and water at T_t — $M_{pw;t} = M_p + (V_p \times p_{w;t})$ **692.44** grams
G_t Specific Gravity of Soil Solids at the T_t — $G_t = M_s / (M_{pw;t} - (M_{psw;t} - M_s))$ **2.737**
G Specific Gravity of Soil Solids at the 20°C — $G = K \times G_t$ **2.735**

Soils containing plus #4 material tested per ASTM C 127:

R % of Soil retained on the #4 sieve _____
P % of Soil passing the #4 sieve _____

Note: Deviation or remove this note

G_{+4} Apparent Specific Gravity of plus #4 material at the 23°C per ASTM C127 _____
Apparent Specific Gravity of plus #4 material corrected to 20°C _____

G_{total} The Average total sample Specific Gravity

$$G_{total} = \frac{1}{\frac{R}{100-G_{+4}} + \frac{P}{100-G}} = 2.735$$

References: ASTM D854 Specific Gravity of Soil Solids by Water Pycnometer ASTM C 127: Specific Gravity and Absorption of Coarse Aggregates
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Technician Name: Chana Savanapridi

Technical Responsibility: Mal Krajan

QCI # 1433
Certification #

Signature

Laboratory Supervisor
Position

S&ME

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method "C")

Test Date(s): 9/23 - 9/28/04
Report Date: 09/29/04

Project #: 1054-04-955
Project Name: Belews Creek Steam Plant
Client Name:
Client Address:
Boring #: BC-19 Sample #: Bag-1 Depth/Elevation: 2 - 7 ft. Sample Date: NA
Location: Project Site Offset: NA Sample Description: Orange-Brown Sandy SILT (MH)
Liquid Limit: 72 Specific Gravity: 2.735 Sample Type: lab-compacted Sampled By: S&ME
Plastic Limit: 44 Plasticity Index: 28 Percent Passing #200: 83.8 Maximum Particle Size: 3/8"

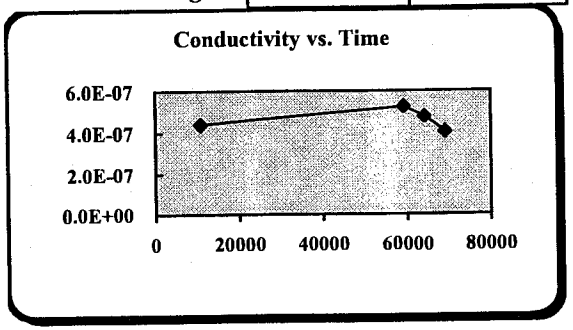
Initial Sample Conditions				Final Sample Conditions			
Height (cm):	9.342	Wet Unit Weight (lbs/ft^3):	113.2	Height (cm):	9.342	Dry Unit Weight (lbs/ft^3):	83.2
Diameter (cm):	7.315	Dry Unit Weight (lbs/ft^3):	83.2	Diameter (cm):	7.315	Percent Saturation:	100.0
Area (cm^2):	42.03	Percent Saturation:	83.8	Area (cm^2)	42.03	Void Ratio:	1.0511
Volume (cm^3):	392.64	Void Ratio:	1.0511	Volume (cm^3)	392.64	Porosity:	0.5125
Wet weight (grams):	711.7	Porosity:	0.5125	Wet weight (grams)	750.3		
Dry Weight (grams):	523.3	Station Corrections (cm)		Dry Weight (grams)	523.3		
Percent Moisture:	32.2	Influent: -2.190	Effluent: -2.825	Percent Moisture:	43.4		

Measured ***B*** coefficient: 0.98
MDD (pcf): 87.8 Optimum (%): 32.4

Testing Station	Burette Areas (cm^2):			Effective Consolidation Stress (psi):	7.0	Permeant Liquid Used:	Deaired Demineralized water
2	Influent:	0.720	Influent: 0.720	Cell Pressure (psi):	77.0	Influent Pressure (psi): 70.0	Effluent Pressure (psi) 70.0

Start Date	Start Time	End Date	End Time	Time (seconds)	Temperature (°C) Initial	Final	Avg.	Corr. Factor	Initial INF.	Initial EFF.	Final INF.	Final EFF.	h_1 (cm)	h_2 (cm)	Gradient	K-Value (cm/sec) Uncorrected	Corrected
10/12/04	1:28:00 PM	10/12/04	4:28:00 PM	10800	23.1	23.1	23.1	0.927	11.85	42.65	12.90	41.75	31.44	29.49	3.3	4.74E-07	4.39E-07
10/12/04	4:28:00 PM	10/13/04	5:55:00 AM	48420	23.1	23.1	23.1	0.927	12.90	41.75	16.90	37.20	29.49	20.94	2.7	5.66E-07	5.25E-07
10/13/04	5:55:00 AM	10/13/04	7:17:00 AM	4920	23.1	23.1	23.1	0.927	16.90	37.20	17.20	36.85	20.94	20.29	2.2	5.13E-07	4.76E-07
10/13/04	7:17:00 AM	10/13/04	8:39:00 AM	4920	23.1	25.1	24.1	0.906	17.20	36.85	17.50	36.60	20.29	19.74	2.1	4.47E-07	4.05E-07
															Averages:	**5.00E-07**	**4.61E-07**

Remarks: Specimen was compacted to 95% at opt. moisture content.



References:
ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D 2216: Laboratory Determination of Water Content of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plasticity Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 854: Specific Gravity of Soils
ASTM D 422: Particle Size Analysis of Soils

Technician / Certification #: David Duffy/Mal Krajan Certification #:
Technical Responsibility: Mal Krajan Position: Laboratory Supervisor

Particle Size Analysis of Soils

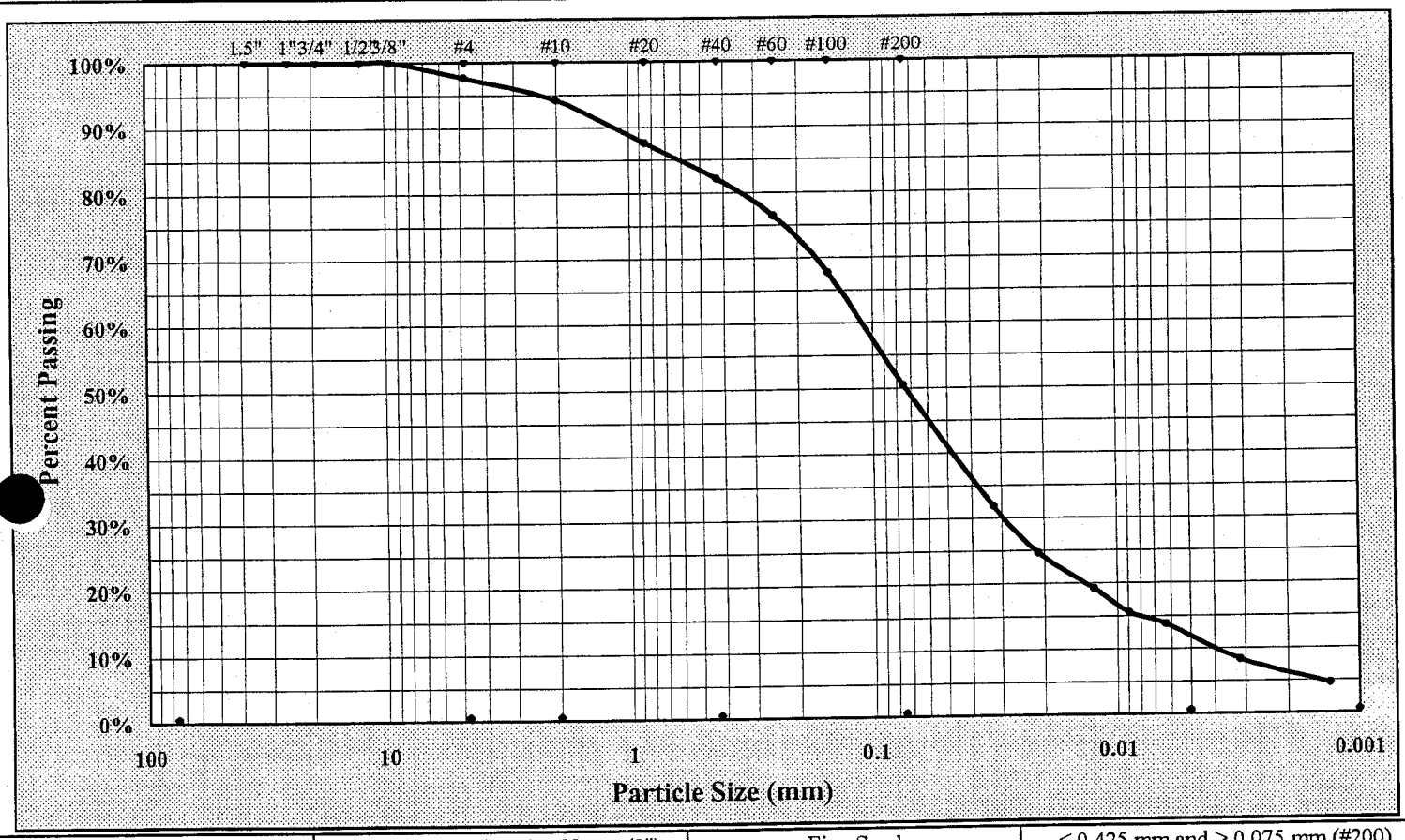
ASTM D 422

S&ME

S&ME Project #: **1054-04-955**
Project Name: **Belew Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: 09/21/2004
Test Date(s): 09/13 - 09/17/2004

Boring #:	BC-20	Sample #:	Bag-1	Sample Date:	9/1/04
Location:	Site Borehole	Offset:	NA	Depth (ft):	1 - 6 ft.
Sample Description:	Tan-Brown Sandy CLAY (CL)				



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/8"	Gravel	2.4%	Silt	38.1%
Silt & Clay (% Passing #200)	50.3%	Sand	47.3%	Clay	12.2%
Apparent Relative Density	2.779	Moisture Content	10.5%	Colloids	4.5%
Liquid Limit	36	Plastic Limit	22	Plastic Index	14

Description of Sand & Gravel Particles Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: ASTM D 422: Particle Size Analysis of Soils
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan — Signature — Laboratory Supervisor — Position

Liquid Limit, Plastic Limit, and Plastic Index

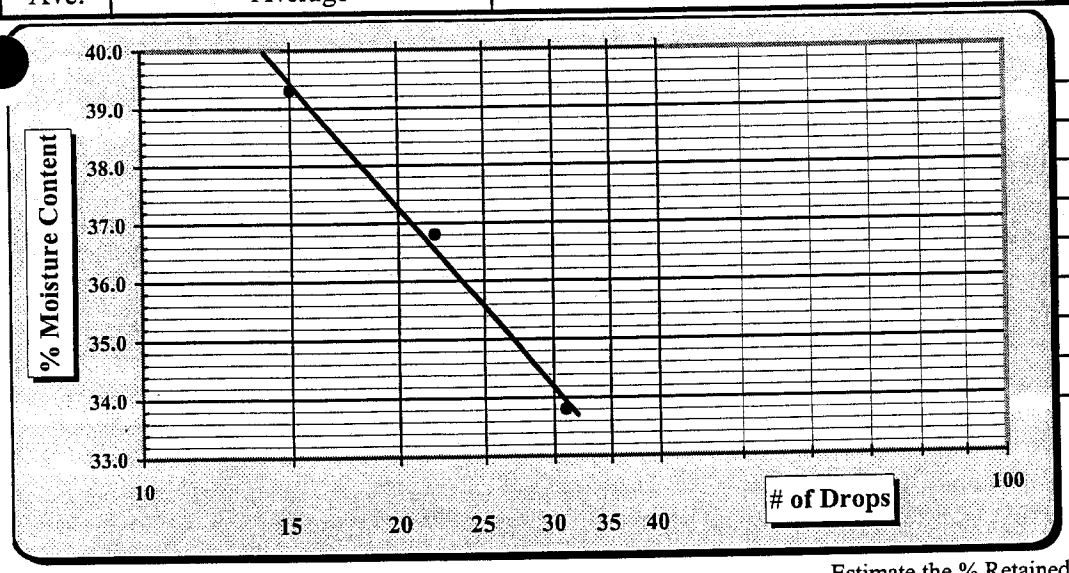
S&ME

Project #: **1054-04-955**
Project Name: Belews Creek Steam Plant
Client Name: Duke Energy
Client Address:

Report Date: 9/21/2004
Test Date(s): 09/10 - 09/15/2004

Boring #: BC-20 Sample #: Bag-1 Sample Date: 9/1/2004
Location: Site Borehole Offset: NA Depth (ft): 1-6 ft.
Sample Description: Tan-Brown Sandy CLAY (CL)

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	15	23	51				12	18	
A	Tare Weight	21.00	20.95	20.94				21.10	20.91	
B	Wet Soil Weight + A	35.64	34.40	34.95				28.81	28.36	
C	Dry Soil Weight + A	31.94	30.78	31.00				27.41	27.06	
D	Water Weight (B-C)	3.70	3.62	3.95				1.40	1.30	
E	Dry Soil Weight (C-A)	10.94	9.83	10.06				6.31	6.15	
F	% Moisture Content (D/E)*100	33.8%	36.8%	39.3%				22.2%	21.1%	
N	# OF DROPS	31	22	15				*Moisture Contents determined by ASTM D 2216*		
LL	LL = F * FACTOR									
Ave.	Average							21.7%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation ☐	Dry Preparation ☐	Air Dried ☒	NP, Non-Plastic	☐
Liquid limit Test:	Multipoint Method ☒	One-point Method ☐		Liquid Limit	36
Classification:	ASTM D 2487 ☒	AASHTO M 145 ☐		Plastic Limit	22
Liquid limit Test:	ASTM D 4318 ☒	AASHTO T 89 ☐		Plastic Index	14
Plastic limit Test:	ASTM D 4318 ☒	AASHTO T 90 ☐		Group Symbol	CL

Technician Name: Chana Savanapridi OCT-1433 (Certification #)

Technical Responsibility: Mal Krajan (Signature) Laboratory Supervisor (Position)

Laboratory Report Version 4.2

Specific Gravity of Soils

S&ME

ASTM D 854 *Method A: Moist Specimens* ☐ *Method B: Oven-dried Specimens* ☒

Project #: **1054-04-955**
Project Name: **Belews Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: September 21, 2004
Test Date(s) 09/13 - 09/16/2004

Boring No.	BC-20	Sample No.	Bag-1	Sample Date:	09/01/04
Location:	Site Borehole	Offset:	NA	Depth (ft):	1-6 ft.

Sample Description: Tan-Brown Sandy CLAY (CL)
Percent of Soil Passing #4 Sieve: **100.0** Material Excluded:
LL = 36 PL = 22 PI = 14

	Pycnometer #	**103**	**Balance ID#**	Readability	**.01 gram**
V_p	Pycnometer Volume (V_p)	**499.67 ml.**		Calibration Date	
PM	Pycnometer Mass	**179.56 g.**	**Balance Verification**		
M_p	Ave. Pycnometer Mass (Mp)	**179.59 g.**		Mass	**500 gram**
[PM-M_p]	Verify Pycnometer Mass	**0.03 g.**		Mass Determination	**500.00**

If [PM-M_p] is greater than .06 grams recalibrate the dry mass of the pycnometer or the balance.

Method A: Moist Specimens

	Initial Moisture Content	Tare #:	
A	Tare Weight		
B	Wet Wt + Tare Wt		
C	Dry Wt. + Tare Wt.		
D	Water Weight	B-C	
E	Dry Weight	C-A	
F	**Moisture Content**	100*D/E	

Target Dry Mass (see Table 1 ASTM D854)	Low Limit	High Limit
Target Wet Mass		

Wet Mass of test specimen _____ grams

Method B: Oven-dried Specimens

Initial Dry Mass of test specimen **29.86** grams

Per T-100

$M_{psw;t}$ Mass of the Pycnometer, soil, and water **697.17** grams

Mass of Dry Soil (grams)			
		Tare #	3
A	Tare Weight		
C	Dry Wt. + Tare Wt.		29.86
M_s	Dry Weight	C-A	**29.86**

T_t	Test Temperature T_t	23.5 °C
K	Temperature Coefficient at T_t	0.99923
K	Temperature Coefficient at 23°C	0.99933
$p_{w;t}$	Density of Water at T_t	0.99742 g./ml.
	See Table 2 ASTM D 854	

$M_{pw;t}$ Mass of the Pycnometer and water at T_t — $M_{pw;t} = M_p + (V_p \times p_{w;t})$ = **677.97** grams

G_t Specific Gravity of Soil Solids at the T_t — $G_t = M_s / (M_{pw;t} - (M_{psw;t} - M_s))$ = **2.801**

G Specific Gravity of Soil Solids at the 20°C — $G = K \times G_t$ = **2.799**

Soils containing plus #4 material tested per ASTM C 127:

Note: Deviation or remove this note

R % of Soil retained on the #4 sieve _____

P % of Soil passing the #4 sieve _____

G_{+4} Apparent Specific Gravity of plus #4 material at the 23°C per ASTM C127 _____

Apparent Specific Gravity of plus #4 material corrected to 20°C _____

G_{total} The Average total sample Specific Gravity

$$G_{total} = \frac{1}{\frac{R}{100\text{-}G_{+4}} + \frac{P}{100\text{-}G}} = 2.799$$

References: ASTM D854 Specific Gravity of Soil Solids by Water Pycnometer
ASTM C 127: Specific Gravity and Absorption of Coarse Aggregates
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Technician Name: Chana Savanapridi

QCTa - 1433
Certification #

Technical Responsibility: Mal Krajan

Signature

Laboratory Supervisor
Position

Laboratory Report Version 4.2

Moisture - Density Report

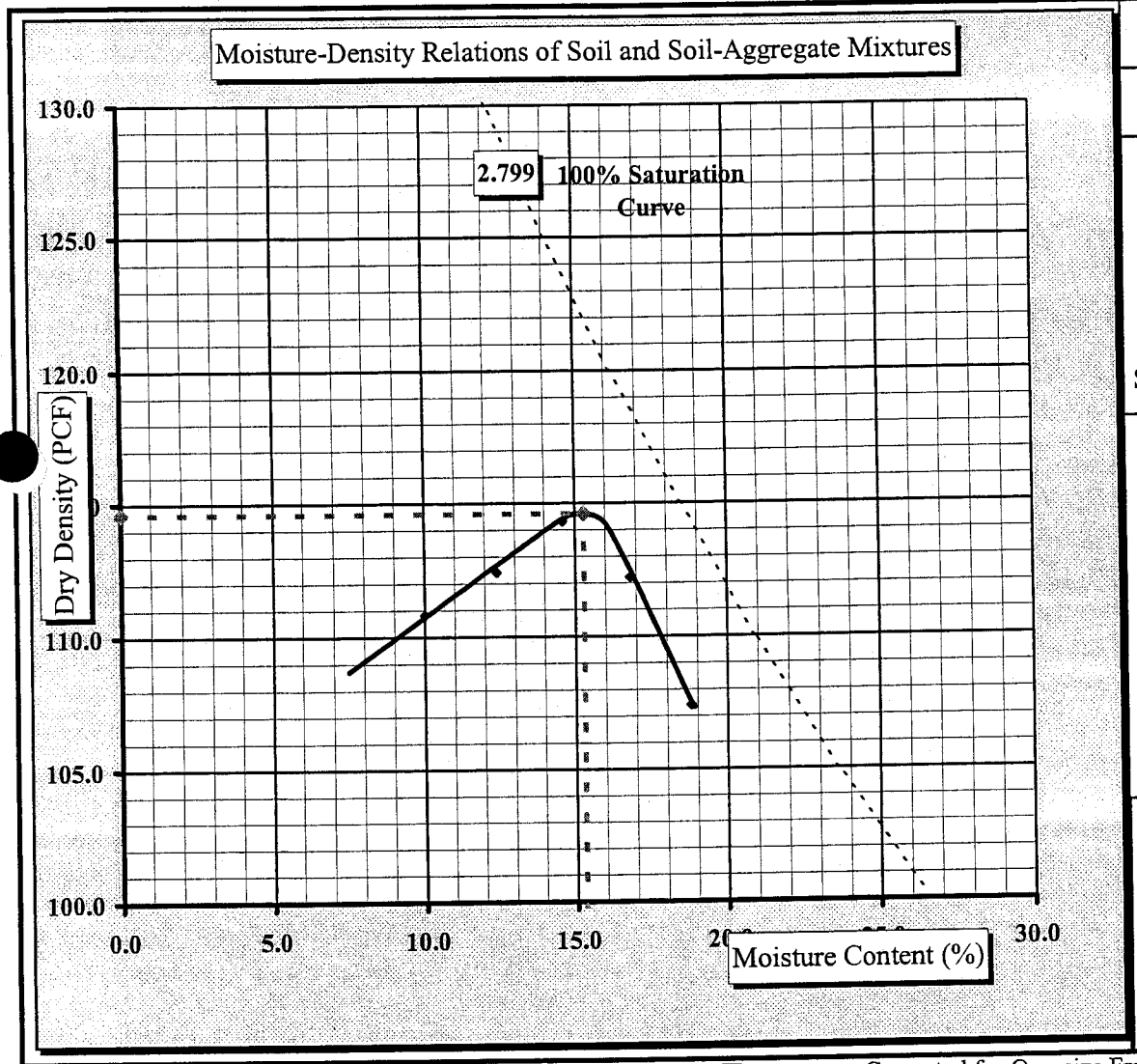
S&ME

S&ME Project #:	**1054-04-955**	Report Date:	September 21, 2004
Project Name:	**Belews Creek Steam Plant**	Test Date(s):	09/14 - 09/16/2004
Client Name:	Duke Energy		
Client Address:			

Boring #:	BC-20	Sample #:	Bag-1	Sample Date:	September 1, 2004
Location:	Site-Borehole	Offset:	NA	Depth (ft):	1 - 6'
Sample Description:	Tan-Brown Sandy CLAY (CL)				

Maximum Dry Density **114.6** **PCF.** **Optimum Moisture Content** **15.3** **%**

ASTM D 698 Method A



Soil Properties

Natural Moisture Content:	10.5%
Liquid Limit:	36
Plastic Limit:	22
Plastic Index:	14
Specific Gravity:	2.799

% Passing

#4	100.0

Oversize Fraction

Bulk Sp. Gravity
% Moisture
Oversize Fraction
MDD
Opt. MC

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐

Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

References: ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 422: Particle Size Analysis of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan *Signature* Laboratory Supervisor *Position*

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S&ME

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method "C")

Project #: 1054-04-955 Test Date(s): 9/22 - 10/5/04

Project Name: Belews Creek Steam Plant Report Date: 10/05/04

Client Name:

Client Address:

Boring #: CB-20 Sample #: Bag-1 Depth/Elevation: 1-6 ft. Sample Date: 09/01/04

Location: Project Site Offset: NA Sample Description: Tan-Brown Sandy CLAY (CL)

Liquid Limit: 36 Specific Gravity: 2.799 Sample Type: lab-compacted Sampled By: S&ME

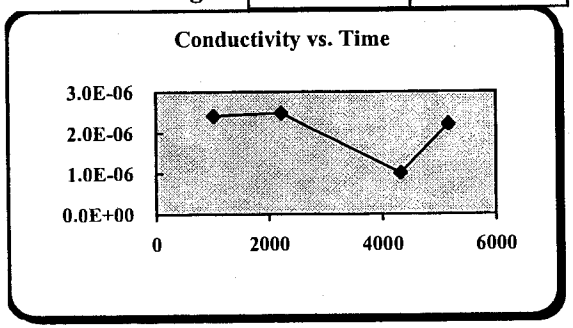
Plastic Limit: 12 Plasticity Index: 14 Percent Passing #200: 50.3 Maximum Particle Size: 3/8"

Initial Sample Conditions				Final Sample Conditions			
Height (cm):	9.642	Wet Unit Weight (lbs/ft^3):	126.2	Height (cm):	9.642	Dry Unit Weight (lbs/ft^3):	109.5
Diameter (cm):	7.315	Dry Unit Weight (lbs/ft^3):	109.5	Diameter (cm):	7.315	Percent Saturation:	100.0
Area (cm^2):	42.03	Percent Saturation:	72.5	Area (cm^2)	42.03	Void Ratio:	0.5944
Volume (cm^3):	405.25	Void Ratio:	0.5944	Volume (cm^3)	405.25	Porosity:	0.3728
Wet weight (grams):	819.5	Porosity:	0.3728	Wet weight (grams)	888.4	Measured ***B*** coefficient: 0.95	
Dry Weight (grams):	711.1	Station Corrections (cm)		Dry Weight (grams)	711.1	MDD (pcf): 114.6	Optimum (%): 15.3
Percent Moisture:	15.4	Influent: 18.181	Effluent: 18.656	Percent Moisture:	24.9		

Testing Station	Burette Areas (cm^2):			Effective Consolidation Stress (psi):	7.0	Permeant Liquid Used:	Deaired Demineralized water		
6	Influent:	0.196	Influent: 0.196	Cell Pressure (psi):	87.1	Influent Pressure (psi):	80.1	Effluent Pressure (psi)	80.1

Start		End		Time	Temperature (°C)			Corr.	Initial		Final		h_1	h_2	Grad-	K-Value (cm/sec)	
Date	Time	Date	Time	(seconds)	Initial	Final	Avg.	Factor	INF.	EFF.	INF.	EFF.	(cm)	(cm)	ient	Uncorrected	Corrected
09/30/04	4:04:00 PM	09/30/04	4:21:00 PM	1020	25.0	25.0	25.0	0.887	6.37	8.27	6.47	8.16	9.22	8.15	0.9	2.72E-06	2.41E-06
09/30/04	4:21:00 PM	09/30/04	4:41:00 PM	1200	25.0	25.0	25.0	0.887	6.47	8.16	6.58	8.05	8.15	7.02	0.8	2.80E-06	2.48E-06
09/30/04	4:41:00 PM	09/30/04	5:16:00 PM	2100	25.0	25.0	25.0	0.887	6.58	8.05	6.66	7.99	7.02	6.31	0.7	1.14E-06	1.01E-06
09/30/04	5:16:00 PM	09/30/04	5:30:00 PM	840	25.0	25.0	25.0	0.887	6.66	7.99	6.69	7.91	6.31	5.75	0.6	2.49E-06	2.21E-06
															Averages:	**2.29E-06**	**2.03E-06**

Remarks: Test specimen compacted to 95% at optimum moisture content.



References:
ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D 2216: Laboratory Determination of Water Content of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plasticity Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 854: Specific Gravity of Soils
ASTM D 422: Particle Size Analysis of Soils

Technician / Certification #: David Duffy/Mal Krajan , Certification #:

Technical Responsibility: Mal Krajan Position: Laboratory Supervisor

Laboratory Report Version 4.2

Particle Size Analysis of Soils

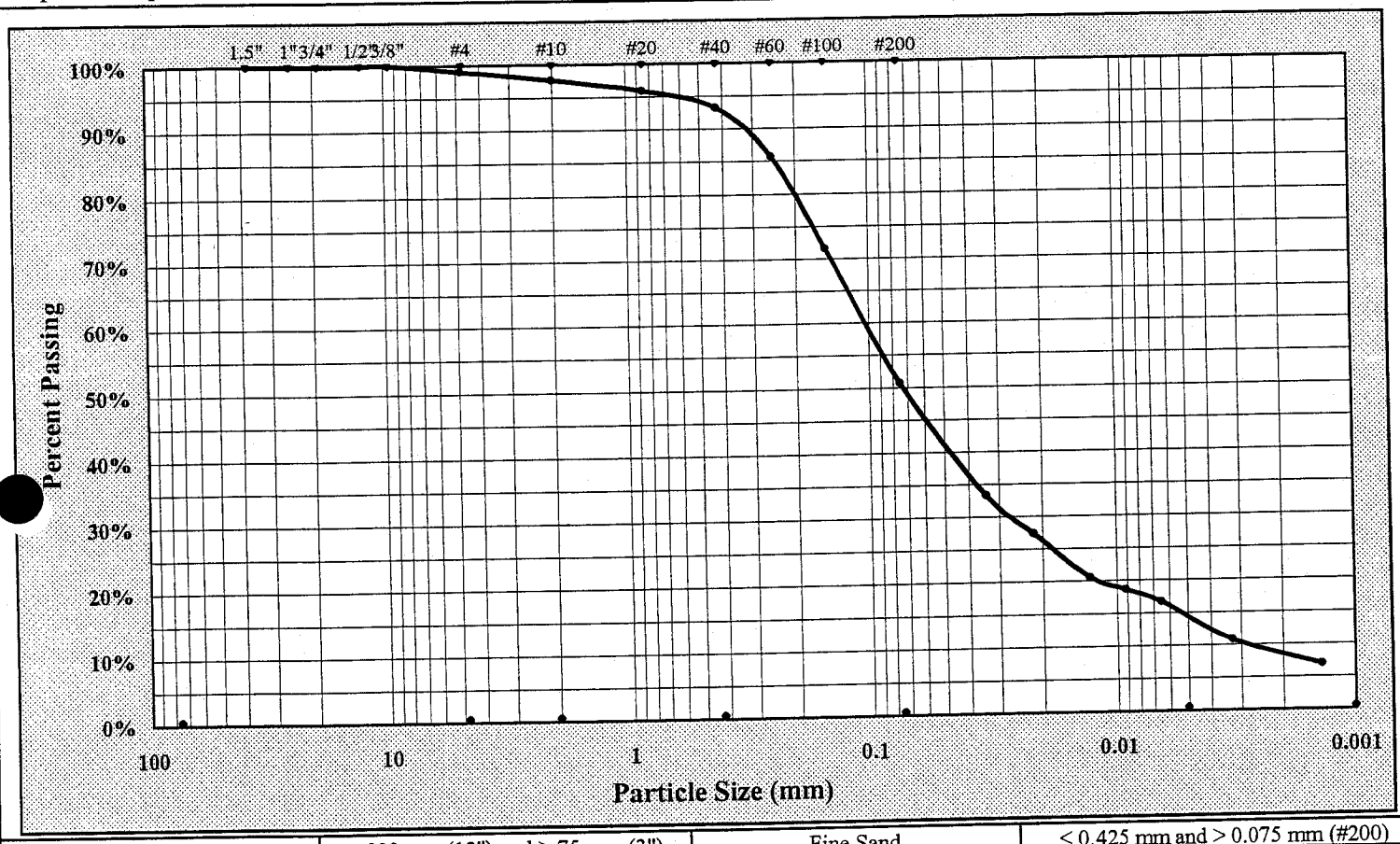
ASTM D 422

S&ME

S&ME Project #: **1054-04-955**
Project Name: **Belew Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: 09/21/2004
Test Date(s): 09/13 - 09/17/2004

Boring #:	BC-21	Sample #:	Bag-1	Sample Date:	9/1/04
Location:	Site Borehole	Offset:	NA	Depth (ft):	0 - 5'
Sample Description:	Tan-Brown Sandy Clayey SILT (CL-ML)				



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/8"	Gravel	1.0%	Silt	36.6%
Silt & Clay (% Passing #200)	50.6%	Sand	48.4%	Clay	14.0%
Apparent Relative Density	2.654	Moisture Content	21.4%	Colloids	6.8%
Liquid Limit	26	Plastic Limit	20	Plastic Index	6

Description of Sand & Gravel Particles Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: ASTM D 422: Particle Size Analysis of Soils
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan (Signature) Laboratory Supervisor (Position)

S&ME, INC. 3109 Spring Forest Road, Raleigh, N.C. 27616 BC-21 Bag-1 Classification.xls

Laboratory Record Version 4.2

Liquid Limit, Plastic Limit, and Plastic Index

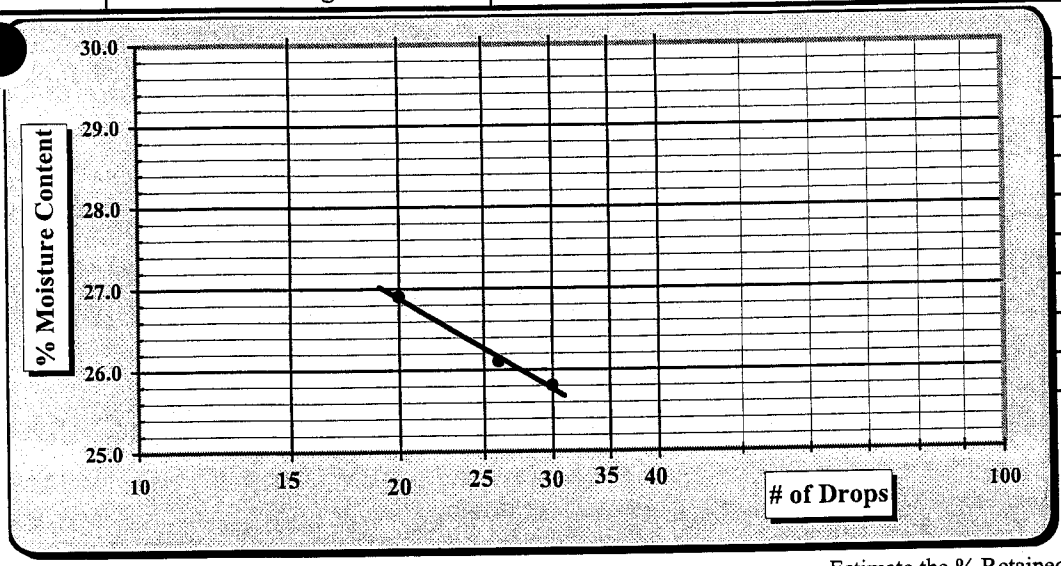
S&ME

Project #: **1054-04-955**
Project Name: Belews Creek Steam Plant
Client Name: Duke Energy
Client Address:

Report Date: 9/21/2004
Test Date(s): 09/13 - 09/17/2004

Boring #: BC-21 Sample #: Bag-1 Sample Date: 9/1/2004
Location: Site Borehole Offset: NA Depth (ft): 0 - 5'
Sample Description: Tan-Brown Sandy Clayey SILT (CL-ML)

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	19	28	26				38	53	
A	Tare Weight	20.90	21.04	21.00				20.91	20.85	
B	Wet Soil Weight + A	39.83	38.37	37.71				29.88	31.51	
C	Dry Soil Weight + A	35.82	34.78	34.28				28.37	29.78	
D	Water Weight (B-C)	4.01	3.59	3.43				1.51	1.73	
E	Dry Soil Weight (C-A)	14.92	13.74	13.28				7.46	8.93	
F	% Moisture Content (D/E)*100	26.9%	26.1%	25.8%				20.2%	19.4%	
N	# OF DROPS	20	26	30				*Moisture Contents determined by ASTM D 2216*		
LL	LL = F * FACTOR									
Ave.	Average							19.8%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation ☐	Dry Preparation ☐	Air Dried ☒	NP, Non-Plastic	☐
Liquid limit Test:	Multipoint Method ☒	One-point Method ☐		Liquid Limit	26
Classification:	ASTM D 2487 ☒	AASHTO M 145 ☐		Plastic Limit	20
Liquid limit Test:	ASTM D 4318 ☒	AASHTO T 89 ☐		Plastic Index	6
Plastic limit Test:	ASTM D 4318 ☒	AASHTO T 90 ☐		Group Symbol	CL-ML

Technician Name: Chana Savanapridi OCT-1433 (Certification #)

Technical Responsibility: Mal Krajan (Signature) Laboratory Supervisor (Position)

Laboratory Report Version 4.2

Specific Gravity of Soils

S&ME

ASTM D 854 *Method A: Moist Specimens* ☒ *Method B: Oven-dried Specimens* ☐

Project #: **1054-04-955**
Project Name: **Belews Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: September 21, 2004
Test Date(s) 09/13 - 09/16/2004

Boring No.	BC-21	Sample No.	Bag-1	Sample Date:	09/01/04
Location:	Site Borehole	Offset:	NA	Depth (ft):	0 - 5'

Sample Description: Tan-Brown Sandy Clayey SILT (CL-ML)

Percent of Soil Passing #4 Sieve: **99.0** Material Excluded: **1.0**

LL = 26 PL = 20 PI = 6

	Pycnometer #	**105**	**Balance ID#**	Readability	**.01 gram**
V_p	Pycnometer Volume (V_p)	**499.39 ml.**		Calibration Date	
PM	Pycnometer Mass	**194.32 g.**	**Balance Verification**		
M_p	Ave. Pycnometer Mass (Mp)	**194.31 g.**		Mass	**500 gram**
[PM-M_p]	Verify Pycnometer Mass	**0.01 g.**		Mass Determination	**500.00**

If [PM-M_p] is greater than .06 grams recalibrate the dry mass of the pycnometer or the balance.

Method A: Moist Specimens

	Initial Moisture Content	Tare #:	
A	Tare Weight		
B	Wet Wt + Tare Wt		
C	Dry Wt. + Tare Wt.		
D	Water Weight	B-C	
E	Dry Weight	C-A	
F	**Moisture Content**	100*D/E	

Target Dry Mass (see Table 1 ASTM D854)	Low Limit	High Limit
Target Wet Mass		

Wet Mass of test specimen _____ grams

Method B: Oven-dried Specimens

Initial Dry Mass of test specimen 29.86 grams

T-100

$M_{psw;t}$ Mass of the Pycnometer, soil, and water 711.90 grams

Mass of Dry Soil (grams)				T_t	Test Temperature T_t	23.2 °C
		Tare #	3	K	Temperature Coefficient at T_t	0.99929
A	Tare Weight			K	Temperature Coefficient at 23°C	0.99933
C	Dry Wt. + Tare Wt.		31.20	$\rho_{w;t}$	Density of Water at T_t	0.99749 g./ml.
M_s	Dry Weight	C-A	31.20		See Table 2 ASTM D 854	

$M_{pw;t}$ Mass of the Pycnometer and water at T_t — $M_{pw;t} = M_p + (V_p \times \rho_{w;t})$ = 692.45 grams

G_t Specific Gravity of Soil Solids at the T_t — $G_t = M_s / (M_{pw;t} - (M_{psw;t} - M_s))$ = 2.656

G Specific Gravity of Soil Solids at the 20°C — $G = K \times G_t$ = 2.654

Soils containing plus #4 material tested per ASTM C 127:

Note: Deviation or remove this note

R % of Soil retained on the #4 sieve _____

P % of Soil passing the #4 sieve _____

G_{+4} Apparent Specific Gravity of plus #4 material at the 23°C per ASTM C127 _____

Apparent Specific Gravity of plus #4 material corrected to 20°C _____

G_{total} The Average total sample Specific Gravity

$$G_{total} = \frac{1}{\frac{R}{100-G_{+4}} + \frac{P}{100-G}} = 2.654$$

References: ASTM D854 Specific Gravity of Soil Solids by Water Pycnometer ASTM C 127: Specific Gravity and Absorption of Coarse Aggregates
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Technician Name: Chana Savanapridi

OCT - 1433
Certification #

Technical Responsibility: Mal Krajan

Signature

Laboratory Supervisor
Position

Laboratory Report Version 4.2

Moisture - Density Report

S&ME

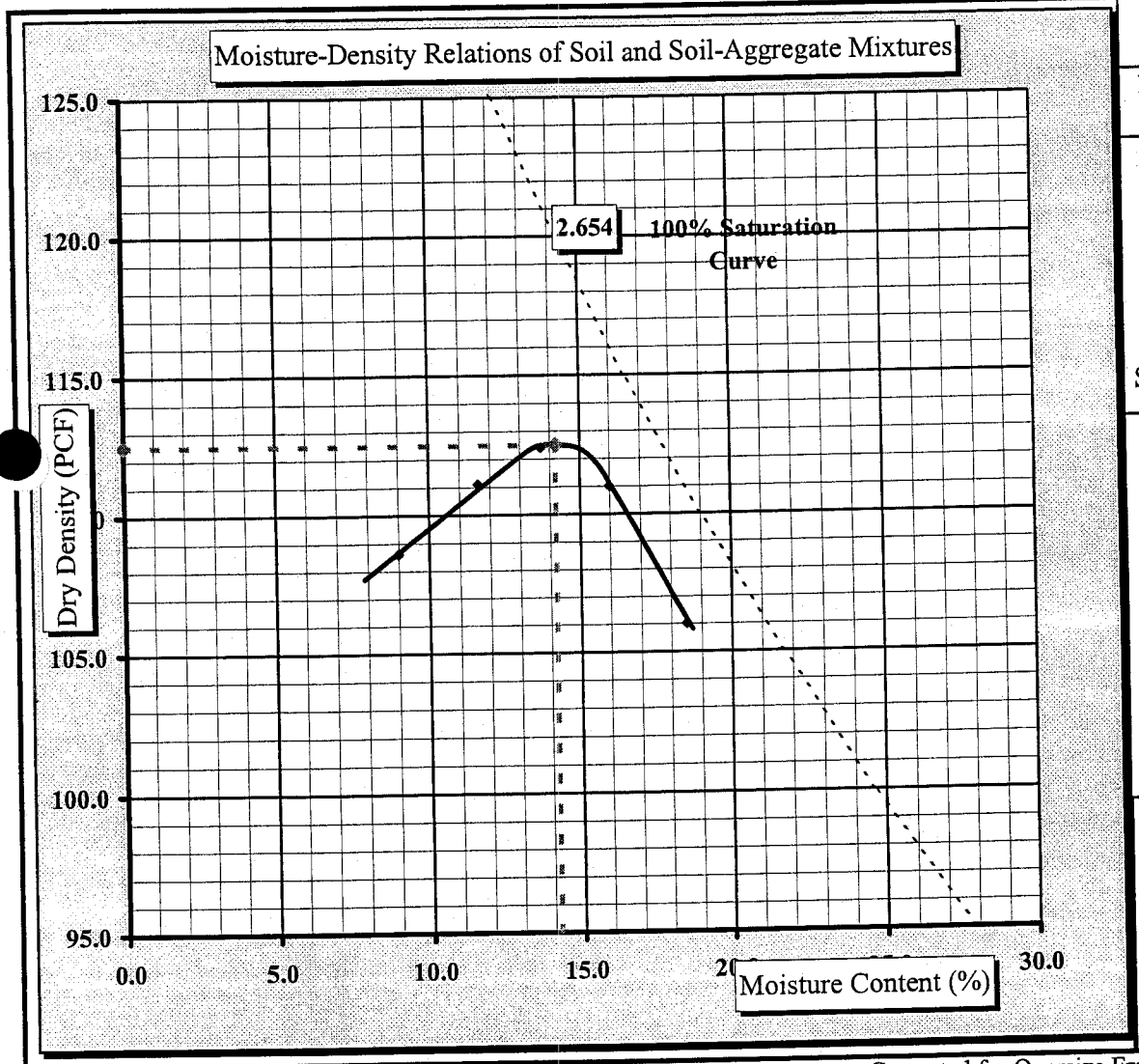
S&ME Project #: **1054-04-955**
Project Name: **Belews Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: September 21, 2004
Test Date(s): September 15, 2004

Boring #:	BC-21	Sample #:	Bag-1	Sample Date:	September 1, 2004
Location:	Site-Borehole	Offset:	NA	Depth (ft):	0 - 5'
Sample Description:	Tan-Brown Sandy Clayey SILT (CL-ML)				

Maximum Dry Density **112.5** **PCF.** **Optimum Moisture Content** **14.2** **%**

ASTM D 698 Method A



Soil Properties

Natural Moisture Content:	21.4%
Liquid Limit:	26
Plastic Limit:	20
Plastic Index:	6
Specific Gravity:	2.654

% Passing
#4 100.0

Oversize Fraction

Bulk Sp. Gravity
% Moisture
Oversize Fraction
MDD
Opt. MC

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐
Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐
Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

References: ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 422: Particle Size Analysis of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan *Signature* Laboratory Supervisor *Position*

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S&ME

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method "C")

Project #: 1054-04-955 Test Date(s): 9/22 - 10/5/04

Project Name: Belews Creek Steam Plant Report Date: 10/05/04

Client Name:

Client Address:

Boring #: BC-21 Sample #: Bag-1 Depth/Elevation: NA Sample Date: 09/01/04

Location: Project Site Offset: NA Sample Description: Tan-Brown Sandy Clayey SILT (CL-ML)

Liquid Limit: 26 Specific Gravity: 2.654 Sample Type: lab-compacted Sampled By: S&ME

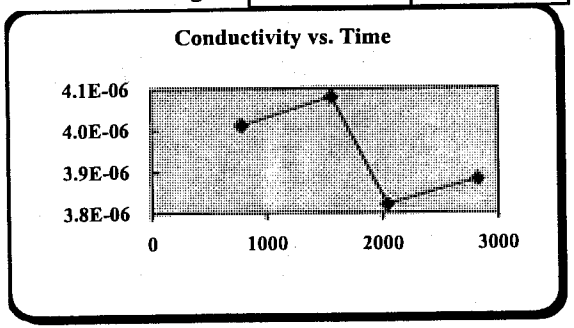
Plastic Limit: 20 Plasticity Index: 6 Percent Passing #200: 50.6 Maximum Particle Size: 3/8"

Initial Sample Conditions				Final Sample Conditions			
Height (cm):	9.642	Wet Unit Weight (lbs/ft^3):	122.1	Height (cm):	9.642	Dry Unit Weight (lbs/ft^3):	105.6
Diameter (cm):	7.315	Dry Unit Weight (lbs/ft^3):	105.6	Diameter (cm):	7.315	Percent Saturation:	98.7
Area (cm^2):	42.03	Percent Saturation:	68.7	Area (cm^2)	42.03	Void Ratio:	0.5675
Volume (cm^3):	405.25	Void Ratio:	0.5675	Volume (cm^3)	405.25	Porosity:	0.3620
Wet weight (grams):	792.8	Porosity:	0.3620	Wet weight (grams)	830.6	Measured ***B*** coefficient: 0.95	
Dry Weight (grams):	685.8	Station Corrections (cm)		Dry Weight (grams)	685.8	MDD (pcf): 112.5	Optimum (%): 14.2
Percent Moisture:	14.7	Influent: 18.219	Effluent: 18.335	Percent Moisture:	21.1		

Testing Station	Burette Areas (cm^2):			Effective Consolidation Stress (psi):	7.0	Permeant Liquid Used:	Deaired Demineralized water		
5	Influent:	0.196	Influent: 0.196	Cell Pressure (psi):	87.0	Influent Pressure (psi):	80.0	Effluent Pressure (psi)	80.0

Start		End		Time	Temperature (°C)			Corr.	Initial		Final		h_1	h_2	Grad-	K-Value (cm/sec)	
Date	Time	Date	Time	(seconds)	Initial	Final	Avg.	Factor	INF.	EFF.	INF.	EFF.	(cm)	(cm)	ient	Uncorrected	Corrected
09/30/04	1:56:00 PM	09/30/04	2:09:00 PM	780	25.0	25.0	25.0	0.887	4.18	9.99	4.60	9.57	29.53	25.24	2.8	4.52E-06	4.01E-06
09/30/04	2:09:00 PM	09/30/04	2:22:00 PM	780	25.0	25.0	25.0	0.887	4.60	9.57	4.96	9.20	25.24	21.52	2.4	4.60E-06	4.08E-06
09/30/04	2:22:00 PM	09/30/04	2:30:00 PM	480	25.0	25.0	25.0	0.887	4.96	9.20	5.14	9.01	21.52	19.63	2.1	4.31E-06	3.82E-06
09/30/04	2:30:00 PM	09/30/04	2:43:00 PM	780	25.0	25.0	25.0	0.887	5.14	9.01	5.41	8.74	19.63	16.87	1.9	4.37E-06	3.88E-06
															Averages:	**4.45E-06**	**3.95E-06**

Remarks: Test specimen compacted to 95% at optimum moisture content.



References:
ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D 2216: Laboratory Determination of Water Content of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plasticity Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 854: Specific Gravity of Soils
ASTM D 422: Particle Size Analysis of Soils

Technician / Certification #: David Duffy/Mal Krajan Certification #:

Technical Responsibility: Mal Krajan Position: Laboratory Supervisor

Laboratory Report Version 4.2

Moisture - Density Report

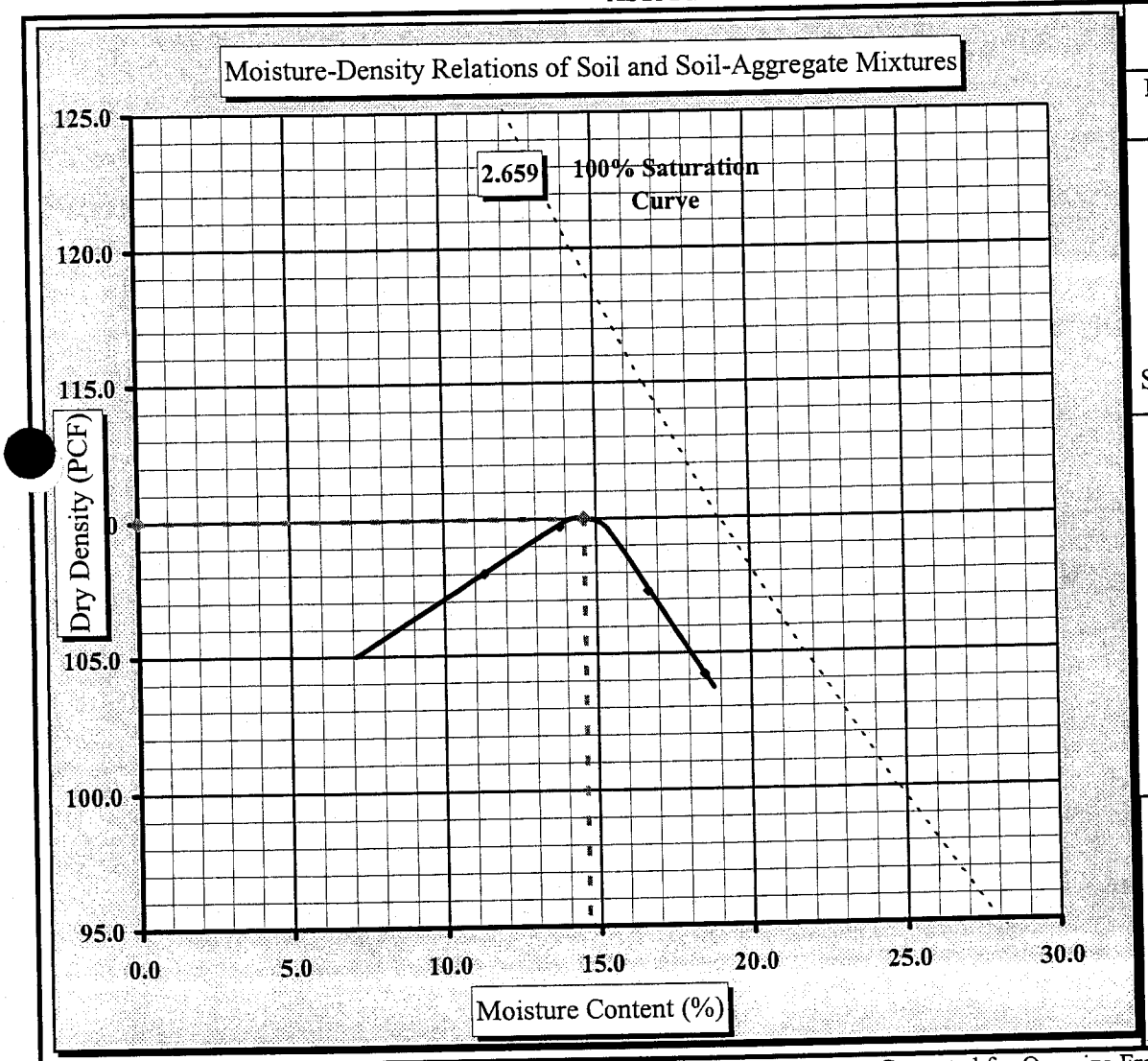
S&ME

S&ME Project #:	1054-04-955	Report Date:	October 8, 2004
Project Name:	Belews Creek Steam Plant	Test Date(s):	09/29 - 09/30/2004
Client Name:	Duke Energy		
Client Address:			

Boring #:	BC-22	Sample #:	Bag-1	Sample Date:	September 1, 2004
Location:	Site Borehole	Offset:	NA	Depth (ft):	0 - 5'
Sample Description:	Tan-Brown Sandy Silty CLAY (CL)				

Maximum Dry Density 110.0 **PCF.** **Optimum Moisture Content** 14.6 **%**

ASTM D 698 Method A



Soil Properties

Natural Moisture Content:	15.4%
Liquid Limit:	35
Plastic Limit:	23
Plastic Index:	12
Specific Gravity:	2.659
% Passing #4	100.0

Oversize Fraction

Bulk Sp. Gravity	2.650
% Moisture	
Oversize Fraction	
MDD	
Opt. MC	

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐

Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

References: ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 422: Particle Size Analysis of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan *Signature* Laboratory Supervisor *Position*

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Laboratory Report Version 4.2

Specific Gravity of Soils

S&ME

ASTM D 854 *Method A: Moist Specimens* ☐ *Method B: Oven-dried Specimens* ☒

Project #: **1054-04-955**
Project Name: **Belews Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: October 8, 2004
Test Date(s) 09/29 - 09/30/2004

Boring No.	BC-22	Sample No.	Bag-1	Sample Date:	09/01/04
Location:	Site Borehole	Offset:	NA	Depth (ft):	0 - 5'

Sample Description: Tan-Brown Sandy Silty CLAY (CL)

Percent of Soil Passing #4 Sieve: **100.0** Material Excluded:

LL = 35 PL = 23 PI = 12

	Pycnometer #	103	Balance ID#	Readability	.01 gram
V_p	Pycnometer Volume (V_p)	499.80 ml.		Calibration Date	
PM	Pycnometer Mass	179.55 g.	Balance Verification		
M_p	Ave. Pycnometer Mass (Mp)	179.46 g.		Mass	500 gram
[PM-M_p]	Verify Pycnometer Mass	0.09 g.		Mass Determination	500.00

If [PM-M_p] is greater than .06 grams recalibrate the dry mass of the pycnometer or the balance.

Method A: Moist Specimens

Initial Moisture Content		Tare #:	37
A	Tare Weight		7.93
B	Wet Wt + Tare Wt		54.24
C	Dry Wt. + Tare Wt.		48.07
D	Water Weight	B-C	6.17
E	Dry Weight	C-A	40.14
F	**Moisture Content**	100*D/E	**15.4%**

Target Dry Mass (see Table 1 ASTM D854)	Low Limit	High Limit
Target Wet Mass		

Wet Mass of test specimen _____ grams

Method B: Oven-dried Specimens

Initial Dry Mass of test specimen **36.03** grams

T-100

$M_{psw;t}$ Mass of the Pycnometer, soil, and water **700.46** grams

Mass of Dry Soil (grams)				T_t	Test Temperature T_t	23.5 °C
		Tare #	2	K	Temperature Coefficient at T_t	0.99923
A	Tare Weight			K	Temperature Coefficient at 23°C	0.99933
C	Dry Wt. + Tare Wt.		36.03	$p_{w;t}$	Density of Water at T_t	0.99742 g./ml.
M_s	Dry Weight	C-A	36.03		See Table 2 ASTM D 854	

$M_{pw;t}$ Mass of the Pycnometer and water at T_t — $M_{pw;t} = M_p + (V_p \times p_{w;t})$ = 677.97 grams

G_t Specific Gravity of Soil Solids at the T_t — $G_t = M_s / (M_{pw;t} - (M_{psw;t} - M_s))$ = 2.661

G Specific Gravity of Soil Solids at the 20°C — $G = K \times G_t$ = 2.659

Soils containing plus #4 material tested per ASTM C 127:

Note: Deviation or remove this note

R % of Soil retained on the #4 sieve _____

P % of Soil passing the #4 sieve _____

G_{+4} Apparent Specific Gravity of plus #4 material at the 23°C per ASTM C127 _____

Apparent Specific Gravity of plus #4 material corrected to 20°C _____

G_{total} The Average total sample Specific Gravity

$$G_{total} = \frac{1}{\frac{R}{100-G_{+4}} + \frac{P}{100-G}} = 2.659$$

References: ASTM D854 Specific Gravity of Soil Solids by Water Pycnometer ASTM C 127: Specific Gravity and Absorption of Coarse Aggregates
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Technician Name: Chana Savanapridi

QCT - 1433
Certification #

Technical Responsibility: Mal Krajan

Signature

Laboratory Supervisor
Position

Laboratory Report Version 4.2

Particle Size Analysis of Soils

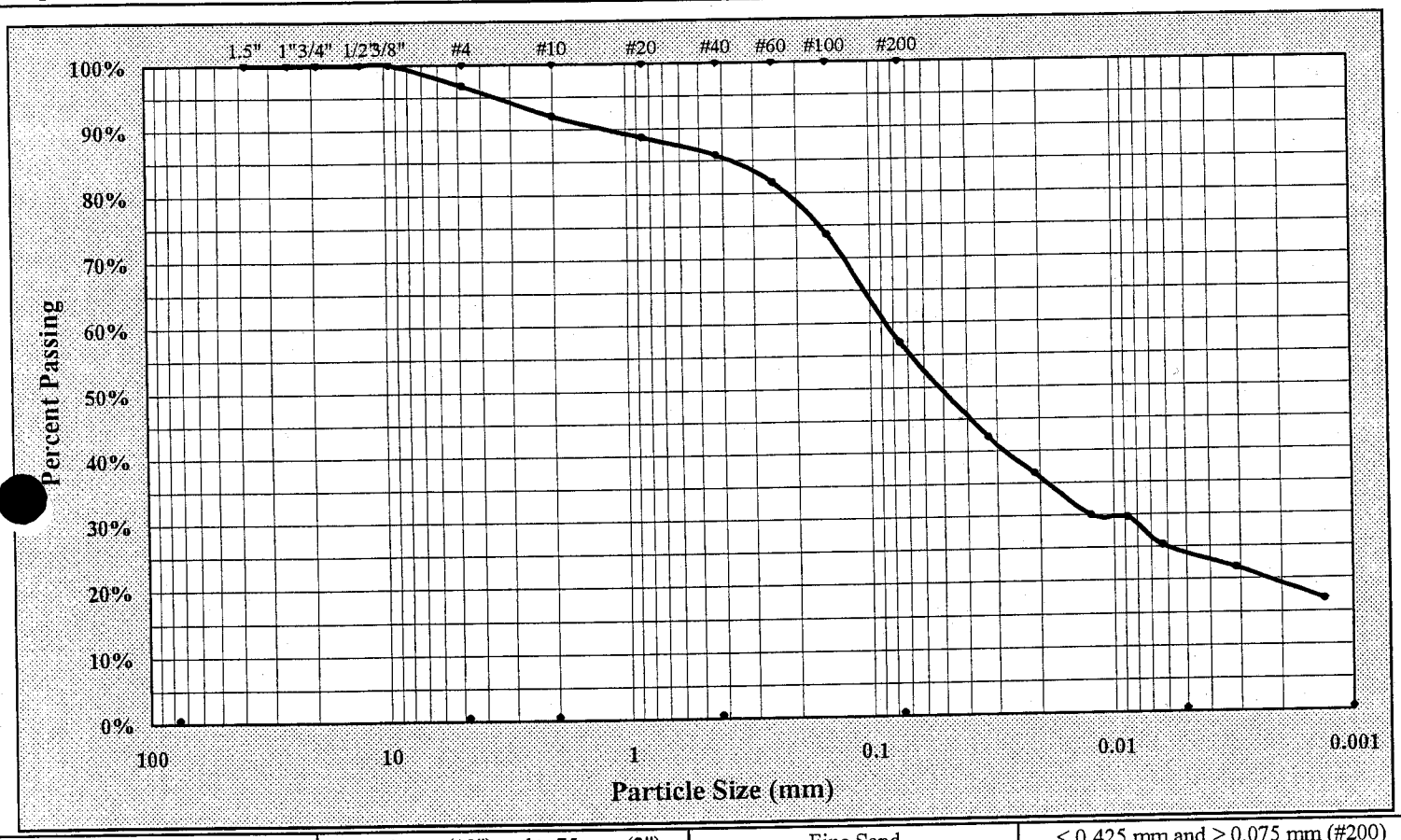
ASTM D 422

S&ME

S[illegible]E Project #: **1054-04-955**
Project Name: **Belews Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: 10/08/2004
Test Date(s): 09/28 - 10/07/2004

Boring #:	BC-22	Sample #:	Bag-1	Sample Date:	9/1/04
Location:	Site Borehole	Offset:	NA	Depth (ft):	0 - 5'
Sample Description:	Tan-Brown Sandy Silty CLAY (CL)				



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/8"	Gravel	3.3%	Silt	32.9%
Silt & Clay (% Passing #200)	56.9%	Sand	39.8%	Clay	24.0%
Apparent Relative Density	2.659	Moisture Content	15.4%	Colloids	16.8%
Liquid Limit	35	Plastic Limit	23	Plastic Index	12

Description of Sand & Gravel Particles Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: ASTM D 422: Particle Size Analysis of Soils
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan — Signature — Laboratory Supervisor — Position

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BC-22 Bag-1 Classification.xls

Laboratory Record Version 4.2

Liquid Limit, Plastic Limit, and Plastic Index

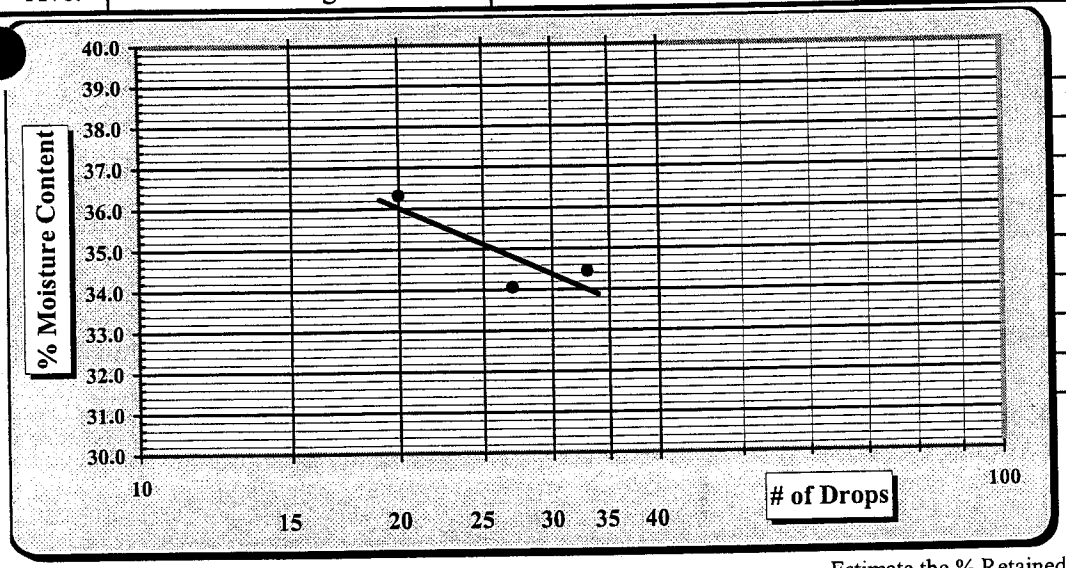
S&ME

Project #: **1054-04-955**
Project Name: Belew Creek Steam Plant
Client Name: Duke Energy
Client Address:

Report Date: 9/17/2004
Test Date(s): 9/13 - 9/17/04

Boring #: BC-22 Sample #: Bag-1 Sample Date: 9/1/2004
Location: Site Borehole Offset: NA Depth (ft): 0 - 5'
Sample Description: Tan-Brown Sandy Silty CLAY (CL)

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	52	31	6				19	57	
A	Tare Weight	18.54	18.47	17.58				21.02	21.00	
B	Wet Soil Weight + A	29.09	28.08	27.30				29.90	30.23	
C	Dry Soil Weight + A	26.41	25.52	24.81				28.21	28.49	
D	Water Weight (B-C)	2.68	2.56	2.49				1.69	1.74	
E	Dry Soil Weight (C-A)	7.87	7.05	7.23				7.19	7.49	
F	% Moisture Content (D/E)*100	34.1%	36.3%	34.4%				23.5%	23.2%	
N	# OF DROPS	27	20	33				*Moisture Contents determined by ASTM D 2216*		
LL	LL = F * FACTOR									
Ave.	Average							23.4%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation ☐	Dry Preparation ☐	Air Dried ☒	NP, Non-Plastic	☐
Liquid limit Test:	Multipoint Method ☒	One-point Method ☐		Liquid Limit	35
Classification:	ASTM D 2487 ☒	AASHTO M 145 ☐		Plastic Limit	23
Liquid limit Test:	ASTM D 4318 ☒	AASHTO T 89 ☐		Plastic Index	12
Plastic limit Test:	ASTM D 4318 ☒	AASHTO T 90 ☐		Group Symbol	CL

Technician Name: Chana Savanapridi OCT-1433 (Certification #)

Technical Responsibility: Mal Krajan (Signature) Laboratory Supervisor (Position)

S&ME

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method "C")

Project #: 1054-04-955 Test Date(s): 10/11 - 10/13/04

Project Name: Belews Creek Steam Plant Report Date: 09/13/04

Client Name:

Client Address:

Boring #: BC-22 Sample #: Bag-1 Depth/Elevation: 0 - 5 ft. Sample Date: 09/01/04

Location: Project Site Offset: NA Sample Description: Tan-Brown Sandy Silty CLAY (CL)

Liquid Limit: 35 Specific Gravity: 2.659 Sample Type: lab-compacted Sampled By: S&ME

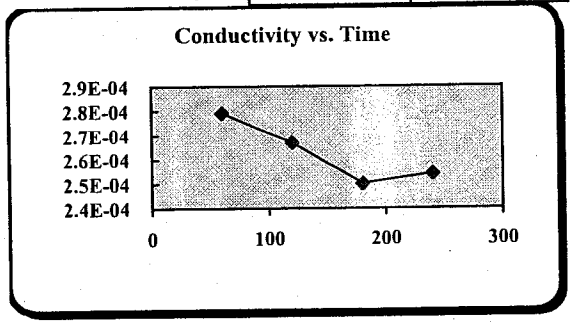
Plastic Limit: 23 Plasticity Index: 12 Percent Passing #200: 56.9 Maximum Particle Size: 3/8"

Initial Sample Conditions				Final Sample Conditions			
Height (cm):	9.642	Wet Unit Weight (lbs/ft^3):	118.1	Height (cm):	9.622	Dry Unit Weight (lbs/ft^3):	103.9
Diameter (cm):	7.315	Dry Unit Weight (lbs/ft^3):	103.7	Diameter (cm):	7.310	Percent Saturation:	97.1
Area (cm^2):	42.03	Percent Saturation:	69.5	Area (cm^2)	41.97	Void Ratio:	0.5972
Volume (cm^3):	405.25	Void Ratio:	0.6006	Volume (cm^3)	403.84	Porosity:	0.3739
Wet weight (grams):	766.7	Porosity:	0.3752	Wet weight (grams)	819.8	Measured *B* coefficient: 0.98	
Dry Weight (grams):	672.9	Station Corrections (cm)		Dry Weight (grams)	672.9	MDD (pcf): 110.0	Optimum (%): 14.6
Percent Moisture:	15.7	Influent: -2.454	Effluent: -2.613	Percent Moisture:	21.8		

Testing Station	Burette Areas (cm^2):			Effective Consolidation Stress (psi):	7.0	Permeant Liquid Used:	Deaired Demineralized water		
4	Influent:	0.720	Influent: 0.720	Cell Pressure (psi):	87.0	Influent Pressure (psi):	80.0	Effluent Pressure (psi)	80.0

Start		End		Time	Temperature (°C)			Corr.	Initial		Final		h_1	h_2	Grad-	K-Value (cm/sec)	
Date	Time	Date	Time	(seconds)	Initial	Final	Avg.	Factor	INF.	EFF.	INF.	EFF.	(cm)	(cm)	ient	Uncorrected	Corrected
10/13/04	5:37:00 AM	10/13/04	5:38:00 AM	60	23.1	23.1	23.1	0.927	23.10	48.40	25.40	45.70	25.46	20.46	2.4	3.01E-04	2.79E-04
10/13/04	5:38:00 AM	10/13/04	5:39:00 AM	60	23.1	24.0	23.6	0.916	25.40	45.70	27.40	43.80	20.46	16.56	1.9	2.91E-04	2.67E-04
10/13/04	5:39:00 AM	10/13/04	5:40:00 AM	60	24.0	24.0	24.0	0.908	27.40	43.80	28.80	42.20	16.56	13.56	1.6	2.75E-04	2.50E-04
10/13/04	5:40:00 AM	10/13/04	5:41:00 AM	60	24.0	24.0	24.0	0.908	28.80	42.20	30.00	40.90	13.56	11.06	1.3	2.80E-04	2.54E-04
															Averages:	**2.87E-04**	**2.63E-04**

Remarks: Specimen was compacted to 95% at opt. moisture content.



References:
ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D 2216: Laboratory Determination of Water Content of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plasticity Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 854: Specific Gravity of Soils
ASTM D 422: Particle Size Analysis of Soils

Technician / Certification #: David Duffy/Mal Krajan Certification #:

Technical Responsibility: Mal Krajan Position: Laboratory Supervisor

Laboratory Report Version 4.2

Moisture - Density Report

S&ME

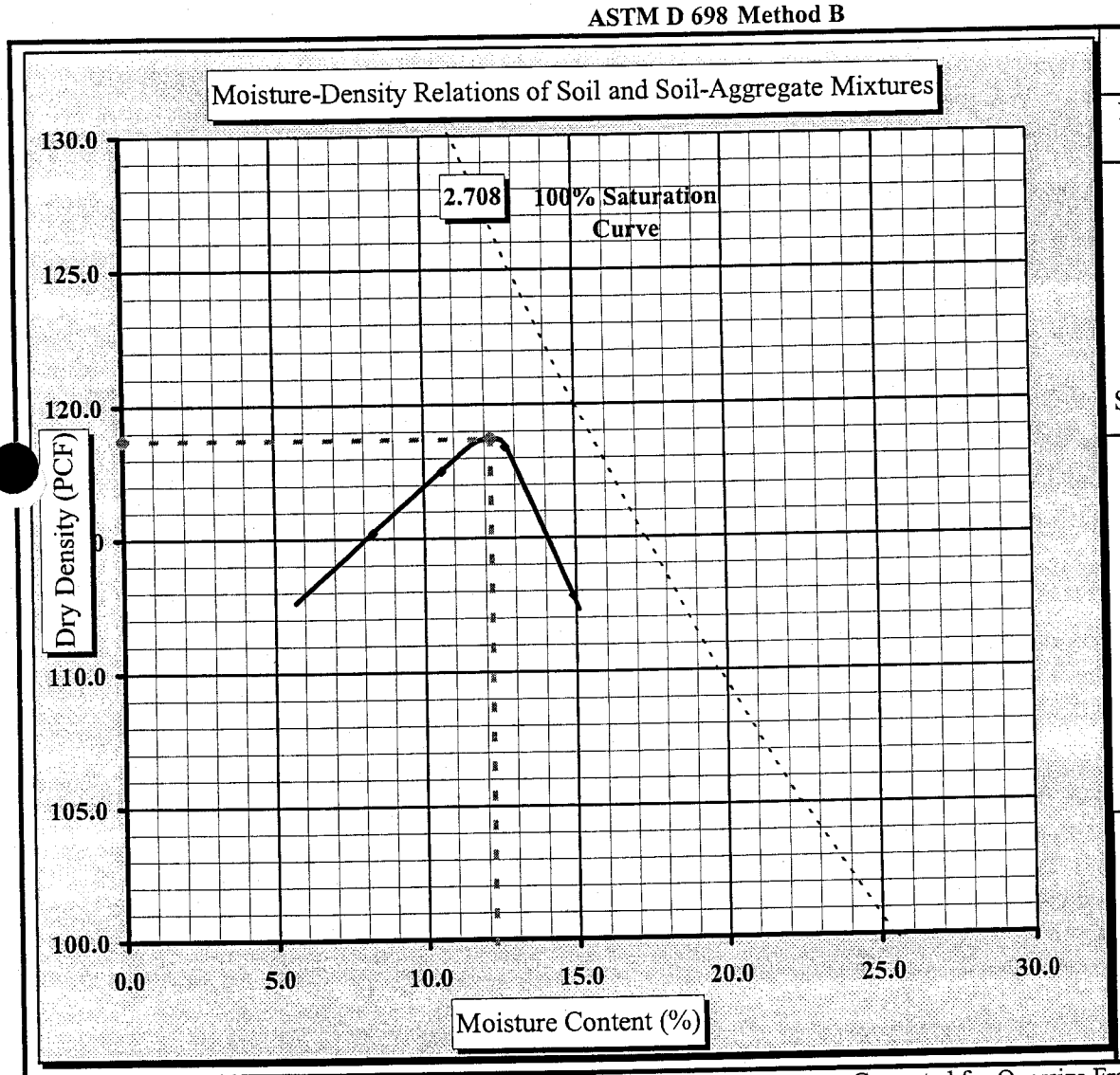
S&ME Project #:	1054-04-955	Report Date:	October 8, 2004
Project Name:	Belews Creek Steam Plant	Test Date(s):	09/29 - 09/30/2004
Client Name:	Duke Energy		
Client Address:			

Boring #:	BC-23	Sample #:	Bag-1	Sample Date:	September 1, 2004
Location:	Site Borehole	Offset:	NA	Depth (ft):	1 - 6'

Sample Description: Tan-Orange Silty Clayey SAND with Gravel (SC-SM)

Maximum Dry Density 118.7 **PCF.** **Optimum Moisture Content** 12.2 %

ASTM D 698 Method B



Soil Properties

Natural Moisture Content:	
Liquid Limit:	22
Plastic Limit:	16
Plastic Index:	6
Specific Gravity:	2.708

% Passing

3/8"	94.5

Oversize Fraction

Bulk Sp. Gravity	2.650
% Moisture	0.2%
Oversize Fraction	5.5%
MDD	**120.6**
Opt. MC	**11.5%**

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☐ 3/8 inch Sieve ☒ 3/4 inch Sieve ☐

Mechanical Hammer ☐ Manual Hammer ☒ Moist Preparation ☒ Dry Preparation ☐

References: ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 422: Particle Size Analysis of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ND=Not Determined

Technical Responsibility: Mal Krajan *Signature* Laboratory Supervisor *Position*

Laboratory Report Version 4.2

Specific Gravity of Soils

S&ME

ASTM D 854 *Method A: Moist Specimens* ☐ *Method B: Oven-dried Specimens* ☒

Project #: **1054-04-955**
Project Name: **Belews Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: October 8, 2004
Test Date(s) 09/29 - 09/30/2004

Boring No. BC-23 Sample No. Bag-1 Sample Date: 09/01/04
Location: Site Borehole Offset: NA Depth (ft): 1 - 6'
Sample Description: Tan-Orange Silty Clayey SAND with Gravel (SC-SM)
Percent of Soil Passing #4 Sieve: **85.0** Material Excluded: **15.0**
LL = 22 PL = 16 PI = 6

	Pycnometer #	**108**	**Balance ID#**	Readability	**.01 gram**
V_p	Pycnometer Volume (V_p)	**499.64 ml.**		Calibration Date	
PM	Pycnometer Mass	**182.44 g.**	**Balance Verification**		
M_p	Ave. Pycnometer Mass (Mp)	**182.43 g.**		Mass	**500 gram**
[PM-M_p]	Verify Pycnometer Mass	**0.01 g.**		Mass Determination	500.00

If [PM-M_p] is greater than .06 grams recalibrate the dry mass of the pycnometer or the balance.

Method A: Moist Specimens

	Initial Moisture Content	Tare #:	
A	Tare Weight		
B	Wet Wt + Tare Wt		
C	Dry Wt. + Tare Wt.		
D	Water Weight	B-C	
E	Dry Weight	C-A	
F	**Moisture Content**	100*D/E	

Target Dry Mass (see Table 1 ASTM D854)	Low Limit	High Limit
Target Wet Mass		

Wet Mass of test specimen _____ grams

Method B: Oven-dried Specimens

Initial Dry Mass of test specimen 42.60 grams

T-100

$M_{psw;t}$ Mass of the Pycnometer, soil, and water 707.66 grams

	Mass of Dry Soil (grams)		
		Tare #	4
A	Tare Weight		
C	Dry Wt. + Tare Wt.		42.60
M_s	Dry Weight	C-A	42.60

T_t	Test Temperature T_t	23.5 °C
K	Temperature Coefficient at T_t	0.99923
K	Temperature Coefficient at 23°C	0.99933
$p_{w;t}$	Density of Water at T_t	0.99742 g./ml.
	See Table 2 ASTM D 854	

$M_{pw;t}$ Mass of the Pycnometer and water at T_t $M_{pw;t} = M_p + (V_p \times p_{w;t})$ 680.78 grams
G_t Specific Gravity of Soil Solids at the T_t $G_t = M_s / (M_{pw;t} - (M_{psw;t} - M_s))$ 2.710
G Specific Gravity of Soil Solids at the 20°C $G = K \times G_t$ 2.708

Soils containing plus #4 material tested per ASTM C 127:
Note: Deviation or remove this note

R % of Soil retained on the #4 sieve _____
P % of Soil passing the #4 sieve _____

G_{+4} Apparent Specific Gravity of plus #4 material at the 23°C per ASTM C127 _____
Apparent Specific Gravity of plus #4 material corrected to 20°C _____

G_{total} The Average total sample Specific Gravity

$$G_{total} = \frac{1}{\frac{R}{100-G_{+4}} + \frac{P}{100-G}} = 2.708$$

References: ASTM D854 Specific Gravity of Soil Solids by Water Pycnometer
ASTM C 127: Specific Gravity and Absorption of Coarse Aggregates
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Technician Name: Chana Savanapridi OCT - 1433 (Certification #)
Technical Responsibility: Mal Krajan (Signature) Laboratory Supervisor (Position)

S&ME

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method "C")

Test Date(s): 9/28 - 10/7/04
Report Date: 10/07/04

Project #: 1054-04-955
Project Name: Belews Creek Steam Plant
Client Name:
Client Address:
Boring #: BC-23 Sample #: Bag-1 Depth/Elevation: 1 - 6 ft. Sample Date: 09/01/04
Location: Project Site Offset: NA Sample Description: Tan-Orange Silty Clayey SAND with Gravel (SC-SM)
Liquid Limit: 22 Specific Gravity: 2.708 Sample Type: lab-compacted Sampled By: S&ME
Plastic Limit: 16 Plasticity Index: 6 Percent Passing #200: 24.9 Maximum Particle Size: 3/4"

Initial Sample Conditions			
Height (cm):	9.642	Wet Unit Weight (lbs/ft^3):	125.7
Diameter (cm):	7.315	Dry Unit Weight (lbs/ft^3):	111.0
Area (cm^2):	42.03	Percent Saturation:	68.0
Volume (cm^3):	405.25	Void Ratio:	0.5217
Wet weight (grams):	815.8	Porosity:	0.3428
Dry Weight (grams):	720.8	Station Corrections (cm)	
Percent Moisture:	13.1	Influent: 3.174	Effluent: 3.174

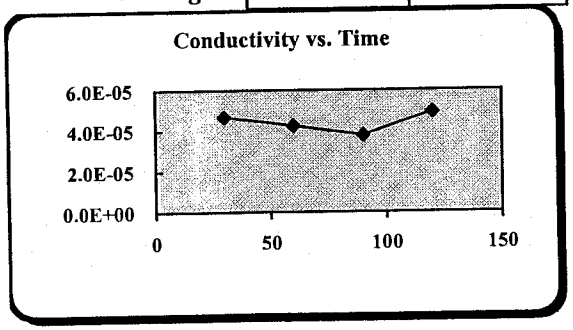
Final Sample Conditions			
Height (cm):	9.619	Dry Unit Weight (lbs/ft^3):	111.3
Diameter (cm):	7.300	Percent Saturation:	97.2
Area (cm^2)	41.85	Void Ratio:	0.5181
Volume (cm^3)	402.56	Porosity:	0.3413
Wet weight (grams)	855.2		
Dry Weight (grams)	720.8		
Percent Moisture:	18.6		

Measured ***B*** coefficient: 0.98
MDD (pcf): 118.7 Optimum (%): 12.2

Testing Station	Burette Areas (cm^2):			Effective Consolidation Stress (psi):	7.0	Permeant Liquid Used:	Deaired Demineralized water
10	Influent:	0.720	Influent: 0.720	Cell Pressure (psi):	77.0	Influent Pressure (psi):	70.0	Effluent Pressure (psi)	70.0

Start		End		Time	Temperature (°C)			Corr.	Initial		Final		h_1	h_2	Grad-	K-Value (cm/sec)	
Date	Time	Date	Time	(seconds)	Initial	Final	Avg.	Factor	INF.	EFF.	INF.	EFF.	(cm)	(cm)	ient	Uncorrected	Corrected
10/07/04	3:19:00 PM	10/07/04	3:19:30 PM	30	23.6	23.6	23.6	0.916	13.20	37.75	13.40	37.50	24.55	24.10	2.5	5.10E-05	4.67E-05
10/07/04	3:19:30 PM	10/07/04	3:20:00 PM	30	23.6	23.6	23.6	0.916	13.40	37.50	13.65	37.35	24.10	23.70	2.5	4.62E-05	4.23E-05
10/07/04	3:20:00 PM	10/07/04	3:20:30 PM	30	23.6	23.6	23.6	0.916	13.65	37.35	13.80	37.15	23.70	23.35	2.4	4.10E-05	3.76E-05
10/07/04	3:20:30 PM	10/07/04	3:21:00 PM	30	23.6	23.6	23.6	0.916	13.80	37.15	14.00	36.90	23.35	22.90	2.4	5.37E-05	4.92E-05
															Averages:	**4.80E-05**	**4.40E-05**

Remarks: Specimen was compacted to 95% at opt. moisture content.



References:
ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D 2216: Laboratory Determination of Water Content of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plasticity Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 854: Specific Gravity of Soils
ASTM D 422: Particle Size Analysis of Soils

Technician / Certification #: David Duffy/Mal Krajan Certification #:
Technical Responsibility: Mal Krajan Position: Laboratory Supervisor

Laboratory Report Version 4.2

Particle Size Analysis of Soils

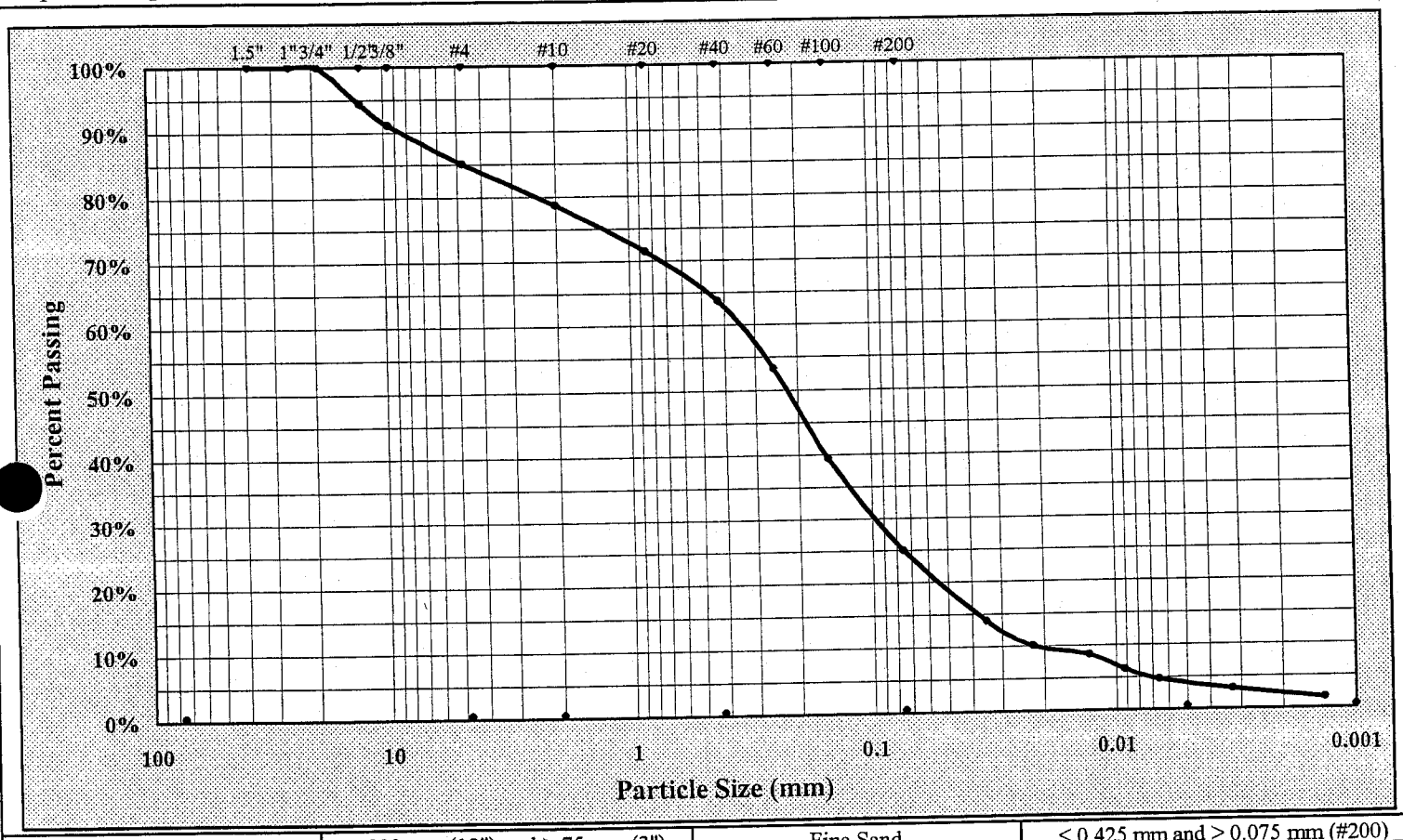
ASTM D 422

S&ME

[redacted]E Project #: **1054-04-955**
Project Name: **Belews Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: 10/08/2004
Test Date(s): 09/28 - 10/07/2004

Boring #:	BC-23	Sample #:	Bag-1	Sample Date:	9/1/04
Location:	Site Borehole	Offset:	NA	Depth (ft):	1 - 6'
Sample Description:	Tan-Orange Silty Clayey SAND with Gravel (SC-SM)				



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	1"	Gravel	15.0%	Silt	20.6%
Silt & Clay (% Passing #200)	24.9%	Sand	60.1%	Clay	4.3%
Apparent Relative Density	2.708	Moisture Content	2.7%	Colloids	1.5%
Liquid Limit	22	Plastic Limit	16	Plastic Index	6

Description of Sand & Gravel Particles Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

[redacted]chanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

[redacted]erences: ASTM D 422: Particle Size Analysis of Soils
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan — Laboratory Supervisor
(Signature) (Position)

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

ject #: **1054-04-955** Report Date: 10/8/2004

Project Name: Belews Creek Steam Plant Test Date(s): 09/28 - 10/07/2004

Client Name: Duke Energy

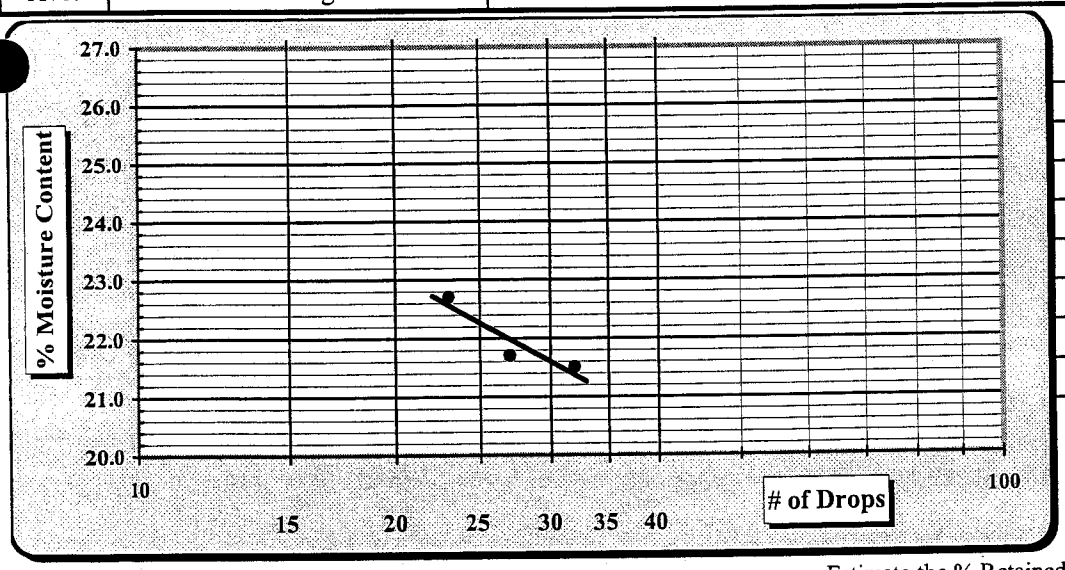
Client Address:

Boring #: BC-23 Sample #: Bag-1 Sample Date: 9/1/2004

Location: Site Borehole Offset: NA Depth (ft): 1 - 6'

Sample Description: Tan-Orange Silty Clayey SAND with Gravel (SC-SM)

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	48	2	83				40	15	
A	Tare Weight	20.62	15.25	20.79				21.00	21.00	
B	Wet Soil Weight + A	43.17	32.05	31.00				32.67	29.70	
C	Dry Soil Weight + A	39.00	29.06	29.19				31.08	28.44	
D	Water Weight (B-C)	4.17	2.99	1.81				1.59	1.26	
E	Dry Soil Weight (C-A)	18.38	13.81	8.40				10.08	7.44	
F	% Moisture Content (D/E)*100	22.7%	21.7%	21.5%				15.8%	16.9%	
N	# OF DROPS	23	27	32				*Moisture Contents determined by ASTM D 2216*		
LL	LL = F * FACTOR									
Ave.	Average							16.4%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation ☐	Dry Preparation ☐	Air Dried ☒	NP, Non-Plastic	☐
Liquid limit Test:	Multipoint Method ☒	One-point Method ☐		Liquid Limit	22
Classification:	ASTM D 2487 ☒	AASHTO M 145 ☐		Plastic Limit	16
Liquid limit Test:	ASTM D 4318 ☒	AASHTO T 89 ☐		Plastic Index	6
...astic limit Test:	ASTM D 4318 ☒	AASHTO T 90 ☐		Group Symbol	SC-SM

Technician Name: Chana Savanapridi OCT-1433 (Certification #)

Technical Responsibility: Mal Krajan (Signature) Laboratory Supervisor (Position)

APPENDIX VIII

LABORATORY TEST RESULTS
SHELBY TUBE SAMPLES

Laboratory Report Version 4.0

Particle Size Analysis of Soils

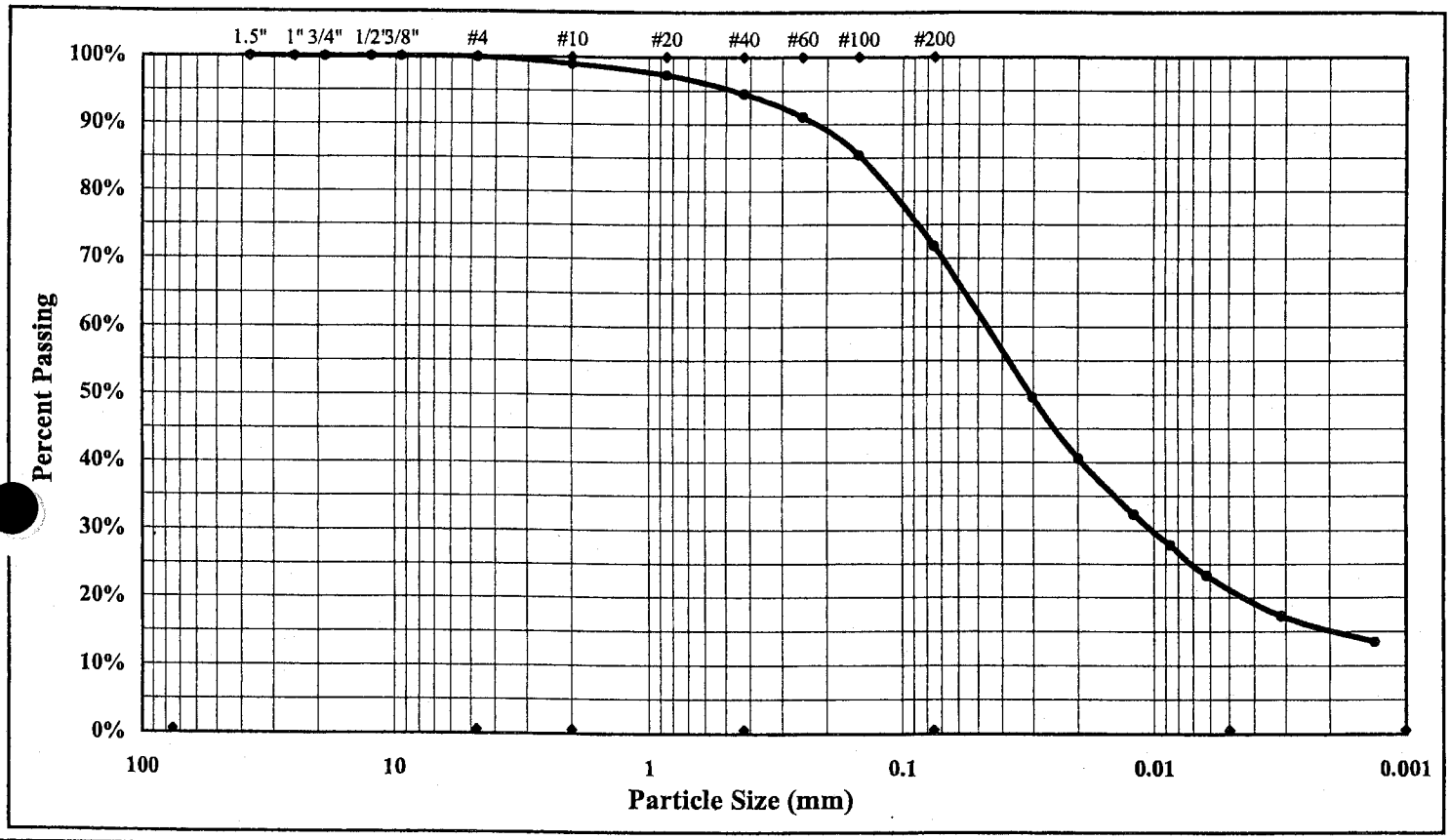
ASTM D 422

S&ME

S&ME Project #: 1264-02-576
Project Name: Duke Power-Belews Creek Landfill
Client Name:
Client Address:

Report Date: April 1, 2003
Test Date(s): 3/25/03-4/1/03

Boring #:	BC-6	Sample #:	UD-1	Sample Date:	NA
Location:		Offset:		Depth (ft):	18.0 - 20.0
Sample Description:	Tan-Brown Sandy Clayey SILT (ML)				



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Moisture Content		Gravel	0.1%	Liquid Limit	44
Silt & Clay (% Passing #200)	71.8%	Sand	28.1%	Plastic Limit	32
Maximum Particle Size	3/8"	Silt	49.9%	Plastic Index	12
Specific Gravity	2.752	Clay	21.9%	Colloids	13.5%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

ASTM D 422: Particle Size Analysis of Soils

Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter
Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min.

References: ASTM D 854: Specific Gravity of Soils
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility / Position: Mal Krajan — Laboratory Supervisor

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

Project #: 1264-02-576 Report Date: March 31, 2003

Project Name: Duke Power-Belews Creek Landfill Test Date(s): 3/25/03-3/31/03

Client Name:

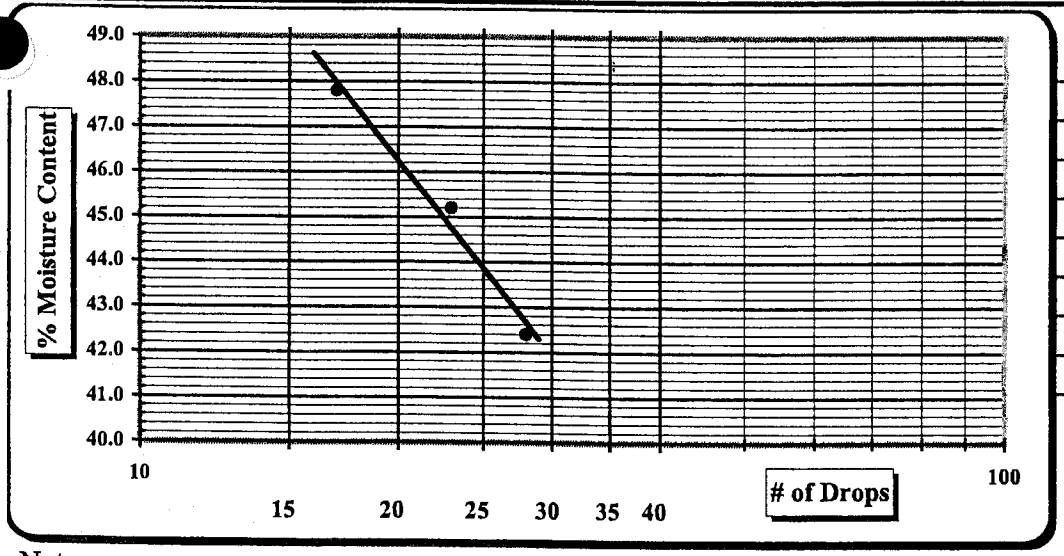
Client Address:

Boring #: BC-6 Sample #: UD-1 Sample Date: NA

Location: Offset: Depth (ft): 18.0 - 20.0

Sample Description: Tan-Brown Sandy Clayey SILT (ML)

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	17	101	28				8	36	
A	Tare Weight	8.47	8.06	8.24				6.29	6.39	
B	Wet Soil Weight + A	24.97	19.34	23.22				13.90	13.84	
C	Dry Soil Weight + A	20.06	15.69	18.56				12.04	12.03	
D	Water Weight (B-C)	4.91	3.65	4.66				1.86	1.81	
E	Dry Soil Weight (C-A)	11.59	7.63	10.32				5.75	5.64	
F	% Moisture Content (D/E)*100	42.4	47.8	45.2				32.3	32.1	
N	# OF DROPS	28	17	23						
LL	LL = F * FACTOR									
Ave.	Average							32.2		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation	☐	Dry Preparation	☐	Air Dried	☒	NP, Non-Plastic ☐
Liquid limit Test:	Multipoint Method	☒	One-point Method	☐			Liquid Limit 44
Classification:	ASTM D 2487	☒	AASHTO M 145	☐			Plastic Limit 32
Liquid limit Test:	ASTM D 4318	☒	AASHTO T 89	☐			Plastic Index 12
Plastic limit Test:	ASTM D 4318	☒	AASHTO T 90	☐			Group Symbol ML

Technician Name / Certification #: Tom Savanpridi

Technical Responsibility / Position: Mal Krajan Laboratory Supervisor

Hydraulic Conductivity o[illegible]turated Porous Materials Using a Flexible Wall Permeameter (Method "C")

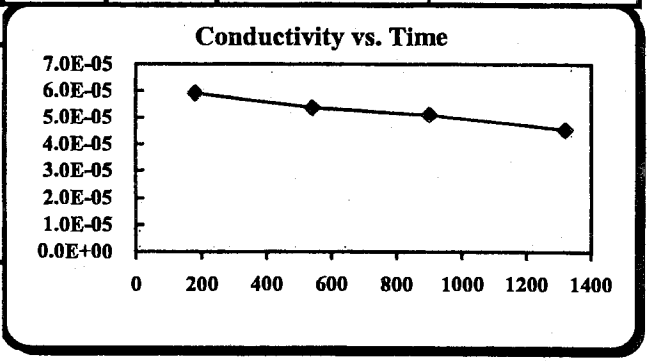
Project #:	1264-02-576	Test Date(s):	03/25/03 - 04/01/03
Project Name:	Duke Power - Belews County Landfill	Report Date:	04/01/03
Client Name:			
Client Address:			

Boring #:	BC-6	Sample #:		Depth/Elevation:	18-20'	Sample Date:	not reported
Location:		Offset:		Sample Description:	Tan-Brown Sandy Clayey SILT (ML)		
Liquid Limit:	44	Specific Gravity:	2.752	Sample Type:	undisturbed	Sampled By:	not reported
Plastic Limit:	32	Plasticity Index:	12	Percent Passing #200:		Maximum Particle Size:	

Initial Sample Conditions				Final Sample Conditions			
Length (cm):	10.439	Wet Density (PCF):	101.9	Length (cm):	10.053	Wet Density (PCF):	127.0
Diameter (cm):	7.267	Dry Density (PCF):	82.5	Diameter (cm):	6.982	Dry Density (PCF):	92.8
Area (cm^2)	41.476	Percent Saturation:	59.8	Area (cm^2)	38.291	Percent Saturation:	100.0
Volume (cm^3)	432.97			Volume (cm^3)	384.94	b value:	0.95
Wet weight (grams)	706.9	Void Ratio:	1.082	Wet weight (grams)	783.0	Void Ratio:	0.851
Dry Weight (grams)	572.4	Porosity:	0.520	Dry Weight (grams)	572.4	Porosity:	0.460
Percent Moisture:	23.5			Percent Moisture:	36.8		
Test Parameters:	Effective Consolidation Stress (psi):		7.1	Permeant Liquid Used:		Deaired Demineralized water	
Burette Area (cm^2):	0.720	Cell Pressure (psi):	77.0	Back Pressure (psi):	69.9	Pore Pressure (psi)	69.9

Time (24-hr)			Temperature (°C)				Measurements						Ratio	Grad-ient	K-Value (cm/sec)	
Start	End	Time (sec)	Initial	Final	Ave.	Factor	$h_{out}1$	$h_{in}1$	$h_{out}2$	$h_{in}2$	h1	h2			Uncorrected K-Value	Corrected K-Value
7:32	7:35	180	23.5	23.5	23.5	0.9183	45.05	24.65	43.80	25.75	20.4	18.1	1.14	1.80	6.43E-05	5.90E-05
7:35	7:41	360	23.5	23.5	23.5	0.9183	43.80	25.75	41.90	27.45	18.1	14.5	1.12	1.44	5.84E-05	5.36E-05
7:41	7:47	360	23.5	23.5	23.5	0.9183	41.90	27.45	40.50	28.80	14.5	11.7	1.04	1.16	5.54E-05	5.09E-05
7:47	7:54	420	23.5	23.5	23.5	0.9183	40.50	28.80	39.30	29.90	11.7	9.4	1.09	0.94	4.93E-05	4.52E-05
													Averages:		***5.68E-05***	***5.22E-05***

Notes:



References:
ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D2216: Laboratory Determination of Water Content of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soil
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 854: Specific Gravity of Soils
ASTM D 422: Particle Size Analysis of Soils

Technician / Certification #: John Dailly Certification #:

Technical Responsibility: Mal Krajan Position: Laboratory Manager

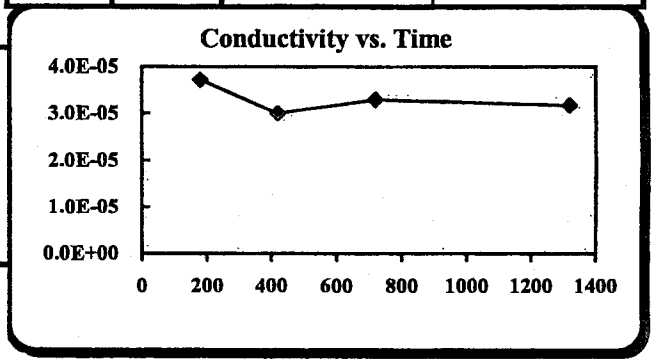
Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method "C")

Project #:	1264-02-576	Test Date(s):	03/25/03 - 04/01/03
Project Name:	Duke Power - Belews County Landfill	Report Date:	04/01/03
Client Name:			
Client Address:			

Boring #:	BC-6	Sample #:		Depth/Elevation:	18-20'	Sample Date:	not reported
Location:		Offset:		Sample Description:	Tan-Brown Sandy Clayey SILT (ML)		
Liquid Limit:	44	Specific Gravity:	2.752	Sample Type:	undisturbed	Sampled By:	not reported
Plastic Limit:	32	Plasticity Index:	12	Percent Passing #200:		Maximum Particle Size:	

Initial Sample Conditions				Final Sample Conditions			
Length (cm):	10.439	Wet Density (PCF):	101.9	Length (cm):	9.832	Wet Density (PCF):	134.0
Diameter (cm):	7.267	Dry Density (PCF):	82.5	Diameter (cm):	6.804	Dry Density (PCF):	100.0
Area (cm^2)	41.476	Percent Saturation:	59.8	Area (cm^2)	36.355	Percent Saturation:	100.0
Volume (cm^3)	432.97			Volume (cm^3)	357.44	b value:	0.95
Wet weight (grams)	706.9	Void Ratio:	1.082	Wet weight (grams)	767.6	Void Ratio:	0.719
Dry Weight (grams)	572.4	Porosity:	0.520	Dry Weight (grams)	572.4	Porosity:	0.418
Percent Moisture:	23.5			Percent Moisture:	34.1		
Test Parameters:	Effective Consolidation Stress (psi):		24.8	Permeant Liquid Used:		Deaired Demineralized water	
Burette Area (cm^2):	0.720	Cell Pressure (psi):	94.7	Back Pressure (psi):	69.9	Pore Pressure (psi)	69.9

Time (24-hr)			Temperature (°C)				Measurements						Ratio	Grad-ient	K-Value (cm/sec)	
Start	End	Time (sec)	Initial	Final	Ave.	Factor	$h_{out}1$	$h_{in}1$	$h_{out}2$	$h_{in}2$	h1	h2			Uncorrected K-Value	Corrected K-Value
10:16	10:19	180	22.2	22.2	22.2	0.9509	35.50	24.00	35.10	24.40	11.5	10.7	1.00	1.09	3.90E-05	3.71E-05
10:19	10:23	240	22.2	22.2	22.2	0.9509	35.10	24.40	34.70	24.80	10.7	9.9	1.00	1.01	3.15E-05	3.00E-05
10:23	10:28	300	22.2	22.2	22.2	0.9509	34.70	24.80	34.20	25.30	9.9	8.9	1.00	0.91	3.46E-05	3.29E-05
10:28	10:38	600	22.2	22.2	22.2	0.9509	34.20	25.30	33.35	26.10	8.9	7.3	1.06	0.74	3.33E-05	3.16E-05
Notes:												*Averages:*	*1.02*	*0.93*	*3.46E-05*	*3.29E-05*



References:
ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D2216: Laboratory Determination of Water Content of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soil
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 854: Specific Gravity of Soils
ASTM D 422: Particle Size Analysis of Soils

Technician / Certification #: John Dailly Certification #:

Technical Responsibility: Mal Krajan Position: Laboratory Manager

Laboratory Report Version 4.0

Particle Size Analysis of Soils

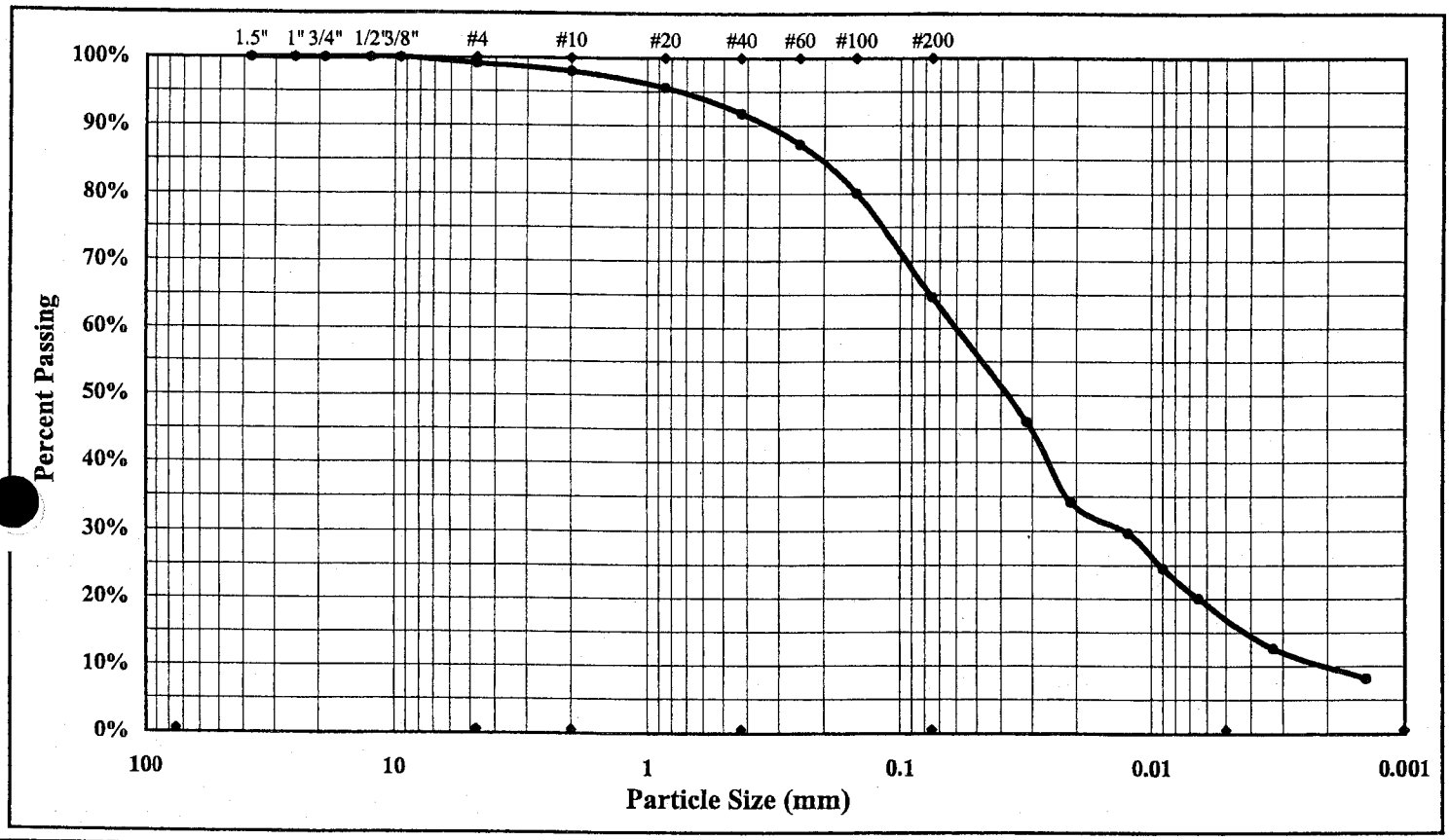
ASTM D 422

S&ME

ME Project #: **1264-02-576**
Project Name: **Duke Power-Belews Creek Landfill**
Client Name:
Client Address:

Report Date: April 1, 2003
Test Date(s): 3/26/2003-34/1/03

Boring #: BC-7	Sample #: UD-1	Sample Date: NA
Location:	Offset:	Depth (ft): 14.0 - 16.0
Sample Description: Tan Sandy Clayey SILT (ML)		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Moisture Content		Gravel	0.9%	Liquid Limit	38
Silt & Clay (% Passing #200)	64.7%	Sand	34.4%	Plastic Limit	29
Maximum Particle Size	3/8"	Silt	47.4%	Plastic Index	9
Specific Gravity	2.652	Clay	17.3%	Colloids	8.2%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

ASTM D 422: Particle Size Analysis of Soils — Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter; Mechanical Stirring Apparatus (A); Length of Dispersion Period: 1 min.

References: ASTM D 854: Specific Gravity of Soils
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility / Position: Mal Krajan — Laboratory Supervisor

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

Project #: 1264-02-576 Report Date: March 31, 2003

Project Name: Duke Power-Belews Creek Landfill Test Date(s): 3/25/03-3/31/03

Client Name:

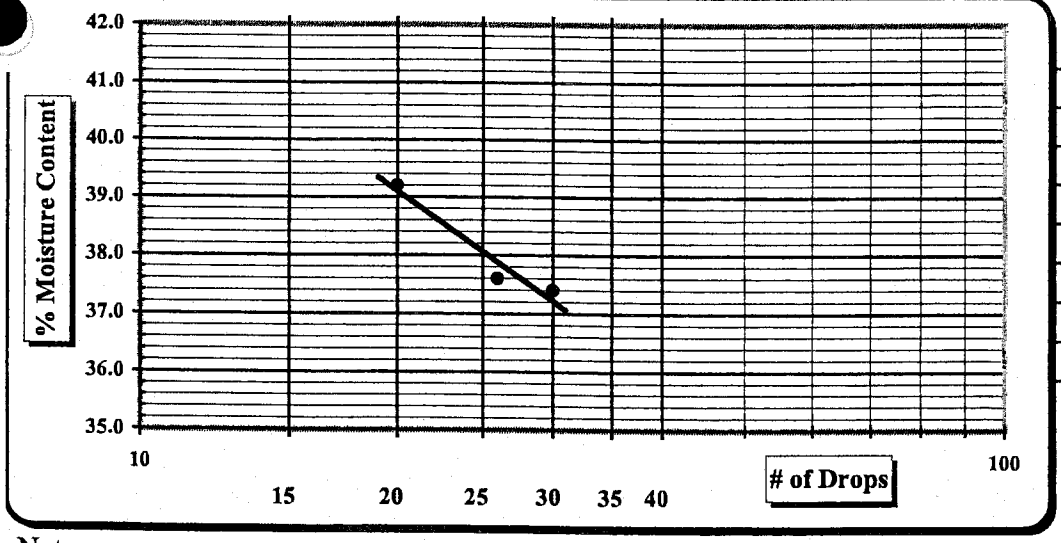
Client Address:

Boring #: BC-7 Sample #: UD-1 Sample Date: NA

Location: Offset: Depth (ft): 14.0 - 16.0

Sample Description: Tan Sandy Clayey SILT (ML)

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	23	93	103				78	42	
A	Tare Weight	8.25	8.04	8.22				6.18	6.59	
B	Wet Soil Weight + A	22.58	24.29	21.53				14.07	13.83	
C	Dry Soil Weight + A	18.68	19.85	17.78				12.27	12.20	
D	Water Weight (B-C)	3.90	4.44	3.75				1.80	1.63	
E	Dry Soil Weight (C-A)	10.43	11.81	9.56				6.09	5.61	
F	% Moisture Content (D/E)*100	37.4	37.6	39.2				29.6	29.1	
N	# OF DROPS	30	26	20						
LL	LL = F * FACTOR									
Ave.	Average							29.4		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation ☐	Dry Preparation ☐	Air Dried ☒	NP, Non-Plastic	☐
Liquid limit Test:	Multipoint Method ☒	One-point Method ☐		Liquid Limit	38
Classification:	ASTM D 2487 ☒	AASHTO M 145 ☐		Plastic Limit	29
Liquid limit Test:	ASTM D 4318 ☒	AASHTO T 89 ☐		Plastic Index	9
Plastic limit Test:	ASTM D 4318 ☒	AASHTO T 90 ☐		Group Symbol	ML

Technician Name / Certification #: Tom Savanpridi

Technical Responsibility / Position: Mal Krajan Laboratory Supervisor

S&ME

Labora[illegible]rd Version 4.1

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method "C")

Project #:	1264-02-576	Test Date(s):	03/25/03 - 04/01/03
Project Name:	Duke Power - Belews County Landfill	Report Date:	04/01/03
Client Name:			
Client Address:			

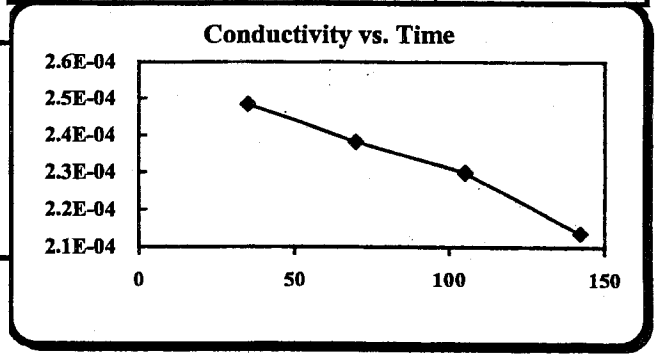
Boring #:	BC-7	Sample #:		Depth/Elevation:	14-16'	Sample Date:	not reported
Location:		Offset:		Sample Description:	Tan Sandy Clayey SILT (ML)		
Liquid Limit:	38	Specific Gravity:	2.652	Sample Type:	undisturbed	Sampled By:	not reported
Plastic Limit:	29	Plasticity Index:	9	Percent Passing #200:		Maximum Particle Size:	

Initial Sample Conditions				Final Sample Conditions			
Length (cm):	8.727	Wet Density (PCF):	89.0	Length (cm):	8.209	Wet Density (PCF):	130.3
Diameter (cm):	7.211	Dry Density (PCF):	78.6	Diameter (cm):	6.741	Dry Density (PCF):	95.6
Area (cm^2)	40.840	Percent Saturation:	31.7	Area (cm^2)	35.685	Percent Saturation:	100.0
Volume (cm^3)	356.41			Volume (cm^3)	292.94	b value:	0.95
Wet weight (grams)	508.1	Void Ratio:	1.106	Wet weight (grams)	611.3	Void Ratio:	0.731
Dry Weight (grams)	448.9	Porosity:	0.525	Dry Weight (grams)	448.9	Porosity:	0.422
Percent Moisture:	13.2			Percent Moisture:	36.2		
Test Parameters:	Effective Consolidation Stress (psi):		6.0	Permeant Liquid Used:		Deaired Demineralized water	
Burette Area (cm^2):	0.720	Cell Pressure (psi):	87.7	Back Pressure (psi):	81.7	Pore Pressure (psi)	81.7

Time (24-hr)			Temperature (°C)				Measurements						Ratio	Grad-ient	K-Value (cm/sec)	
Start	End	Time (sec)	Initial	Final	Ave.	Factor	$h_{out}1$	$h_{in}1$	$h_{out}2$	$h_{in}2$	h1	h2			Uncorrected K-Value	Corrected K-Value
7:34	7:34	35	23.5	23.5	23.5	0.9183	42.40	26.20	41.55	27.10	16.2	14.5	0.94	1.76	2.70E-04	2.48E-04
7:34	7:35	35	23.5	23.5	23.5	0.9183	41.55	27.10	40.80	27.85	14.5	13.0	1.00	1.58	2.59E-04	2.38E-04
7:35	7:35	35	23.5	23.5	23.5	0.9183	40.80	27.85	40.15	28.50	13.0	11.7	1.00	1.42	2.50E-04	2.30E-04
7:35	7:36	37	23.5	23.5	23.5	0.9183	40.15	28.50	39.60	29.10	11.7	10.5	0.92	1.28	2.33E-04	2.14E-04
Notes:												*Averages:*	*0.97*	*1.51*	*2.53E-04*	*2.33E-04*

Flow rate does not conform to rates for which this test method is applicable.

References:
ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D2216: Laboratory Determination of Water Content of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soil
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 854: Specific Gravity of Soils
ASTM D 422: Particle Size Analysis of Soils



Technician / Certification #: John Dailly Certification #:

Technical Responsibility: Mal Krajan Position: Laboratory Manager

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method "C")

Project #:	1264-02-576	Test Date(s):	03/25/03 - 04/01/03
Project Name:	Duke Power - Belews County Landfill	Report Date:	04/01/03
Client Name:			
Client Address:			

Boring #:	BC-7	Sample #:		Depth/Elevation:	14-16'	Sample Date:	not reported
Location:		Offset:		Sample Description:	Tan Sandy Clayey SILT (ML)		
Liquid Limit:	38	Specific Gravity:	2.652	Sample Type:	undisturbed	Sampled By:	not reported
Plastic Limit:	28	Plasticity Index:	10	Percent Passing #200:		Maximum Particle Size:	

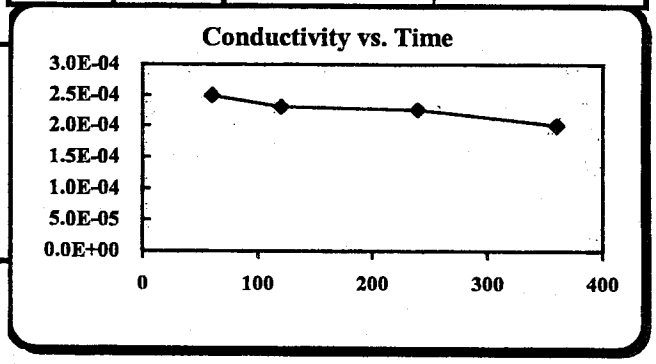
Initial Sample Conditions				Final Sample Conditions			
Length (cm):	8.727	Wet Density (PCF):	89.0	Length (cm):	8.153	Wet Density (PCF):	133.1
Diameter (cm):	7.211	Dry Density (PCF):	78.6	Diameter (cm):	6.684	Dry Density (PCF):	97.9
Area (cm^2)	40.840	Percent Saturation:	31.7	Area (cm^2)	35.089	Percent Saturation:	100.0
Volume (cm^3)	356.41			Volume (cm^3)	286.08	b value:	0.95
Wet weight (grams)	508.1	Void Ratio:	1.106	Wet weight (grams)	610.0	Void Ratio:	0.690
Dry Weight (grams)	448.9	Porosity:	0.525	Dry Weight (grams)	448.9	Porosity:	0.408
Percent Moisture:	13.2			Percent Moisture:	35.9		
Test Parameters:	Effective Consolidation Stress (psi):		13.0	Permeant Liquid Used:		Deaired Demineralized water	
Burette Area (cm^2):	0.720	Cell Pressure (psi):	94.7	Back Pressure (psi):	81.7	Pore Pressure (psi)	81.7

Time (24-hr)			Temperature (°C)				Measurements						Ratio	Grad-ient	K-Value (cm/sec)	
Start	End	Time (sec)	Initial	Final	Ave.	Factor	$h_{out}1$	$h_{in}1$	$h_{out}2$	$h_{in}2$	h1	h2			Uncorrected K-Value	Corrected K-Value
9:10	9:11	60	22.1	22.1	22.1	0.9509	42.05	25.40	40.70	26.90	16.7	13.8	0.90	1.69	2.62E-04	2.49E-04
9:11	9:12	60	22.1	22.1	22.1	0.9509	40.70	26.90	39.60	28.00	13.8	11.6	1.00	1.42	2.42E-04	2.30E-04
9:12	9:14	120	22.1	22.1	22.1	0.9509	39.60	28.00	37.90	29.65	11.6	8.3	1.03	1.01	2.38E-04	2.26E-04
9:14	9:16	120	22.1	22.1	22.1	0.9509	37.90	29.65	36.90	30.80	8.3	6.1	0.87	0.75	2.10E-04	2.00E-04
Notes:												*Averages:*	***0.95***	***1.22***	***2.38E-04***	***2.26E-04***

Flow rate does not conform to rates for which this test method is applicable.

References:

ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D2216: Laboratory Determination of Water Content of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soil
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 854: Specific Gravity of Soils
ASTM D 422: Particle Size Analysis of Soils



Technician / Certification #: John Dailly Certification #:

Technical Responsibility: Mal Krajan Position: Laboratory Manager

Laboratory Report Version 4.0

Particle Size Analysis of Soils

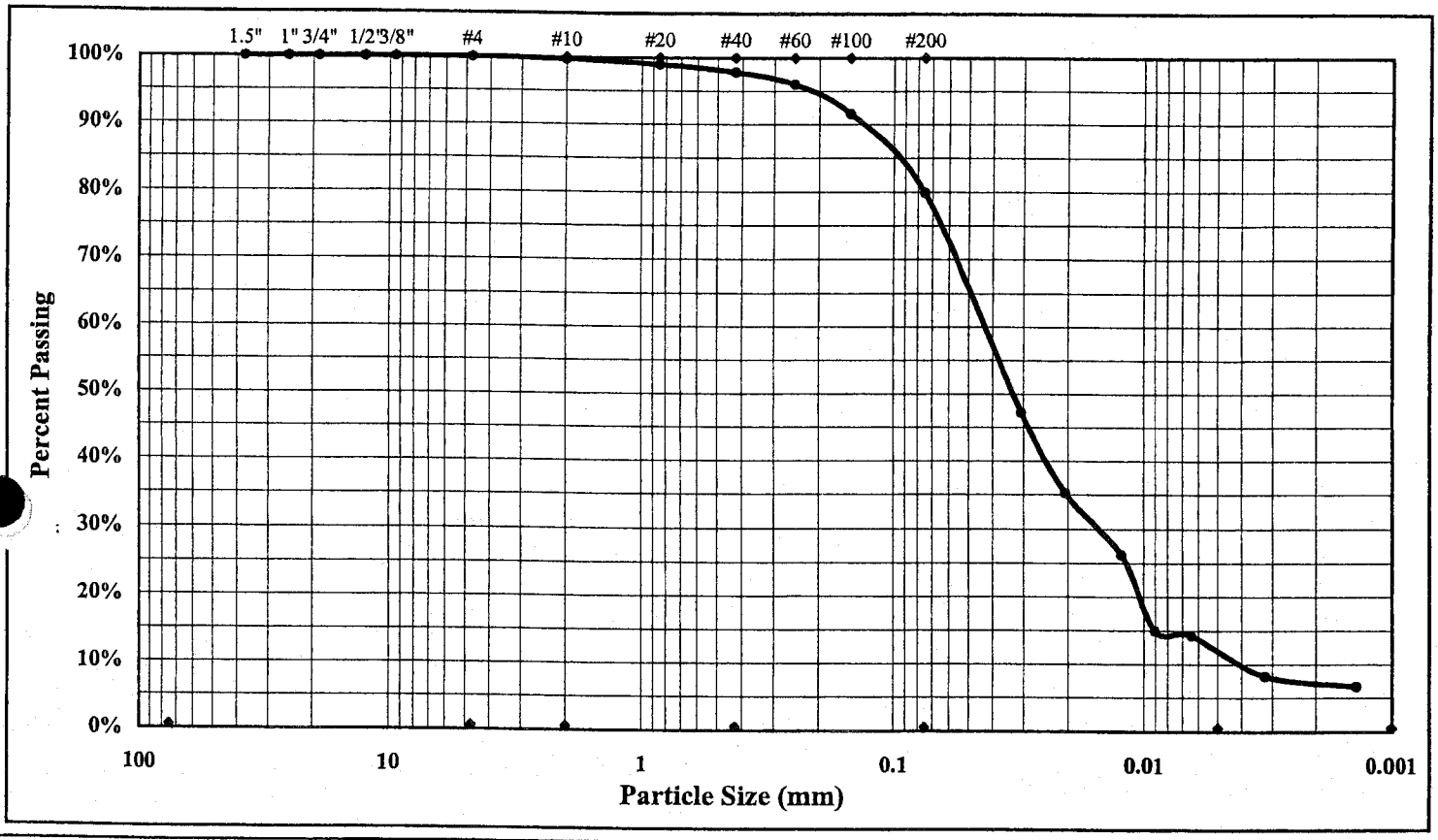
ASTM D 422

S&ME

ME Project #: 1264-02-576
Project Name: Duke Power-Belews Creek Landfill
Client Name:
Client Address:

Report Date: April 1, 2003
Test Date(s): 3/26 - 4/1/03

Boring #: BC-10	Sample #: UD-1	Sample Date: NA
Location:	Offset:	Depth (ft): 12.0 - 14.0
Sample Description: Yellow and Tan-Brown Sandy Clayey SILT (MH)		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Moisture Content		Gravel	0.0%	Liquid Limit	59
Silt & Clay (% Passing #200)	79.9%	Sand	20.1%	Plastic Limit	45
Maximum Particle Size	#4	Silt	67.9%	Plastic Index	14
Specific Gravity	2.797	Clay	12.0%	Colloids	6.7%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

ASTM D 422: Particle Size Analysis of Soils

Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter
Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min.

References: ASTM D 854: Specific Gravity of Soils
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility / Position: Mal Krajan — Laboratory Supervisor

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

Project #: 1264-02-576 Report Date: March 31, 2003

Project Name: Duke Power-Belews Creek Landfill Test Date(s): 3/25/03-3/31/03

Client Name:

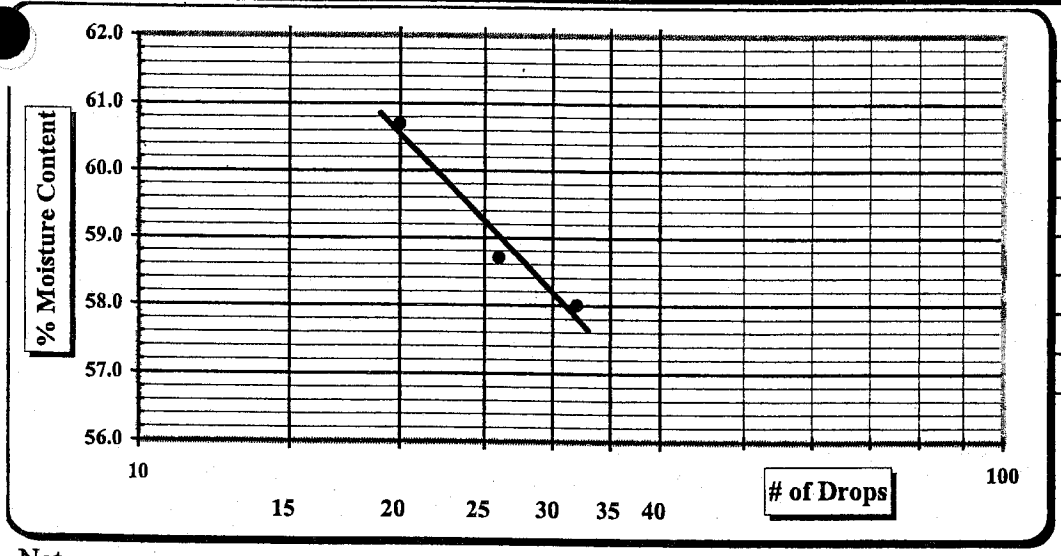
Client Address:

Boring #: BC-10 Sample #: UD-1 Sample Date: NA

Location: Offset: Depth (ft): 12.0 - 14.0

Sample Description: Yellow and Tan-Brown Sandy Clayey SILT (MH)

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	34	1	A-33				68	91	
A	Tare Weight	8.24	8.08	8.05				6.33	6.50	
B	Wet Soil Weight + A	21.45	20.38	18.38				12.85	13.14	
C	Dry Soil Weight + A	16.60	15.83	14.48				10.84	11.10	
D	Water Weight (B-C)	4.85	4.55	3.90				2.01	2.04	
E	Dry Soil Weight (C-A)	8.36	7.75	6.43				4.51	4.60	
F	% Moisture Content (D/E)*100	58.0	58.7	60.7				44.6	44.3	
N	# OF DROPS	32	26	20						
LL	LL = F * FACTOR									
Ave.	Average							44.5		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation	☐	Dry Preparation	☐	Air Dried	☒	NP, Non-Plastic ☐
Liquid limit Test:	Multipoint Method	☒	One-point Method	☐			Liquid Limit 59
Classification:	ASTM D 2487	☒	AASHTO M 145	☐			Plastic Limit 45
Liquid limit Test:	ASTM D 4318	☒	AASHTO T 89	☐			Plastic Index 14
Plastic limit Test:	ASTM D 4318	☒	AASHTO T 90	☐			Group Symbol MH

Technician Name / Certification #: Tom Savanpridi

Technical Responsibility / Position: Mal Krajan Laboratory Supervisor

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method "C")

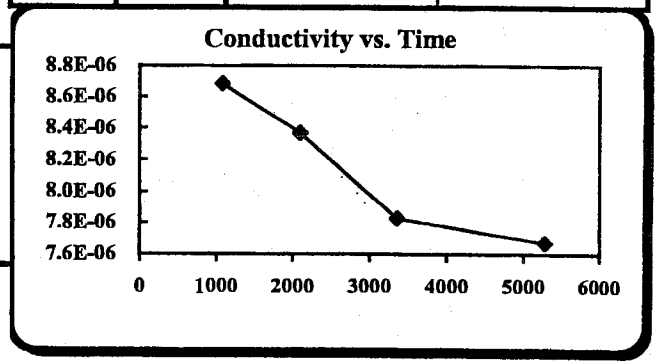
Project #:	1264-02-576	Test Date(s):	03/25/03 - 04/01/03
Project Name:	Duke Power - Belews County Landfill	Report Date:	04/01/03
Client Name:			
Client Address:			

Boring #:	BC-10	Sample #:		Depth/Elevation:	12-14'	Sample Date:	not reported.
Location:		Offset:		Sample Description:	Yellow and Tan-Brown Sandy Clayey SILT (MH)		
Liquid Limit:	59	Specific Gravity:	2.797	Sample Type:	undisturbed	Sampled By:	not reported
Plastic Limit:	45	Plasticity Index:	14	Percent Passing #200:		Maximum Particle Size:	

Initial Sample Conditions				Final Sample Conditions			
Length (cm):	10.020	Wet Density (PCF):	106.4	Length (cm):	9.957	Wet Density (PCF):	114.5
Diameter (cm):	7.214	Dry Density (PCF):	75.4	Diameter (cm):	7.168	Dry Density (PCF):	76.8
Area (cm^2)	40.874	Percent Saturation:	87.5	Area (cm^2)	40.357	Percent Saturation:	100.0
Volume (cm^3)	409.56			Volume (cm^3)	401.83	b value:	0.95
Wet weight (grams)	697.9	Void Ratio:	1.318	Wet weight (grams)	736.9	Void Ratio:	1.274
Dry Weight (grams)	494.3	Porosity:	0.569	Dry Weight (grams)	494.3	Porosity:	0.560
Percent Moisture:	41.2			Percent Moisture:	49.1		
Test Parameters:	Effective Consolidation Stress (psi):		3.7	Permeant Liquid Used:		Deaired Demineralized water	
Burette Area (cm^2):	0.720	Cell Pressure (psi):	64.9	Back Pressure (psi):	61.2	Pore Pressure (psi)	61.2

Time (24-hr)			Temperature (°C)				Measurements						Ratio	Grad-ient	K-Value (cm/sec)	
Start	End	Time (sec)	Initial	Final	Ave.	Factor	$h_{out}1$	$h_{in}1$	$h_{out}2$	$h_{in}2$	h1	h2			Uncorrected K-Value	Corrected K-Value
15:14	15:32	1080	24.3	24.3	24.3	0.9015	37.80	20.60	36.80	21.50	17.2	15.3	1.11	1.54	9.63E-06	8.68E-06
15:32	15:49	1020	24.3	24.4	24.4	0.8995	36.80	21.50	36.00	22.25	15.3	13.8	1.07	1.38	9.30E-06	8.37E-06
15:49	16:10	1260	24.4	24.5	24.5	0.8975	36.00	22.25	35.20	23.05	13.8	12.2	1.00	1.22	8.72E-06	7.83E-06
16:10	16:42	1920	24.5	24.6	24.6	0.8975	35.20	23.05	34.15	24.05	12.2	10.1	1.05	1.01	8.55E-06	7.67E-06
													1.06	***1.29***	***9.05E-06***	***8.14E-06***

Notes: ***Averages:***



References:
ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D2216: Laboratory Determination of Water Content of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soil
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 854: Specific Gravity of Soils
ASTM D 422: Particle Size Analysis of Soils

Technician / Certification #: John Dailly Certification #:

Technical Responsibility: Mal Krajan Position: Laboratory Manager

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method "C")

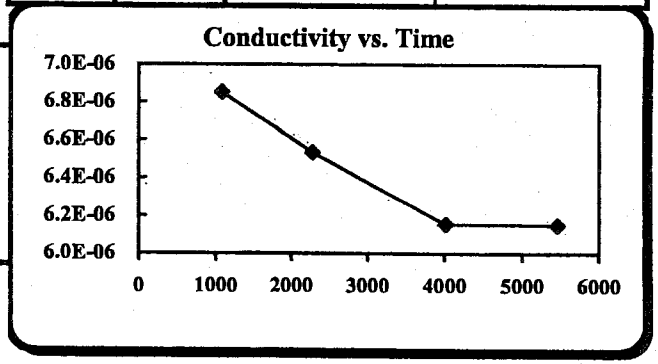
Project #:	1264-02-576	Test Date(s):	03/25/03 - 04/01/03
Project Name:	Duke Power / Belews County Landfill	Report Date:	04/01/03
Client Name:			
Client Address:			

Boring #:	BC-10	Sample #:		Depth/Elevation:	12-14'	Sample Date:	not reported.
Location:		Offset:		Sample Description:	Yellow and Tan-Brown Sandy Clayey SILT (MH)		
Liquid Limit:	59	Specific Gravity:	2.797	Sample Type:	undisturbed	Sampled By:	not reported
Plastic Limit:	45	Plasticity Index:	14	Percent Passing #200:		Maximum Particle Size:	

Initial Sample Conditions				Final Sample Conditions			
Length (cm):	10.020	Wet Density (PCF):	106.4	Length (cm):	9.853	Wet Density (PCF):	117.0
Diameter (cm):	7.214	Dry Density (PCF):	75.4	Diameter (cm):	7.091	Dry Density (PCF):	79.3
Area (cm^2)	40.874	Percent Saturation:	87.5	Area (cm^2)	39.489	Percent Saturation:	100.0
Volume (cm^3)	409.56			Volume (cm^3)	389.08	b value:	0.95
Wet weight (grams)	697.9	Void Ratio:	1.318	Wet weight (grams)	729.0	Void Ratio:	1.202
Dry Weight (grams)	494.3	Porosity:	0.569	Dry Weight (grams)	494.3	Porosity:	0.546
Percent Moisture:	41.2			Percent Moisture:	47.5		
Test Parameters:	Effective Consolidation Stress (psi):		11.9	Permeant Liquid Used:		Deaired Demineralized water	
Burette Area (cm^2):	0.720	Cell Pressure (psi):	73.1	Back Pressure (psi):	61.2	Pore Pressure (psi)	61.2

Time (24-hr)			Temperature (°C)				Measurements						Ratio	Grad-ient	K-Value (cm/sec)	
Start	End	Time (sec)	Initial	Final	Ave.	Factor	$h_{out}1$	$h_{in}1$	$h_{out}2$	$h_{in}2$	h1	h2			Uncorrected K-Value	Corrected K-Value
10:59	11:17	1080	22.3	22.3	22.3	0.9465	40.50	21.30	39.70	22.10	19.2	17.6	1.00	1.79	7.24E-06	6.85E-06
11:17	11:37	1200	22.3	22.3	22.3	0.9465	39.70	22.10	38.90	22.85	17.6	16.1	1.07	1.63	6.90E-06	6.53E-06
11:37	12:06	1740	22.3	22.3	22.3	0.9465	38.90	22.85	37.90	23.75	16.1	14.2	1.11	1.44	6.50E-06	6.16E-06
12:06	12:30	1440	22.3	22.3	22.3	0.9465	37.90	23.75	37.20	24.45	14.2	12.8	1.00	1.29	6.50E-06	6.15E-06
													1.04	***1.54***	***6.79E-06***	***6.42E-06***

Notes: ***Averages:***



References:
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ASTM D2216: Laboratory Determination of Water Content of Soils
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ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 854: Specific Gravity of Soils
ASTM D 422: Particle Size Analysis of Soils

Technician / Certification #: John Dailly Certification #:

Technical Responsibility: Mal Krajan Position: Laboratory Manager

Laboratory Report Version 4.0

Particle Size Analysis of Soils

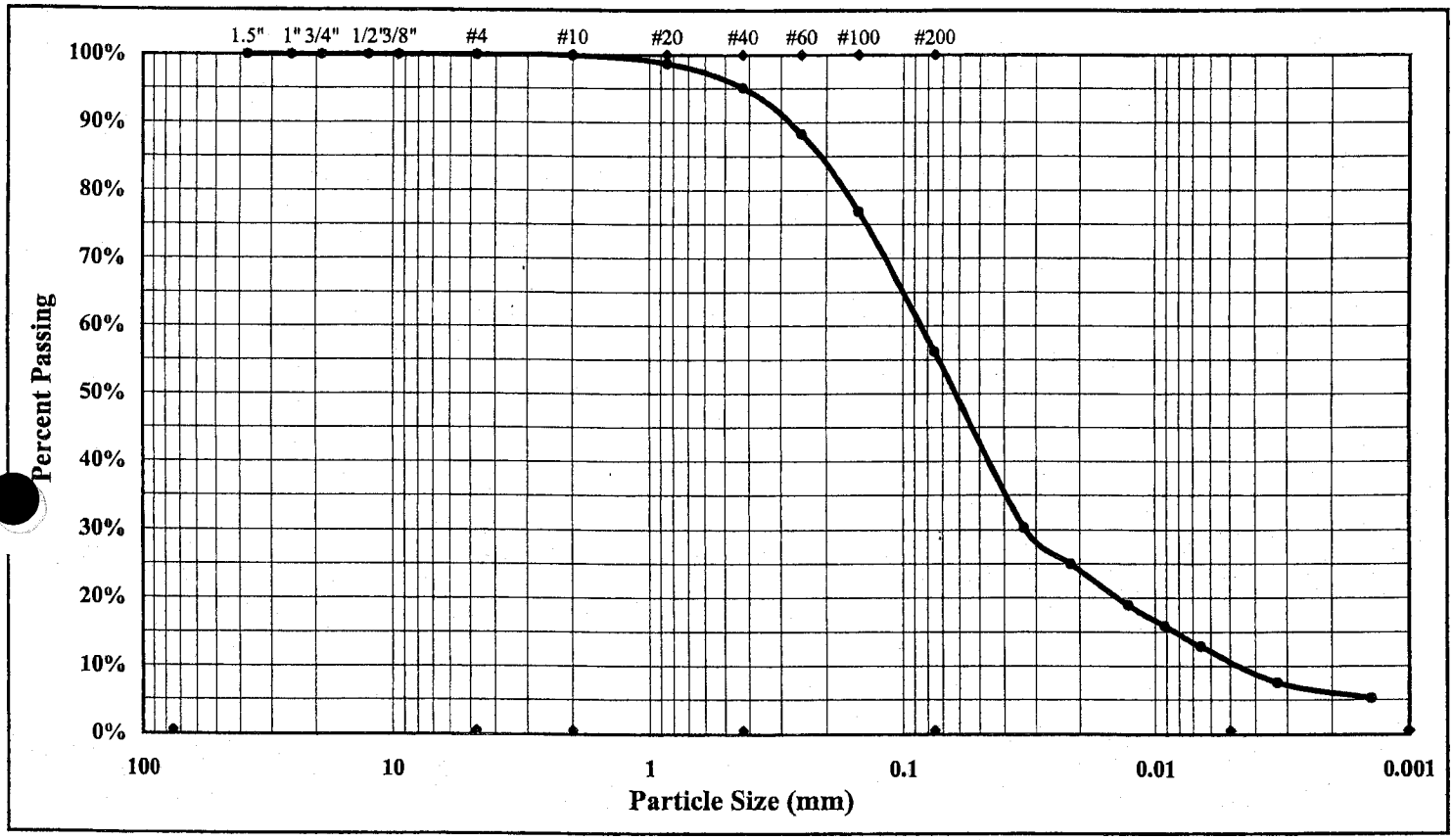
ASTM D 422

S&ME

S&ME Project #: **1264-02-576**
Project Name: **Duke Power-Belews Creek Landfill**
Client Name:
Client Address:

Report Date: April 1, 2003
Test Date(s): 3/25 - 4/1/03

Boring #: BC-11	Sample #: UD-1	Sample Date: NA
Location:	Offset:	Depth (ft): 23.0 - 25.0
Sample Description: Tan-Brown Sandy Clayey SILT (ML)		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Moisture Content		Gravel	0.0%	Liquid Limit	44
Silt & Clay (% Passing #200)	56.2%	Sand	43.8%	Plastic Limit	37
Maximum Particle Size	#4	Silt	46.0%	Plastic Index	7
Specific Gravity	2.745	Clay	10.2%	Colloids	5.3%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

ASTM D 422: Particle Size Analysis of Soils — Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter; Mechanical Stirring Apparatus (A); Length of Dispersion Period: 1 min.

References: ASTM D 854: Specific Gravity of Soils
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility / Position: Mal Krajan — Laboratory Supervisor

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

Project #: 1264-02-576 Report Date: March 31, 2003

Project Name: Duke Power-Belews Creek Landfill Test Date(s): 3/25/03-3/31/03

Client Name:

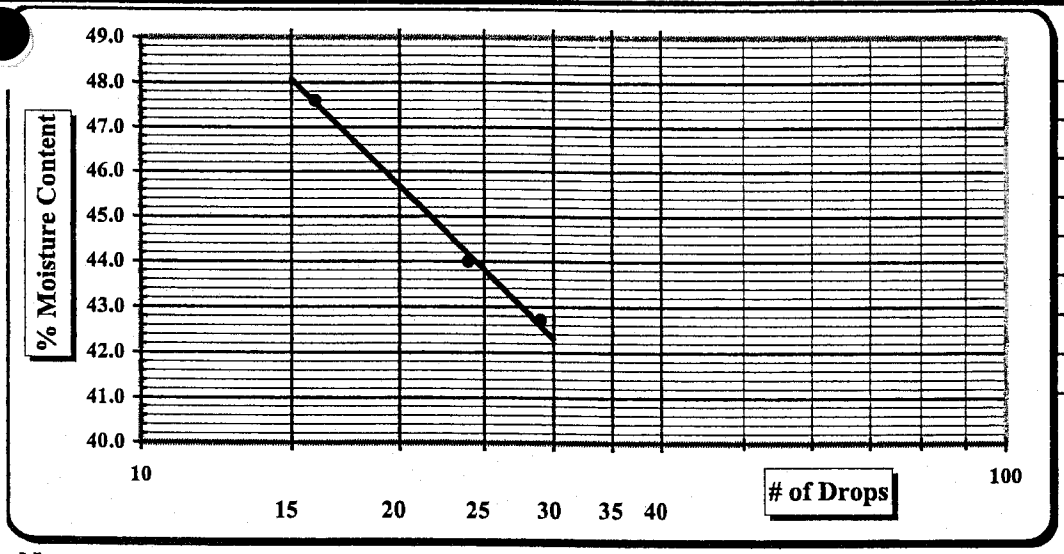
Client Address:

Boring #: BC-11 Sample #: UD-1 Sample Date: NA

Location: Offset: Depth (ft): 23.0 - 25.0

Sample Description: Tan-Brown Sandy Clayey SILT (ML)

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	M1	83	5				28	459	
A	Tare Weight	8.09	8.23	8.04				6.34	6.48	
B	Wet Soil Weight + A	21.86	22.00	21.08				13.86	14.11	
C	Dry Soil Weight + A	17.42	17.79	17.18				11.84	12.08	
D	Water Weight (B-C)	4.44	4.21	3.90				2.02	2.03	
E	Dry Soil Weight (C-A)	9.33	9.56	9.14				5.50	5.60	
F	% Moisture Content (D/E)*100	47.6	44.0	42.7				36.7	36.3	
N	# OF DROPS	16	24	29						
LL	LL = F * FACTOR									
Ave.	Average							36.5		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation	☐	Dry Preparation	☐	Air Dried	☒	NP, Non-Plastic ☐
Liquid limit Test:	Multipoint Method	☒	One-point Method	☐			Liquid Limit 44
Classification:	ASTM D 2487	☒	AASHTO M 145	☐			Plastic Limit 37
Liquid limit Test:	ASTM D 4318	☒	AASHTO T 89	☐			Plastic Index 7
Plastic limit Test:	ASTM D 4318	☒	AASHTO T 90	☐			Group Symbol ML

Technician Name / Certification #: Tom Savanpridi

Technical Responsibility / Position: Mal Krajan Laboratory Supervisor

S&ME

Labora[illegible]ord Version 4.1

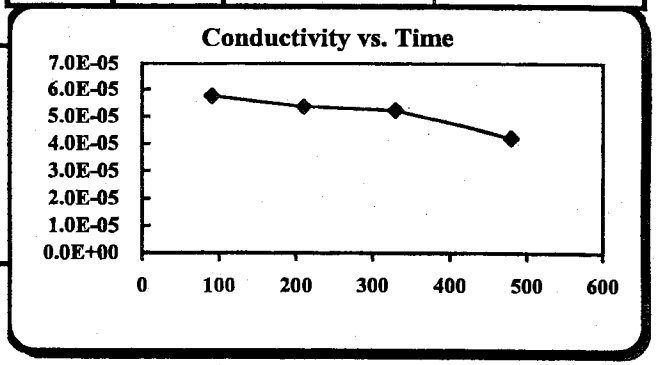
Hydraulic Conductivity o[illegible]turated Porous Materials Using a Flexible Wall Permeameter (Method "C")

Project #:	1264-02-576	Test Date(s):	03/25/03 - 04/01/03
Project Name:	Duke Power - Belews County Landfill	Report Date:	04/01/03
Client Name:			
Client Address:			

Boring #:	BC-11	Sample #:		Depth/Elevation:	23-25'	Sample Date:	not reported
Location:		Offset:		Sample Description:	Tan Sandy Clayey SILT (ML)		
Liquid Limit:	44	Specific Gravity:	2.745	Sample Type:	undisturbed	Sampled By:	not reported
Plastic Limit:	37	Plasticity Index:	7	Percent Passing #200:		Maximum Particle Size:	

Initial Sample Conditions				Final Sample Conditions			
Length (cm):	12.286	Wet Density (PCF):	107.7	Length (cm):	11.570	Wet Density (PCF):	141.5
Diameter (cm):	7.275	Dry Density (PCF):	91.4	Diameter (cm):	6.810	Dry Density (PCF):	110.8
Area (cm^2)	41.568	Percent Saturation:	55.9	Area (cm^2)	36.423	Percent Saturation:	100.0
Volume (cm^3)	510.70			Volume (cm^3)	421.41	b value:	0.95
Wet weight (grams)	881.3	Void Ratio:	0.874	Wet weight (grams)	955.4	Void Ratio:	0.546
Dry Weight (grams)	748.1	Porosity:	0.466	Dry Weight (grams)	748.1	Porosity:	0.353
Percent Moisture:	17.8			Percent Moisture:	27.7		
Test Parameters:	Effective Consolidation Stress (psi):		8.0	Permeant Liquid Used:		Deaired Demineralized water	
Burette Area (cm^2):	0.196	Cell Pressure (psi):	78.0	Back Pressure (psi):	70.0	Pore Pressure (psi)	70.0

Time (24-hr)			Temperature (°C)				Measurements						Ratio	Grad-ient	K-Value (cm/sec)	
Start	End	Time (sec)	Initial	Final	Ave.	Factor	$h_{out}1$	$h_{in}1$	$h_{out}2$	$h_{in}2$	h1	h2			Uncorrected K-Value	Corrected K-Value
9:22	9:24	90	23.5	23.5	23.5	0.9183	9.70	1.20	8.99	1.90	43.4	36.2	1.01	3.13	6.27E-05	5.76E-05
9:24	9:26	120	23.5	23.5	23.5	0.9183	8.99	1.90	8.28	2.62	36.2	28.9	0.99	2.50	5.84E-05	5.36E-05
9:26	9:28	120	23.5	23.5	23.5	0.9183	8.28	2.62	7.73	3.19	28.9	23.2	0.96	2.01	5.70E-05	5.23E-05
9:28	9:30	150	23.5	23.5	23.5	0.9183	7.73	3.19	7.28	3.64	23.2	18.6	1.00	1.61	4.59E-05	4.21E-05
Notes:												*Averages:*	*0.99*	*2.31*	*5.60E-05*	*5.14E-05*



References:
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ASTM D2216: Laboratory Determination of Water Content of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soil
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 854: Specific Gravity of Soils
ASTM D 422: Particle Size Analysis of Soils

Technician / Certification #: John Dailly Certification #:

Technical Responsibility: Mal Krajan Position: Laboratory Manager

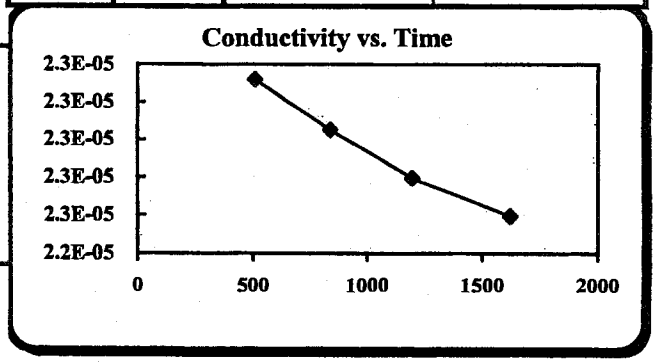
Laborat[illegible]rd Version 4.1

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method "C")

Project #:	1264-02-576	Test Date(s):	03/25/03 - 04/01/03
Project Name:	Duke Power - Belews County Landfill	Report Date:	04/01/03
Client Name:			
Client Address:			
Boring #:	BC-11	Sample #:	
Depth/Elevation:	23-25'	Sample Date:	not reported
Location:		Offset:	
Sample Description:	Tan Sandy Clayey SILT (ML)		
Liquid Limit:	44	Specific Gravity:	2.745
Sample Type:	undisturbed	Sampled By:	not reported
Plastic Limit:	37	Plasticity Index:	7
Percent Passing #200:		Maximum Particle Size:	

Initial Sample Conditions				Final Sample Conditions			
Length (cm):	12.286	Wet Density (PCF):	107.7	Length (cm):	11.295	Wet Density (PCF):	151.5
Diameter (cm):	7.275	Dry Density (PCF):	91.4	Diameter (cm):	6.606	Dry Density (PCF):	120.6
Area (cm^2)	41.568	Percent Saturation:	55.9	Area (cm^2)	34.274	Percent Saturation:	100.0
Volume (cm^3)	510.70			Volume (cm^3)	387.12	b value:	0.95
Wet weight (grams)	881.3	Void Ratio:	0.874	Wet weight (grams)	939.7	Void Ratio:	0.420
Dry Weight (grams)	748.1	Porosity:	0.466	Dry Weight (grams)	748.1	Porosity:	0.296
Percent Moisture:	17.8			Percent Moisture:	25.6		
Test Parameters:	Effective Consolidation Stress (psi):		27.9	Permeant Liquid Used:		Deaired Demineralized water	
Burette Area (cm^2):	0.196	Cell Pressure (psi):	98.0	Back Pressure (psi):	70.1	Pore Pressure (psi)	70.1

Time (24-hr)			Temperature (°C)				Measurements						Ratio	Grad-ient	K-Value (cm/sec)	
Start	End	Time (sec)	Initial	Final	Ave.	Factor	$h_{out}1$	$h_{in}1$	$h_{out}2$	$h_{in}2$	h1	h2			Uncorrected K-Value	Corrected K-Value
11:03	11:11	510	22.3	22.3	22.3	0.9465	9.81	1.37	8.46	2.74	43.0	29.2	0.99	2.58	2.46E-05	2.33E-05
11:11	11:17	330	22.3	22.3	22.3	0.9465	8.46	2.74	7.84	3.38	29.2	22.7	0.97	2.01	2.44E-05	2.30E-05
11:17	11:23	360	22.3	22.3	22.3	0.9465	7.84	3.38	7.31	3.90	22.7	17.4	1.02	1.54	2.41E-05	2.28E-05
11:23	11:30	420	22.3	22.3	22.3	0.9465	7.31	3.90	6.87	4.37	17.4	12.8	0.94	1.13	2.39E-05	2.26E-05
Notes:												*Averages:*	*0.98*	*1.82*	*2.42E-05*	*2.29E-05*



References:
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ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 854: Specific Gravity of Soils
ASTM D 422: Particle Size Analysis of Soils

Technician / Certification #: John Dailly Certification #:

Technical Responsibility: Mal Krajan Position: Laboratory Manager

Laboratory Report Version 4.0

Particle Size Analysis of Soils

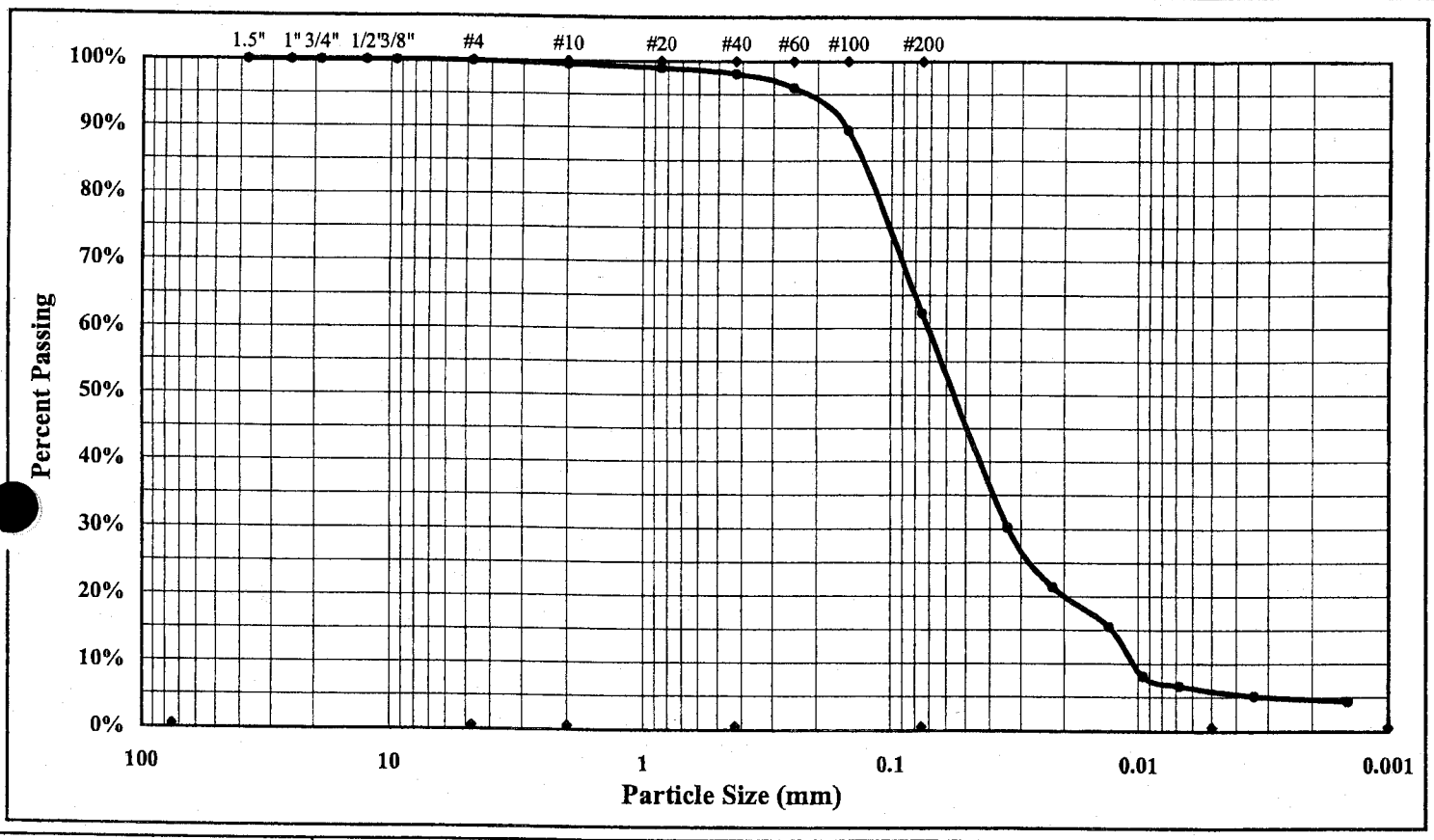
ASTM D 422

S&ME

S&ME Project #: 1264-02-576
Project Name: **Duke Power-Belew's Creek Landfill**
Client Name:
Client Address:

Report Date: April 1, 2003
Test Date(s): 3/25/2003-4/1/03

Boring #: BC-12	Sample #: UD-1	Sample Date: NA
Location:	Offset:	Depth (ft): 27.0 - 28.0
Sample Description: Tan Sandy Clayey SILT (ML)		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Moisture Content		Gravel	0.1%	Liquid Limit	32
Silt & Clay (% Passing #200)	62.3%	Sand	37.6%	Plastic Limit	26
Maximum Particle Size	#20	Silt	56.3%	Plastic Index	6
Specific Gravity	2.654	Clay	6.0%	Colloids	4.4%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

ASTM D 422: Particle Size Analysis of Soils — Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter; Mechanical Stirring Apparatus (A); Length of Dispersion Period: 1 min.

References: ASTM D 854: Specific Gravity of Soils
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility / Position: Mal Krajan — Laboratory Supervisor

Liquid Limit, Plastic Limit, and Plastic Index

S&ME

Project #: 1264-02-576 Report Date: March 31, 2003

Project Name: Duke Power-Belew's Creek Landfill Test Date(s): 3/25/03-3/31/03

Client Name:

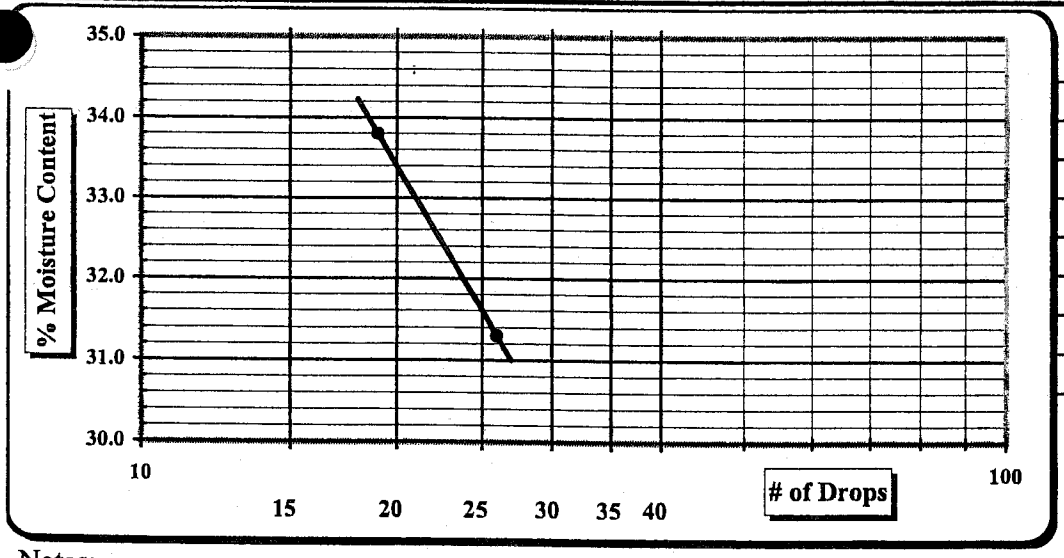
Client Address:

Boring #: BC-12 Sample #: UD-1 Sample Date: NA

Location: Offset: Depth (ft): 27.0 - 28.0

Sample Description: Tan Sandy Clayey SILT (ML)

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	12	M-6					35	93	
A	Tare Weight	8.20	8.38					6.54	6.62	
B	Wet Soil Weight + A	21.86	23.49					13.20	13.42	
C	Dry Soil Weight + A	18.41	19.89					11.79	12.04	
D	Water Weight (B-C)	3.45	3.60					1.41	1.38	
E	Dry Soil Weight (C-A)	10.21	11.51					5.25	5.42	
F	% Moisture Content (D/E)*100	33.8	31.3					26.9	25.5	
N	# OF DROPS	19	26							
LL	LL = F * FACTOR									
Ave.	Average							26.2		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation	☐	Dry Preparation	☐	Air Dried	☒	NP, Non-Plastic ☐
Liquid limit Test:	Multipoint Method	☒	One-point Method	☐			Liquid Limit 32
Classification:	ASTM D 2487	☒	AASHTO M 145	☐			Plastic Limit 26
Liquid limit Test:	ASTM D 4318	☒	AASHTO T 89	☐			Plastic Index 6
Plastic limit Test:	ASTM D 4318	☒	AASHTO T 90	☐			Group Symbol ML

Technician Name / Certification #: Tom Savanpridi

Technical Responsibility / Position: Mal Krajan Laboratory Supervisor

Hydraulic Conductivity o[illegible]turated Porous Materials Using a Flexible Wall Permeameter (Method "C")

Project #:	1264-02-576	Test Date(s):	03/25/03 - 04/01/03
Project Name:	Duke Power - Belews County Landfill	Report Date:	04/01/03
Client Name:			
Client Address:			

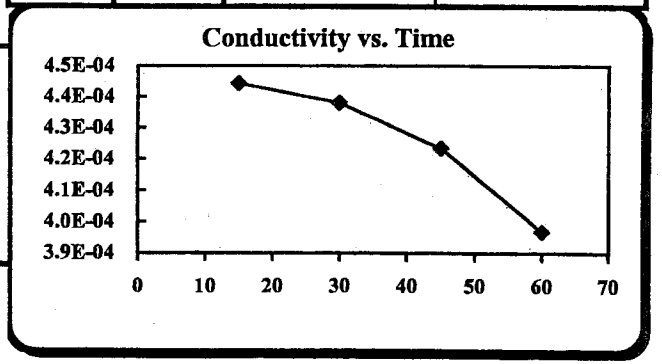
Boring #:	BC-12	Sample #:		Depth/Elevation:	27-28'	Sample Date:	not reported
Location:		Offset:		Sample Description:	Tan Sandy Clayey SILT (ML)		
Liquid Limit:	32	Specific Gravity:	2.654	Sample Type:	undisturbed	Sampled By:	not reported
Plastic Limit:	26	Plasticity Index:	6	Percent Passing #200:		Maximum Particle Size:	

Initial Sample Conditions				Final Sample Conditions			
Length (cm):	4.496	Wet Density (PCF):	79.5	Length (cm): *	4.438	Wet Density (PCF):	103.3
Diameter (cm):	7.292	Dry Density (PCF):	66.8	Diameter (cm):	7.196	Dry Density (PCF):	69.5
Area (cm^2)	41.762	Percent Saturation:	34.1	Area (cm^2)	40.670	Percent Saturation:	93.3
Volume (cm^3)	187.76			Volume (cm^3)	180.49	b value:	0.95
Wet weight (grams)	239.2	Void Ratio:	1.479	Wet weight (grams)	298.7	Void Ratio:	1.383
Dry Weight (grams)	201.0	Porosity:	0.597	Dry Weight (grams)	201.0	Porosity:	0.580
Percent Moisture:	19.0			Percent Moisture:	48.6		
Test Parameters:	Effective Consolidation Stress (psi):		9.0	Permeant Liquid Used:		Deaired Demineralized water	
Burette Area (cm^2):	0.196	Cell Pressure (psi):	84.0	Back Pressure (psi):	75.0	Pore Pressure (psi)	75.0

Time (24-hr)			Temperature (°C)				Measurements						Ratio	Grad-ient	K-Value (cm/sec)	
Start	End	Time (sec)	Initial	Final	Ave.	Factor	$h_{out}1$	$h_{in}1$	$h_{out}2$	$h_{in}2$	h1	h2			Uncorrected K-Value	Corrected K-Value
10:07	10:07	15	23.5	23.5	23.5	0.9183	8.64	0.71	6.69	2.68	40.4	20.5	0.99	4.62	4.84E-04	4.44E-04
10:07	10:07	15	23.5	23.5	23.5	0.9183	6.69	2.68	5.71	3.66	20.5	10.5	1.00	2.37	4.77E-04	4.38E-04
10:07	10:07	15	23.5	23.5	23.5	0.9183	5.71	3.66	5.22	4.15	10.5	5.5	1.00	1.24	4.61E-04	4.23E-04
10:07	10:08	15	23.5	23.5	23.5	0.9183	5.22	4.15	4.98	4.39	5.5	3.0	1.00	0.68	4.32E-04	3.97E-04
												Averages:	*1.00*	*2.23*	*4.63E-04*	*4.26E-04*

Notes: **Final sample length is estimated.**

Flow rate does not conform to rates for which this test method is applicable.



References:
ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D2216: Laboratory Determination of Water Content of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soil
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 854: Specific Gravity of Soils
ASTM D 422: Particle Size Analysis of Soils

Technician / Certification #: Mal Krajan Certification #:

Technical Responsibility: Mal Krajan Position: Laboratory Manager

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method "C")

Project #:	1264-02-576	Test Date(s):	03/25/03 - 04/01/03
Project Name:	Duke Power - Belews County Landfill	Report Date:	04/01/03
Client Name:			
Client Address:			

Boring #:	BC-12	Sample #:		Depth/Elevation:	27-28'	Sample Date:	not reported
Location:		Offset:		Sample Description:	Tan Sandy Clayey SILT (ML)		
Liquid Limit:	32	Specific Gravity:	2.654	Sample Type:	undisturbed	Sampled By:	not reported
Plastic Limit:	26	Plasticity Index:	6	Percent Passing #200:		Maximum Particle Size:	

Initial Sample Conditions				Final Sample Conditions			
Length (cm):	4.496	Wet Density (PCF):	79.5	Length (cm):	4.308	Wet Density (PCF):	110.4
Diameter (cm):	7.292	Dry Density (PCF):	66.8	Diameter (cm):	6.966	Dry Density (PCF):	76.4
Area (cm^2)	41.762	Percent Saturation:	34.1	Area (cm^2)	38.117	Percent Saturation:	100.0
Volume (cm^3)	187.76			Volume (cm^3)	164.21	b value:	0.95
Wet weight (grams)	239.2	Void Ratio:	1.479	Wet weight (grams)	290.5	Void Ratio:	1.168
Dry Weight (grams)	201.0	Porosity:	0.597	Dry Weight (grams)	201.0	Porosity:	0.539
Percent Moisture:	19.0			Percent Moisture:	44.5		
Test Parameters:	Effective Consolidation Stress (psi):		29.0	Permeant Liquid Used:		Deaired Demineralized water	
Burette Area (cm^2):	0.196	Cell Pressure (psi):	104.1	Back Pressure (psi):	75.1	Pore Pressure (psi)	75.1

Time (24-hr)			Temperature (°C)				Measurements						Ratio	Grad-ient	K-Value (cm/sec)	
Start	End	Time (sec)	Initial	Final	Ave.	Factor	$h_{out}1$	$h_{in}1$	$h_{out}2$	$h_{in}2$	h1	h2			Uncorrected K-Value	Corrected K-Value
12:16	12:16	15	22.3	22.3	22.3	0.9465	9.08	4.36	8.17	5.30	24.1	14.6	0.97	3.40	3.67E-04	3.48E-04
12:16	12:16	15	22.3	22.3	22.3	0.9465	8.17	5.30	7.62	5.85	14.6	9.0	1.00	2.10	3.57E-04	3.38E-04
12:16	12:16:45	15	22.3	22.3	22.3	0.9465	7.62	5.85	7.29	6.17	9.0	5.7	1.03	1.33	3.38E-04	3.20E-04
12:16	12:17	15	22.3	22.3	22.3	0.9465	7.29	6.17	7.09	6.37	5.7	3.7	1.00	0.85	3.26E-04	3.09E-04
													1.00	*1.92*	*3.47E-04*	*3.29E-04*

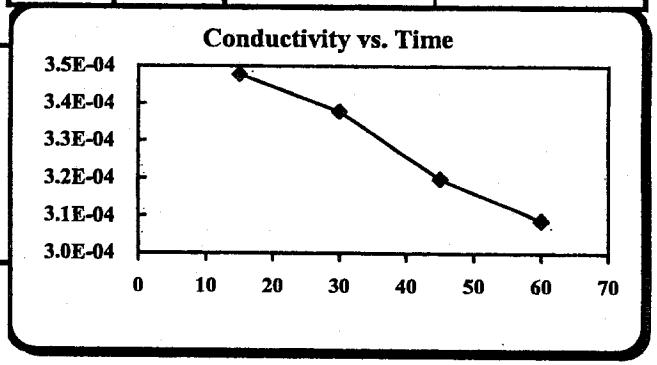
Averages:

Notes:

Flow rate does not conform to rates for which this test method is applicable.

References:

STM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
STM D2216: Laboratory Determination of Water Content of Soils
STM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soil
STM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
STM D 854: Specific Gravity of Soils
STM D 422: Particle Size Analysis of Soils



Technician / Certification #: John Dailly Certification #:

Technical Responsibility: Mal Krajan Position: Laboratory Manager

Laboratory Report Version 4.2

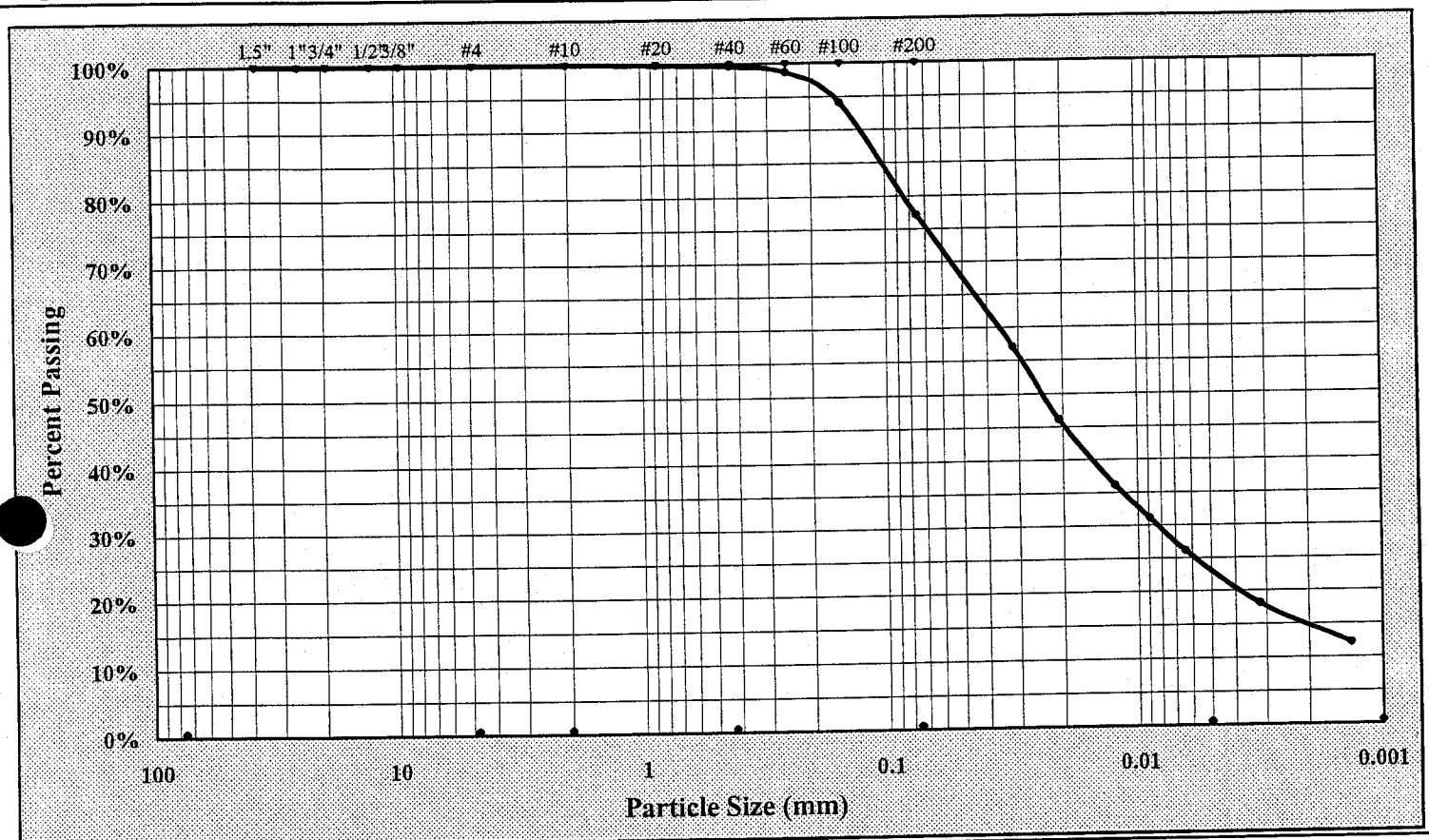
Particle Size Analysis of Soils

ASTM D 422

S&ME Project #: **1054-04-955**
Project Name: **Belew Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: 09/27/2004
Test Date(s): 09/20 - 09/25/2004

Boring #:	BC-17	Sample #:	UD-1	Sample Date:	9/1/04
Location:	Site Borehole	Offset:	NA	Depth (ft):	5.9 - 8.4'
Sample Description:	Orange Silty Sandy CLAY (CL)				



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	#4	Gravel	0.0%	Silt	53.5%
Silt & Clay (% Passing #200)	77.0%	Sand	23.0%	Clay	23.5%
Apparent Relative Density	2.658	Moisture Content		Colloids	12.0%
Liquid Limit	41	Plastic Limit	25	Plastic Index	16

Description of Sand & Gravel Particles Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: ASTM D 422: Particle Size Analysis of Soils
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan — Laboratory Supervisor
(Signature) (Position)

S&ME, INC. 3109 Spring Forest Road, Raleigh, N.C. 27616

BC-17 UD-1 Classification.xls

Liquid Limit, Plastic Limit, and Plastic Index

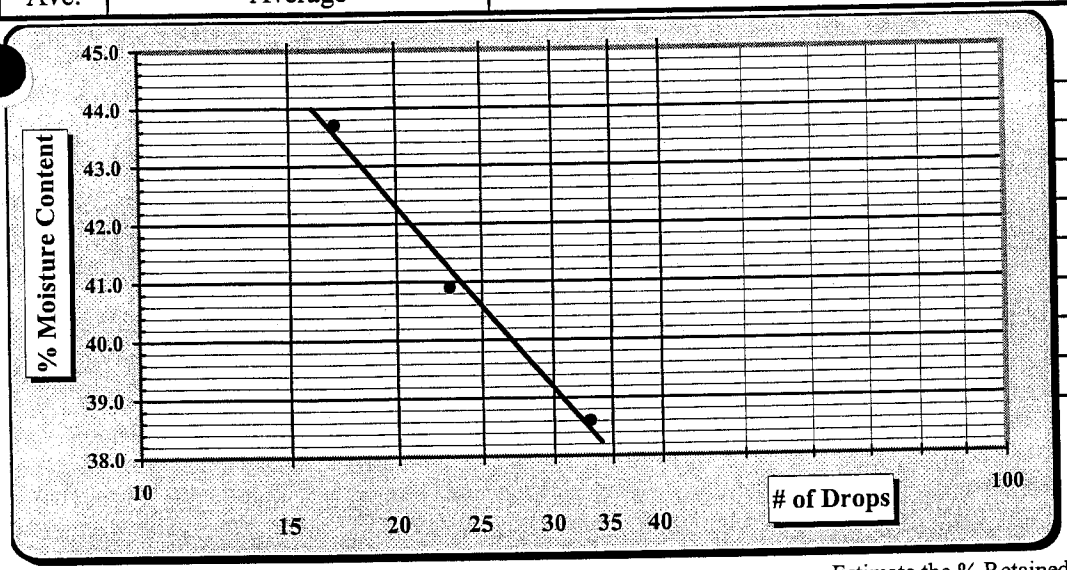
S&ME

Project #: **1054-04-955**
Project Name: Belews Creek Steam Plant
Client Name: Duke Energy
Client Address:

Report Date: 9/27/2004
Test Date(s): 09/20 - 09/25/2004

Boring #: BC-17 Sample #: UD-1 Sample Date: 9/1/2004
Location: Site Borehole Offset: NA Depth (ft): 5.9 - 8.4'
Sample Description: Orange Silty Sandy CLAY (CL)

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	7	37	42				15	18	
A	Tare Weight	15.39	18.55	18.65				21.02	20.91	
B	Wet Soil Weight + A	30.08	35.12	34.20				30.46	31.36	
C	Dry Soil Weight + A	25.61	30.31	29.87				28.55	29.26	
D	Water Weight (B-C)	4.47	4.81	4.33				1.91	2.10	
E	Dry Soil Weight (C-A)	10.22	11.76	11.22				7.53	8.35	
F	% Moisture Content (D/E)*100	43.7%	40.9%	38.6%				25.4%	25.1%	
N	# OF DROPS	17	23	33				*Moisture Contents determined by ASTM D 2216*		
LL	LL = F * FACTOR									
Ave.	Average							25.3%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation	☐	Dry Preparation	☐	Air Dried	☒	NP, Non-Plastic ☐
Liquid limit Test:	Multipoint Method	☒	One-point Method	☐			Liquid Limit 41
Classification:	ASTM D 2487	☒	AASHTO M 145	☐			Plastic Limit 25
Liquid limit Test:	ASTM D 4318	☒	AASHTO T 89	☐			Plastic Index 16
Plastic limit Test:	ASTM D 4318	☒	AASHTO T 90	☐			Group Symbol CL

Technician Name: Chana Savanapridi QCT-1433 (Certification #)

Technical Responsibility: Mal Krajan (Signature) Laboratory Supervisor (Position)

Laboratory Report Version 4.2

Particle Size Analysis of Soils

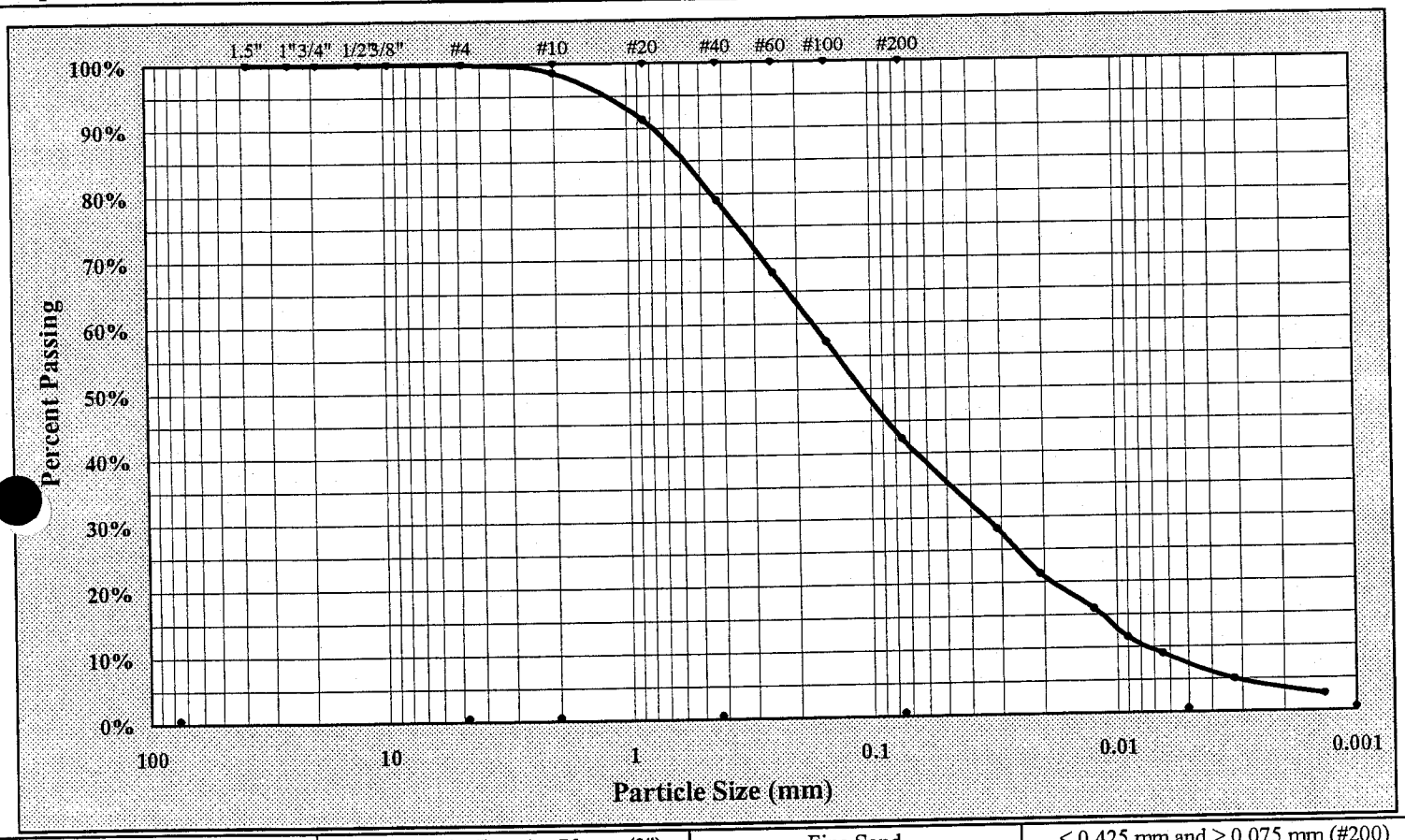
ASTM D 422

S&ME

S&ME Project #: **1054-04-955**
Project Name: **Belews Creek Steam Plant**
Client Name: Duke Energy
Client Address:

Report Date: 10/08/2004
Test Date(s): 09/30 - 10/07/204

Boring #:	BC-19	Sample #:	UD-1	Sample Date:	9/1/04
Location:	Site Borehole	Offset:	NA	Depth (ft):	27 - 29'
Sample Description:	Brown Clayey SAND (SC)				



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	3/8"	Gravel	0.1%	Silt	34.9%
Silt & Clay (% Passing #200)	42.1%	Sand	57.8%	Clay	7.2%
Apparent Relative Density	2.665	Moisture Content		Colloids	2.5%
Liquid Limit	31	Plastic Limit	22	Plastic Index	9

Description of Sand & Gravel Particles Rounded ☐ Angular ☐ Hard & Durable ☐ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus (A) Length of Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References: ASTM D 422: Particle Size Analysis of Soils
ASTM D 421: Dry Preparation of Soil Samples
ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils
ASTM D 854: Specific Gravity of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Technical Responsibility: Mal Krajan — Laboratory Supervisor
Signature — Position
S&ME, INC. 3109 Spring Forest Road, Raleigh, N.C. 27616
BC-19 UD-1 Classification.xls

Liquid Limit, Plastic Limit, and Plastic Index

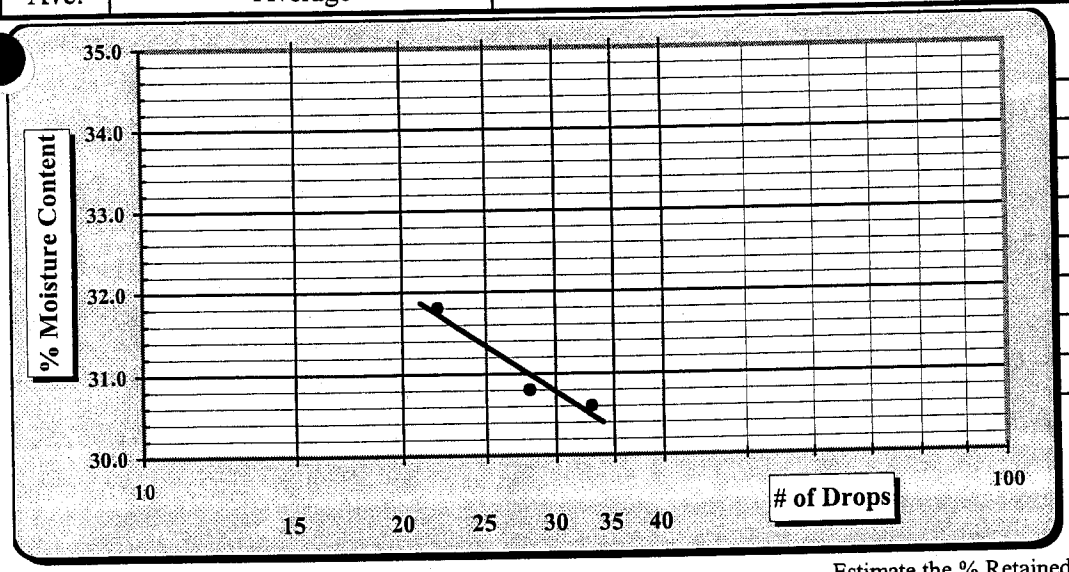
S&ME

Project #: **1054-04-955**
Project Name: Belews Creek Steam Plant
Client Name: Duke Energy
Client Address:

Report Date: 10/08/204
Test Date(s): 09/30 - 10/07/2004

Boring #: BC-19 Sample #: UD-1 Sample Date: 9/1/2004
Location: Site Borehole Offset: NA Depth (ft): 27 - 29'
Sample Description: Brown Clayey SAND (SC)

Pan #		Liquid Limit						Plastic Limit		
	Test #	1	2	3	4	5	6	1	2	3
	Tare #	58	10	2				12	27	
A	Tare Weight	18.46	15.27	18.65				21.07	20.65	
B	Wet Soil Weight + A	35.01	31.76	30.00				29.10	29.51	
C	Dry Soil Weight + A	31.02	27.90	27.33				27.63	27.91	
D	Water Weight (B-C)	3.99	3.86	2.67				1.47	1.60	
E	Dry Soil Weight (C-A)	12.56	12.63	8.68				6.56	7.26	
F	% Moisture Content (D/E)*100	31.8%	30.6%	30.8%				22.4%	22.0%	
N	# OF DROPS	22	33	28				*Moisture Contents determined by ASTM D 2216*		
LL	LL = F * FACTOR									
Ave.	Average							22.2%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.990	29	1.018
24	0.995	30	1.022
25	1.000		

Notes: Estimate the % Retained on the #40 Sieve

Special Sampling Methods:

Sample Preparation:	Wet Preparation ☐	Dry Preparation ☐	Air Dried ☒	NP, Non-Plastic	☐
Liquid limit Test:	Multipoint Method ☒	One-point Method ☐		Liquid Limit	31
Classification:	ASTM D 2487 ☒	AASHTO M 145 ☐		Plastic Limit	22
Liquid limit Test:	ASTM D 4318 ☒	AASHTO T 89 ☐		Plastic Index	9
Plastic limit Test:	ASTM D 4318 ☒	AASHTO T 90 ☐		Group Symbol	SC

Technician Name: Chana Savanapridi OCT-1433 (Certification #)

Technical Responsibility: Mal Krajan (Signature) Laboratory Supervisor (Position)

S&ME

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method "C")

Project #: 1054-04-955 Test Date(s): 9/30 - 10/5/04

Project Name: Belews Creek Steam Plant Report Date: 10/05/04

Client Name:

Client Address:

Boring #: BC-19 Sample #: UD-1 Depth/Elevation: 27 - 29 ft. Sample Date: 09/01/04

Location: Project Site Offset: NA Sample Description: Brown Clayey SAND (SC)

Liquid Limit: 31 Specific Gravity: 2.665 Sample Type: undisturbed Sampled By: S&ME

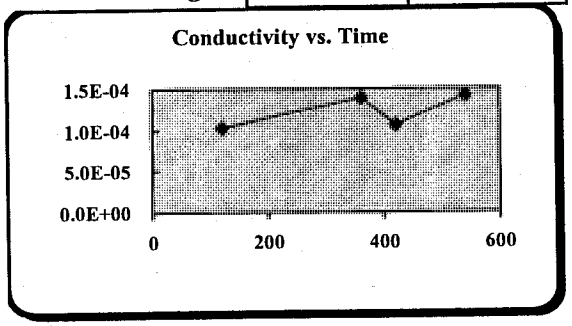
Plastic Limit: 22 Plasticity Index: 9 Percent Passing #200: 42.1 Maximum Particle Size: 3/8"

Initial Sample Conditions				Final Sample Conditions			
Height (cm):	7.734	Wet Unit Weight (lbs/ft^3):	109.1	Height (cm):	7.717	Dry Unit Weight (lbs/ft^3):	90.4
Diameter (cm):	7.323	Dry Unit Weight (lbs/ft^3):	90.2	Diameter (cm):	7.310	Percent Saturation:	100.0
Area (cm^2):	42.12	Percent Saturation:	63.8	Area (cm^2)	41.97	Void Ratio:	0.8399
Volume (cm^3):	325.76	Void Ratio:	0.8442	Volume (cm^3)	323.88	Porosity:	0.4565
Wet weight (grams):	569.4	Porosity:	0.4578	Wet weight (grams)	620.0	Measured *B* coefficient: 0.98	
Dry Weight (grams):	470.5	Station Corrections (cm)		Dry Weight (grams)	470.5	MDD (pcf): 0.0	Optimum (%): 0.0
Percent Moisture:	20.2	Influent: -2.190	Effluent: -2.825	Percent Moisture:	31.8		

Testing Station	Burette Areas (cm^2):		Effective Consolidation Stress (psi):	7.0	Permeant Liquid Used:	Deaired Demineralized water		
2	Influent: 0.720	Influent: 0.720	Cell Pressure (psi):	77.0	Influent Pressure (psi):	70.0	Effluent Pressure (psi)	70.0

Start		End		Time	Temperature (°C)			Corr.	Initial		Final		h_1	h_2	Grad-	K-Value (cm/sec)	
Date	Time	Date	Time	(seconds)	Initial	Final	Avg.	Factor	INF.	EFF.	INF.	EFF.	(cm)	(cm)	ient	Uncorrected	Corrected
10/05/04	7:39:00 AM	10/05/04	7:41:00 AM	120	25.1	25.1	25.1	0.885	15.30	39.90	17.60	37.40	25.24	20.44	3.0	1.16E-04	1.03E-04
10/05/04	7:41:00 AM	10/05/04	7:45:00 AM	240	25.1	24.0	24.6	0.895	12.90	41.75	19.40	35.60	29.49	16.84	3.0	1.55E-04	1.39E-04
10/05/04	7:45:00 AM	10/05/04	7:46:00 AM	60	24.0	24.0	24.0	0.908	19.40	35.60	20.20	34.70	16.84	15.14	2.1	1.17E-04	1.06E-04
10/05/04	7:46:00 AM	10/05/04	7:48:00 AM	120	24.0	25.1	24.6	0.895	20.20	34.70	22.10	32.80	15.14	11.34	1.7	1.59E-04	1.42E-04
															Averages:	**1.37E-04**	**1.23E-04**

Remarks:



References:
ASTM D 5084: Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D 2216: Laboratory Determination of Water Content of Soils
ASTM D 4318: Liquid Limit, Plastic Limit, & Plasticity Index of Soils
ASTM D 2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 854: Specific Gravity of Soils
ASTM D 422: Particle Size Analysis of Soils

Technician / Certification #: David Duffy/Mal Krajan Certification #:

Technical Responsibility: Mal Krajan Position: Laboratory Supervisor

APPENDIX IX

SHELBY TUBE CONFINING PRESSURE CALCULATIONS

Belews Creek Scrubber Landfill

	Well	Landfill Finished Elev. (ft)	Exsiting Ground Elev. (ft)	Depth of Material over Well (ft)	TUBE DEPTH	GW DEPTH
BC-	9	810.0	775.7	34.3	NO TUBE	NA
	10	820.0	781.8	38.2	2-14	28
	11	875.0	784.8	90.2	23-25	40
	12	890.0	802.9	87.1	27-26	52
	6	880.0	800.6	79.4	8.5-20	32
	7	805.0	775.8	29.2	4-16	40
	14	875.0	756.8	118.2	NO TUBE	NA

Note : **BC-6, 7, and 14 are outside the footprint of Phase I, but will be in thePhase II footprint.**

Post-it® Fax Note 7671	Date 3/20/03	# of pages ▶ 6
To SAM WATTS	From LACEY	
Co./Dept. STE PRL. ENV.	Co.	
Phone #	Phone #	
Fax #	Fax #	

S&ME

JOB NO. 126407 576

SHEET NO. _____

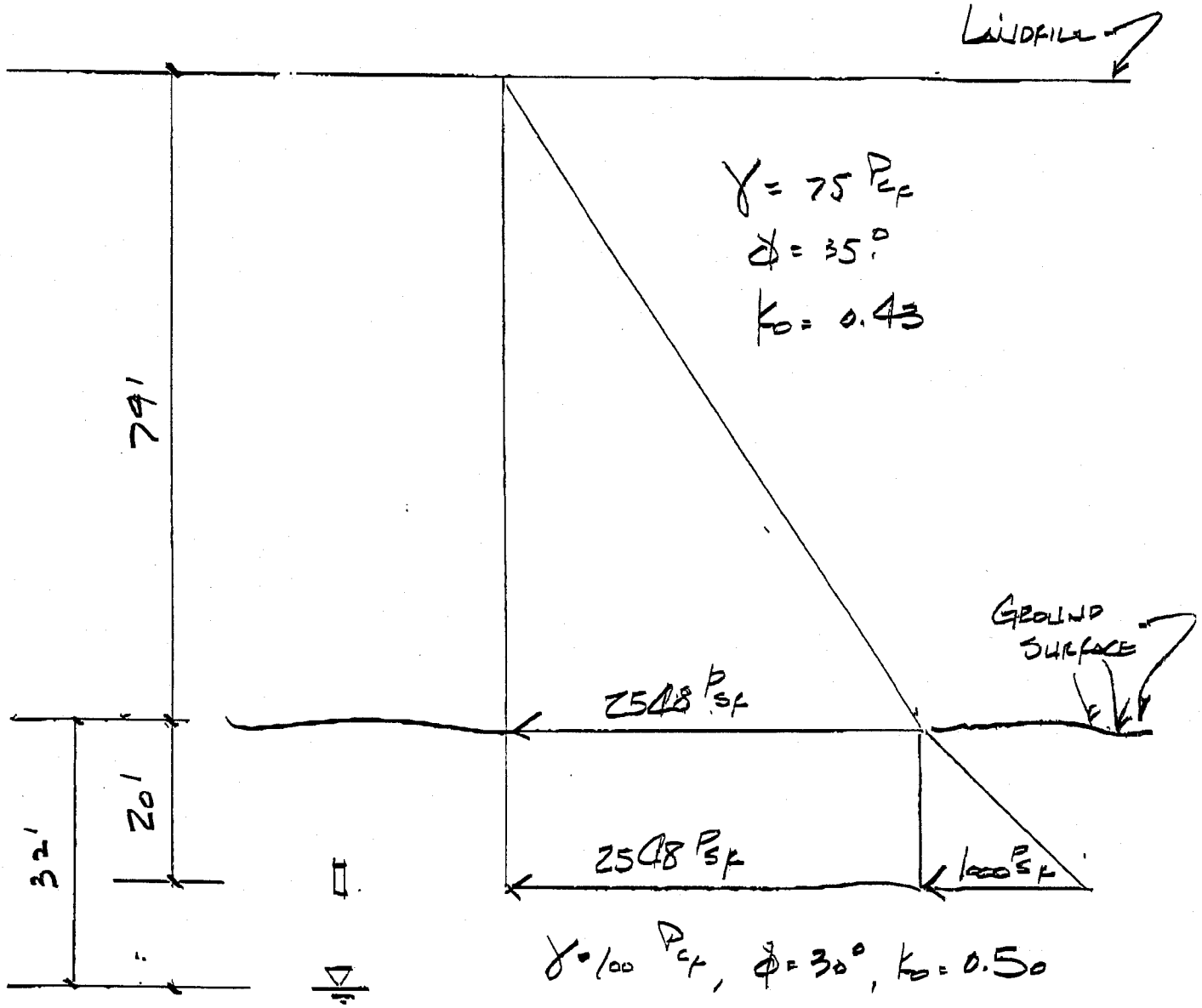
DATE _____

JOB NAME BELEWS CREEK FGD LANDFILL

SUBJECT UD TUBE/SC-LO CONFINING PRESSURE

COMPUTED BY LABSTRONG

CHECKED BY _____



CONFINING PRESSURE W/O LANDFILL = $1000\ \#/FT^2 \left(\frac{1\ FT^2}{144\ IN^2}\right) = 7\ PSI$

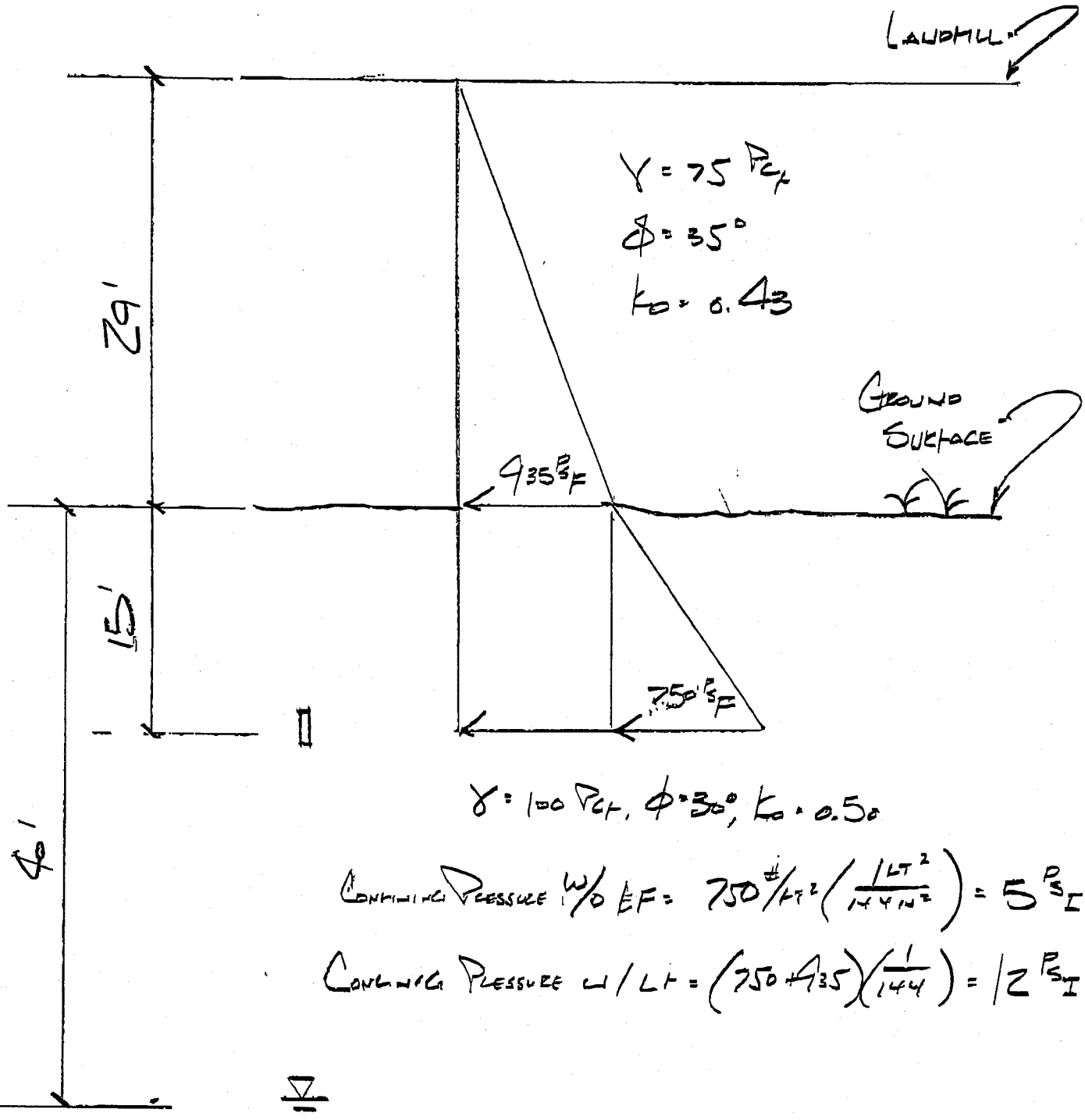
CONFINING PRESSURE W/ LANDFILL = $(1000 + 2548)\left(\frac{1}{144}\right) = 25\ PSI$

S&ME

JOB NO. 164-02-574
SHEET NO.
DATE

JOB NAME BELEWS CREEK FGD LANDFILL
SUBJECT LIDTUBE PC-7 CONFINING PRESSURES

COMPUTED BY LAMSTRONG
CHECKED BY



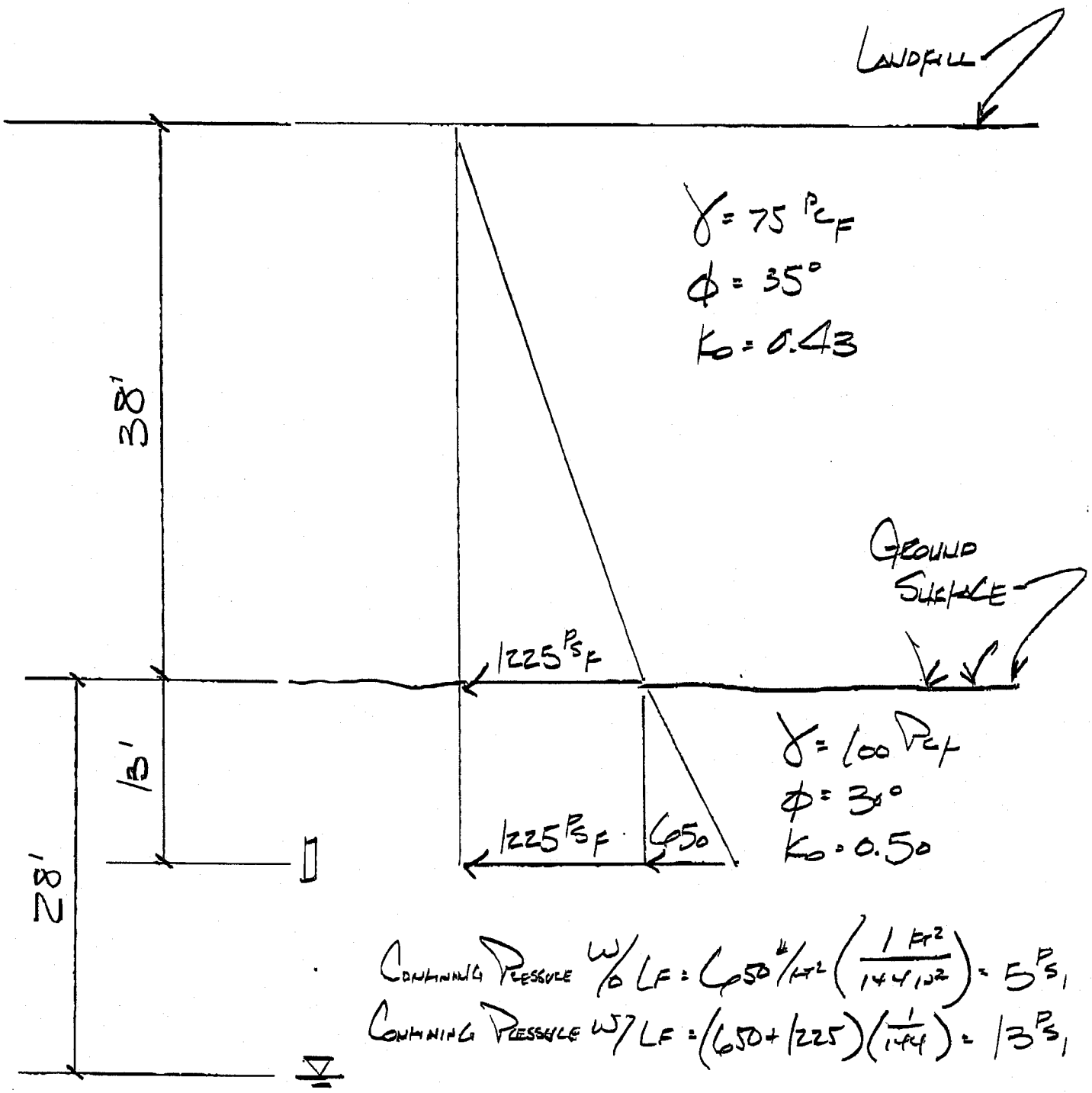
γ = 100 PCF, φ = 30°, K₀ = 0.50

CONFINING PRESSURE W/O EF = $750\ \#/FT^2 \left(\frac{1\ FT^2}{144\ IN^2}\right) = 5\ PSI$

CONFINING PRESSURE W/ LF = $(750 + 435)\left(\frac{1}{144}\right) = 12\ PSI$

S&ME

JOB NO. 164-2574
SHEET NO.
DATE
JOB NAME BELEWS CREEK EGD LANDFILL
COMPUTED BY L. ARMSTRONG
SUBJECT LD TUBE #C-10 CONFINING PRESSURES
CHECKED BY



Confining Pressure w/o LF: $650\ \#/ft^2 \left(\frac{1\ ft^2}{144\ in^2}\right) = 5\ psi$

Confining Pressure w/ LF: $(650 + 1225)\left(\frac{1}{144}\right) = 13\ psi$

S&ME

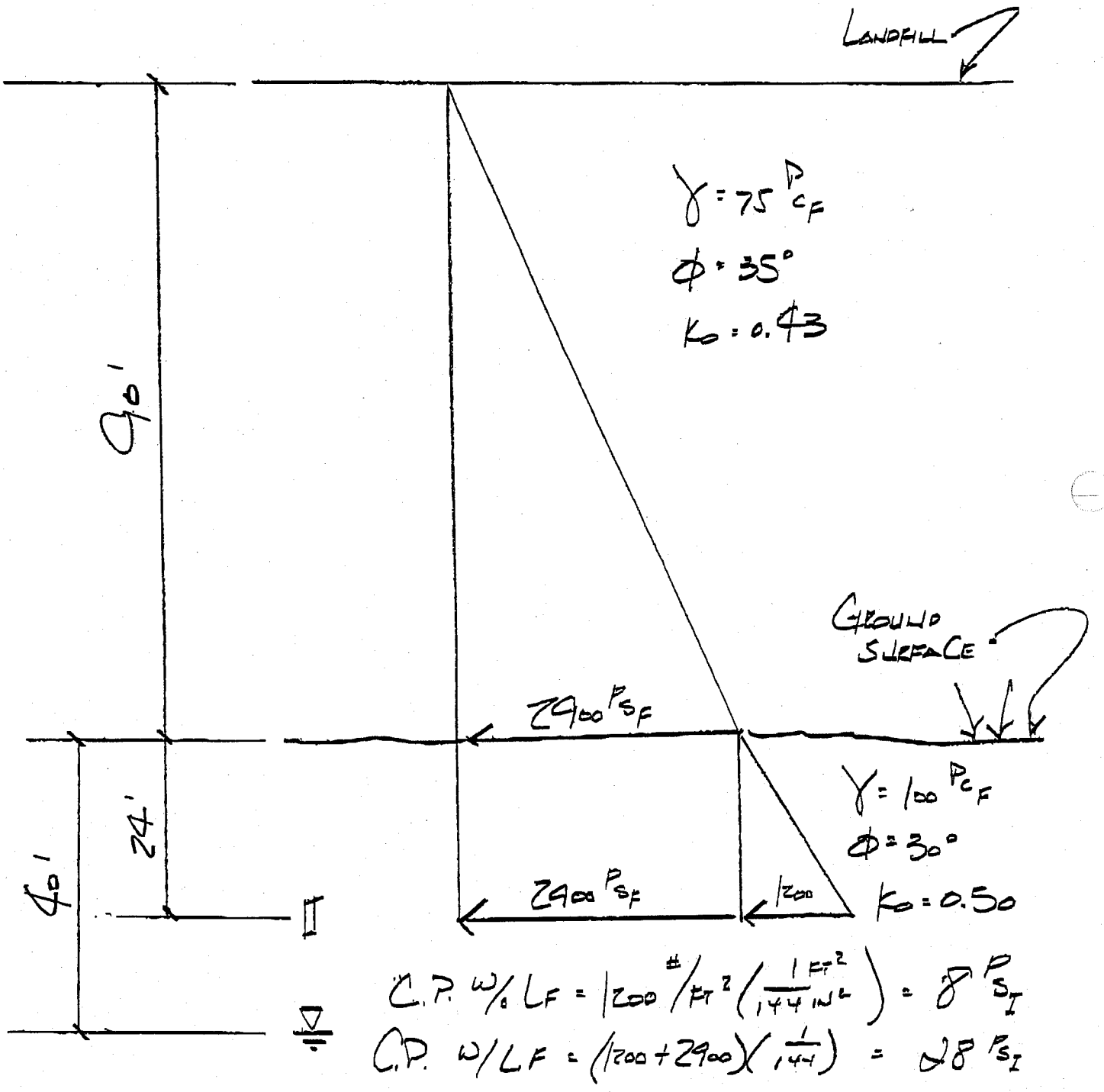
JOB NO. 122025790

SHEET NO. _____

DATE _____

NAME Belews Creek FGD Landfill COMPUTED BY L. Armstrong

SUBJECT UD Tube PZC-11 Confining Pressures CHECKED BY _____



S&ME

JOB NO. 164-0257G

SHEET NO. _____

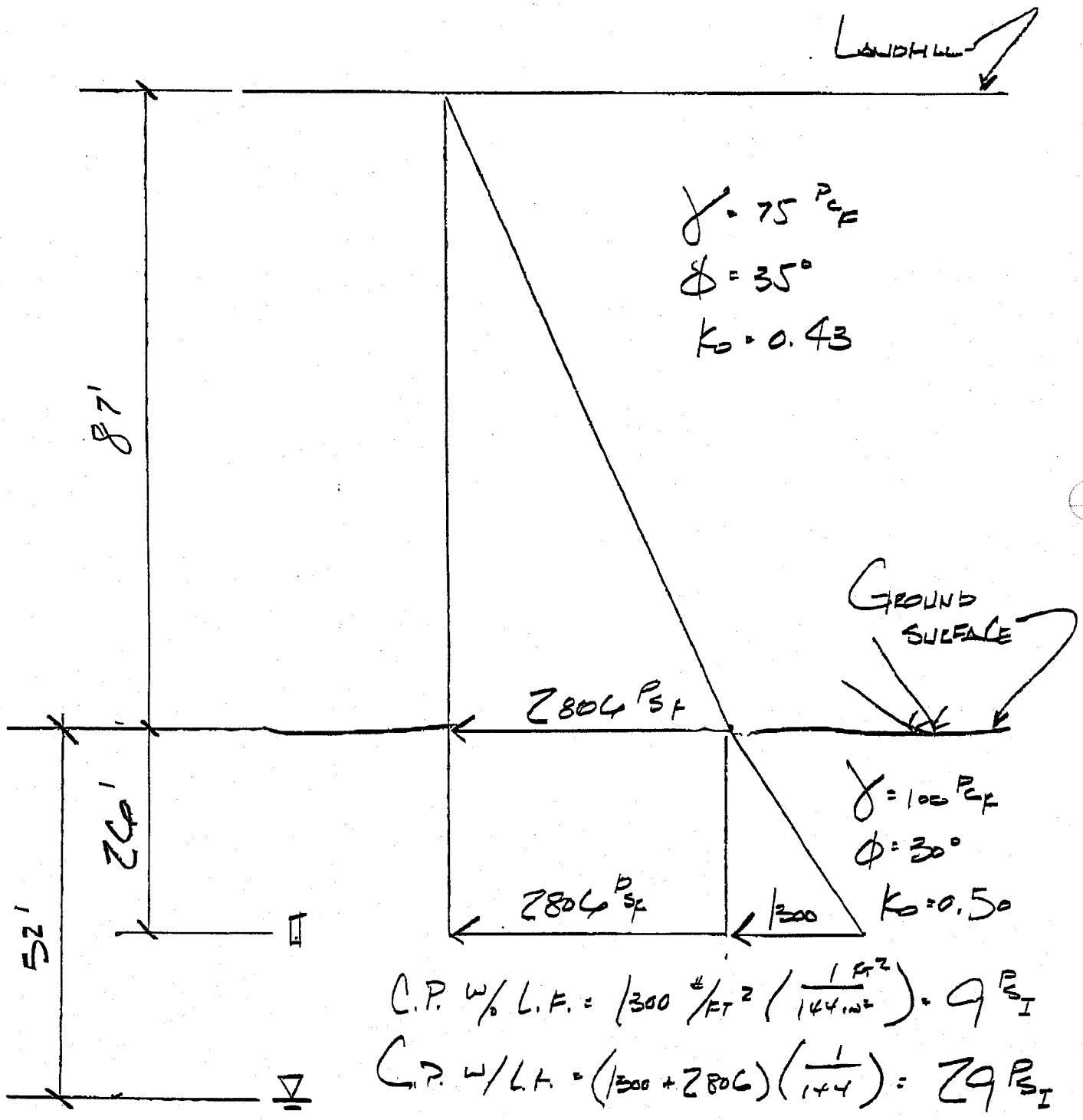
DATE _____

NAME BELEWS CREEK FGD LANDFILL

SUBJECT UD TUBE BC-12 LONNING PRESSURE

COMPUTED BY LABRSTRONG

CHECKED BY _____

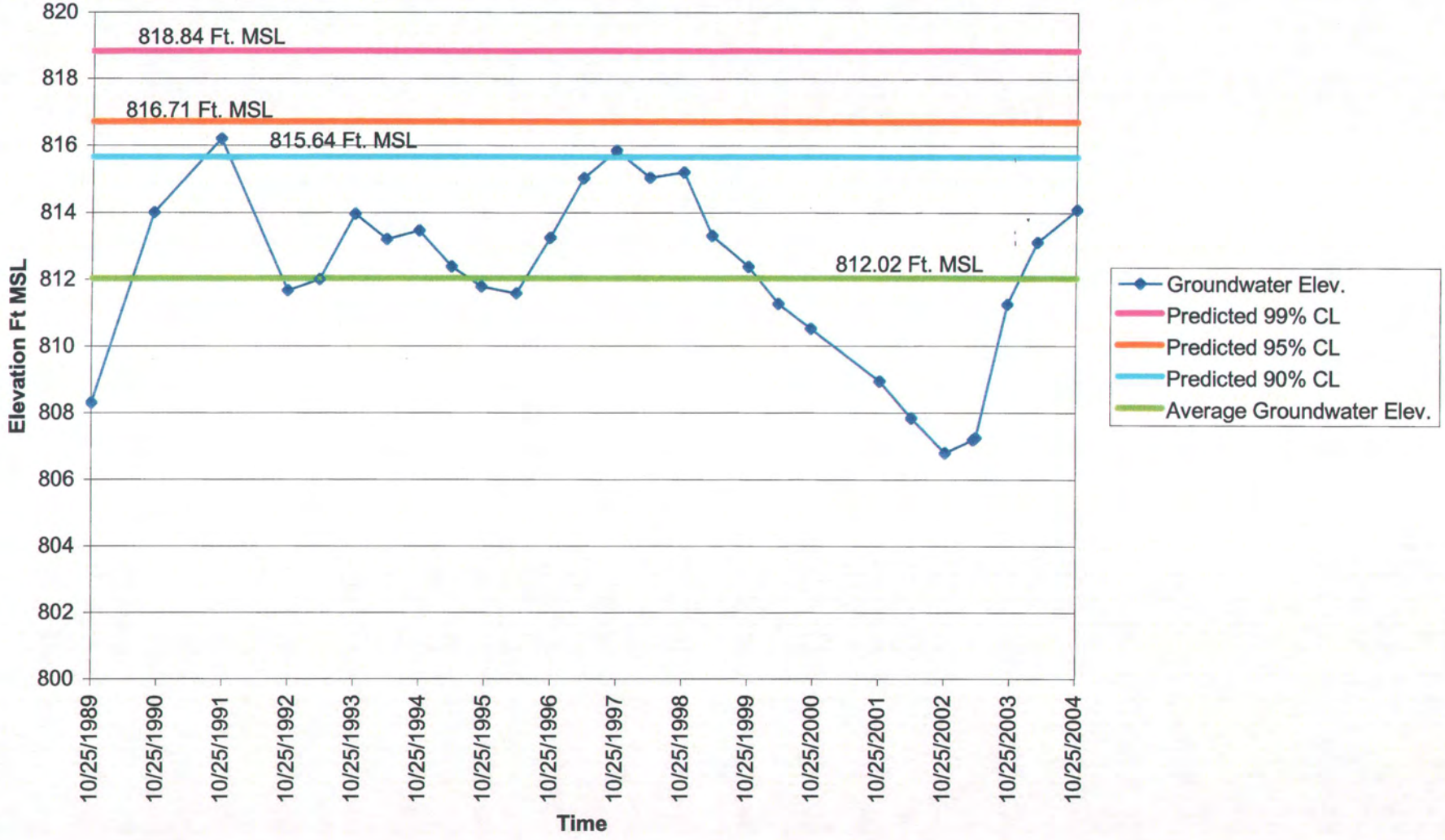


C.P. W/O L.F. = $1300\ ^{\#}/_{FT^2} \left(\frac{1\ FT^2}{144\ IN^2}\right) = 9\ PSI$

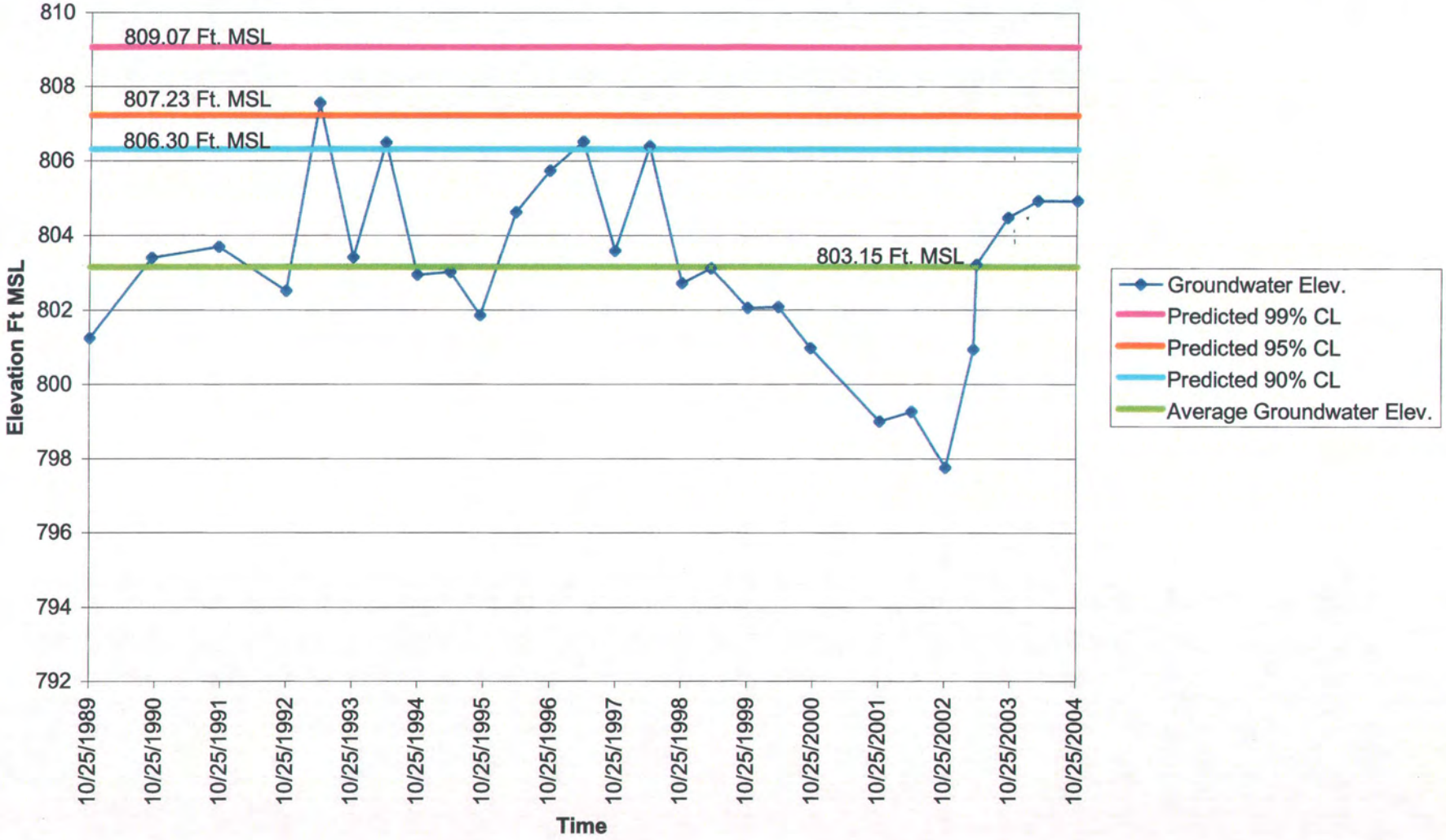
C.P. W/ L.F. = $(1300 + 2804)\left(\frac{1}{144}\right) = 29\ PSI$

Water Levels in MW-1
Pine Hall Road Landfill

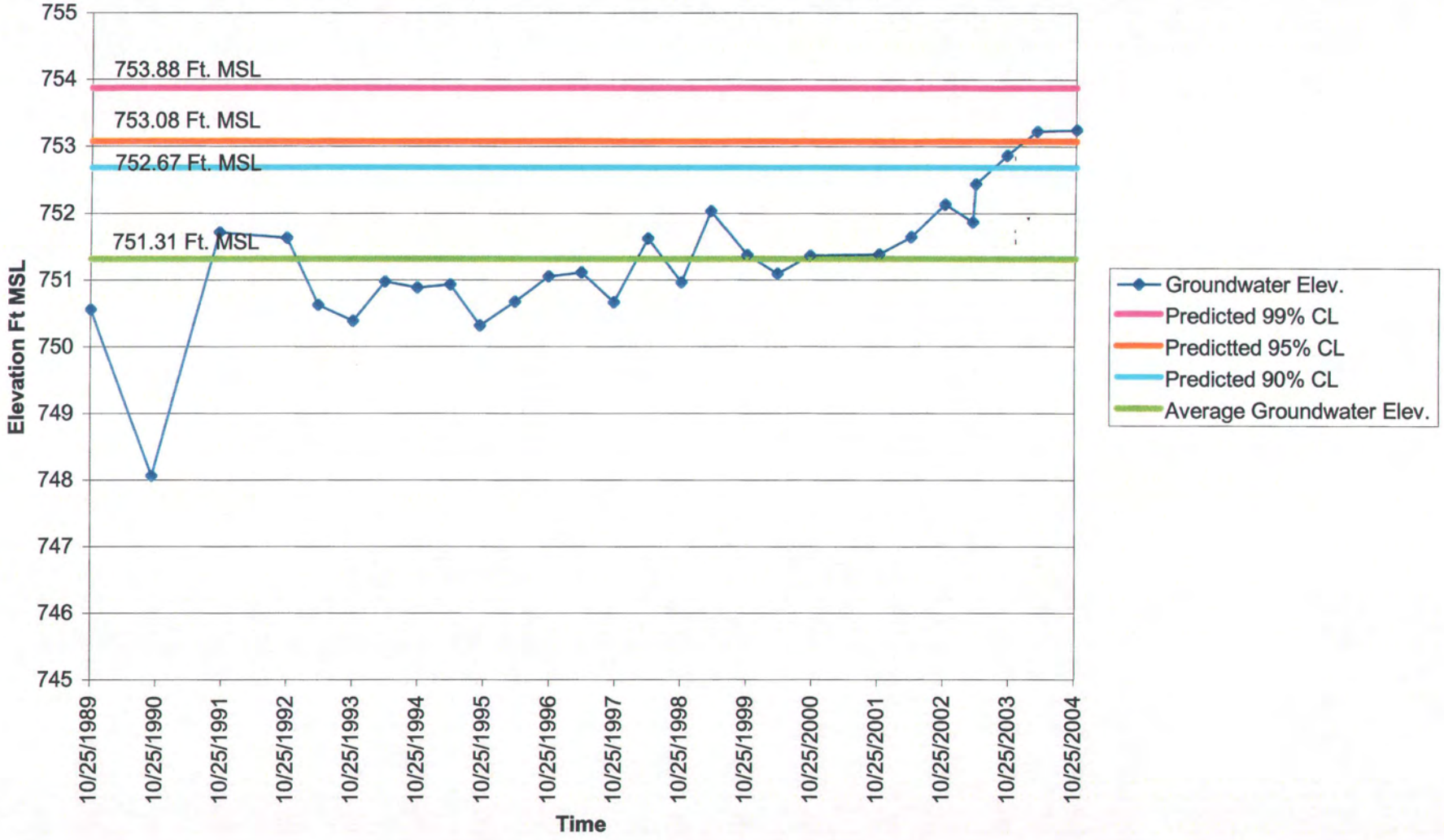
Water Levels in MW-2
Pine Hall Road Landfill



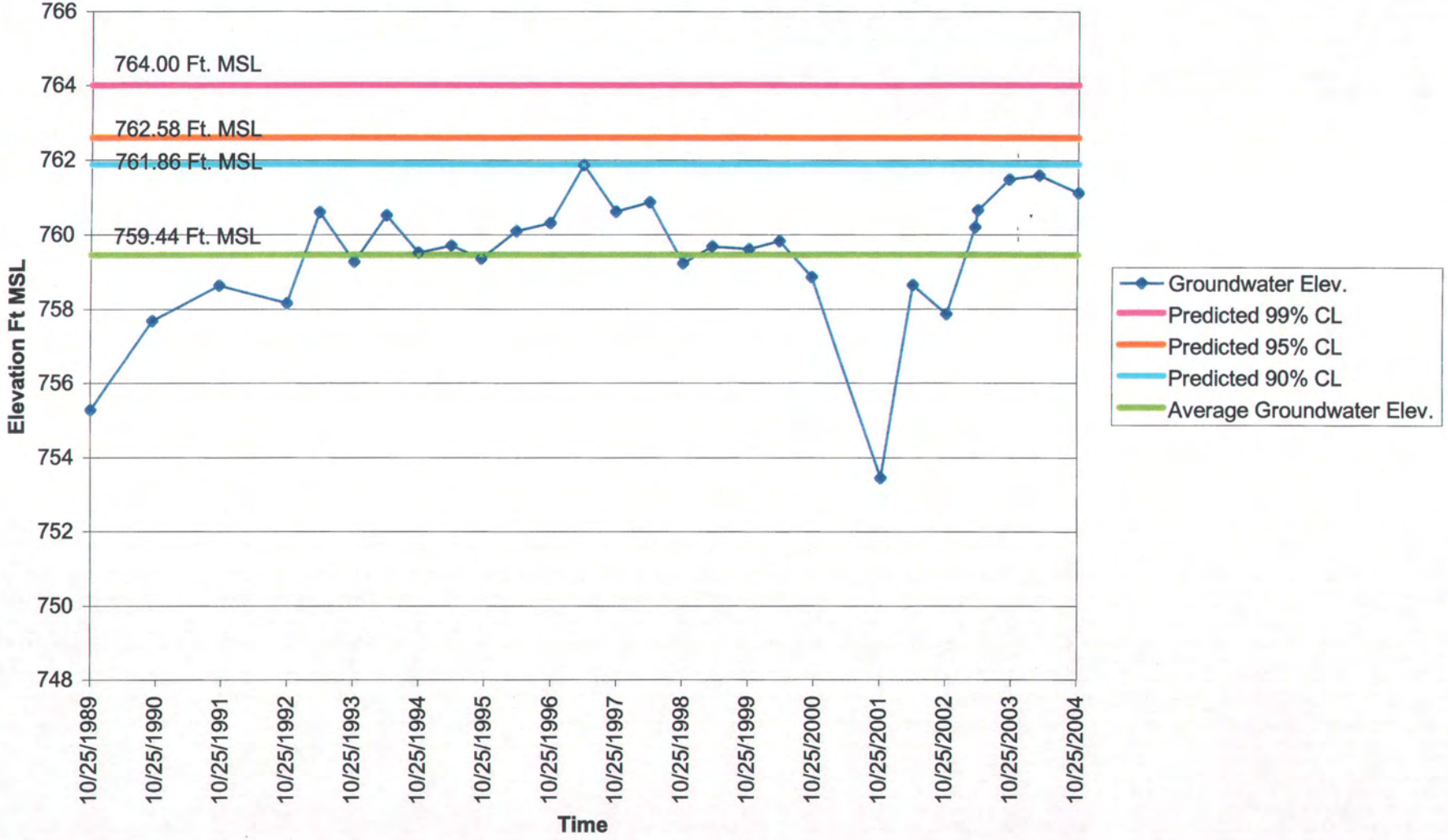
Water Levels in MW-3
Pine Hall Road Landfill



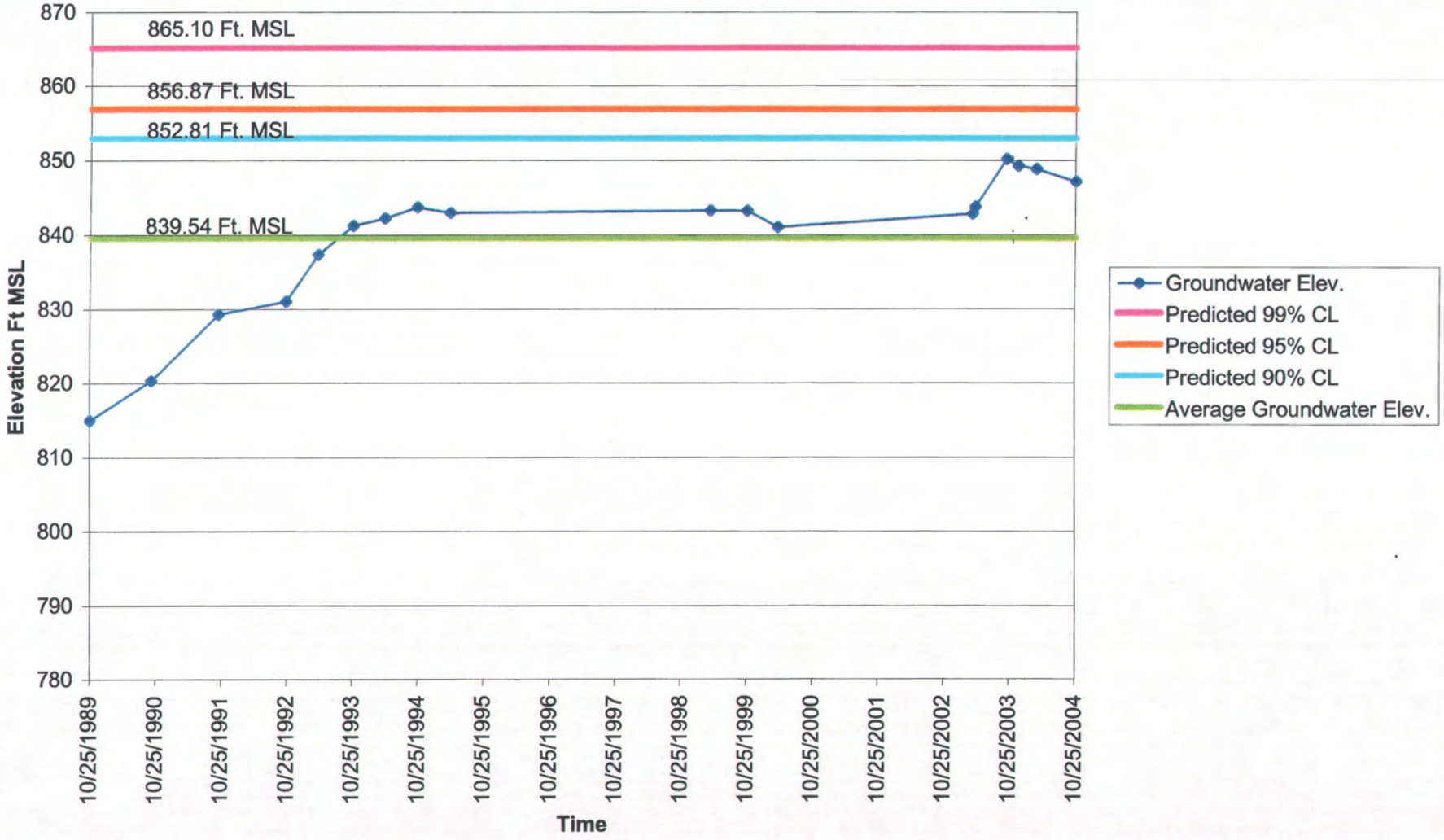
Water Levels in MW-4
Pine Hall Road Landfill



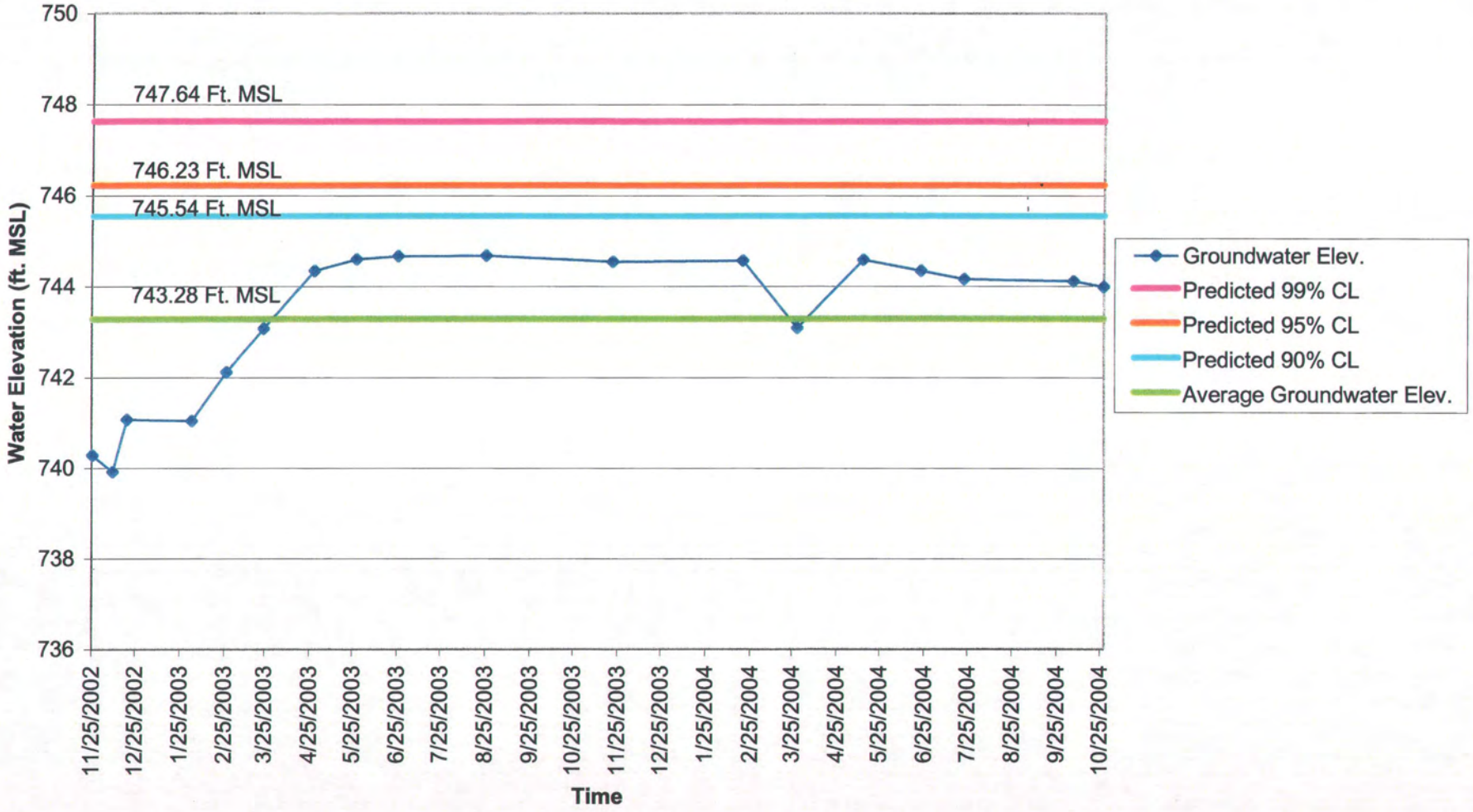
Water Levels in MW-5
Pine Hall Road Landfill



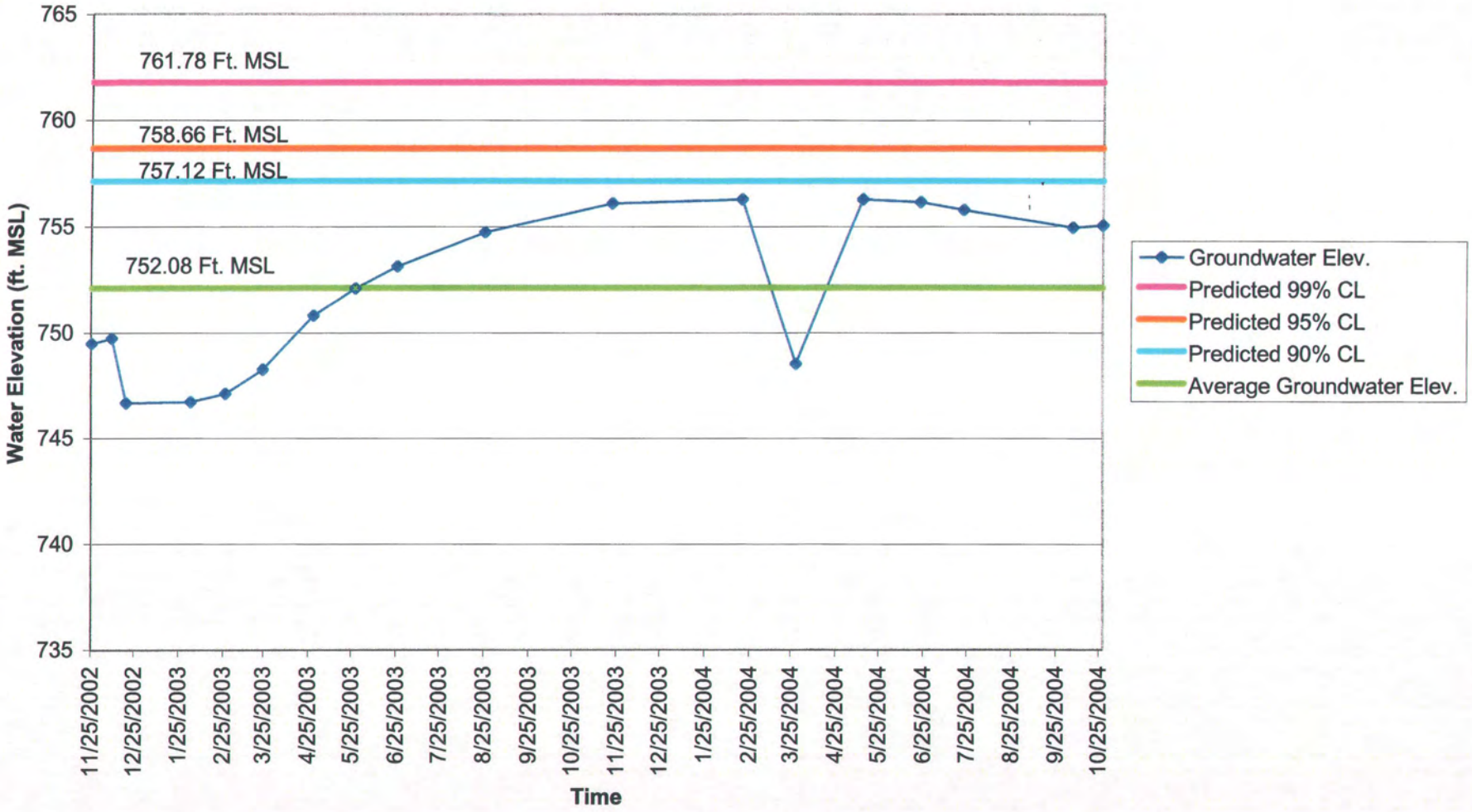
Water Levels in OB-1
Pine Hall Road Landfill



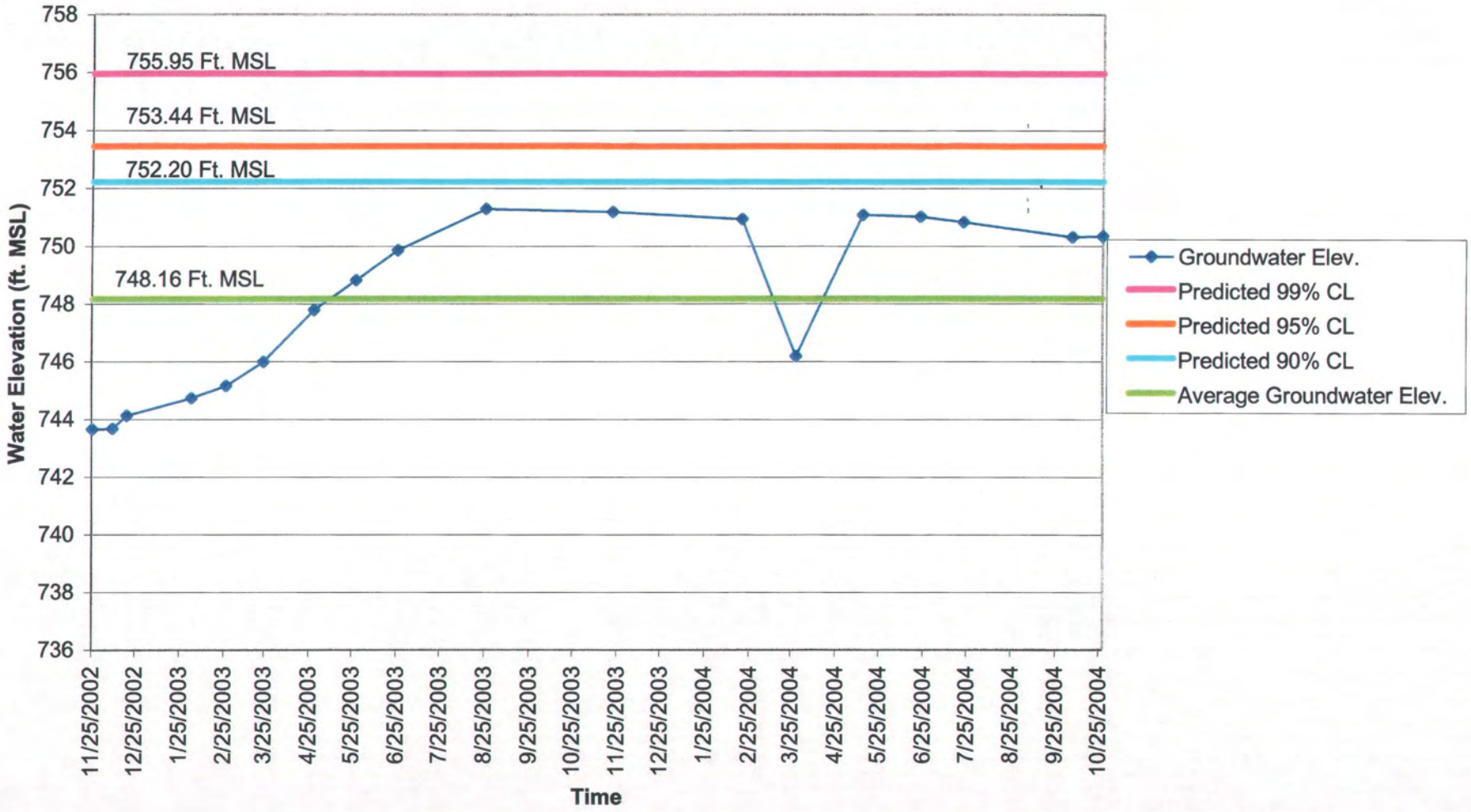
Well BC-14
Belews Creek
S&ME Project No. 1054-04-955



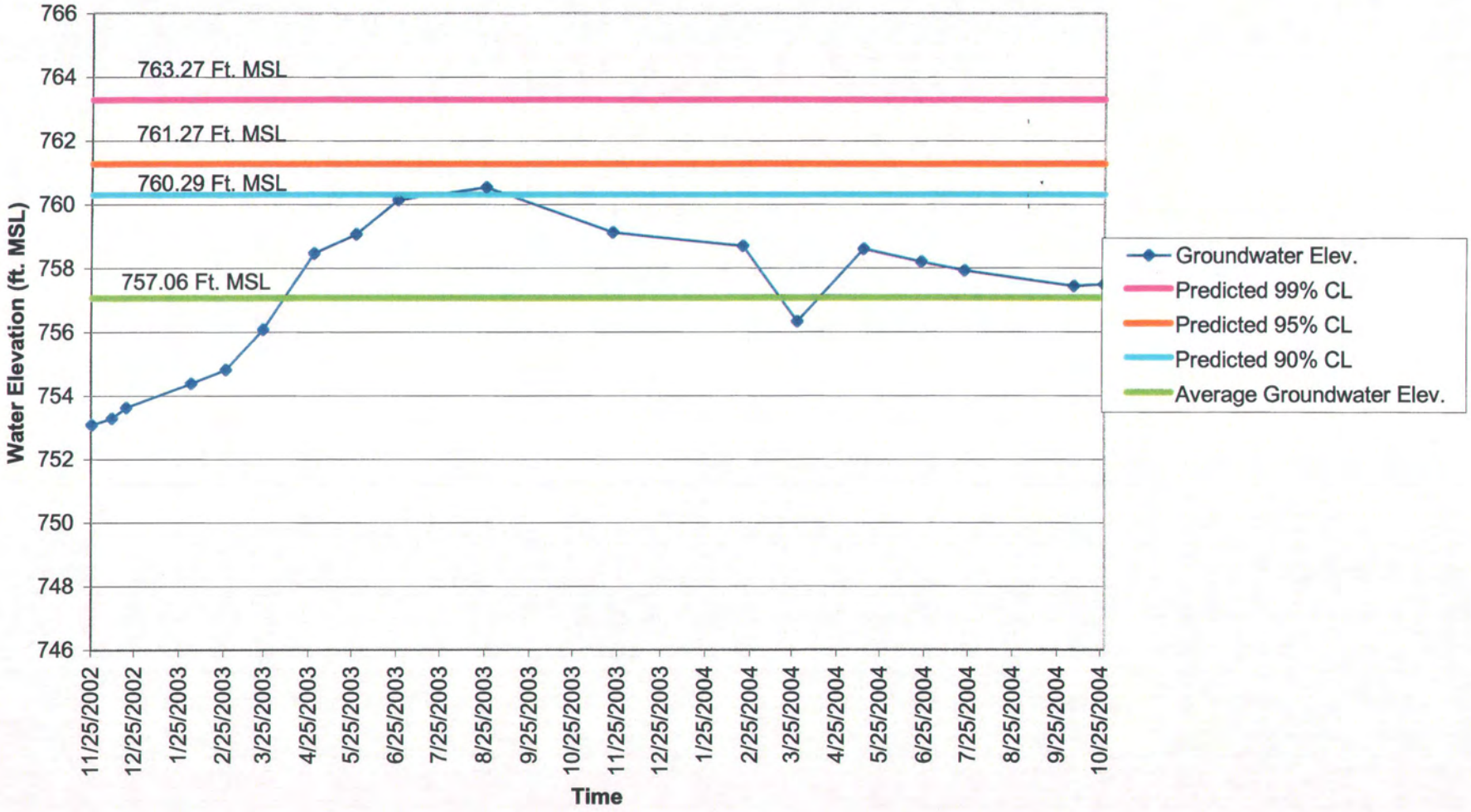
Well BC-12
Belews Creek
S&ME Project No. 1054-04-955



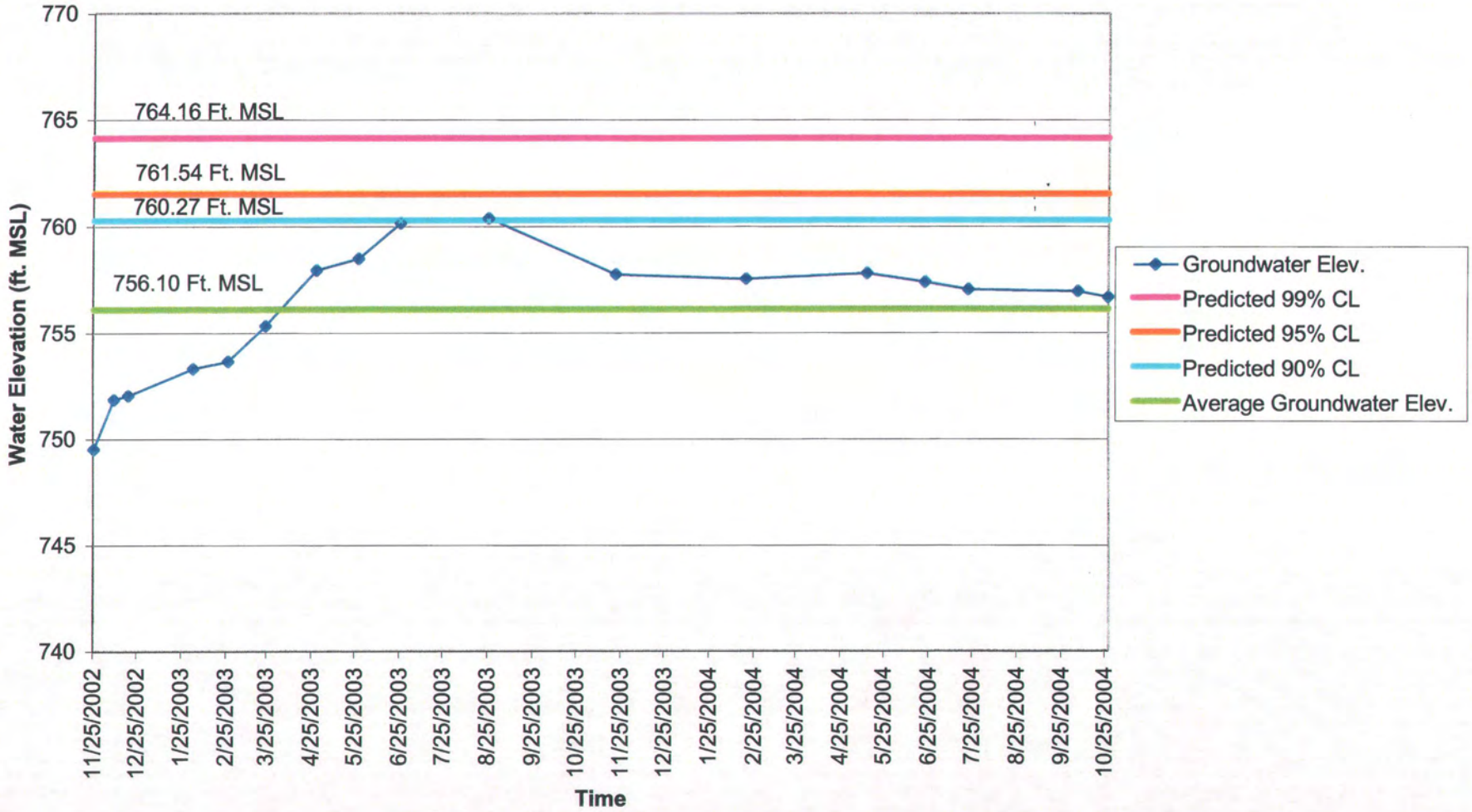
Well BC-11
Belews Creek
S&ME Project No. 1054-04-955



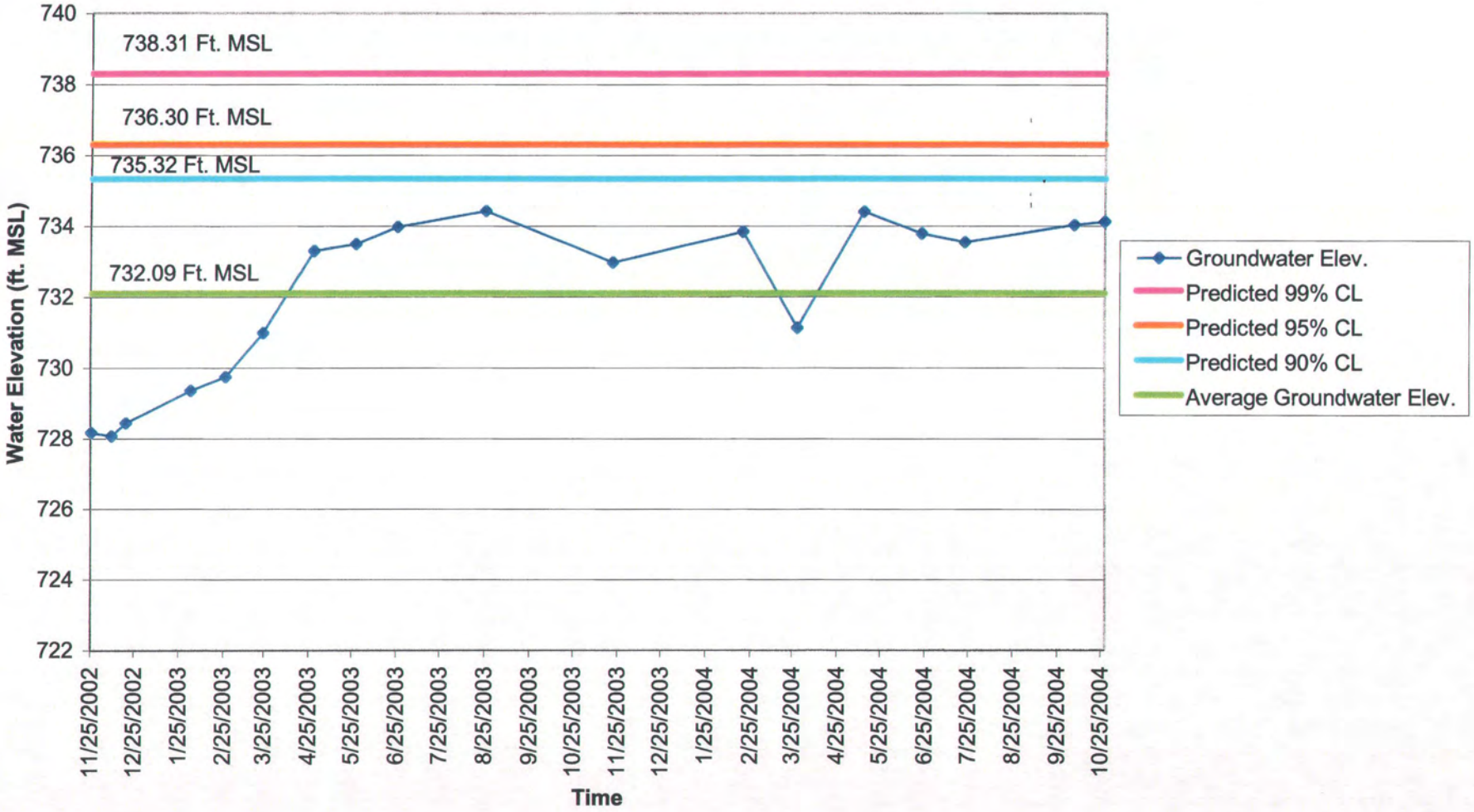
Well BC-10
Belews Creek
S&ME Project No. 1054-04-955



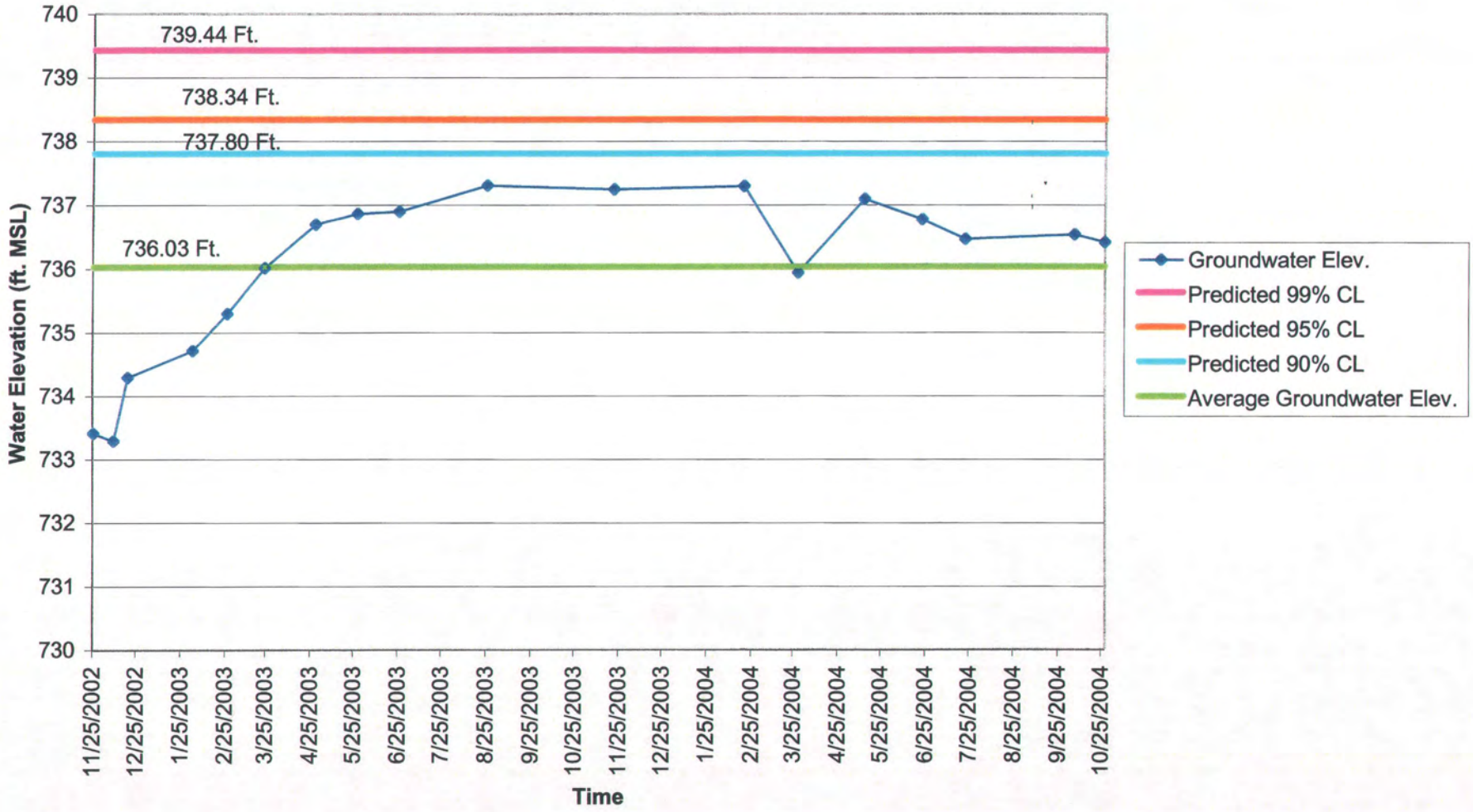
Well BC-9
Belews Creek
S&ME Project No. 1054-04-955



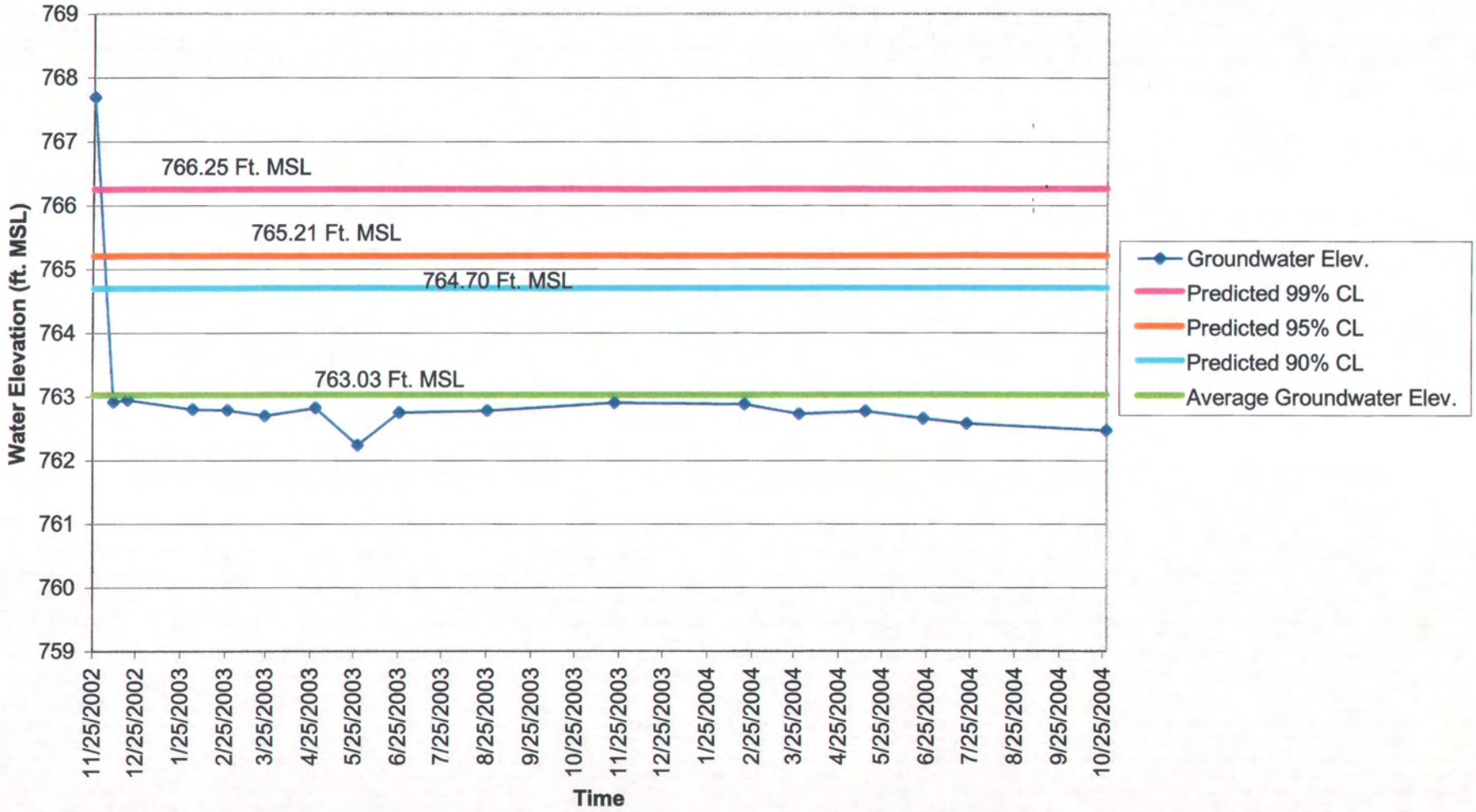
Well BC-8
Belews Creek
S&ME Project No. 1054-04-955



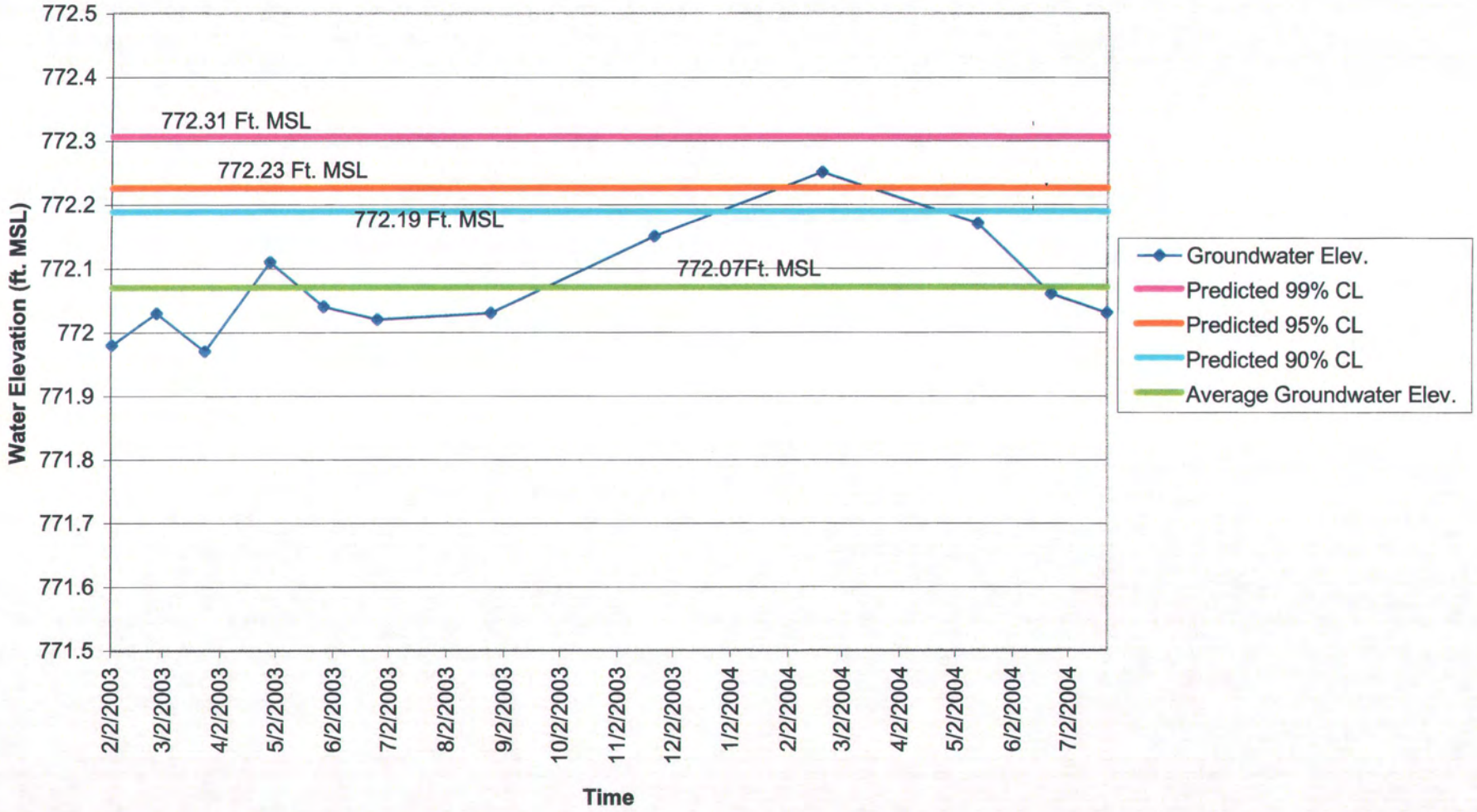
Well BC-7
Belews Creek
S&ME Project No. 1054-04-955



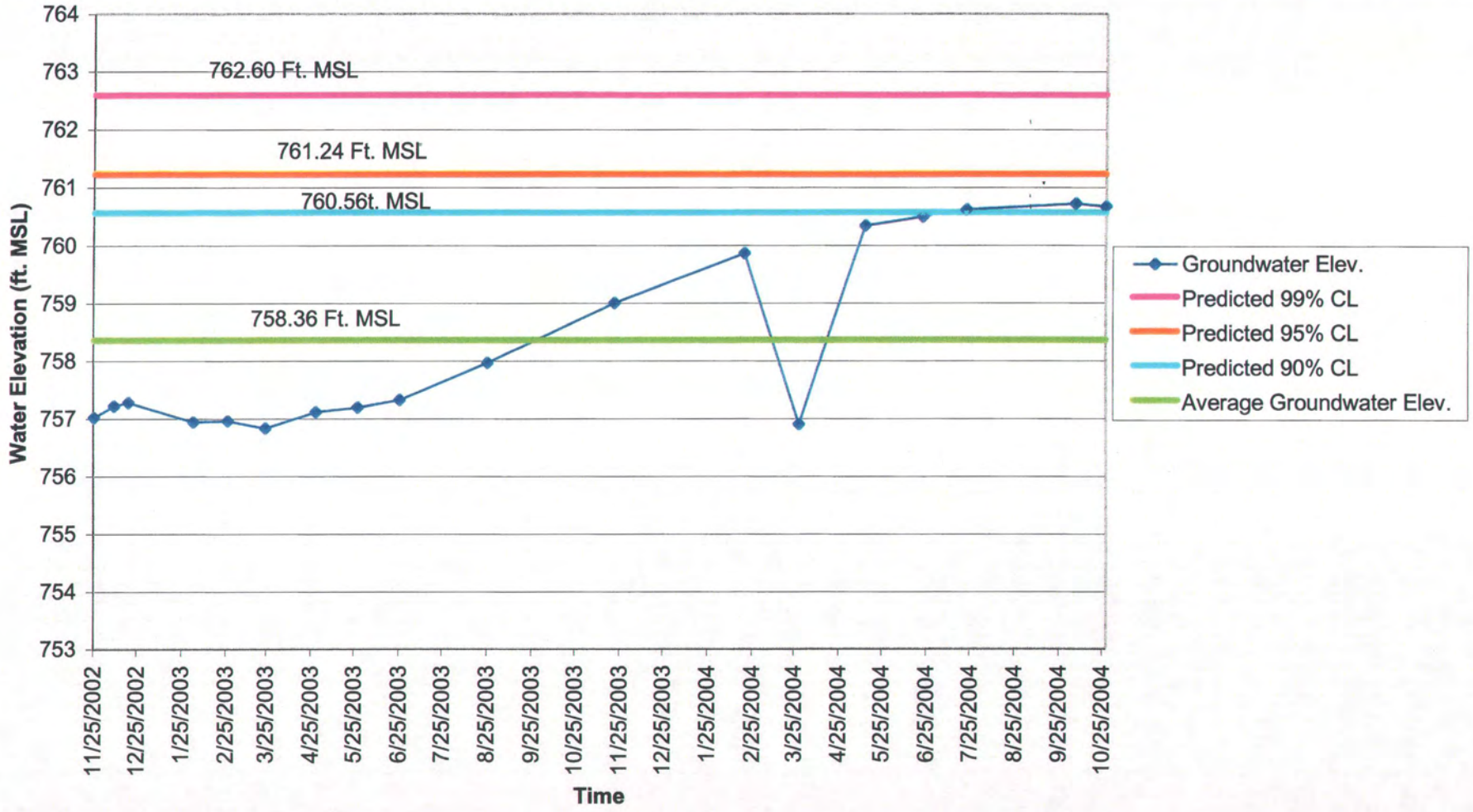
Well BC-6
Belews Creek
S&ME Project No. 1054-04-955



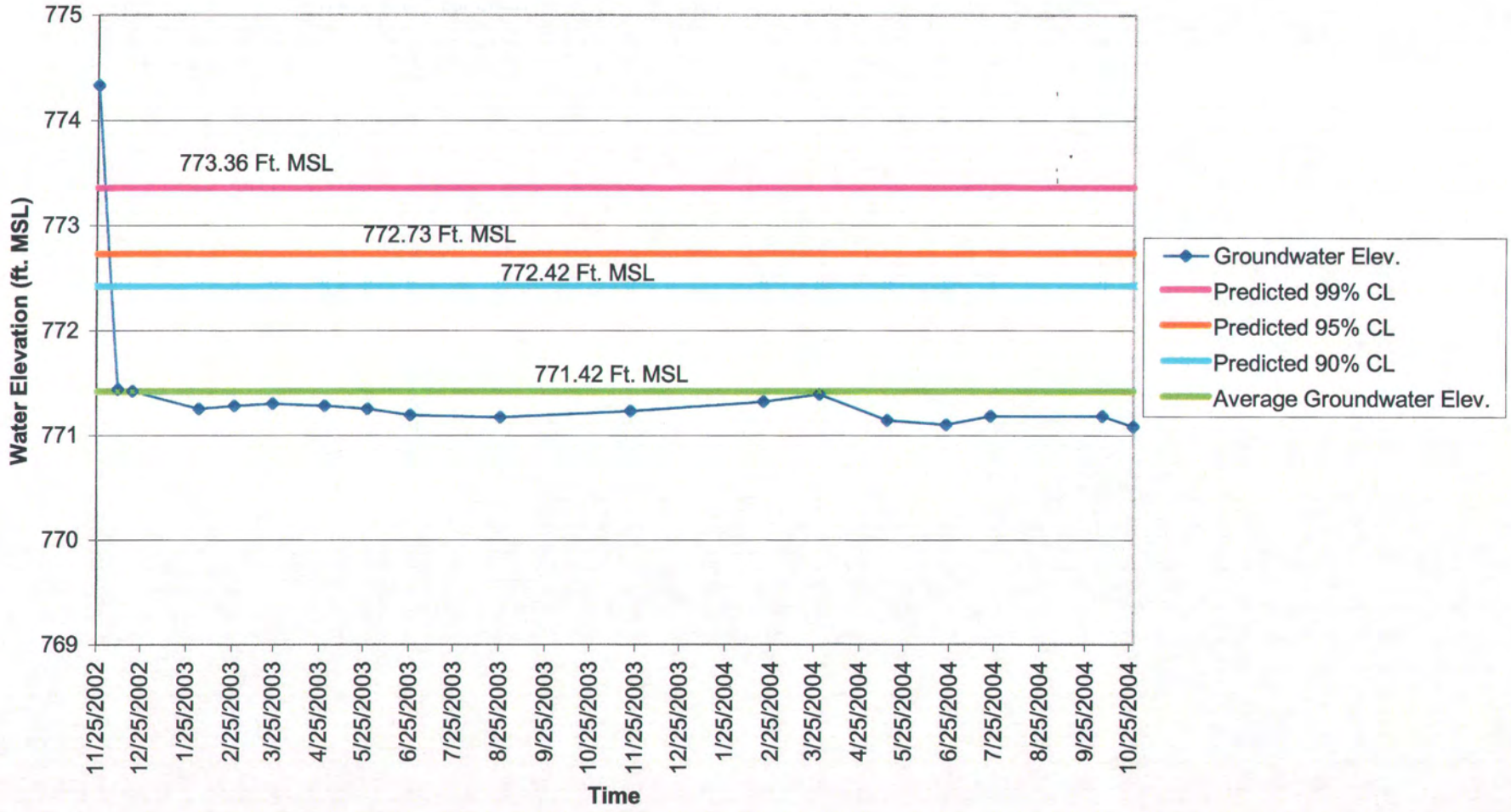
Well BC-5
Belews Creek
S&ME Project No. 1054-04-955



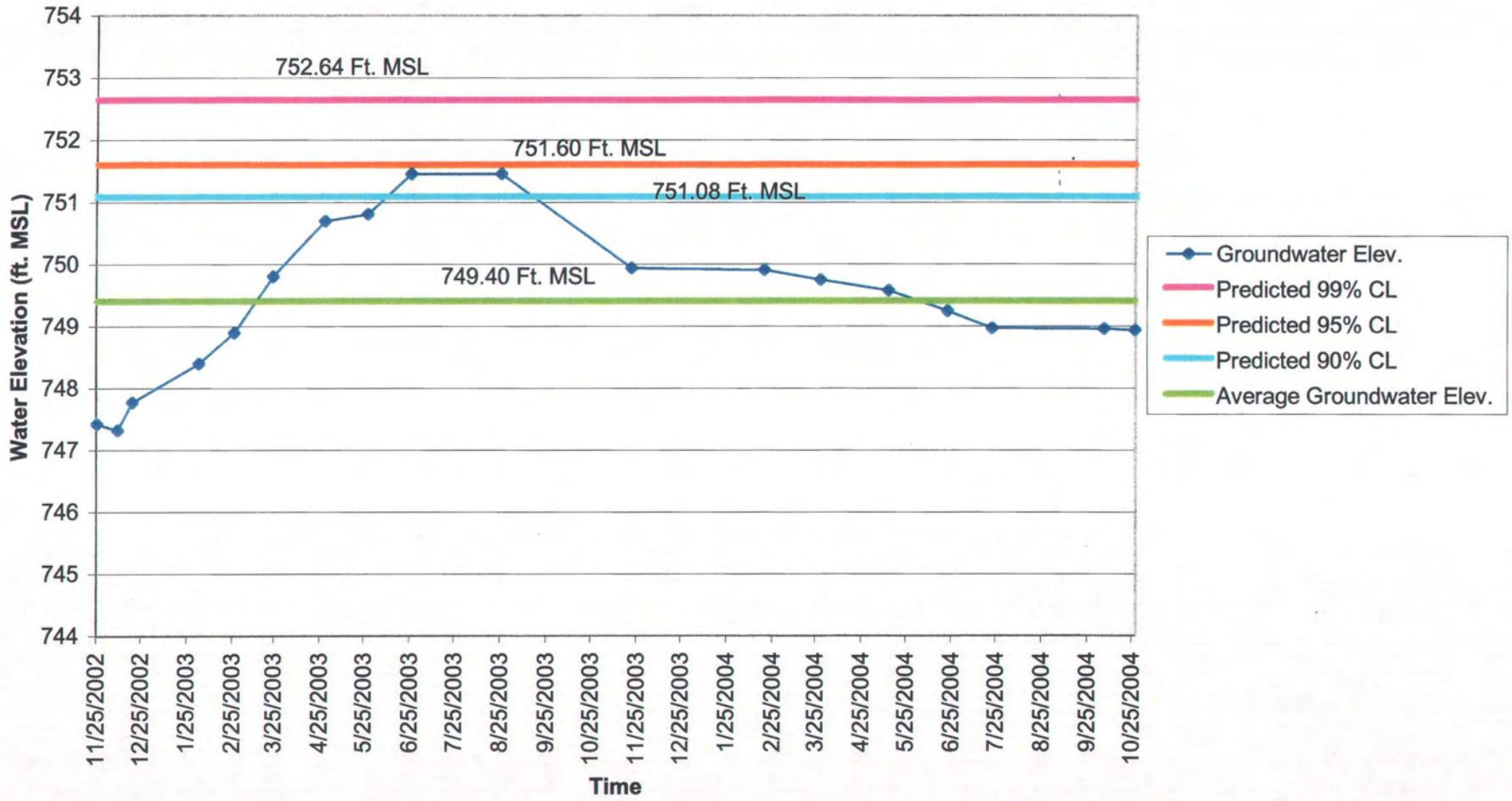
Well BC-4
Belews Creek
S&ME Project No. 1054-04-955



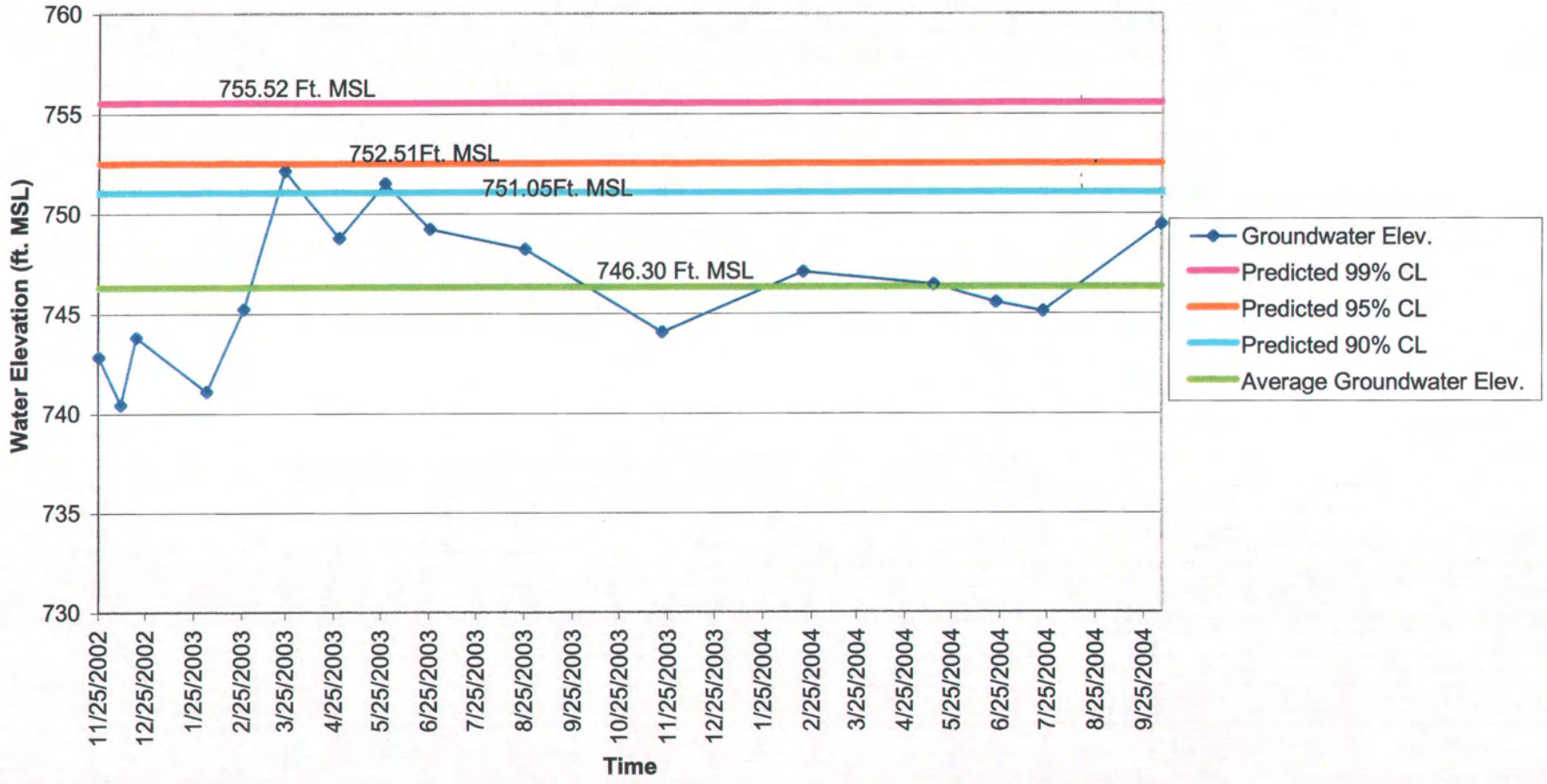
Well BC-3A
Belews Creek
S&ME Project No. 1054-04-955

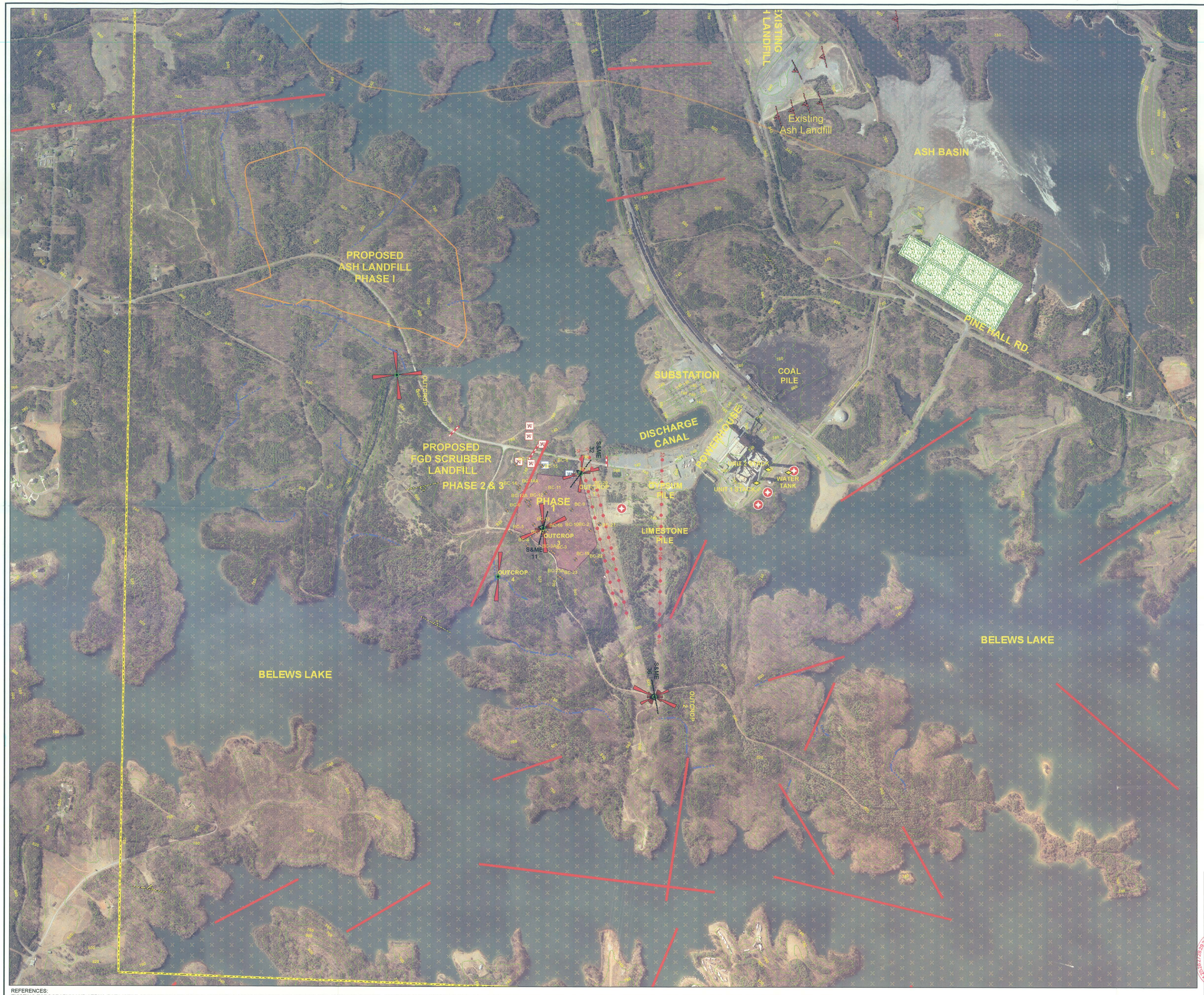


Well BC-2
Belews Creek
S&ME Project No. 1054-04-955



Well BC-1
Belews Creek
S&ME Project No. 1054-04-955





Legend

- PROPOSED FGD SCRUBBER OUTPUT LANDFILL SOIL BORING - S&ME
- SW BORING LOCATION - DUKE
- CULVERT - DUKE
- OVERHEAD DUKE POWERLINE - DUKE
- DUKE PROPOSED STRUCTURE - DUKE
- TRIBUTARIES - S&ME GPS/INTERPOLATED
- STOKES COUNTY BOUNDARY
- EXISTING STOKES COUNTY TOPO

GEOLOGIC DATA - USGS

GEOLOGIC FEATURES

- bc: BIOTITE-QUARTZ-FELDSPAR GNEISS AND AUGEN GNEISS
- qgc: QUARTZ-FELDSPAR GNEISS AND QUARTZ-FELDSPAR SCHIST
- ROCK OUTCROP - S&ME
- ROSE DIAGRAM - S&ME
- STRIKE & DIP LOCATION - S&ME
- STRIKE & DIP LOCATION - USGS
- STRIKE & DIP LOCATION - DUKE
- LINAMENT SURVEY - S&ME
- ABANDONED POTABLE WELLS - DUKE
- ATTEMPTED POTABLE WELL LOCATIONS - DUKE

500 250 0 500 1,000 1,500 Feet

NORTH CAROLINA LICENSED GEOLOGIST SEAL 1906 SAMUEL P. WATTS

REFERENCES:
EXISTING TOPOGRAPHY AND AERIAL DATA WERE OBTAINED FROM STOKES COUNTY GEOGRAPHIC INFORMATION SYSTEMS (GIS) DEPARTMENT. THE WETLAND TREATMENT SYSTEM AND SW BORING LOACTION DATA WAS PROVIDED BY DUKE ENERGY. PLEASE NOTE THIS DATA IS FOR INFORMATIONAL PURPOSES ONLY. IT IS NOT MEANT FOR DESIGN, LEGAL, OR ANY OTHER USES. THERE ARE NO GUARANTEES ABOUT ITS ACCURACY. S&ME, INC. ASSUMES NO RESPONSIBILITY FOR ANY DECISION MADE OR ANY ACTIONS TAKEN BY THE USER BASED UPON INFORMATION OBTAINED FROM THE ABOVE DATA. THE STREAM TRIBUTARY DATA WAS APPROXIMATELY LOCATED VIA A DIFFERENTIALLY CORRECTED GLOBAL POSITIONING SYSTEM (TRIMBLE PRO XRS GPS UNIT) AND INTERPOLATED BASED ON THE STOKES COUNTY EXISITNG TOPOGRAPHY DATA. THE COORDINATES FOR THESE LOCATIONS WERE NOT OBTAINED BY A REGISTERED LAND SURVEYOR AND ARE NOT INTENDED TO REPRESENT SURVEYED LOCATIONS FOR USE IN LEGAL DOCUMENTS (E.G. DEEDS, TAX MAPS, PROPERTY MAPS, ETC.) OR OTHER OFFICIAL PURPOSES. THESE COORDINATES ARE INTENDED FOR GENERAL INFORMATION PURPOSES ONLY AND ARE NOT TO BE USED AS SURVEYED DATA POINTS.

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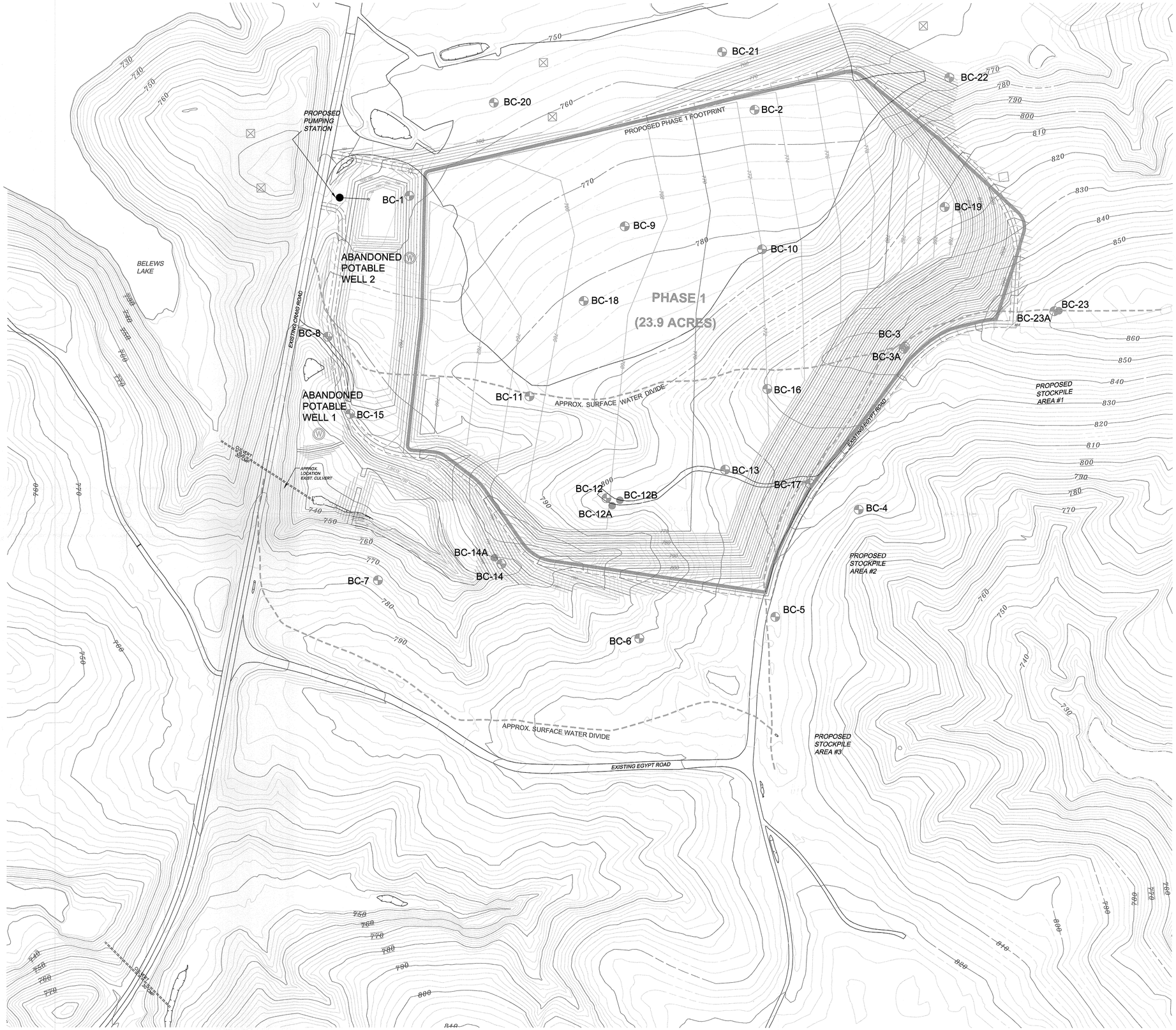
FIELD MAPPING DATA AND LINEAMENT SURVEY
BELEWS CREEK STEAM STATION
FGD SCRUBBER RESIDUE DISPOSAL SITE
BELEWS CREEK, NORTH CAROLINA

SCALE:	DRAWN BY:	CHECKED BY:
AS SHOWN	DPM/LSE	CJLS/SPW
PROJECT NO:	**DATE:**	**FIGURE:**
1054-04-955	2-21-05	12



LEGEND

- 650 — EXISTING GRADE CONTOUR
- 760 — PROPOSED LANDFILL BASE GRADE CONTOUR
- TREELINE
- EXISTING MONITOR WELL
- SOIL BORING (ABANDONED)
- POTABLE WELL
- PROPOSED PHASE 1 LINE
- WATER
- APPROX. SURFACE WATER DIVIDE

NOTE

1. BACKGROUND INFORMATION FOR THIS DRAWING INCLUDING MONITOR WELL SURVEY, PROVIDED BY DUKE ENERGY.
2. BORINGS BC-12A, BC-12B, BC-14A AND BC-23A WERE NOT SURVEYED. LOCATIONS ARE APPROXIMATE BASED ON FIELD MEASUREMENTS.
3. PROPOSED LANDFILL BASE GRADE CONTOURS PROVIDED BY CHAS H. SELLS, INC.

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100 0 100
GRAPHIC SCALE IN FEET

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3118 SPRING FOREST ROAD
RALEIGH, NC 27616
PH. 919-872-2660
FAX. 919-790-9827
WWW.SMEINC.COM

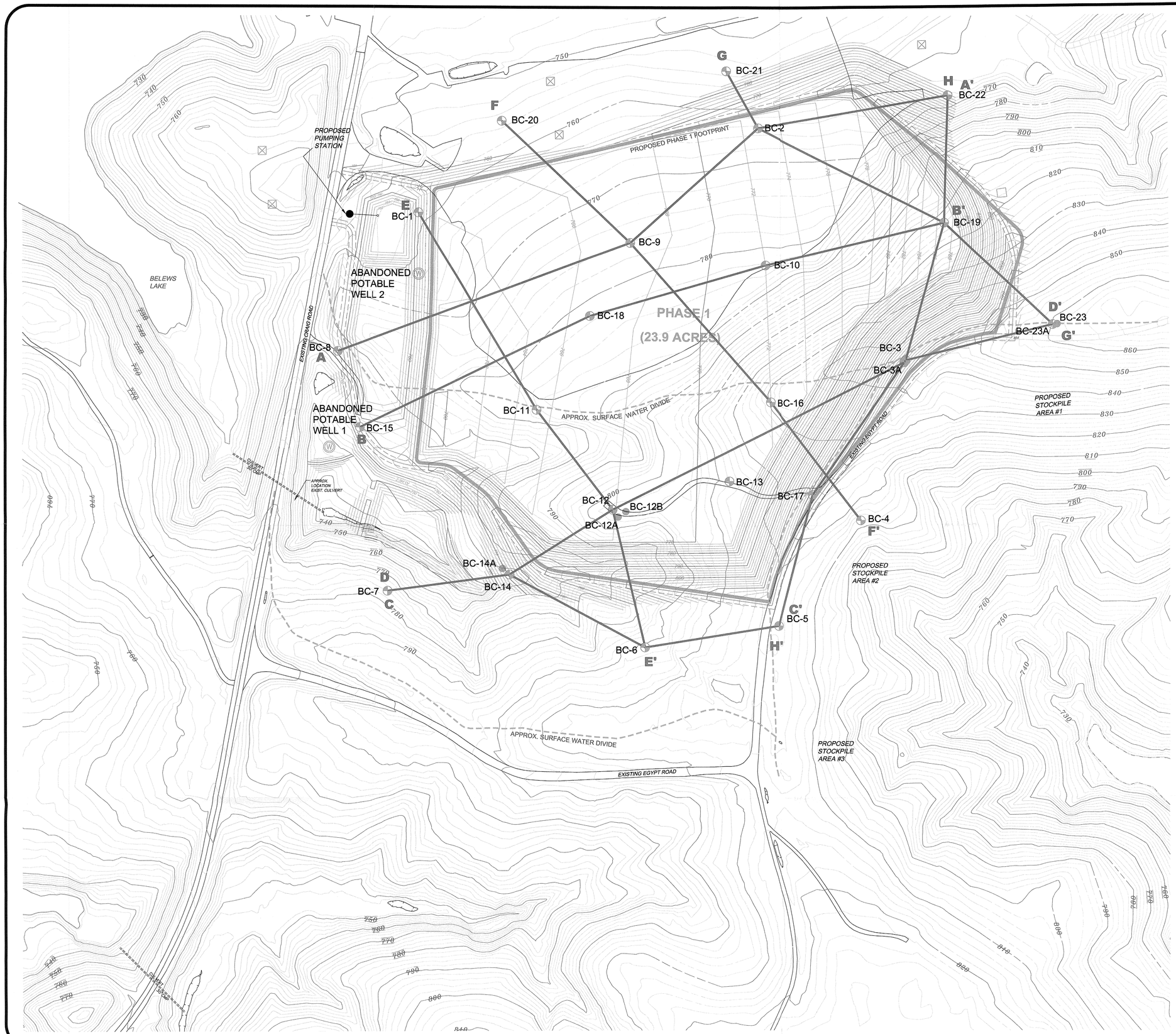
NORTH CAROLINA LICENSED SEAL 1806 GEOLOGIST SAMUEL P. WAITS

NO.	DATE	DESCRIPTION	BY
1	12/10/04	REVISED PROPOSED LANDFILL BASE GRADE CONTOUR	SPW

LANDFILL AREA SITE PLAN
DUKE POWER BELEWS CREEK
STEAM STATION

FGD SCRUBBER RESIDUE DISPOSAL SITE
BELEWS CREEK, NORTH CAROLINA

DRAWN BY: JCJ	CHECKED BY: LSE
DESIGNED BY:	APPROVED BY: SPW
PROJECT NUMBER 1054-04-955	
SCALE: 1" = 100'	DATE: FEB. 2005
DRAWING: 2	OF: 22



LEGEND

- EXISTING GRADE CONTOUR
- PROPOSED LANDFILL BASE GRADE CONTOUR
- TREELINE
- EXISTING MONITOR WELL
- SOIL BORING (ABANDONED)
- POTABLE WELL
- PROPOSED PHASE 1 LINE
- WATER
- APPROX. SURFACE WATER DIVIDE
- A-A' CROSS SECTION VIEW (TYPICAL)

NOTE

1. BACKGROUND INFORMATION FOR THIS DRAWING INCLUDING MONITOR WELL SURVEY, PROVIDED BY DUKE ENERGY.
2. BORINGS BC-12A, BC-12B, BC-14A AND BC-23A WERE NOT SURVEYED. LOCATIONS ARE APPROXIMATE BASED ON FIELD MEASUREMENTS.
3. PROPOSED LANDFILL BASE GRADE CONTOURS PROVIDED BY CHAS H. SELLS, INC.

Received APR 2005 Solid Waste Section

100 0 100
GRAPHIC SCALE IN FEET

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NORTH CAROLINA LICENSED GEOLOGIST SEAL 4806 SAMUEL P. WAITS

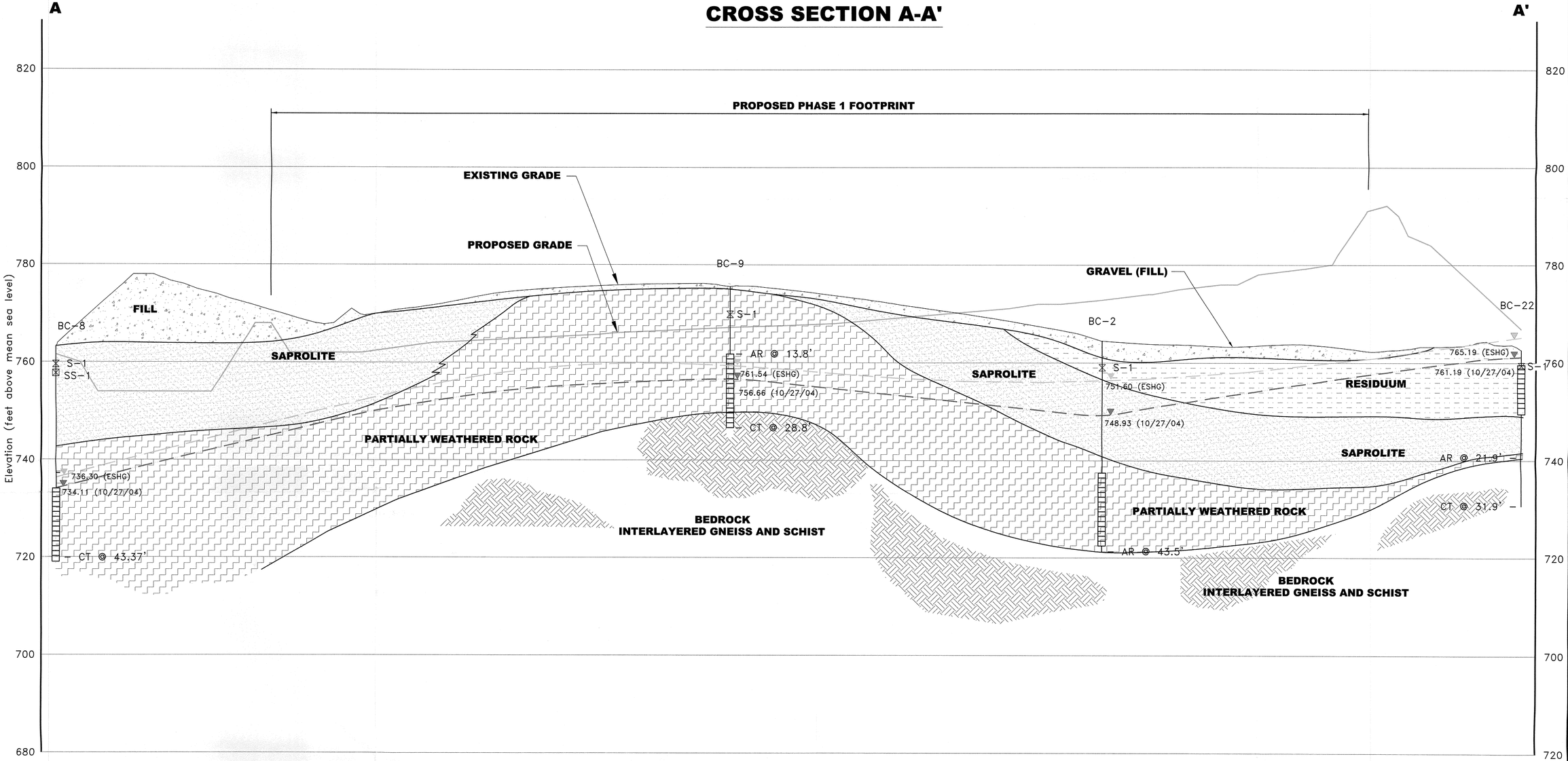
NO.	DATE	DESCRIPTION	BY
1	12/10/04	REVISED PROPOSED LANDFILL BASE GRADE CONTOUR	SPW

LIMITS OF LITHOLOGIC CROSS-SECTIONS
DUKE POWER BELEWS CREEK
STEAM STATION

FGD SCRUBBER RESIDUE DISPOSAL SITE
BELEWS CREEK, NORTH CAROLINA

DRAWN BY: JCJ	CHECKED BY: LSE
DESIGNED BY:	APPROVED BY: SPW
PROJECT NUMBER 1054-04-955	
SCALE: 1" = 100'	DATE: FEB. 2005
DRAWING: 3	OF: 22

CROSS SECTION A-A'



LEGEND

BC-1	MONITOR WELL IDENTIFICATION	■ ST	SHELBY TUBE
AR	AUGER REFUSAL	⊠ SS	SPLIT SPOON
CT	CORING TERMINATED	⧖ S	BULK SAMPLE
	RESIDUUM		
	SAPROLITE		
	PARTIALLY WEATHERED ROCK		
	BEDROCK		
	FILL		

(743.81) — SCREENED INTERVAL AND POTENTIOMETRIC HEAD (FEET ABOVE MEAN SEA LEVEL)

WATER TABLE SURFACE (MEASURED ON 10/27/04)

ESTIMATED SEASONAL HIGH GROUNDWATER (ESHG) SURFACE

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Solid Waste Section

50 0 50
GRAPHIC SCALE IN FEET
HORIZONTAL

10 0 10
GRAPHIC SCALE IN FEET
VERTICAL

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FAX: 919.790.9827
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NORTH CAROLINA LICENSED GEOLOGIST SEAL 1305 SAMUEL P. WATTS

NO.	DATE	DESCRIPTION
1	12/10/04	REVISED PROPOSED LANDFILL BASE GRADE

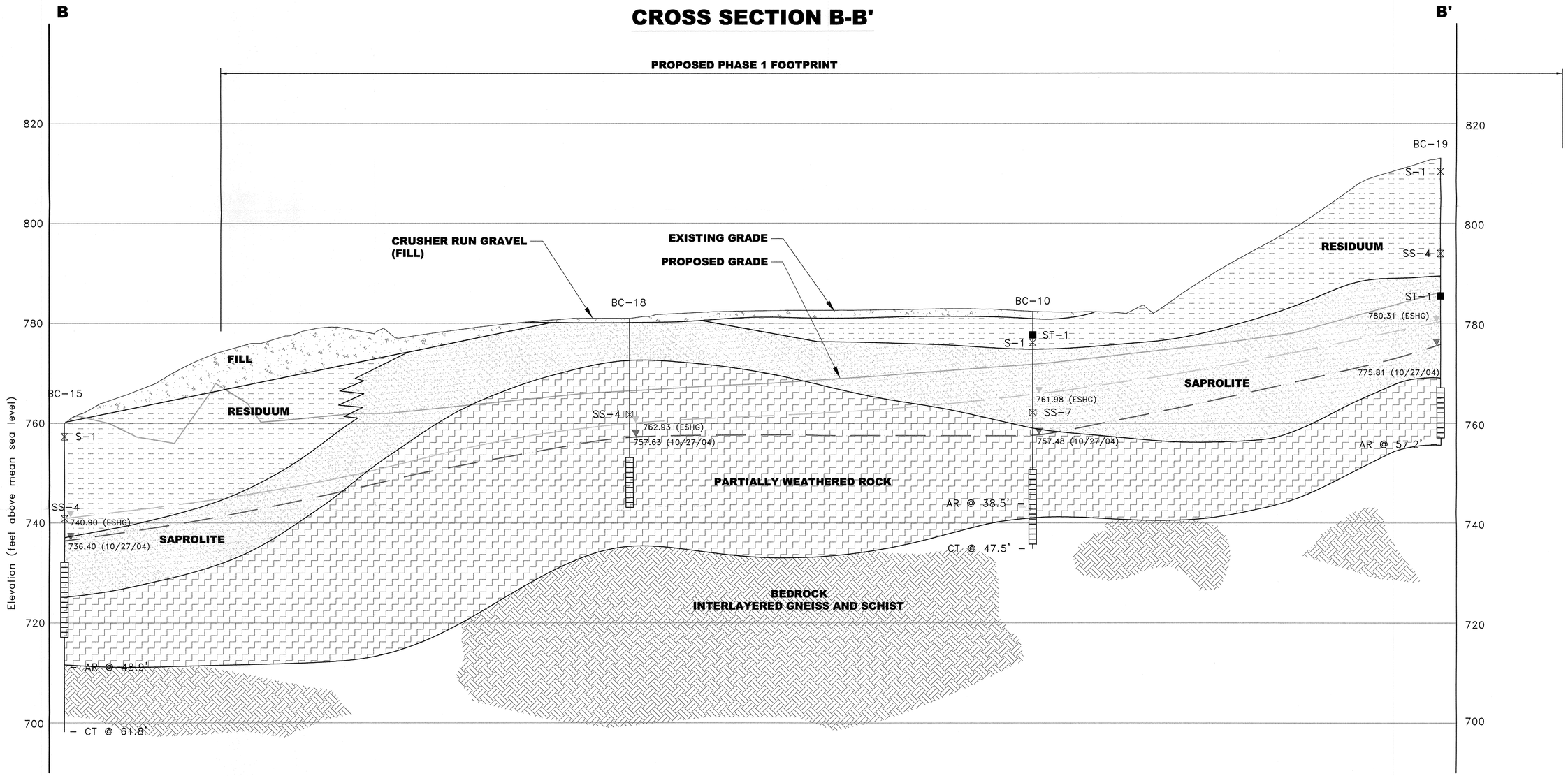
SPW BY

LITHOLOGIC CROSS-SECTION A-A'
DUKE POWER BELEWS CREEK
STEAM STATION

FGD SCRUBBER RESIDUE DISPOSAL SITE
BELEWS CREEK, NORTH CAROLINA

DRAWN BY: JCJ	CHECKED BY: LSF
DESIGNED BY:	APPROVED BY: SPW
PROJECT NUMBER: 1054-04-955	
SCALE: AS SHOWN	DATE: FEB. 2005
DRAWING: 4	OF: 22

CROSS SECTION B-B'



LEGEND

BC-1	MONITOR WELL IDENTIFICATION	■ ST	SHELBY TUBE
AR	AUGER REFUSAL	⊠ SS	SPLIT SPOON
CT	CORING TERMINATED	⧖ S	BULK SAMPLE
	RESIDUUM		
	SAPROLITE		
	PARTIALLY WEATHERED ROCK		
	BEDROCK		
	FILL		

(743.81) SCREENED INTERVAL AND POTENTIOMETRIC HEAD (FEET ABOVE MEAN SEA LEVEL)

WATER TABLE SURFACE (MEASURED ON 10/27/04)

ESTIMATED SEASONAL HIGH GROUNDWATER (ESHG) SURFACE

Received
APR 2005
Solid Waste Section

50 0 50
GRAPHIC SCALE IN FEET HORIZONTAL

10 0 10
GRAPHIC SCALE IN FEET VERTICAL

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RALEIGH, NC 27616
PH 919.876.6888
FAX 919.790.9827
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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 1806 SAMUEL P. SLIMP

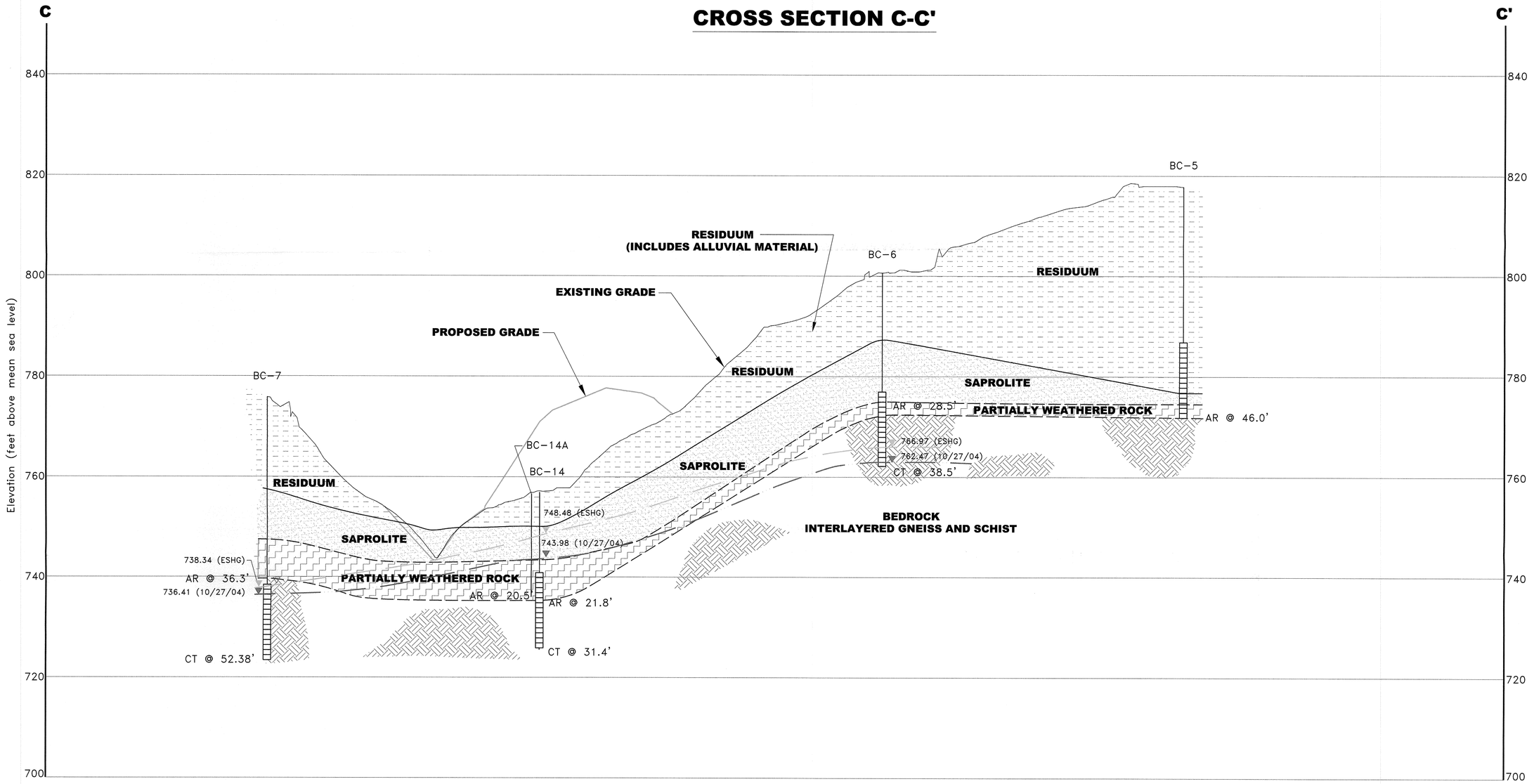
NO.	DATE	DESCRIPTION	BY
1	12/10/04	REVISED PROPOSED LANDFILL BASE GRADE	SPW

LITHOLOGIC CROSS-SECTION B-B'
DUKE POWER BELEWS CREEK STEAM STATION

FGD SCRUBBER RESIDUE DISPOSAL SITE
BELEWS CREEK, NORTH CAROLINA

DRAWN BY: JCJ	CHECKED BY: LSE
DESIGNED BY:	APPROVED BY: SPW
PROJECT NUMBER: 1054-04-955	
SCALE:	DATE: FEB. 2005
DRAWING: 5	OF: 22

CROSS SECTION C-C'



LEGEND

(743.81) — SCREENED INTERVAL AND POTENTIOMETRIC HEAD (FEET ABOVE MEAN SEA LEVEL)

WATER TABLE SURFACE (MEASURED ON 10/27/04)

ESTIMATED SEASONAL HIGH GROUNDWATER (ESHG) SURFACE

BC-1	MONITOR WELL IDENTIFICATION
AR	AUGER REFUSAL
CT	CORING TERMINATED
	RESIDUUM
	SAPROLITE
	PARTIALLY WEATHERED ROCK
	BEDROCK
	FILL

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GRAPHIC SCALE IN FEET HORIZONTAL: 50 0 50

GRAPHIC SCALE IN FEET VERTICAL: 10 0 10

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NORTH CAROLINA REGISTERED SEAL 1806 GEOLOGIST STEVEN P. SAMMET

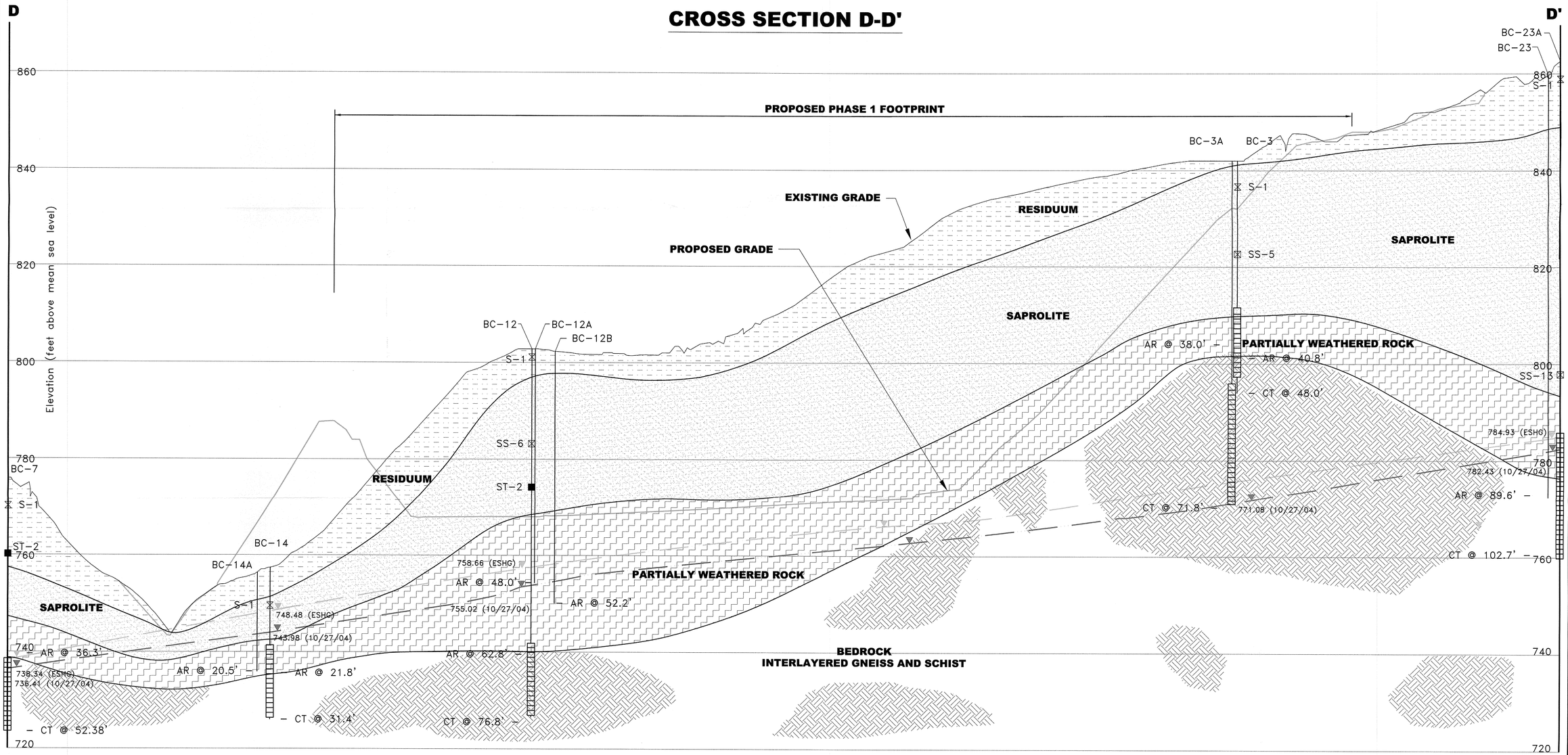
NO.	DATE	DESCRIPTION	BY
1	12/10/04	REVISED PROPOSED LANDFILL BASE GRADE	SPW

LITHOLOGIC CROSS-SECTION C-C'
DUKE POWER BELEWS CREEK STEAM STATION

FGD SCRUBBER RESIDUE DISPOSAL SITE
BELEWS CREEK, NORTH CAROLINA

DRAWN BY: JCJ	CHECKED BY: LSE
DESIGNED BY:	APPROVED BY: SPW
PROJECT NUMBER: 1054-04-955	
SCALE: As Shown	DATE: FEB. 2005
DRAWING: 6	OF: 22

CROSS SECTION D-D'



LEGEND

(743.81)	SCREENED INTERVAL AND POTENTIOMETRIC HEAD (FEET ABOVE MEAN SEA LEVEL)	BC-1	MONITOR WELL IDENTIFICATION
		AR	AUGER REFUSAL
		CT	CORING TERMINATED
	WATER TABLE SURFACE (MEASURED ON 10/27/04)		RESIDUUM
			SAPROLITE
	ESTIMATED SEASONAL HIGH GROUNDWATER (ESHG) SURFACE		PARTIALLY WEATHERED ROCK
			BEDROCK
			FILL

■ ST	SHELBY TUBE
⊠ SS	SPLIT SPOON
⧖ S	BULK SAMPLE

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50 0 50 GRAPHIC SCALE IN FEET HORIZONTAL

10 0 10 GRAPHIC SCALE IN FEET VERTICAL

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NORTH CAROLINA LICENSED SEAL 1898 GEOLOGIST SAMUEL P. WATTS

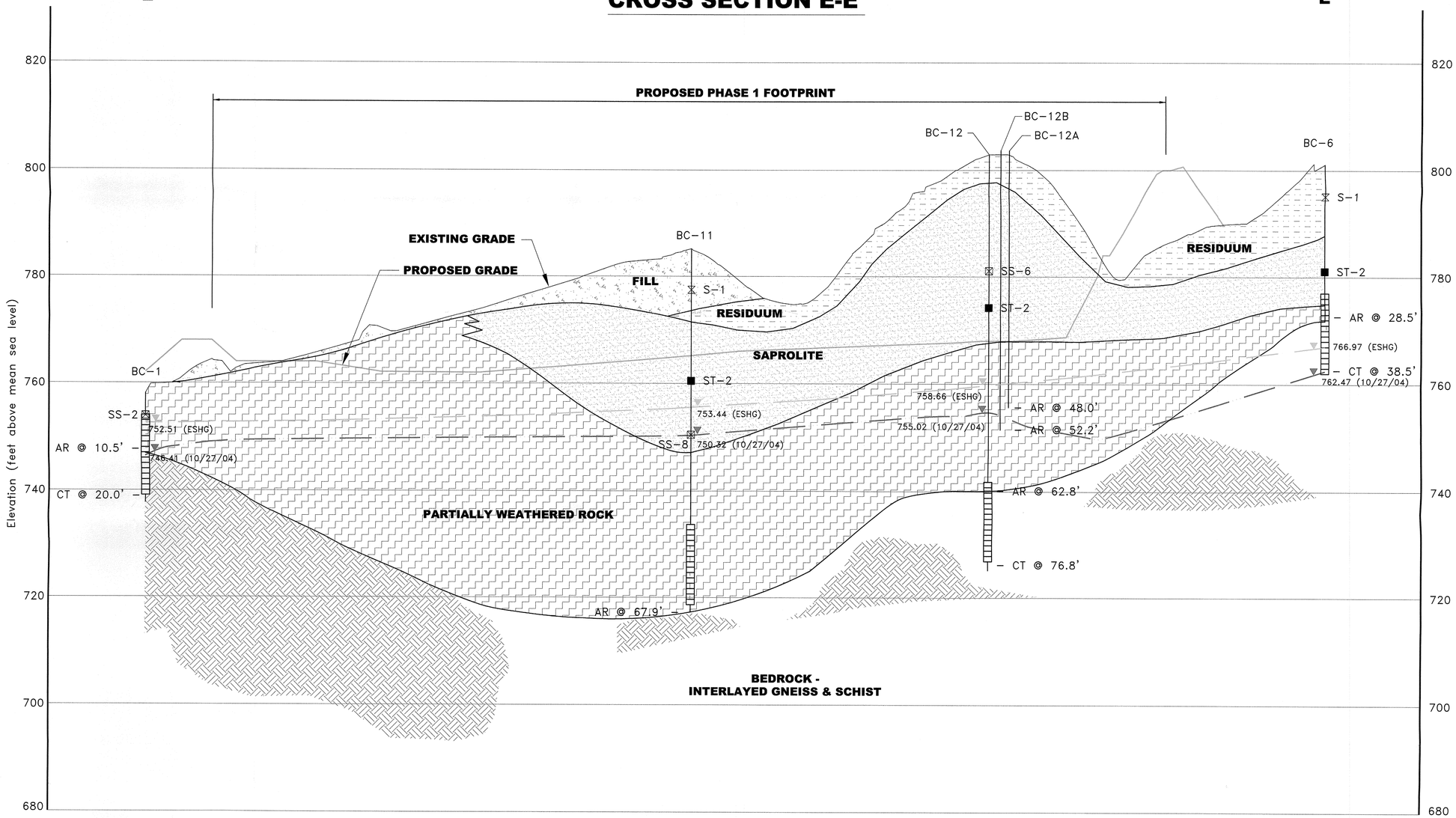
NO.	DATE	DESCRIPTION	BY
1	12/10/04	REVISED PROPOSED LANDFILL BASE GRADE	SPW

LITHOLOGIC CROSS-SECTION D-D'
DUKE POWER BELEWS CREEK
STEAM STATION

FGD SCRUBBER RESIDUE DISPOSAL SITE
BELEWS CREEK, NORTH CAROLINA

DRAWN BY: JCJ	CHECKED BY: LSE
DESIGNED BY:	APPROVED BY: SPW
PROJECT NUMBER 1054-04-955	
SCALE: As Shown	DATE: FEB. 2005
DRAWING: 7	OF: 22

CROSS SECTION E-E'



LEGEND

(743.81) — SCREENED INTERVAL AND POTENTIOMETRIC HEAD (FEET ABOVE MEAN SEA LEVEL)

WATER TABLE SURFACE (MEASURED ON 10/27/04)

ESTIMATED SEASONAL HIGH GROUNDWATER (ESHG) SURFACE

BC-1	MONITOR WELL IDENTIFICATION	■ ST	SHELBY TUBE
AR	AUGER REFUSAL	⊠ SS	SPLIT SPOON
CT	CORING TERMINATED	⧖ S	BULK SAMPLE
	RESIDUUM		
	SAPROLITE		
	PARTIALLY WEATHERED ROCK		
	BEDROCK		
	FILL		

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GRAPHIC SCALE IN FEET HORIZONTAL (50 0 50)

GRAPHIC SCALE IN FEET VERTICAL (10 0 10)

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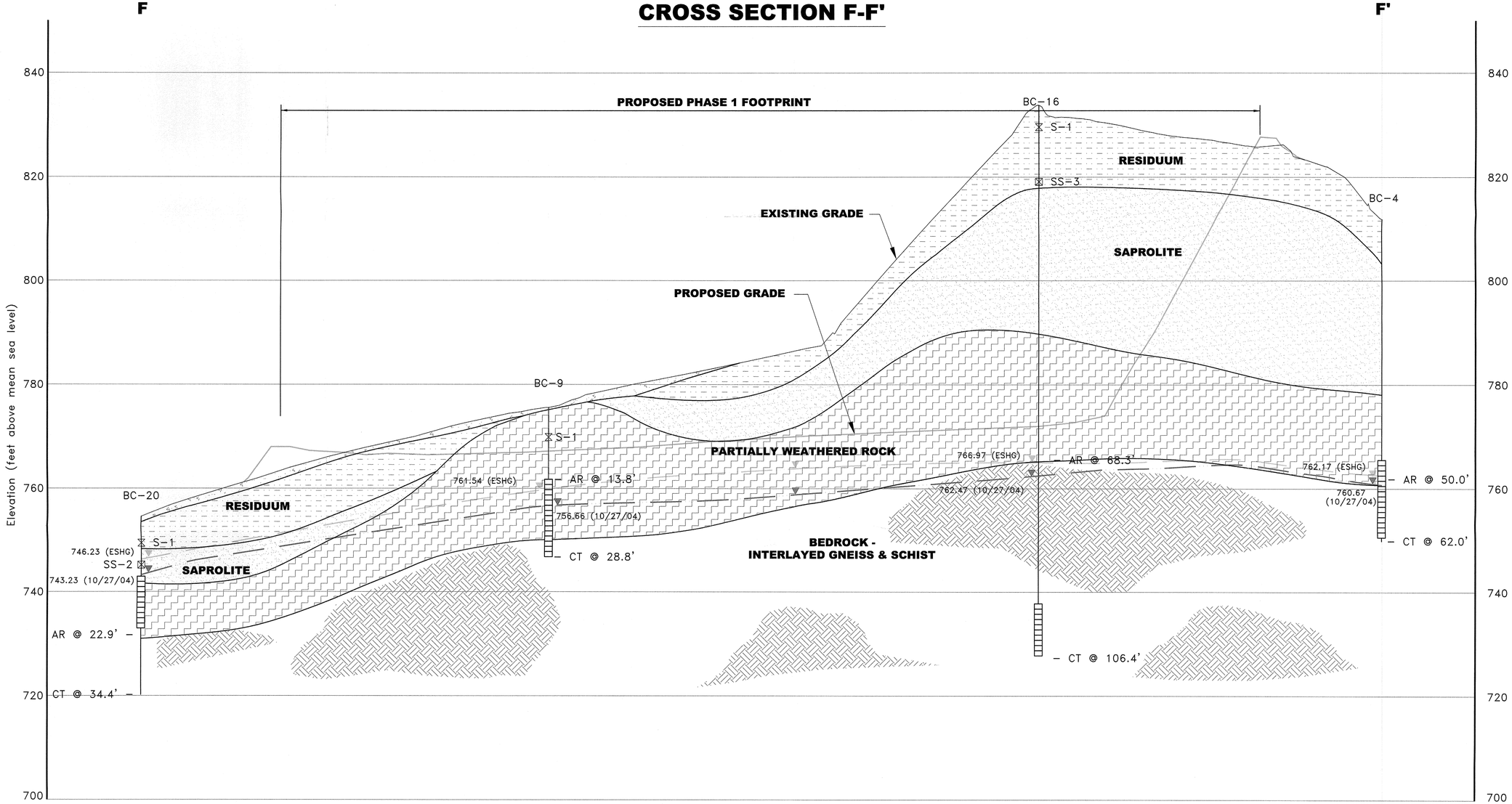
NO.	DATE	DESCRIPTION	BY
1	12/10/04	REVISED PROPOSED LANDFILL BASE GRADE	SPW
2	3/17/05	REVISED BC-1 SCREENED INTERVAL	SPW

LITHOLOGIC CROSS-SECTION E-E'
DUKE POWER BELEWS CREEK STEAM STATION

FGD SCRUBBER RESIDUE DISPOSAL SITE
BELEWS CREEK, NORTH CAROLINA

DRAWN BY: JCJ	CHECKED BY:
DESIGNED BY:	APPROVED BY:
PROJECT NUMBER: 1054-04-955	
SCALE: 1" = 100'	DATE: FEB. 2005
DRAWING: 8	OF: 22

CROSS SECTION F-F'



LEGEND

(743.81)	SCREENED INTERVAL AND POTENTIOMETRIC HEAD (FEET ABOVE MEAN SEA LEVEL)	BC-1	MONITOR WELL IDENTIFICATION
		AR	AUGER REFUSAL
		CT	CORING TERMINATED
	WATER TABLE SURFACE (MEASURED ON 10/27/04)		RESIDUUM
			SAPROLITE
	ESTIMATED SEASONAL HIGH GROUNDWATER (ESHG) SURFACE		PARTIALLY WEATHERED ROCK
			BEDROCK
			FILL

■ ST	SHELBY TUBE
⊠ SS	SPLIT SPOON
⧖ S	BULK SAMPLE

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GRAPHIC SCALE IN FEET HORIZONTAL (50 0 50)

GRAPHIC SCALE IN FEET VERTICAL (10 0 10)

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NORTH CAROLINA LICENSED SEAL 1806 SECOND ST. SAMUEL P. WATTS

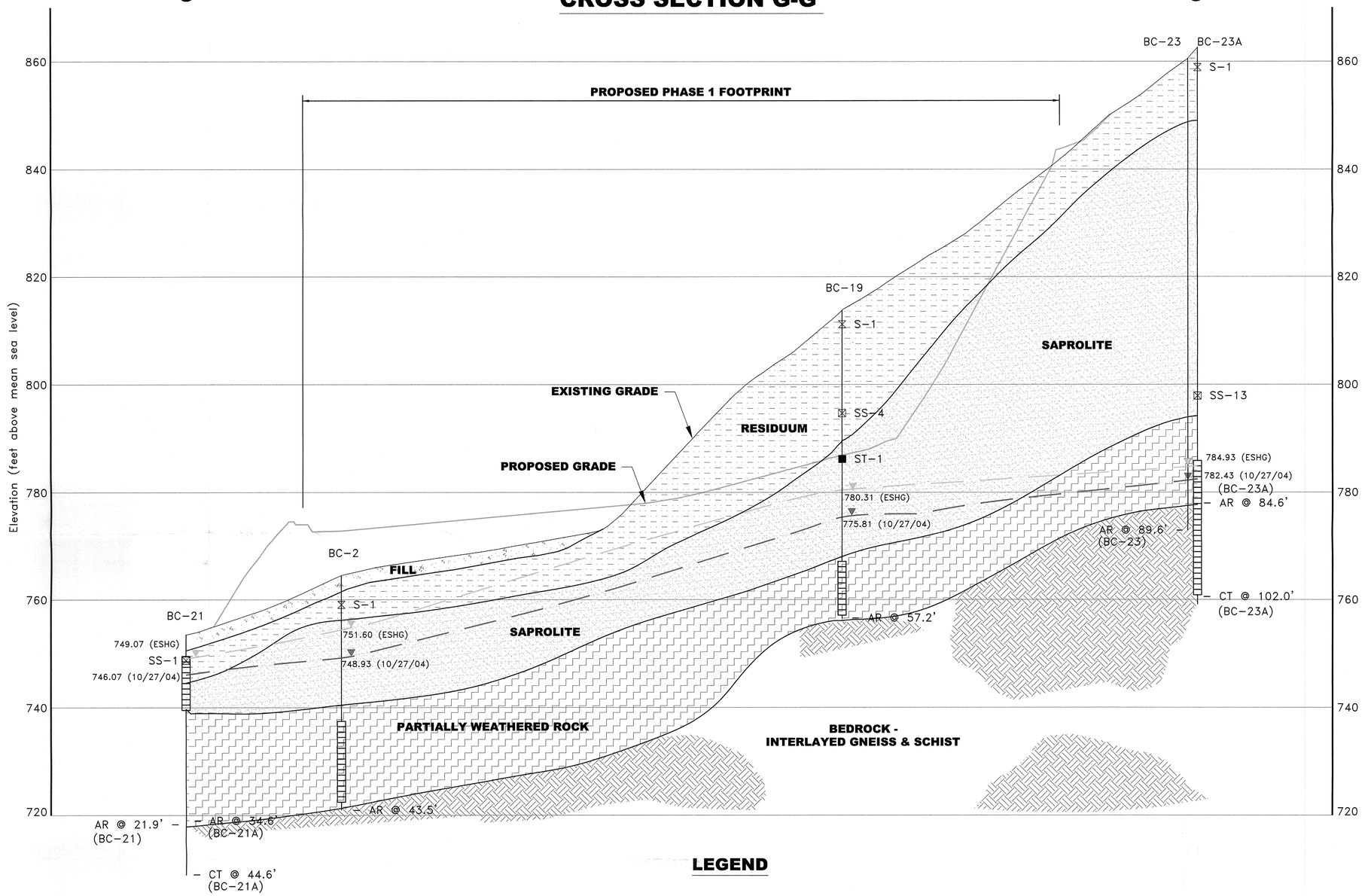
NO.	DATE	DESCRIPTION	BY
1	12/10/04	REVISED PROPOSED LANDFILL BASE GRADE	SPW

LITHOLOGIC CROSS-SECTION F-F'
DUKE POWER BELEWS CREEK
STEAM STATION

FGD SCRUBBER RESIDUE DISPOSAL SITE
BELEWS CREEK, NORTH CAROLINA

DRAWN BY: JCJ	CHECKED BY: LSE
DESIGNED BY:	APPROVED BY: SAW
PROJECT NUMBER: 1054-04-955	
SCALE: As Shown	DATE: FEB. 2005
DRAWING: 9	OF: 22

CROSS SECTION G-G'



LEGEND

BC-1	MONITOR WELL IDENTIFICATION	■ ST	SHELBY TUBE
AR	AUGER REFUSAL	⊠ SS	SPLIT SPOON
CT	CORING TERMINATED	⧖ S	BULK SAMPLE
	RESIDUUM		
	SAPROLITE		
	PARTIALLY WEATHERED ROCK		
	BEDROCK		
	FILL		

(743.81) SCREENED INTERVAL AND POTENTIOMETRIC HEAD (FEET ABOVE MEAN SEA LEVEL)

WATER TABLE SURFACE (MEASURED ON 10/27/04)

ESTIMATED SEASONAL HIGH GROUNDWATER (ESHG) SURFACE

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GRAPHIC SCALE IN FEET HORIZONTAL: 50 0 50

GRAPHIC SCALE IN FEET VERTICAL: 10 0 10

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NORTH CAROLINA REGISTERED GEOLOGIST SEAL 1686 SAMUEL P. WATTS

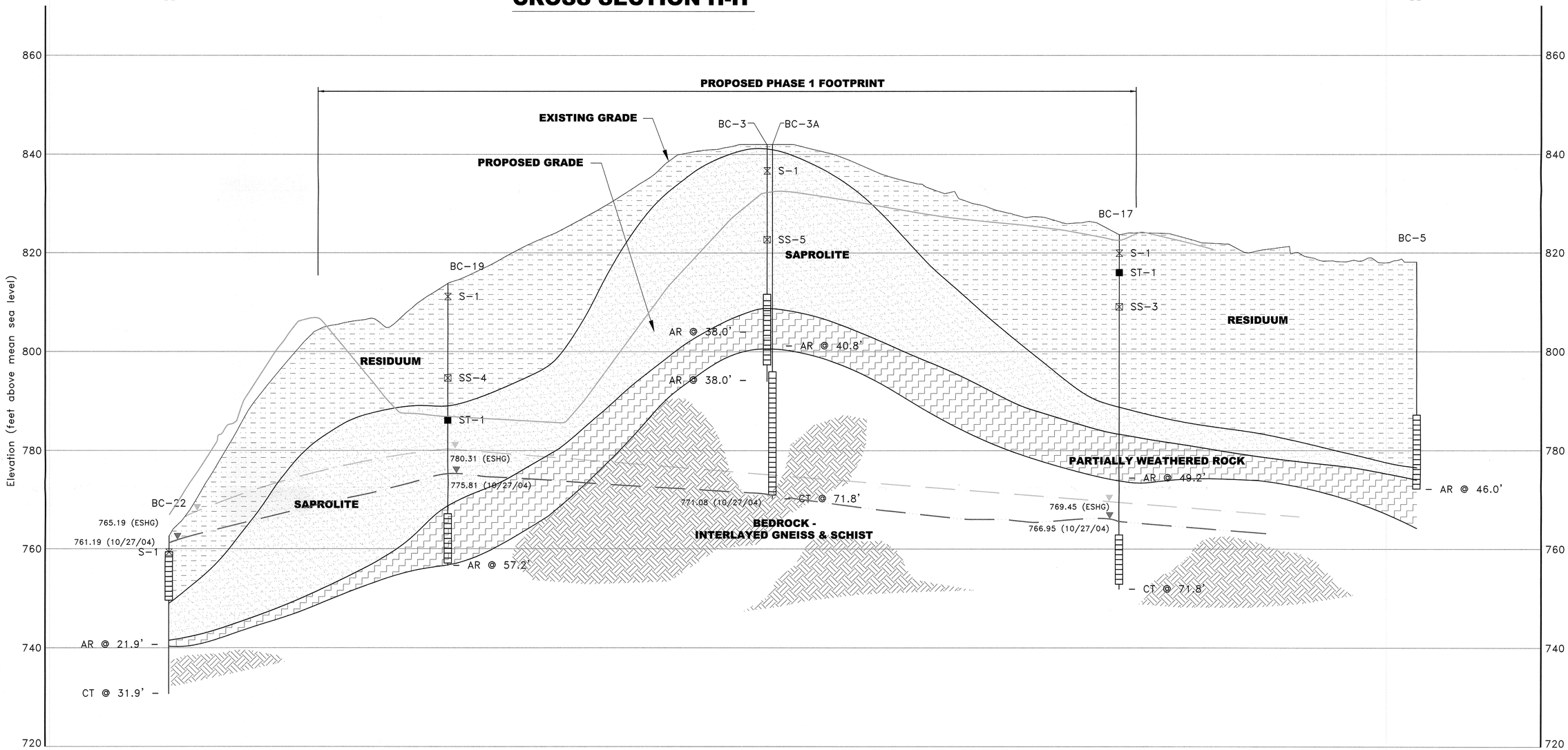
NO.	DATE	DESCRIPTION	BY
1	12/10/04	REVISED PROPOSED LANDFILL BASE GRADE	SPW

LITHOLOGIC CROSS-SECTION G-G'
DUKE POWER BELEWS CREEK
STEAM STATION

FGD SCRUBBER RESIDUE DISPOSAL SITE
BELEWS CREEK, NORTH CAROLINA

DRAWN BY: JCJ	CHECKED BY: LSF
DESIGNED BY:	APPROVED BY: SPW
PROJECT NUMBER: 1054-04-955	
SCALE: As shown	DATE: FEB. 2005
DRAWING: 10	OF: 22

CROSS SECTION H-H'



LEGEND

(743.81)	SCREENED INTERVAL AND POTENTIOMETRIC HEAD (FEET ABOVE MEAN SEA LEVEL)
	WATER TABLE SURFACE (MEASURED ON 10/27/04)
	ESTIMATED SEASONAL HIGH GROUNDWATER (ESHG) SURFACE

BC-1	MONITOR WELL IDENTIFICATION
AR	AUGER REFUSAL
CT	CORING TERMINATED
	RESIDUUM
	SAPROLITE
	PARTIALLY WEATHERED ROCK
	BEDROCK
	FILL

■ ST	SHELBY TUBE
⊠ SS	SPLIT SPOON
⧖ S	BULK SAMPLE

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50 0 50 GRAPHIC SCALE IN FEET HORIZONTAL

10 0 10 GRAPHIC SCALE IN FEET VERTICAL

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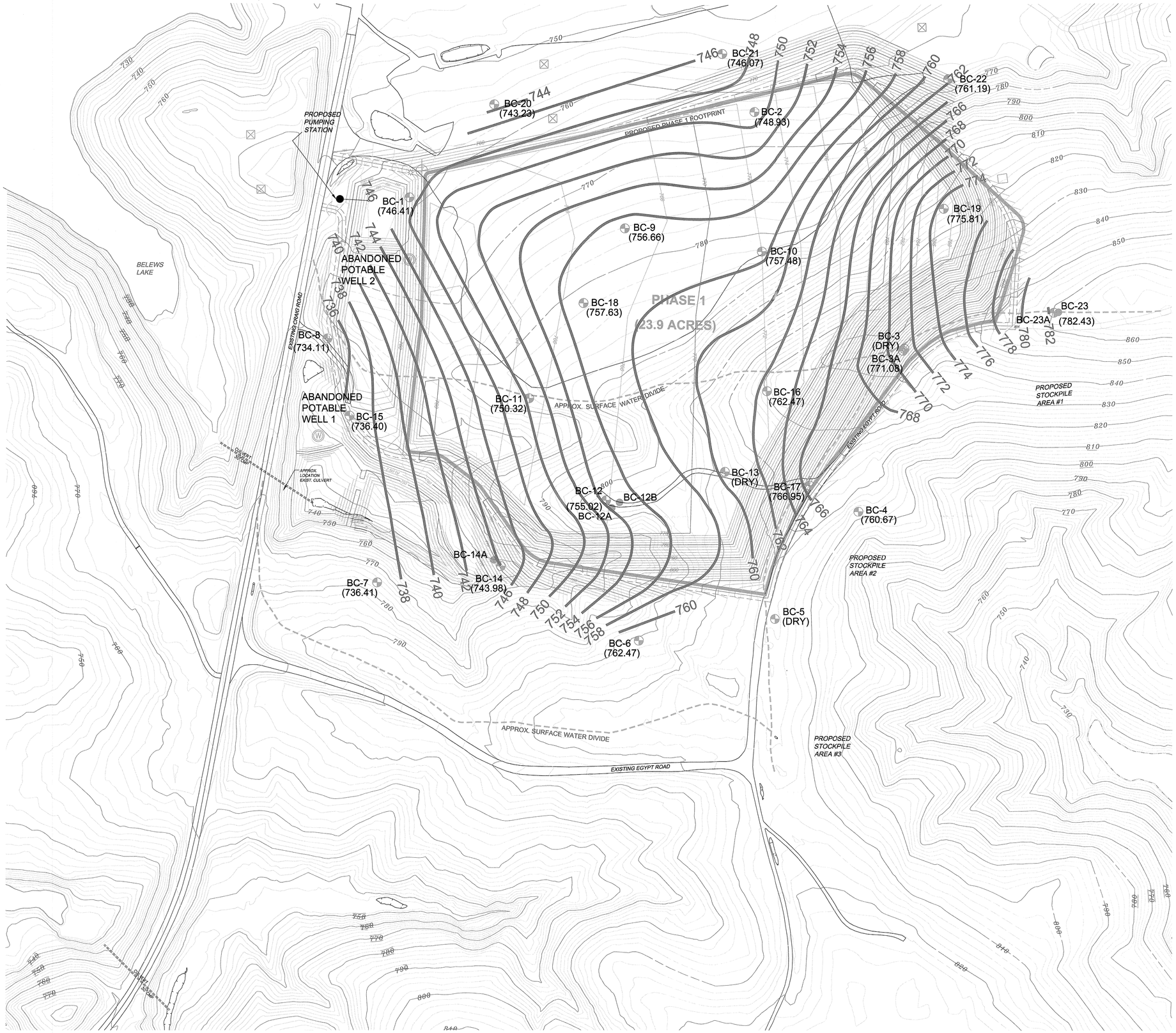
NORTH CAROLINA LICENSED SEAL 1606 GEOLOGIST SAMUEL P. WATTS

NO.	DATE	DESCRIPTION	BY
1	12/10/04	REVISED PROPOSED LANDFILL BASE GRADE	SPW

LITHOLOGIC CROSS-SECTION H-H'
DUKE POWER BELEWS CREEK
STEAM STATION

FGD SCRUBBER RESIDUE DISPOSAL SITE
BELEWS CREEK, NORTH CAROLINA

DRAWN BY: JCJ	CHECKED BY: LSE
DESIGNED BY:	APPROVED BY: SAW
PROJECT NUMBER 1054-04-955	
SCALE: As Shown	DATE: FEB. 2005
DRAWING: 11	OF: 22



LEGEND

- 650 — EXISTING GRADE CONTOUR
- 760 — PROPOSED LANDFILL BASE GRADE CONTOUR
- TREELINE
- EXISTING MONITOR WELL
- SOIL BORING (ABANDONED)
- POTABLE WELL
- PROPOSED PHASE 1 LINE
- WATER
- APPROX. SURFACE WATER DIVIDE
- POTENTIOMETRIC GROUNDWATER CONTOUR
- (743.81) GROUNDWATER ELEVATION MEASURED OCTOBER 27, 2004

NOTE

1. BACKGROUND INFORMATION FOR THIS DRAWING INCLUDING MONITOR WELL SURVEY, PROVIDED BY DUKE ENERGY.
2. BORINGS BC-12A, BC-12B, BC- 23 AND BC-14A WERE NOT SURVEYED. LOCATIONS ARE APPROXIMATE BASED ON FIELD MEASUREMENTS.
3. GROUNDWATER COUNTOURING DEVELOPED UTILIZING AUTODESK LAND DESKTOP PROGRAM.

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100 0 100
GRAPHIC SCALE IN FEET

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NORTH CAROLINA LICENSED PROFESSIONAL ENGINEER SEAL 1806 GEOLOGIST SAMUEL P. WATTS

NO.	DATE	DESCRIPTION	BY
1	12/10/04	REVISED PROPOSED LANDFILL BASE GRADE CONTOUR	SPW

GROUNDWATER POTENTIOMETRIC MAP
OCTOBER 27, 2004
DUKE POWER BELEWS CREEK
STEAM STATION

FGD SCRUBBER RESIDUE DISPOSAL SITE
BELEWS CREEK, NORTH CAROLINA

DRAWN BY: JCJ	CHECKED BY: LSE
DESIGNED BY:	APPROVED BY: SPW
PROJECT NUMBER 1054-04-955	
SCALE: 1" = 100'	DATE: FEB. 2005
DRAWING: 21	OF: 22

LEGEND

- 650 — EXISTING GRADE CONTOUR
- 760 — PROPOSED LANDFILL BASE GRADE CONTOUR
- TREELINE
- EXISTING MONITOR WELL
- SOIL BORING (ABANDONED)
- POTABLE WELL
- PROPOSED PHASE 1 LINE
- WATER
- APPROX. SURFACE WATER DIVIDE
- 750 — ESTIMATED HIGH GROUNDWATER POTENTIOMETRIC GROUNDWATER CONTOUR
- (743.81) — ESTIMATED HIGH GROUNDWATER POTENTIOMETRIC GROUNDWATER ELEVATION

NOTE

1. BACKGROUND INFORMATION FOR THIS DRAWING INCLUDING MONITOR WELL SURVEY, PROVIDED BY DUKE ENERGY.
2. BORINGS BC-12A, BC-12B, BC- 14A AND BC-23A WERE NOT SURVEYED. LOCATIONS ARE APPROXIMATE BASED ON FIELD MEASUREMENTS.
3. GROUNDWATER COUNTOURING DEVELOPED UTILIZING AUTODESK LAND DESKTOP PROGRAM.

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100 0 100
GRAPHIC SCALE IN FEET

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NORTH CAROLINA LICENSED SEAL 1806 GEOLOGIST SAMUEL P. WAITS

NO.	DATE	DESCRIPTION	BY
1	12/10/04	REVISED PROPOSED LANDFILL BASE GRADE CONTOUR	SPW

EST. HIGH GW POTENTIOMETRIC MAP
DUKE POWER BELEWS CREEK
STEAM STATION

FGD SCRUBBER RESIDUE DISPOSAL SITE
BELEWS CREEK, NORTH CAROLINA

DRAWN BY: JCJ	CHECKED BY: LSE
DESIGNED BY:	APPROVED BY: SPW
PROJECT NUMBER 1054-04-955	
SCALE: 1" = 100'	DATE: FEB. 2005
DRAWING: 22	OF: 22